Geodaesia improved; or, a new and correct method of surveying made exceeding easy in two parts

Burn, A.

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Part I.

Geodæsia Improved:

CHAPTER I.

SECTION I.

NUMERATION.

BY NUMERATION, we learn to read, write, and expreſs the Value of Figures: Which that you may do, obſerve the following

TABLE.

Hundreds of Millions	Tens of Millions	Millions	Hundreds of Thouſands	Tens of Thouſands	Thouſands	Hundreds	Tens	Units
							2	1
						3	2	1
					4	3	2	1
				5	4	3	2	1
			6	5	4	3	2	1
		7	6	5	4	3	2	1
	8	7	6	5	4	3	2	1
9	8	7	6	5	4	3	2	1

In the above Table each Figure to the Left Hand exceeds the former ten Times the Value, and is thus read: Nine hundred eighty-ſeven Millions, ſix hundred fifty-four Thouſand, three Hundred and twenty-one. In reading Figures or Numbers, it is proper

proper that a young Learner ſhould exerciſe himſelf in the leſſer ones firſt, and then proceed to the greater, until he arrives at Perfection therein, which he may do by being ready in the following

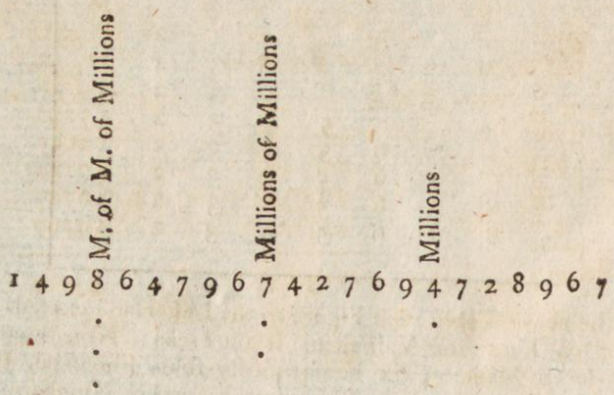
EXAMPLES.

Write in Figures	Eight Seventeen Forty-ſix One hundred and twenty-five.	Anſwer	8 17 46 125

Alſo,

Write in Words	9 19 121	Anſwer	Nine Nineteen One hundred and twenty-one.

And though the foregoing Table goes but to nine Places, yet it is ſufficient to find the Value of any Number, though it conſiſt of one hundred thouſand Places; by pointing out the Millions, as in the Numbers underneath:



ADDI-

ADDITION.

ADDITION of INTEGERS.

ADDITION teacheth to collect two or more Numbers into one Sum.——In ADDITION of INTEGERS, be careful to place Units under Units, Tens under Tens, &c, and for every Ten, carry one to the next Place.

Example.

To work this Example, begin in the Units Place, and say, 4 and 9 is 13, and 6 is 19; all above 10 is 9, which put under the Place of Units, and for the Ten carry One to the next Figure or Place; saying, 1 and 1 is 2, and 8 is 10, and 7 is 17; all above 10 is 7, which put down under the Place of Tens, and carry One for the Ten; saying, 1 and 2 is 3, and 3 is 6, and 4 is 10; all above 10 is nothing, for which place a Cypher under the Place of Hundreds, and carry One for the Ten; and say, 1 and 7 is 8, and 9 is 17, and 7 is 24; all above 20 is 4, which set down; and it being the last Figure, set down the Two that you had to carry for the Twenty, and the Sum will be 42079.

7476	
9389	
7214	
24079	

More Examples.

7694	971927	7196
1767	267276	2697
674	767427	7182
72	226974	6727
6	479671	9767
10213	2713275	33569

ADDITION

ADDITION of MONEY.

Example I.

	l.	*s.*	*d.*
Lent	762	17	9 ½
More	647	16	8 ½
Sum lent	1410	14	5 ¼

In Addition of Money, take Care to place Pounds under Pounds, Shillings under Shillings, and Pence under Pence, &c. And for every four Farthings carry one Penny, for every twelve Pence carry one Shilling, and for every twenty Shillings one Pound.

In the foregoing Example, begin with the Farthings, and say, 2 and 1 is 3, which set in the Place of Farthings; then proceed to the Pence, saying, 8 and 9 is 17, which is one Shilling and five Pence; therefore set down 5, and carry 1 for the Shilling, and say, 1 and 6 is 7, and 7 is 14; set down 4, and carry 10 to the Tens, saying, 1 and 1 is 2, and 1 is 3, *to wit*, 3 ten Shillings is 1*l.* 10*s.* set one in the Tens Place, which makes 14, and carry 1 to the Pounds, saying, 1 and 7 is 8, and 2 is 10, set down a Cypher, and carry 1 to the next Place, and then proceed as in whole Numbers, and the Sum is 1410*l.* 14*s.* 5*d.*¼.

More Examples

l.	*s.*	*d.*
79	17	8 ½
27	16	11 ¼
14	19	7 ¾
122	14	3 ½

l.	*s.*	*d.*
167	19	11 ½
76	16	7 ¾
7	14	8 ¾
2	14	3 ½
0	6	4 ½
0	0	6 ½
255	12	6

l.	*s.*	*d.*	*qr.*
2	7	6	1
0	9	7	2
0	7	3	3
0	2	6	2
0	1	7	1
0	9	6	3
0	16	7	1
0	2	10	1
0	1	10	2
0	4	10	1
5	4	4	¼

If

If your Sum in the Pence Row, be very long, you may either point at every 60, which is 5 *s.* otherwiſe divide it into Parts, and ſum up thoſe Parts, and collect their different Sums together, which will be equal to the Whole.

ADDITION of LAND MEASURE.

Example I.

	A.	R.	P.
	76	1	24
	14	2	29
	91	0	13

Begin with the Poles, and ſay, 9 and 4 is 13; ſet down 3, and carry 1 to 2 which makes 3, and 2 is 5, which as it is in the Tens Place, makes 50, and take 40 out of it for one Rood, becauſe 40 Poles make 1 Rood; and ſet down the remaining 10 to the 3, makes 13, and 1 that you carry to 2 is 3, and 1 is 4; and as 4 Rood is 1 Acre, ſet down 0, and carry 1 to the Acres, ſaying, 1 and 4 is 5, and 6 is 11; ſet 1 down, and carry 1 to 1 is 2, and 7 is 9; and as it is the laſt Figure, ſet it down alſo; and the Sum is 91 0 13.

More Examples.

A.	R.	P.
37	1	31
14	2	12
3	1	33
55	1	36

A.	R.	P.
967	1	27
74	1	37
8	3	17
1050	3	1

A.	R.	P.
71	2	14
9	1	35
0	3	17
0	1	28
6	3	14
1	2	39

Let to the following Perſons, MEADOWING, *viz.*

		A.	R.	P.
To John Tentwell,	—	2	3	14
To James Croft,	—	1	1	27
To Andrew Fielding,	—	4	1	13
To Jacob Cartwell,	—	2	0	34
To Thomas Stubbs,	—	4	1	13
The Amount,		15	0	21

Proof

Proof of ADDITION.

To prove Addition, add your Numbers downwards, contrary to the common Way, carrying as uſual, which will prevent Miſtakes; if both Ways agree, you are right, otherways not.

The foregoing Examples I hope will be ſufficient to perfect the young Learner in Addition of Land Meaſure: Otherwiſe, if he chuſes to try more Examples, he may ſet himſelf ſome Queſtions herein, after the ſame Manner, and in like Form with the preceding, until he is perfect in the ſame.

SUBTRACTION.

BY SUBTRACTION the Difference of any two Numbers is diſcovered; the leſſer being placed under the greater, and taken therefrom, the Difference will appear.

SUBTRACTION of INTEGERS.

Take Care to place Units under Units, Tens under Tens, &c. and in caſe of Want in Subtraction, borrow 10, and for every 10 ſo borrowed, pay, or carry 1 to the next Place.

Example.

	Acres.
From	7969
Take	2797
	5172

To work this Example, begin with the Units, and ſay, 7 from 9 and there remains 2, ſet down 2, then 9 from 6 you cannot, and therefore muſt borrow 10, (as above directed) but 9 from 16 and there remains 7; ſet down 7 and carry 1; 1 to 7 is 8, 8 from 9 and there remains 1, which ſet down; and laſtly, 2 from 7 and there remains 5; ſet down 5, and the Difference is 5172.

From	7196	Alſo from	4790213
Take	2789	Take	2789674
	4407		2000539

SUB-

SUBTRACTION of MONEY.

I ſhall omit (as I have done in Addition) Subtraction of divers Denominations, (Money and ſuperficial Meaſurement only excepted) as nothing elſe have any Connection with the following Treatiſe.

Subtraction of Money differs very little from that of Integers; only obſerve to place your Numbers right; Pounds under Pounds, Shillings under Shillings, and Pence under Pence, &c. you muſt in caſe of Want in the Farthings, borrow 4 or 1 Penny, and in the Pence 12, or 1 Shilling, and in the Shillings borrow 20, or 1 Pound; always remembering to pay what you borrow in the next Place, by calling the lower Figure one more than it is.

Note, In Subtraction of Pounds, Shillings, and Pence, proceed as directed in whole Numbers; or when the Subtrahends are leſs than your uppermoſt Number, add in your Mind 4 to Farthings, 12 to the Pence, and 20 to the Shillings; and then ſubtract, but remember to carry 1 from the Farthings to the Pence, from the Pence to Shillings, and from the Shillings to the Pounds.

Otherwiſe you may perform your Subtractions thus,

Example,

	l.	*s.*	*d.*
Lent,	32	2	$3\frac{1}{2}$
Receiv'd	17	13	$7\frac{1}{2}$
Remains unpaid,	14	8	$7\frac{1}{2}$

Begin with the Farthings, and ſay, 3 from 1 I cannot, but 3 from 4 and 1 remains; 1 and 1 is 2, ſet down 2 or $\frac{1}{2}$, then go to the Pence, and ſay, 1 that I borrowed and 7 is 8, from 3 I cannot, but 8 from 12 and 4 remains, 4 and 3 is 7, which ſet down, and carrying 1 to 13 makes 14; 14 from 2 I cannot, but 14 from 20 and 6 remains, 6 and 2 is 8, ſet down 8 and carry 1 to the Pounds, ſaying, 1 and 7 is 8 from 2 I cannot, but 8 from 12 and 4 remains, ſet down 4 and carry 1 to 1 is 2 from 3 and 1 remains; ſo that the Sum remaining is 14*l.* 8*s.* 7*d.*$\frac{1}{2}$ as appears above.

More Examples,

	l.	*s.*	*d.*
From	967	17	9
Take	273	14	$8\frac{1}{2}$
Remains	694	3	$0\frac{1}{2}$

	l.	*s.*	*d.*
From	742	10	0
Take	278	16	2
Remains	463	13	10

	l.	*s.*	*d.*
Lent	2762	16	3
Receiv'd	1796	19	7
Remains	965	16	8

	l.	*s.*	*d.*
Lent	2700	0	0
Receiv'd	1476	18	6
Remains	1223	1	6

	l.	*s.*	*d.*
Borrowed,	27	6	9
	67	16	11
	27	14	8
Sum borrowed	122	17	4
Paid in Part,	100	0	0
Remains unpaid,	22	17	0
Proof,	100	0	0

	l.	*s.*	*d.*
Borrowed,	73	16	8
Paid in Part,	27	19	$7\frac{1}{2}$
Remains,	45	17	$0\frac{1}{2}$
Proof,	73	16	8

SUBTRACTION of LAND MEASURE.

In Subtraction of Land Meaſure, in caſe of Want in the Perches, borrow 10 in the Units Place, and 4 in the Tens Place, and in caſe of Want in the Roods, borrow 4, or 1 Acre; and then proceed as you were directed in Integers: Be careful to place (as in Addition) your Figures properly, that is to ſay, Acres under Acres, Roods under Roods, and Perches under Perches.

Note, In Subtraction of Acres, Roods, and Perches, you may either ſuppoſe, or add in your Mind, 4 to the Roods, 40 to Perches, (if the under Numbers or fractional Parts be greater)

and

and then ſubtract as you did in Pounds, Shillings, &c. otherwiſe you may proceed as follows.

Example.

	A.	R.	P.
From	36	3	31
Take	17	1	38
Remains	19	1	33

Begin with the Perches, and ſay. 8 from 1 I cannot, but 8 from 11 and 3 remains; ſet down 3 and carry 1; 1 to 3 is 4; 4 from 3 I cannot, but 4 from 4 and nought remains; ſet down 3 and carry 1 to the Roods, and ſay, 1 and 1 is 2, from 3, and 1 remains, which I ſet down and go to the Acres, and work as you were taught in Subtraction of Integers; there will remain 19 1 33.

Other Examples for Practice.

	A.	R.	P.		A.	R.	P.		A.	R.	P.
From	7	1	13	From	60	0	0	From	2	0	24
Take	3	0	17	Take	17	1	33	Take	1	1	18
Remains	4	0	36	Remains	42	2	7	Remains	0	3	6

Proof of Subtraction.

To prove Subtraction you muſt add the Difference of your Numbers to the leſſer Number; and if the Sum be equal to the Number from which you did ſubtract, your Work is right, elſe not.

More Examples.

	A.	R.	P.		A.	R.	P.
From	71	1	31	From	62	0	10
Take	27	2	14	Take	14	1	16
Remains	43	3	17	Remains	47	2	34
Proof	71	1	31	Proof	62	0	10

The Proof the above Examples is ſo exceeding eaſy, that any farther Explanation, I think, would be quite unneceſſary.

MULTIPLICATION.

BY Multiplication, one Number is increaſed or multiplied by another, at oft as there are Units in either of the Numbers; and all thoſe that would be Land Meaſurers, ought to be exceeding perfect therein; ſince little or nothing can be performed in ſurveying without the Aſſiſtance of this moſt uſeful Rule.

In Multiplication are three Numbers to be particularly Noticed.

Firſt, The Multiplicand, or Number to be multiplied.
Secondly, The Multiplier or Number which we multiply by.
Thirdly, The Product or Number proceeding or produced from both.

In MULTIPLICATION *it holds,*

As 1: Multiplier: : Multiplicand to the Product.

But e're any Progreſs can be made herein, the Learner muſt be perfectly acquainted with the following Table.

MULTIPLICATION TABLE.

3 Times	3	is	9	5 Times	5	is	25
	4	—	12		6	—	30
	5	—	15		7	—	35
	6	—	18		8	—	40
	7	—	21		9	—	45
	8	—	24				
	9	—	27	6 Times	6	—	36
4 Times	4	—	16		7	—	42
	5	—	20		8	—	48
	6	—	24		9	—	54
	7	—	28	7 Times	7	—	49
	8	—	32		8	—	56
	9	—	36		9	—	63
				8 Times	8	—	64
					9	—	72
				9 Times	9	—	81

To read the above Table, you muſt begin at the Top, *i. e.*

at

at the Figures 3 and 3, saying, 3 times 3 is 9; secondly, 3 times 4 is 12, &c. next, 4 times 4 is 16, &c. &c. and lastly, 9 times 9 is 81.

The foregoing Table contains the Multiplication of the nine Digits, which is sufficient for our Purpose.

Note, When any Number is given to be multiplied by another, set down the greater Number uppermost, which is call'd the Multiplicand; and under that the Multiplier, in the same Order as in Addition, &c. viz. Units under Units, and Tens, &c. then draw a Line under the Numbers, and begin at the Right Hand, and multiply every particular Figure of the Multiplicand, by every Figure severally in the Multiplier.

Example I.

How much is 6 times 369?

369 Multiplicand,
6 Multiplier,

2214 Product.

Here I say, 6 times 9 is 54; I set down the 4, and carry 5 to the next Place, saying, 6 times 6 is 36, and 5 that I carry is 41, the 1 I set down and carry 4; and lastly, 6 times 3 is 18, and 4 makes 22, which, as it is the last, I set down 22, and the Work is done. So that you see in the Example, that 6 Times 369 is 2214.

More Examples in Multiplication.

Multiply	373	Also,	96734	Also,	7967009	
By -	9	By -	8	By	7	
	3357		773872		55769063	Product.

When the Multiplier consists of more Figures than one, then there must be as many several Products as there are Figures in the Multiplier; being placed in Order under each other, and added together, the Total is the Product required; but always observe to place the first directly under the Figure you multiply by, and in so doing, you move one Place towards the Left Hand in every several Product, though there were ever so many Figures.

Example,

Example.

How much is 32 times 761?

761
32
1522
2283
24352

The Numbers being placed in Order, as above, having drawn a Line under them, begin with the firſt Figure in the Multiplier, namely 2, ſaying, 2 times, or twice 1 is 2, which place under 2; then twice 6 is 12, ſet down 2 and carry 1, and twice 7 is 14, and 1 is 15, which ſet down, you have done with the Figure 2; then proceed to the ſecond Figure in the Multiplier, viz. 3, and multiply all the Figures in the Multiplicand by it alſo; ſaying, 3 times one is 3, which ſet down under the Figure 3 directly, being one Place to the Left Hand; then 3 times 6 is 18, ſet down 8 and carry 1, and 3 times 7 is 21, and 1 is 22, which alſo ſet down, then you have done with this Figure alſo; laſtly, draw a Line under thoſe two Products, then add them together, and their Sum is 24352.

More Examples.

Multiply	708967	Alſo,	73896
By —	697	By	7064
	4962769		295584
	6380703		443376
	4253802		5172720
Anſwer,	494149999		522001344

As I do not intend to write a Treatiſe upon Arithmetic in this Book, ſince the Size thereof will not admit of it, am therefore obliged to be as brief as poſſible in each Rule, until I come to the Branch propoſed, wherein I ſhall be very particular; however, as Multiplication is in general the moſt uſeful Rule, not only in Arithmetic as well as in many Branches of the Mathematics, but

but more particularly in this new Method of Surveying; I ſhall therefore dwell ſomething longer thereon than I intended, as it behoves every Learner to be exceeding ready therein; and that he may be certain his Work is right, let him be careful to obſerve the following Directions.

To prove Multiplication.

1. The Method generally uſed in Schools is performed by the Croſs, which every one that hath any Knowledge in Figures will readily grant to be no ways infallible or correct; ſo that I would not recommend it here; however, I can aſſure the young Learner, that if any Sum be right, it will appear ſo by the Croſs. Notwithſtanding, it makes a Sum often right that is abſolutely falſe; which is owing to the Figure 9 being call'd Nought or Cypher, when the Nines are caſt out of the Multiplicand, &c. ſo that it is not to be relied on for a certain Proof: An Example herein is quite unneceſſary.

2. The moſt ſure Way of proving Multiplication is by Diviſion, viz. the Product divided by the Multiplier quotes the Multiplicand; but we are not come to that yet.

3dly. There is another Way very correct, but rather too tedious, namely, the Multiplier being multiplied by the Multiplicand, if the Product be the ſame Figures as before, it is right, otherways not.

Example.

Let it be required to multiply 736 by 72 both Ways.

736		72	
72		736	
1472		432	
5152		216	
		504	
52992	Product.	52992	Product as before.

The Learner may perceive by the foregoing Example, that this Way of proving Multiplication is very perfect or juſt; but as I think it too troubleſome as well as prolix, I ſhall here ſhew him another leſs tedious Method, that will anſwer the ſame End: When the Multiplier and Multiplicand conſiſt of more Figures each than

than one, let him caſt the Nines out of the Multiplicand, and ſet down the Remainder apart, and multiply it by the firſt Figure in the Multiplier (that ſtands in the Units Place) caſt the Nines out of the Product, and ſet apart the Remainder; then caſt the Nines out of the firſt Line in the Products, and ſee if the Remainder agree with the former; if not, it is moſt certainly wrong: Perhaps you'll ſay, though it did agree it may notwithſtanding be ſtill wrong; I'll grant it, but if ſo, that will appear when the Nines are caſt out of the Sum of all the Products collected at the Bottom; you muſt proceed in like Manner with the ſecond Line in the Products, caſting the Nines out as before, and alſo multiplying the Figure remaining in the Multiplicand (firſt ſet apart) by the ſecond Figure in the Multiplier, and when the Nines are caſt out of the ſecond Line of the Products, the Remainder muſt agree as before, otherways it is alſo wrong. Thus you muſt proceed with every Figure in the Multiplier reſpectively, and if there be Errors committed in the Multiplication, this Method will undoubtedly diſcover it; but be careful in adding your Numbers together, and you may depend upon the Reſult to be right. A few Examples will render it eaſy.

Examples.

remains.

Multiply 7367———5 Again, 5 Again, 5
By 384 by 4 By 8 3

29468—2 20—9's =2 40—9's =4 15—9's =6
58936—4
22101—6

2828928

When the Nines are caſt out of the Multiplicand, there remains ——— 5 and when they are caſt out of the Multiplier there remains 6

30—the 9's =3

The Nines caſt out, there remains 3, which proves the Work.

To

To prove the foregoing Example, caſt the Nines out of the Multiplicand thus, 7 and 3 is 10, all above 9 is 1, otherwiſe ſay 7 and 3 is 10, 1 and 6 is 7, and 7 is 14; ſet down 5 apart, and multiply it by the firſt Figure in the Multiplier, namely, 4; ſaying 4 times 5 is 20; the Nines caſt out reſts 2: then caſt the Nines out of the firſt Line in the Products, viz. 29468, ſaying, 2 and 4 is 6, and 6 is 12, 3 and 8 is 11, all above 9 is 2, which agrees with the former.

Secondly, multiply the ſecond Figure in the Multiplier, viz. 8 by 5 = 40, or 4 when the Nines are caſt out, and caſt the Nines out of the ſecond Line in the Products, viz. 58936, ſaying, 5 and 8 is 13, 4 and 3 is 7, and 6 is 13, 4 which alſo agrees with the former.

Thirdly, multiply the third Figure in the Multiplier by the ſame 5 which remained, when the Nines were caſt out of the Multiplicand, and ſaying, 3 times 5 is 15, 6; then caſt the Nines out of the third Line in the Products, viz. 22101, ſaying, 2 and 2 is 4, and 1 is 5, and 1 is 6, which likewiſe agrees with the former 6.

Laſtly, caſt the Nines out of the Multiplier 384, and there remains 6, which multiply by the ſame 5, and caſting the Nines out of their Product, viz. 30, there remains 3; then caſt the Nines out of the Products collected at the Bottom, and there alſo remains 3, which proves the Work.

When the Learner is ready in this Way of proving his Multiplications, he may do it as faſt almoſt as Thought, with as much Correctneſs as if he made uſe of Diviſion; there will be no Occaſion to ſet down any Figure, except the Figure that remained when the Nines were caſt out of the Multiplicand; and then proceed, as is directed in the following Examples:

Multiply 3246—the Nines, 6 remains.
By 234—ditto———0 ditto.

0

12984—6 right.
9738 ditto See the Remainders ſumm'd
6492——3 ditto. up make 9, nothing.

759564 0 ditto.

More Examples.

Multiply	71362—1	Alſo	9007—7	7.
	2876—5	By	1030—4	4
	428172		270210 right.	28—1
	499534		90070 ditto.	
	570896			
	142724		9277210 ditto—1	
	205237112 ditto.			

The Learner may ſee by the foregoing Examples, that a Daſh or Point with a Pen may do as well as Figures; and if he finds that any Line in the Products diſagree with the foregoing Directions, he muſt ſtrictly examine the ſame until he diſcovers the Miſtake.

Note, If you were to caſt the Nines out of any Numbers, as 38 or 76, &c. you muſt not ſay how often 9 in 38, or in 76, but ſay, 3 and 8 is 11,—2; or 7 and 6 is 13,—4.

Note alſo, When the Nines are caſt out of the Multiplicand, or out of the Multiplier, and nought ſhould remain in either, conſequently there will remain nothing when the Nines are caſt out of the Product; alſo for this ſufficient Reaſon: If you multiply nothing by ſomething, or ſomething by nothing, the Product of Courſe muſt be nothing alſo.

And laſtly, I ſhall ſhew by Multiplication a ready Way of anſwering numberleſs Queſtions, that frequently occur in Surveying, &c. When the Price of a Perch, Rood, or Acre, is given, by this Rule you may know how to find the Value of many ſuch Things at that Rate; which ſhews that Queſtions in the Rule of Three may be performed in a much more conciſe Manner, and by ſuch eaſy Rules and Directions, that any one who underſtands Addition of Money, may as readily caſt up by this Way, as work a Sum of Pounds, Shillings, and Pence; for there is nothing more required here, than to carry from one Demonination to the next; it may therefore be truly affirm'd, that this Rule performs the Work of many Additions.

Example,

Example.

What would 5 Perches of Potatoe Ground come to, at 1*s.* 3*d.* per Perch?——See the Work:

s.	*d.*
1	3
	5
6	3

The Rule. Multiply the Price by the Quantity, and the Product is the Anſwer.

In the above Queſtion ſay, 5 times 3 is 15, that is 15 Pence, or 1*s.* 3*d.* ſet down 3 Pence, and carry 1 to the next, ſaying, 5 times 1 is 5, and 1 you carry is 6, ſet down 6 alſo, which makes 6*s.* 3*d.* the Anſwer.

More Examples.

What does 9 Perches come to at 1*s.* 10*d.* Alſo 8 Perches at 2*s.* 2$d\frac{1}{2}$?

See the Work.

s.	*d.*
1	10
	9
Anſwer, 16	6

See the Work.

s.	*d.*
2	$2\frac{1}{2}$
	8
Anſwer, 17	8

What does 10 Perches at 1*s.* 1$d\frac{1}{2}$? And alſo 7 of any Thing elſe, at 3*s.* 11*d.* each?

s.	*d.*
1	$1\frac{1}{2}$
	10
Anſwer, 11	3

l.	*s.*	*d.*
0	3	11
		7
Anſwer, 1	7	5

If 1 Acre is let for 1*l.* 2*s.* 6*d.* what will 5 Acres amount to at that Rate.

l.	*s.*	*d.*
1	2	6
		5
Anſwer, 5	12	6

If 1 Acre of Land be ſet for 18*s.* 4*d.* What will 8 Acres come to at that Rate?

Here ſet down the Figures in Order, as before, and ſay, 8 times 4 is 32 Pence, or 2*s.* 8*d.* ſet down the 8 and carry 2 to the next Place, namely, the Shillings, ſaying, 8 times 8 is 64, and 2 makes 66; ſet down 6 and carry 6 for the 60, or 6 Tens, and ſay, 8 times 1 is 8, and 6 is 14, that is 14 Tens or Angels; then take the half of 14 (becauſe 2 Angels make 1 Pound) viz. 7, and ſet it down in the Pounds Place.

l.	*s.*	*d.*
0	18	4
		8
7	6	8

But if the Sum of the Angels had been an odd Number, as ſuppoſe 15, then you muſt take half as before, and ſet down the odd 1, ſaying the half of 15 is 7, which ſet in the Place of Pounds, and the odd Angel or 10 Shillings, ſet in the Place of Shillings, ſo that inſtead of 7*l.* 6*s.* 8*d.* it would become 7*l.* 16*s.* 8*d.*

If 1 Acre of Land be ſet for 1*l.* 13*s.* 8*d.* What will 12 Acres amount to at that Rate?

l.	*s.*	*d.*
1	13	8
		12
Anſwer, 20	4	0

If 1 Acre of Land coſts 36*l.* 17*s.* 2*d.* What will 8 Acres coſt at the ſame Rate?

36	17	2
		8
Anſwer, 294	17	4

Here Note, That when the given Quantity exceeds 12, you muſt find what two Numbers, multiplied by each other, will make the ſame, and then multiply the Rate by one of thoſe Numbers, and that Product by the other, and the laſt Number is the Anſwer.

Example,

Example.

What will 24 Poles of Land come to, at 2*s.* 5*d.* per Pole?

See the Work both Ways,

	l.	*s.*	*d.*		*l.*	*s.*	*d*
	0	2	5	Or thus,	0	2	5
3 times 8 or 4 times 6 is 24.			3				4
	0	7	3		0	9	8
			8				6
Anſwer,	2	18	0	Anſwer,	2	18	0

If 1 Acre of Land be let for 19*s.* 8*d.* What will 42½ Acres come to at that Rate?

In this Example 6 times 7 is 42, which Numbers being ſeverally multiplied by 19*s.* 8*d.* viz. firſt by 6, the Product is 5*l.* 18*s.* which being multiplied by 7, the Product is 41*l.* 6*s.* to which add, 9*s.* 10*d.* the Value of half an Acre, and the Sum gives the Anſwer, viz. 41*l.* 15*s.* 10*d.*

	l.	*s.*	*d.*
	0	19	8
6 times 7 is 42			6
	5	18	0
			7
	41	6	0
Half an Acre comes to	0	9	10
Anſwer,	41	15	10

If 1 Acre of Land ſet for 21*s.* 6*d.* what will 24 Acres, 2 Roods, and 20 Perches come to?

In this Example put down 21*s.* 6*d.* thus, 1*l.* 1*s.* 6*d.* and multiply it by 4, and that Product by 6, becauſe 6 times 4 is 24, equal to the Number of Acres propoſed.

	l.	*s.*	*d.*
	1	1	6
			4
	4	6	0
			6
	25	16	0
Half an Acre,	0	10	9
20 Perches,	0	2	8¼
Anſwer,	26	9	5¼

But

But there ſtill remains unvalued, 2 Roods, 20 Perches, which you may thus find:

Firſt, Two Roods being half an Acre, for which take the half of 21*s.* 6*d.* equal to 10*s.* 9*d.* and place it under 25*l.* 16*s.* as above.

Secondly, 20 Poles being the 4th Part of two Roods, take alſo the 4th Part of 10*s.* 9*d.* equal to 2*s.* 8*d.* ¼, which you muſt alſo place under 10*s.* 9*d.* then add your Numbers together, and their Sum makes 26*l.* 9*s.* 5*d.* ¼, the Value of 24 Acres, 2 Roods, and 20 Perches.

Note, By the Help of the Golden Rule you may find the Value of any Number of Perches or Roods, when the Value of an Acre be given, &c. which ſee.

DIVISION.

FIRST, Diviſion is a Rule, by which we diſcover how often one Number is contain'd in another; as if it were aſked how often 6 is contain'd in 24, the Anſwer would be 4 Times.

Secondly, This Rule conſiſts of four Parts, three certain, and one uncertain, viz.

1. The Dividend, or Number to be divided.
2. The Diviſor, or Number given to divide by.
3. The Quotient, or Number ariſing from the two former, which ſhews how often the Diviſor is contained in the Dividend.
4. The Remainder (after the Work is done) is always of the ſame Quality with the Dividend, and muſt be leſs than the Diviſor, elſe the Work is wrong.

Thirdly, Diviſion is either ſingle or compound; ſingle when the Diviſor conſiſts of 1 Figure only, and the Dividend of two or more; this Kind is performed by the Multiplication Table; as

as if 48 was to be divided by 6, the Anſwer would be 8; here 48 is the Dividend; 6 the Diviſor; and 8 the Quotient.

Fourthly, Compound Diviſion is when both the Diviſor and Dividend conſiſt of more Places than one, as if 160 (the Perches in an Acre) were to be divided by 6, then 160 is the Dividend, 6 the Diviſor, and 10 the Quotient.

See the Work.

Diviſor, *Dividend*, *Quotient*,
6) 160 (10
16

0

A General RULE *to work Queſtions by*,

Obſerve well, { 1ſt. Seek, 2d. Multiply, 3d. Subtract.

You ſee that this Rule comprehends three of the foregoing, and is allowed to be the hardeſt of the five; however I ſhall endeavour to make it appear as eaſy as poſſible, by ſeveral Examples.

Example I.

Divide 3489 by 4. Firſt, place your Numbers as in the laſt Example,

Thus, 4)3489(872
32 ··

28
28

··9
8

1 remains.

Here

Here ſeek how many Times 4, the Diviſor, is contained in 34, the firſt two Figures in the Dividend, (for you cannot get 4 in 3, the firſt Figure,) and you'll find it to be 8 times; place 8 in the Quotient, ſaying, 8 times 4 is 32, which being ſet under 34, ſubtract 32 there from 34, or 2 from 4 and there reſts 2. Secondly, bring down the next Figure in the Dividend, namely, 8, and place it to the right of the 2 remaining, which makes 28; then ſeek how many Times 4 in 28, anſwer 7, which place in the Quotient, and ſay, 7 times 4 is 28, ſet down 28 under 28, and then ſubtract as before, ſaying, 8 from 8 and nought remains, 2 from 2 nothing alſo remains, for which make two Points. Laſtly, bring down the 3d or laſt Figure in the Dividend, and ſeek how often the Diviſor 4 in 9, the Anſwer is 2, which ſet down in the Quotient, ſaying, twice 4 is 8, which being ſet under 9, ſubtract 8 from 9, there remains 1, and the Work is done, as appears by the Example; wherein you find that 4 is contain'd in 3489 juſt 872 Times, and only 1 remaining.

Example II.

Let it be required to divide 8467 Acres of Land among 7 Men equally.

See the Work.

7)8463(1209 Anſwer. Each Man muſt have 1209 Acres.

7 ···

14
14

·63
·63

0

Proof —— 1209 × 7 = 8463

Note, There is another Method of dividing by a ſingle Figure, commonly called, *Short Diviſion*; which is much readier, and performs the Work with leſs Trouble than the above: For Inſtance,

Suppoſe

Suppoſe the preceding Example was to be performed by this Method, the Figures being placed as before, *viz.*

7)8463

1209 Anſwer.

Here ſee how often 7 in 8, and you'll find it 1, which ſet down, and ſay 7 from 8 and 1 remains, which is 10 in the next Place, and 4 makes 14, how oft 7 in 14, two Times, which alſo ſet down, ſaying 14 from 14, and there remains Nothing; then proceed to the next Figure in the Dividend, *viz* 6, and ſay how oft 7 in 6, nought Times, ſet down 0 and carry 6, which, in the next Place, is 60, and 3 makes 63; and then ſay, how oft 7 in 63, 9 Times, which being placed, ſay 9 Times 7 is 63; 63 from 63, and there remains Nothing; thus the Work is done with leſs Figures than before.

Note, When any Number of Figures are to be divided by a ſingle Figure, as above, always remember, that every 1 remaining is 10 in the next Place.

Example III.

Divide 16344 by 9

See the Work.

9)16344

1816 Anſwer.

Example IV.

8)71964

Anſwer 8995——4 remains.

To prove Diviſion.

Diviſion is commonly proved by Multiplication, *viz.* The Quotient being multiplied by the Diviſor, the Product is the Dividend if it be right: But obſerve, when there is a Remainder, you muſt take it in, or add it to the Product.

Example V.

4)169674267426

Anſwer 42418566856 — 2 remains.
4 Diviſor.

Proof 169674267426

Example VI.

5)6496747673

Anſwer 1299349534 — 3 remains.
5 the Diviſor.

Proof 6496747673

When the Diviſor conſiſts of ſeveral Figures, then ariſes all the Difficulty that there is in Diviſion. I could wiſh that the Size of this Book would permit me to remove every trifling Obſtacle that may occur in the Work of Diviſion; notwithſtanding I ſhall be particular in giving or ſhewing plain and eaſy Directions, in a little Compaſs, ſufficient to comprehend or ſurmount all ſeeming Difficulties.

Example VII.

Let it be required to divide 769420 by 365.

See the following Work.

Having placed your Numbers as in the Work, make a Point under the 9, the third Figure in the Dividend, becauſe you cannot get 365 in the firſt or ſecond Figures thereof.

365)769420(2108
....
730
394
365
2920
2920

Then

Then ſee how oft the firſt Figure in your Diviſor is contained in 7, the firſt Figure in the Dividend; the Anſwer is two Times; then put 2 in the Quotient, and multiplying the Diviſor thereby, the Product is 730, which place under 769, then ſubtract, and the Remainder is 39; point and bring down the next Figure (of your Dividend) 4, then ſay how oft 3 in 3, that is to ſay, how oft 365 in the new Dividend, *viz.* 394, Anſwer once; place 1 in the Quotient, and multiply your Diviſor thereby, ſaying, once 5 is 5, once 6 is 6, and once 3 is 3, which you muſt place under 394, and ſubtract as before, *viz* 365 from 394, and there remains 29, to which point and bring down your next Figure in the Dividend, to wit, 2, and ſee how oft your Diviſor 365 in 292, or how oft 3 in 2, Anſwer 0 Times; then, to this new Dividend, as it is leſs than the Diviſor, you muſt bring down another Figure of your Dividend, namely the laſt, to wit, 0, ſaying how oft 365 in 2920, or how oft 3, the firſt Figure, in 29, the two firſt Figures in the new Dividend, the Anſwer will be 9, becauſe 9 Times 3 is 27, but then 9 Times 365 is 3285, which you cannot take from 2920, therefore you muſt try a leſs Figure. Suppoſe 8 before you proceed further, multiply (in your Mind) the ſecond Figure in your Diviſor by 8, or any other likely Figure, and by ſo doing you will find how many you will have to carry to the firſt Figure in the Diviſor; thus, 8 Times 6 is 48, ſo that you can have no leſs than 4 to carry to the next or firſt Figure; then 8 Times 3 is 24, and 4 makes 28, which is leſs than 29, therefore you will get it 8 Times, which you place in your Quotient, then multiply the Diviſor by this laſt Figure, namely 8, and the Product is 2920, which place under 2920, ſubtract as before and there reſts 0, and your Work is finiſhed, ſo that your Quotient is found to be 2108. This Queſtion is the ſame as if one ſhould ask in 769420 Days, how many Years?

Example VIII.

Let it be required to divide 1769479241 by 6789.

See the Work.

6789)176947241(25916

13578

40167
33945

62222
61101

11214
6789

44251
40734

3517

The Manner of working this Example being the ſame as the laſt, I ſhall omit the Explication thereof; for the Operation by two or three Figures, being well underſtood, the Work in any other will be eaſy. In this Example, after the Diviſion is finiſhed, you ſee there is a Remainder of 3517, which is the Numerator of a Fraction, and the Diviſor is a Denominator thereunto, ſo that the right or exact Quotient is 25916 $\frac{3517}{6789}$, but as we ſhall have no Manner of Occaſion for Vulgar Fractions in this Treatiſe, I ſhall therefore forbear ſaying any thing concerning the Value thereof.

Note, That after any Subtraction, the Remainder muſt always be leſs than the Diviſor, otherways the Work is moſt certainly wrong, as already obſerved, and muſt be rectified (before you can proceed farther) by increaſing the laſt-found Figure in the Quotient until the Remainder be leſs.

Note alſo, You muſt never bring down, from the Dividend, more than one Figure at a Time, and for every Figure ſo brought down, you muſt place or put a Figure or Cypher in the Quotient.

Of

Of Contractions in Diviſion.

Firſt, When your Diviſor is an Unit with any Number of Cyphers annexed, ſeparate or cut from your Dividend the ſame Number of Places to the Right-hand, the Remainder will be the Quotient, and thoſe cut off will be a Decimal Fraction; ſo if 46769 Acres were to be divided equally amongſt ten Men, every Man's Share would be 4676 Acres and nine Tenths of an Acre: if among 100 Men, every Man's Part would be 467 Acres and the ſixty-ninth Part of an Acre, which Fraction is equal to 2 Roods, 30 Perches and nearly a Half.

Secondly, When your Dividend and Diviſor alſo conſiſts of Cyphers to the Right hand, cut off an equal Number thereof from each, and proceed with the Remainder according to the Rules before given; ſo if 636000 were to be divided by 4000, cut off three Cyphers in each, $\frac{1}{4}$ Part of the Remainder, to wit, 159, is the Quotient ſought.

Thirdly, If your Diviſor has Cyphers annexed, and your Dividend none, cut off as many Figures from your Dividend as there are Cyphers in your Diviſors; with the Remainder proceed as before.

As if 46498 were to be divided by 800, the Quotient would be 58. $\frac{28}{800}$.

See the Work.

800)46498

58 $\frac{28}{800}$

I might, in this Place, amuſe the Learner with ſundry other Remarks in Contractions, but I can aſſure him that thoſe already delivered, are ſufficiently edifying for our Purpoſe.

REDUCTION.

REDUCTION.

REDUCTION is intirely performed by Multiplication and Diviſion, and teaches how to change Numbers of one Denomination to another without the leaſt Alteration of Value,

And conſiſts of two Parts, *viz.* aſcending and deſcending.

Firſt, Reduction deſcending is performed by Multiplication, as if it were required to reduce or bring Pounds into Shillings or Pence, *&c.*

Secondly, Reduction aſcending, is performed by Diviſion, and brings Farthings to Pence, Shillings to Pounds, *&c.* alſo Perches to Roods or Acres.

Of theſe in their Order.

Queſtion I.

In 10 l. how many Shillings, Pence and Farthings?

£.	
10	
20	Shillings make a Pound.
200	Shillings — Anſwer.
12	Pence in a Shilling.
2400	Pence — Anſwer.
4	Farthings make one Penny.
9600	Farthings — Anſwer.

In the above Queſtion it is required to bring Pounds into Shillings, Pence, and Farthings, accordingly it is performed by Reduction deſcending, or Multiplication. So that you multiply 10 l. by 20, the Shillings in a Pound, and the Product is the Shillings in 10 l. Then multiply thoſe Shillings by 12, the Pence in 1 Shilling, and the Product is the Pence in 10 l. and laſtly, multiply

multiply thoſe by 4. the Farthings in a Penny, and the Product is the Farthings in 10 l. and the Anſwer to the Queſtion, as may be ſeen by the preceding Work.

By the above Method, all Kinds of Reduction deſcending is performed, that is, from great Denominations to leſſer, whether it be Money, Weight, or Meaſure.

Queſtion II.

In 96 l. 17 s. 6 d. how many Pence?

See the Work.

l.	s.	d.
96	17	6
20		
1937		
12		

Anſwer 23250 Pence.

In the foregoing Queſtion multiply 96, the given Pounds, by 20, in order to bring them into Shillings, and then take in the 17 Shillings, which makes 1937 Shillings, which multiply by 12, and take in the 6, and the Product is 23250, which is the Pence in 96 l. 17 s. 6 d. and the Anſwer to the Queſtion.

Queſtion III.

In 841 Acres of Land, how many Perches? Anſ. 134560.

See the Work.

841
4 Roods in an Acre.
3364 Roods in 841 Acres.
40

Anſwer 134560 Perches.

Queſtion

Queſtion IV.

A. R. P.
In 145 3 17, how many Perches? Anſwer 23337.

See the Work.

A. R P.
145 3 17
4
583
40

Anſwer 23337 Perches.

The two laſt Queſtions are ſo exceeding eaſy, that I think any other Explications are quite unneceſſary, ſince all ſuch Queſtions are reduced in like Manner.

REDUCTION Aſcending.

Reduction aſcending, is when a leſſer Denomination is brought into a greater; as Farthings to Pounds, Perches to Acres, *&c.* as before-mentioned.

Queſtion I.

In 134560 Perches, how many Acres?

See the Work.

40)134560
4) 3364

Anſwer 841 Acres.

In this Queſtion you divide 134560 Perches by 40, becauſe 40 Perches make 1 Rood; and the Quotient is 3364, which divide by 4, becauſe 4 Roods make 1 Acre, and the Quotient is 841 Acres, the Anſwer to the Queſtion.

Queſtion

Queſtion II.

In 23337 Perches, how many Acres?

See the Work.

4|0)2333|7

4)583 17

Anſwer 145 3 17 Acres, Roods and Perches.

Queſtion III.

In 9600 Farthings, how many Pounds?

See the Work.

4)9600

12)2400

2|0) 20|0

Anſwer 10 Pounds.

Queſtion IV.

In 23250 Pence, how many Shillings and Pounds?

See the Work.

12)23250

2|0)193|7 6 Shillings, Anſwer.

Anſwer 96 17 6

Queſtion V.

In 9476942 Halfpence, how many Pounds?

See the Work.

2)9476942

12)4738471

2|0)394871|2 7

Anſwer 19743l. 12s. 7d.

Let it be required to prove the above Queſtion.

19743l. 12s. 7d.
20

394872
12

4738471
2

Proof 9476942 as appears above.

Note, By the laſt Operation, the Learner may ſee, that to prove the Work in aſcending, he muſt uſe Multiplication, that is, multiply by what he divided by; and in Queſtions deſcending, divide by what he multiplied by, and it will prove the Work if right.

A. R. P.

In 96 1 17 Statue Meaſure, how many Acres of Cheſhire, and alſo Plantation Meaſure?

64 Square Yards in 1 Cheſhire Pole, and 49 Square Yards in 1 Plantation Pole, as obſerved in the Introduction.

96 1 17
4

385
40

15417 Poles.
30.25 Square Yards in a Pole.

77085
30834
46251

466364.25 Square Yards.

49)466364.25
441...

253
245

86
49

374
343

312
294

18

40)95176

4)237 37½

59 1 37½

```
64)466364.25     40)
   448           (72816.95
   ---           --------
    183          4)1826.95
    128          ---------
    ---            45 2 6¾ Anſwer, Cheſhire Meaſure.
     556
     512
     ---
      444
      384
      ---
       602
       566
       ---
        365
        320
        ---
         45
```

Anſwer 96 1 17 Statute Meaſure, is equal

to { 45 2 6¾ Cheſhire, / 59 1 37½ Plantation } Meaſure.

Note, The Learner may paſs over the above Queſtion until he learns Multiplication of Decimals.

The GOLDEN RULE.

IT is commonly called the *Rule of Three*, becauſe there are always three Numbers given to find a fourth, which muſt bear ſuch Proportion to the third, as the ſecond does to the firſt.

The greateſt Difficulty lies in ſtating the Queſtion, but that you may do by obſerving the following Rule:

The

The Golden Rule hath always Numbers three,
First and third muſt in their Names agree;
The Middle Number hath another Name,
Like the Demand muſt ever be the ſame:
Two of thoſe Numbers, when multiplied true,
The third divides, and quotes the Anſwer too.

Queſtion I.

If 3 Acres of Land coſt 42s. per Ann. what will 24 Acres come to at that Rates?

A. S. A.
Thus ſtated: If 3 : 42 : 24

Here you ſee the firſt and third Numbers are Acres, and the middle Number Shillings. Now, to know whether the firſt or third Number muſt be the Diviſor, obſerve this Rule.

When the third Number requires more than the firſt, the leſs Extreme muſt be the Diviſor.

But when the third Number requires leſs, the greater Extreme muſt be the Diviſor.

Note, The firſt and third Numbers are called Extremes.

See the Work of the foregoing Queſtion.

A. S.
If 3 : 42 : : 24
24

168
84

3)1008
20)336 Shillings.

161. 16s. 0d. Anſwer.

Having ſtated the Queſtion as above, you may readily perceive, that the third Number requires more than the firſt; and conſequently the leſs Extreme muſt be the Diviſor; therefore multiply 42. the middle Number, by 24, the laſt Number, and the Product is 1008, which divide by the leſs Extreme, namely 3, and the Quotient is 338 Shillings, equal to 161. 16s. 0d. the Anſwer.

Queſtion

Queſtion II.

If 16 Perches of Potatoe Ground coſt 4s. 4d. what will 320 Perches come to at that Rate?

See the Work.

4s. 4d.
12
—
52 Pence.

P. D. P.
If 16 : 52 : 320
52
—
640
1600
—
16)16640(1040
16
—
64
64
—
0

Anſ. Pence which reduce to Pounds thus:
12)1040
—
20|)8|6 8
—
The Anſ. 4 6 8

Having ſtated the Queſtion as before, you'll find the fourth Number will exceed the ſecond; for it muſt be allowed, that 320 Perches, will get more, or coſt more than 16; Wherefore, multiply the ſecond, or Middle Number, by the greater of the two Extremes, *viz.* 320; then muſt the leſs Extreme, to wit, 16, be the Diviſor. So multiplying 320 by 52, the Product is 16640, which divide by 16, and the Quotient is 1040 Pence, the ſame Name with the middle Number, which reduce to Pounds, as above = 4l. 6s. 8d. The Anſwer.

Queſtion

Question III.

If 1 Acre of Land set for 14s. 6d. what will 36 A. 3 R. 17 P. come to at that Rate?

See the Work.

14s. 6d.
12
174 Pence.

P. D. P.
If 160 : 174 : 5897
174
23588
41279
5897
160)1026078
960...
660
640
207
160
478
320
158 Remainder.
4
632
480
152

A. R P.
36 3 17
4
147
40
5897 Perches.

2)6412¾
240)5314 4
26 14 4¾ Answer.

Question IV.

A. R. P. l. s. d.
If 36 3 17, set for 26 14 4, what is that an Acre?
4 20
147 534
40 12
5897 6412

Note,

Note, Before you can ſtate any ſuch like Queſtion as the foregoing, your Numbers muſt be reduced ſeverally to the loweſt Denomination, namely, Acres to Perches, and Pounds, *&c.* to Pence, as above.

See the Work.

P. D. P.
If 5897 : 6412 : 160
160

384720
6412

d. s. d.
5897)1025920(173 × 1 = 174 = 14 6
5897...

43622
41279

23430
17631

5739 Remainder.
158 Remainder in Queſtion III.

Add 5897)5897(1
5897

...

Theſe Queſtions are, by moſt Authors, eſteemed to be in the Rule of Three Direct, but as I have given a general Rule to find the Diviſor in all Caſes throughout the Golden Rule, I therefore think there is no Neceſſity to amuſe and confound the Learner with ſuch needleſs Diſtinctions between the Rule of Three Direct, and Inverſe. In the above Queſtion, ſay. If 5897 P. require 6412 Pence, how many Pence would 160 Perches require or get? It is reaſonable to conclude that 160, will get leſs than 5897, and conſequently, by the general Rule, the greater Extreme, *viz.* 5897 muſt be the Diviſor; ſo that you muſt multiply the middle Number by the leſs Extreme, divide by the greater, and the Anſwer is 4, as in the Work.

Queſtion

Queſtion V.

If 32 Yards of Cloth coſt 4 l. 2 s. 2 d. what would $4\frac{1}{2}$ Yards come to?

Firſt, Prepare your Numbers for the Station thus:

32 Yards.	l.	d.	d.	Yds.
2	4	2	2	$4\frac{1}{2}$
	20			2
64 half Yards.				
	82			9
	12			
	986			

Then, If 64 : 986 : : 9

64)8874(138 Pence = 11 s. 6 d. $\frac{42}{64}$ Anſ.

64 ··

247
192

554
512

42 remains.
4

168
128

40

The RULE of FELLOWSHIP.

THE Rule of Fellowſhip not only concerns Merchants and other Traders, but likewiſe is very uſeful for Land-holders, *&c.* When Commoning, or other Lands are to be divided amongſt a certain Number of Gentlemen or others, every one's Proportion thereof muſt be according to his Eſtate, Purchaſe, or Rent, and muſt be ſo divided by the Surveyor.

Fellowſhip is divided into two Parts, commonly called Single and Double; the latter we have no Occaſion for here.

Firſt, In ſingle Fellowſhip, having the Rent of a Parcel of Town-field Land, and each Man's reſpective Share therein, to know their Rents ſeverally, obſerve theſe general Rules.

Rule I.

Firſt, As the Contents of the Land (whether rented, purchaſed, *&c*) is to the whole Rent or Purchaſe, *&c.* So is each Man's appointed Share to his reſpective Rent or Purchaſe, *&c.*

Rule II.

Secondly, When Land is rented or purchaſed by two or more Perſons, each one paying a certain Sum, to know their reſpective Shares of the ſaid Land, obſerve,

As the whole Rent or Purchaſe is to the Contents of the Land, ſo is each Man's Rent, or Purchaſe, to his reſpective Share of the Land.

Queſtion I.

Two Men, A. and B. Rent a Farm containing 180 Acres, at 60 l. per Annum, of which A muſt pay 25 l. and B. 35 l. they are reſolved to divide the ſame according to their Rents, I demand each Man's Dividend, or Proportion.

See

See the Work.

	£.	£.	A.	£.
A's Rent	25	as 60	: 180	: : 25
B's ditto	35		25	
	60		900	
			360	
			610)45010	
			75	

	£.	A.	£.
As	60	: 180	: : 35
		35	
		900	
		540	
		610 63010	
		105	

Anſwer, A's Dividend is 75 Acres.
B's ditto — 105

Proof — 180

Queſtion II.

Three Graziers, *viz.* A, B, and C, rent an Eſtate containing 292 Acres, 3 Roods, 17 Perches, at 200 l. per Annum, of which A pays 60 l. B 65 l. and C 75 l. they have agreed that the Eſtate ſhall be divided in Proportion to their Rents, I demand each Man's Dividend or Proportion.

See the Work.

	£.
A's Rent	60
B's ditto	65
C's ditto	75
	200

£. P. £.
As 200 : 46857 : 60.
60

200)2811420(14057.1
200····

811
800

1142
1000

1420
1400

200
200

£. P. £.
As 200 : 46857 : : 65
65

234285
281142

200)3045705(15228.525
200····

1045
1000

457
400

570
400

1705
1600

105 remains, equal to .525 in decimal Fractions.

A. R. P.
292 : 3 : 17
4

1171
40

46857

£.	P.	£.
As 200	: 46857	: : 75

75

234285
327999

200)3514275(17571.375
200 ...

1514
1400

1142
1000

1427
1400

0275
200

75

		Perches.		A. R. P.
Answer,	A's Dividend	14057.1	=	87 3 17
	B's ditto —	15228.525	=	95 0 28
	C's ditto —	17571.375	=	109 3 11
	Proof	46857	=	292 4 16
	The Remainders come to			.1
			Proof	292 3 17

The Learner may see by the Work of the foregoing Question, that single Fellowship differs very little from the Single Rule of Three.

Note, In the above Question I have omitted the fractional Parts of a Perch in each Man's Quantity.

Question

Queſtion III.

Three Men, *viz.* Joſeph, John, and James, rent an Eſtate containing 360 Acres, at 240 l. per Annum, of which Joſeph holds 90, John 120, and James 150 Acres; each Man to pay Rent in Proportion to his Holding, I demand each Man's reſpective Rent?

See the Work.

	A.
Joſeph's Holding	90
John's ditto —	120
James's ditto —	150
	360

A. Rent. A.
As 360 : 240 : : 90
90

360)21600(60 l. Joſeph's Rent.
2160

...0

A. Rent. A.
As 360 : 240 : : 120
120

360)28800(80 l. John's Rent.
2880

...0

A. Rent. A.
As 360 : 240 : : 150
150

12000
2400

360)36000(100
360

...00

Anſwer, Joſeph's Rent is 60 l.
John's ditto — 80
James's ditto - 100

Proof 240

Decimal

Decimal ARITHMETIC.

NUMERATION.

A Decimal Fraction is ſuch, whoſe Denominator is not expreſſed but underſtood; and is an Unit with as many Cyphers annexed, as there are Places in the Numerator; ſo that $\frac{5}{10}$ will be expreſſed thus .5; alſo $\frac{1}{4}$ or $\frac{25}{100}$ thus .25, and $\frac{3}{4}$ or $\frac{75}{100}$ thus .75, *&c.* And in order to diſtinguiſh Decimals from Integers, or whole Numbers, they have always a Point (like a Period) prefixed before them.

Note 1, A Cypher placed to the Left-hand of an Integer, or to the Right-hand of a Decimal, neither increaſeth nor decreaſeth the Value thereof; but placed to the Right hand of an Integer, and to the Left-hand of a Decimal, it increaſeth and decreaſeth the ſame in a ten-fold Proportion; that is to ſay, it increaſeth the Integer, and decreaſeth the Decimal; which appears in the following Table:

Integers.		Decimals.
Five — —	5 . 5 —	Five Tenths
Fifty — —	50 . 05	Five of a Hundred
Five Hundred	500 . 005	Five of a Thouſand
Five Thouſand	5000 . 0005	Five of ten Thouſand.

By this Table you may perceive how a Cypher before a Decimal decreaſeth the Value, *&c.*

2. A Cypher before an Integer, and after a Decimal, is of no Value, ſince 03. Integers is but 3. and .30 in Decimals, is but .3 *&c.*

The

The TABLE.

9	8	7	6	5	4	3	2	1	.	1	2	3	4	5	6	7	8	9
Hundred of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.		Part of Ten.	Parts of 100	Parts of 1000	Parts of 10,000	Parts of 100,000	Parts of 1,000,000	Parts of 10,000,000	Parts of 100,000,000	Parts of 10,000,0000
Integers.									.	Decimals.								

By the Help of the above Table, the Learner may make himſelf acquainted with, and alſo know how to expreſs the Value of a decimal Fraction.

Example.

Suppoſe it were required to expreſs the decimal Fraction .02307, I begin to numerate as in whole Numbers, ſaying, Units, Tens, Hundreds, Thouſands, Tens of Thouſands, the next Riſe, or Step, would be Hundreds of Thouſands; and therefore the expreſs Value of the above Decimal is two Thouſand three Hundred and ſeven of a hundred Thouſand.

I ſhall (though contrary to moſt Authors) proceed in Decimals as in whole Numbers, being determined not to confound the Learner with unneceſſary Queſtions.

ADDITION in Decimals.

ADdition of Decimals is performed like Addition of whole Numbers, but be careful to place Units under Units, *&c.* and the Parts of Ten in the tenth's Place, the Parts of a Hundred in the hundredth's Place, *&c.*

Example

Example I. *and* II.

To .769, add .47367,

Your Numbers placed thus: .769 / .47367

Answer, the Sum is 1.24267

Also, to 33.6347, add the following Numbers *viz.* 7.3 x 963 x 176 9

Place your Numbers thus:

33.6347
7.3000
9630
176.9000

The Sum will be 218.7977

Note, You may prefix Cyphers, at Pleasure, to the Right-hand of your Decimals, as they neither increase nor decrease the Value thereof, which will prevent Mistakes in your Addition, *&c.*

Example III.

Let it be required to add the following Numbers together, *viz.* 7.9674 x 4 of a Hundred x .76 of a Million, and 174 of a hundred Millions.

Place your Numbers thus:

7.96740000
.04000000
.00000760
.00000174

And the Sum will be 8.00740934

Subtraction in Decimals.

SUbtraction in Decimals, differs very little from Subtraction in whole Numbers; but in placing your Numbers you muſt, as in Addition, keep Units under Units, *&c.* in whole Numbers, and Tenths under Tenths in the Decimals.

Example I. *and* II.

From	2.79	Alſo from	.967 take .026
Take	1.98	Placed thus: From	.967
		Take	.026
The Remainder is	.81	The Remainder is	.941

Note, If the decimal Parts in either Number have fewer Places than the other, the Vacancy muſt be ſupplied by annexing ſo many Cyphers as will make them equal, or by ſuppoſing them to be annexed.

Example III.

Cyphers annexed.		Cyphers ſuppoſed annexed.	
From	17.600	From	17.6
Take	2.767	The ſame Numbers	2.767
Remains	14.833	The Remainder	14.933

Note alſo, The above Numbers are ſuppoſed to be of the ſame Denomination.

Multiplication

Multiplication in Decimals.

1. MUltiplication in Decimals, both in placing your Figures, and the Work itſelf, differs not from Multiplication of Integers; but be careful to point off, in your Product, as many decimal Places, as there are decimal Parts in your Multiplier, and Multiplicand; but in caſe of Want in your Product, annex Cyphers to the Left-hand thereof.

2. In Multiplication of Decimals, as in whole Numbers, make that Number the Multiplier that contains the leaſt Number of Figures, though perhaps more or leſs in Quantity, it is not material.

Note 1. If your Multiplier and Multiplicand be Decimals, your Product will be a Decimal alſo.

2. If your Multiplier and Multiplicand be mixt Numbers, that is, Integers and Decimals, the Product will be mixt.

3. But if one of your Numbers be mixt, and the other a Decimal, the Product will ſometimes be mixt, and ſometimes a Decimal.

Example I.

Let it be required to multiply .6753 by 12.15 the Product will be 8.448003

.67 53 Multiplicand is Decimals.
12.51 Multiplier is mixt.

6753
33765
13506
6753

The Product is 8.448003 Anſwer.

In the foregoing Example, I count the Number of decimal Parts in the Multiplicand, and find them to be four, and two in the Multiplier make ſix. I then point off ſix (to the Right-hand) in the Product, and the Work is done.

Example II.

Multiply .75
By — .25

375
150

.875

Example III.

Multiply .125
By — .05

.00625

Example IV.

Multiply 7.5
By — .7

5.25

Example V.

Multiply 8.6
By — 55

430
430

473.0

This Rule is ſo very eaſy, that I hope the above Examples are ſufficient to remove any ſeeming Difficulty which may appear in common Multiplication: However, that the Learner may become perfectly acquainted with Multiplication in Decimals, I ſhall, for his Benefit, propoſe a few more Queſtions herein.

Queſtion I.

Let it be required to multiply 2s. 6d. by 2s. 6d. one Shilling being the Integer; as 6d. is half of 1 Shilling, I call it .5 Tenths,

S.
2.5
Thus: 2.5

125
50

Anſwer 6.25 = 6s. 3d.

Alſo,

Alſo, let it be required to multiply 6s. 3d. by 9s. 9d. one Shilling being the Integer.

The Decimal of 9d. is .75, and 3d. reduced to a Decimal, is .25

Thus: 9.75
6.25

4875
1950
5850

60.9375 = 3l. 0s. 11d. $\frac{1}{4}$ Anſ.
12.

11.2500
4.

1.0000

Queſtion II.

Multiply 2s. 6d. by 2s. 6d. a Pound being the Integer.

Note, 2s. 6d. is the $\frac{1}{8}$ of a Pound in Decimals, equal to .125, which being multiplied by itſelf, as follows:

.125
.125

625
250
125

Anſwer .015625 equal to Twopence Halfpenny,
20. and the two Tenths of a
Farthing.

.312500
12

2.550000
4.

1.100909

Diviſion in Decimals.

DIviſion in Decimals, is performed like Diviſion of whole Numbers; but to find the true Value of the Quotient (which is all that is difficult therein) obſerve the following

RULE.

The Number of decimal Parts in the Diviſor and Quotient, muſt always be made equal to the Number of decimal Parts in the Dividend.

Note, If your Dividend be an Integer, or have leſs Places of Decimals than your Diviſor, add Cyphers to the Dividend, till they be equal, and if nothing remain in the Work, the Numbers ariſing in the Quotient, are Integers.

Example I.

Divide 125.0 by .5

```
.5)125.0(250 Integers.
   10
  ---
   25
   25
  ---
   .0
```

Diviſion in Decimals is proved like Diviſion in Integers.

```
250.
 .5
-----
125.0 Proof.
```

In

In the foregoing Example the Dividend is an Integer, and the Diviſor a Decimal: Therefore add a Cypher (in the Place of Tens) to the Dividend, which makes the Decimals in the Diviſor and Dividend equal in Number, and the Figures in the Quotient are Integers.

Example II.

Where both are mixt Numbers,

Divide 12767.8965 by 7.2565

7.2565)12767.8965(1759.
72565

551139
507955

431846
362825

690215
653085

37130 Remainder.

In this Example there is an equal Number of Decimals in the Diviſor and Dividend, and conſequently the Quotient is Integers. And by annexing Cyphers to the Remainder, proceed as before, and you'll have the true Quantity of the Quotient; always remembering to point off a decimal Part in the Quotient for every Cypher you have annexed, or brought down from the Dividend.

Example III.

Where both are Decimals, divide .75 by .0125 Seeing you cannot do it unleſs you add Cyphers to the Dividend, *viz.* two, and then there will be a like Number pointed off in both, and therefore the Quotient will be Integers.

See the Work.

.0125).7500(60. Anſwer.
750

·00

By

By which you may obſerve, that as Multiplication of Decimals decreaſes their Value, ſo Diviſion of Decimals increaſes the Value, contrary in both Caſes to the Nature of Integers.

This laſt Example is the ſame as if it were required to divide 15 Shillings by Three-pence, the Quotient will be found to be 60 Pounds. Multiplication will make it appear.

For if you multiply 3d. or .0125, the Decimal of 3d. (one Pound being the Integer) by 60. Pounds, the Quotient will be .75 Pounds, or 15 Shillings, as you may ſee by the Work.

.0125
60

·7500 = 15 Shillings.

Example IV. *and* V.

Where the Dividend is an Integer, and the Diviſor a Decimal, it will ſometimes produce a mixt Number, and ſometimes not.

Firſt, Divide 1425.0 by .6252

.6252)1425.0(22792706
12404

17460
12504

49560
43764

57960
56268

16920
12504

44160
43764

39600
37512

Ad infinitum 2088

Note,

Note, Before Diviſion can well be made, you muſt add a Cypher to the Dividend as you proceed in the Work; you muſt alſo add Cyphers to each Remainder. But if you require only the integral Part of the Quotient, you may prefix as many Cyphers to your Dividend at firſt, as your Diviſor conſiſts of, and the Quotient will be Integers: But when decimal Parts are required, you muſt count every Cypher to your Dividend you prefix to your Remainders, and point your Quotient accordingly.

Secondly, Divide 5. by .25

See the Work.

.25)5.00(20. Anſwer.
50

00

Example VI.

Where the Dividend is mixt, and the Diviſor a Decimal,
Divide 529.125, by .425

See the Work.

.425)529.125(1245. the Quotient. Anſ.
425 · · ·

1041
850

1912
1700

2125
2125

Example VII.

Let it be required to divide .04 by. 6.

See the Work.

6).040(666, *&c.*
36

40
36

40
36

4 would ſtill remain, which ſhews it to be an imperfect Decimal.

Note 1, When any decimal Fraction, or mixt Number is to be divided by an Unit with any Number of Cyphers annexed, you muſt remove the Separatrix ſo many Places towards the Left-hand, as there are Cyphers annexed to the Unit.

So if 17.28 was given to be divided by an Unit.

By		The Quotient will be
	10.	1.728
	100.	.1728
	1000.	.01728
	10000.	.001728
	100000.	.0001728

By the foregoing Examples it may be obſerved, that if the Dividend be greater than the Diviſor, the Quotient will either be an Integer, or a mixt Number; but if the Diviſor be greater, the Quotient will be a Decimal.

2. Multiplication and Diviſion in Decimals, as in Integers, interchangeably prove each other.

3. To prove Multiplication, the Product divided by the Multiplier, quotes the Multiplicand. And,

4. To prove Diviſion, the Quotient multiplied by the Diviſor, produces the Dividend; or by the Dividend, produceth the Diviſor.

5. Before

5. Before this Rule is cloſed, I'll beg Leave to recommend to the Learner, the Solution of two excellent Problems, which, perhaps, may be of great Uſe to him.

The firſt is, Having a Multiplicator to find the Diviſor, divide an Unit with Cyphers by the Multiplicator, and the Quotient will be the Diviſor ſought.

Example.

What Diviſor is that, by which dividing 7315, ſhall give a Quotient equal to the Product of the ſame Number multiplied by that Number.

See the Work.

7315
125
36575
14630
7315
914375

125.)1.000).008)7315(914375
1 000
...
72..
11
8
35
32
30
24
60
56
40
40

Here you may obſerve, that the Product and Quotient are the ſame.

The ſecond is, having the Diviſor to find the Multiplicator: This is the Reverſe of the former, for if you divide Unity with Cyphers annexed, by the given Diviſor, the Quotient will be the Multiplicator ſought.

Example.

What Multiplicator is that, by which multiplying 7315, ſhall give a Product equal to the Quotient of the ſame Number divided by .008?

See the Work.

.008)1.00(125 Anſwer, the Multiplicator.
8

20
16

40

Reduction in Decimals.

BY Reduction, we find the Decimal of any fractional Part of Coin, Weight, Meaſure, *&c.* and, on the contrary, reduce any decimal Fraction, to its equivalent fractional Parts of Coin, Weight, Meaſure, *&c.*

PROPOSITION I.

Any vulgar Fraction given, to reduce the ſame into a decimal Fraction of equal Value.

To perform which, you muſt add a competent Number of Cyphers to the Numerator, and divide by the Denominator, the Quotient is the decimal Fraction required.

Example I.

Let it be required to find the decimal Fraction of $\frac{3}{4}$; alſo $\frac{1}{4}$, and $\frac{1}{2}$.

See the Work.

4)3.0(.75 Anſwer
28

20
20

4)1.00(.25 Anſwer
8

20
20

2.)1.0(.5 Anſ.
10

Note,

Note, The Directions given in Diviſion, muſt be obſerved, and the Work will be eaſy.

Example II.

Reduce $\frac{1}{8}$ into a decimal Fraction.

See the Work.

8.)1.0(.125 Anſwer.
8

20
16

40
40

Example III.

Reduce 9. Pence, into the decimal Fraction of a Shilling.

See the Work.

12)9.0(.75 Shillings.
84

60
60

RULE.

Divide the given Number, by the integral Parts of the required Decimal reduced to the ſame Denomination, and the Quotient is the Anſwer required.

Suppoſe the foregoing Queſtion was to be reduced to the decimal Fraction of a Pound Sterling. Seeing that 240 Pence is 1 Pound, 9 Pence is equal to $\frac{9}{240}$, which reduce as before directed.

See

See the Work.

240)9.00(.0375 the Decimal required.
720

1800
1680

1200
1200

Example IV.

Reduce 15s. 6d. into the Decimal of a Pound Sterling.

See the Work.

S.
20.)15.5(.775 Facit.
140

150
140

100
100

But the Decimal answering any Number of Shillings, may more readily be found by halving the Shillings given; so that $\frac{1}{2}$ of 15, is 7. and 1 remains, that is, 1 Shilling, to which suppose a Cypher annexed, makes 10, the Half thereof is 5, to wit, .75 —Then 6d. is $\frac{6}{240}$, which reduced, is .025, to which adding .75, gives ·775, as above.

S.
·75 = 15 Shillings.
025 = ·6 Pence.

·775

Example

Example V.

Reduce 32 Perches to the decimal Fraction of an Acre, 32 Perches being $\frac{32}{160}$.

See the Work.

160.)32.0(.2 Anſwer.
320

Example VI.

Reduce 136 $\frac{1}{2}$ Perches, to the decimal Fraction of an Acre.

See the Work.

160)136.5(.85325 Anſwer.
1280

8500
800

500
480

400
320

800
800

Theſe Examples being well conſidered and underſtood, are ſufficient to reduce any other Meaſures, *&c.* ſo we will conclude this Propoſition.

PROP. II.

To find the Value of a decimal Fraction, in the known Parts of the Integer, as of Coin, Meaſure, *&c.* to perform which obſerve the following Rule:

RULE.

RULE.

Multiply the Decimal given, by the Number of Parts of the next inferior Denomination, cutting off as many Figures from the Product as the given Decimal consists of; the Remainder, if any, multiplied by the next inferior Denomination, cutting off as before. Thus must you do until the given Decimal be brought into its lowest Parts, and the Parts signified by the Decimal, will be thrown over the Separatrix.

Example I.

What is the Value of .125 of a Pound Sterling.

20 Shillings in a Pound.

2.500

12 Pence in a Shilling.

6.000

Answer 2s. 6d.

Example II.

What is the Value of .696875 of a Pound Sterling?

20. Shillings in a Pound.

13.937500

12 Pence in a Shilling.

11.250000

4.

Facit 13s. $11\frac{1}{4}$ 1.00000

Example III.

What is the Value of .75 of and Acre?

4. Roods in an Acre.

Facit 3.00 Roods.

Example

Example IV.

What is the Value of .6275 of an Acre?

4. Roods in an Acre.

2.5100

40 Poles in a Rood.

20.4000 remains leſs than a Pole, ſomething better than $\frac{1}{4}$.

	A.	R.	P.
Facit	0	2	$20\frac{1}{4}$

Example V.

What is the Value of .98765 of an Acre?

4.

3.95060

40

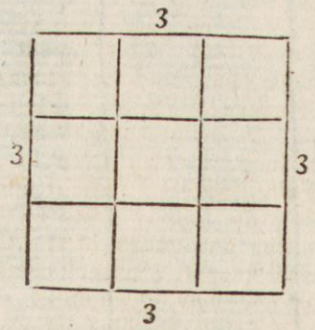
38.02400

	A.	R.	P.
Facit	0	3	38

Theſe Examples are ſo eaſy, that I hope it is needleſs to give any more in this Rule, ſince the above, being well underſtood, is ſufficient for our Purpoſe. It follows next to ſay ſomething of the *Rule of Three in Decimals* in this Place; but, as the Rule of Three, or the Single Golden Rule in whole Numbers, was ſufficiently explained before, I think it unneceſſary to introduce it. For, ſeeing *the Rule of Three in Decimals*, it is the ſame both in working and ſtating of the Queſtion, as in the Rule of Three before taught, (Reſpect being had to the Rules in Decimals aforegoing) any Queſtion of the Golden Rule, though conſiſting of the moſt difficult fractional Parts, will be as eaſily ſolved, as if the Queſtion was compoſed of Integers only. I ſhall therefore omit it here, and proceed to the Square Root, for without a competent Knowledge therein, there is no arriving to Perfection in the Art of Surveying: And, as I am determined to ſpare no Pains in rendering this Treatiſe complete, I ſhall therefore recommend this neceſſary Rule to the Learner, and then conclude this Chapter.

Extraction of the Square Root.

A Square is that which is contained under two equal Numbers, and the Root thereof is one of them; ſo that the Way to know the Square Root of any Number, is to diſcover or find out a leſſer Number, which being multiplied by, or into itſelf, ſhall produce the Number propounded. As for Example: Suppoſe 49 be a Number given to find the Root thereof, I ſay 7 is the Root of it, becauſe 7 multiplied into itſelf, *viz.* 7 Times 7 is 49, the Number given; therefore, the two equal Numbers that the Square 49 are comprehended under, are 7 and 7; and the Square Number 9, is contained under 3 and 3, which plainly appears in the following great Square:



The above Figure repreſents a great Square, containing 9 leſſer Squares, any one of which is the Root of the great Square, but how to diſcover this readily, in any Number, is what I intend to ſhew you next. The Roots of all ſquare Numbers under 100, you have in the Multiplication Table: However, as it is proper for you to keep them in your Mind, obſerve the Table following:

Roots

Roots -	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81

Here you ſee the Root of 9 is 3; the Root of 49 is 7, and ſo of the Reſt.

So far as 100 in whole Numbers, your Memory will aſſiſt you to find the Root; but if the Number propoſed, whoſe Root you ſeek, exceed 100, then put a Point over the firſt Figure on the Right-hand, which is the Place of Units, and ſo proceed to the Left-hand; miſs the ſecond Figure, and Point over the third; then miſſing the fourth, point over the fifth, and ſo on (if there be ever ſo many Figures in the given Number) to the End, pointing every other Figure, as you ſee here:

. . . . .
1 2 9 8 7 6 5 4 3

And ſo many Points as there are, ſo many Figures your Root will conſiſt of, which is very material to remember: Then begin at the firſt Figure on your Left-hand that has a Point over it, which will always be the firſt or ſecond Figure, and find the Root thereof, and when you have found it, or the nigheſt leſs to it, (which you may do by the foregoing Table, or your own Memory) proceed by the following Directions:

" The Root of your firſt Period you
" Muſt place in Quote, if you work true;
" Whoſe Square from your ſaid Period then
" You muſt ſubduct; and to th' Remain,
" Another Period being brought,
" You muſt divide, as here is taught,
" By th' double of your Quote, but ſee
" Your Units Place you do leave free;
" Which Place will be ſupply'd by th' Square
" Of your next quoted Figure there:
" Next multiply, ſubtract, and then
" Repeat your Work unto the End;
" And if your Numbers be irrational,
" Add Pairs of Cyphers for a Decimal."

Note, Irrational Numbers, are all ſuch Squares whoſe Roots cannot be diſcovered by Art exactly, (neither in whole Numbers, nor Fractions) but ſomething will ſtill remain, there being no Proportion (as yet found) betwixt an irrational Number and its Root.

Example.

Let it be required to find the ſquare Root of 208849.

See the Work.

```
  . . .
208849(45
16 .
---
85)488
   425
---
  6349
```

Having pointed it as in the Work, the Root will conſiſt of three Places.

1. Seek the greateſt Root of your firſt Period, *viz* 20, which, by your Table you will find to be 4, which place in your Quotient, and the Square thereof, under the 20, your firſt Period, and ſubtract 16 from it, reſts 4. This is your firſt Work, and is no more to be repeated.

2. To the Remainder bring down your next Period 88, which makes 488 for a Dividend, as may be ſeen in the Work.

3. Double your Quotient makes 8, then ſeek how oft 8 in 48, (reſerving the Units Place for the Square of your ſought Figure) and you will find it to be 5, which you muſt place in the Quotient, and to the Right-hand of the Diviſor alſo, making it 85, then multiply that 85 by 5, and the Product place under the new Dividend, as you may ſee.

This

This Work is every Time to be repeated.

```
  . . .
85)488849(45
    .
    425
  -----
907)6349(7
    6349
  -----
  . . .
```

4. Subtract 425, from 488, reſts 63, to which bring down the third and laſt Period 49, then you will have 6349 for another new Dividend.

5. Double the Quotient 45 = 90 for a new Diviſor. Then ſee how oft 90, or 9 in 63, Anſwer 7 Times (ſtill reſerving the Unit's Place in the Diviſor) which place in the Quotient, and alſo in the Unit's Place of the Diviſor, making it 907, then multiplying 907 by 7, the Product 6340, place under the laſt Dividend, and ſeeing they are equal, and that nothing remains, by which it appears that the given Number was a Square rational Number, and its Root is 457, which ſee.

```
  . . .
)208849(457
 16 . . .
 -------
85)488
   425
 -----
907)6349
    6349
 -----
```

After this Manner the Square Root of any Number may be found.

But if the Number to be extracted has a Remainder, and the Root cannot be got exact; notwithſtanding, by adding Cyphers, you may come as near the Truth as you pleaſe.

Example

Example II.

Let it be required to extract the Square Root of 160, or, which is the ſame Thing, to find the Length of one Side of a ſquare Acre.

See the Work.

```
  . .
 )160(12.64911
   1
  ---
22)·60
    44
  ----
246)1600
    1476
  -----
    12400
```

Having pointed the given Number, and wrought as before directed, you find 12 for your neareſt Root, and 16 to remain, to which you add two Cyphers, and find your next Figure to be 6, which you muſt cut or point off from the reſt, as a decimal Fraction; and by adding Pairs of Cyphers to each Remainder, as below, you increaſe it to 5 Places, which is exact enough for any thing; for if Unity were divided into a hundred Thouſand equal Parts, this Root does not want 2 of thoſe Parts; ſince the Square of 12.64911, is 159.9999837921.

```
2524)12400(12.64911
     10096
    -----
25289)230400
      227601
     ------
252981)279900
       252981
      -------
2529821)2691900
        2529821
       --------
remains  162079
```

Thus

Thus the ſquare Root of any mixt Number may be found, the fractional Part firſt reduced into even Places of Decimals, or ſupplied by Cyphers, if need be; ſo if the ſquare Root of 40 (the Poles in a Rood of Land) were required to 3 Places of Decimals, the Work would ſtand as here, and the ſquare Root would be 6.324.

```
 )40.(6.324
  36
 ----
123)400
    369
 ----
1262)3100
     2524
 ----
12644)57600
      50576
 ----
remains  7024
```

Thus have I finiſhed my firſt Chapter, wherein the Learner will find Arithmetic ſufficient to qualify him for ſurveying. And if any one be deſirous of further Explanations in the foregoing Rules, let him conſult ſome Treatiſe adapted thereto, as *Cocker*, *Hill*, *Fiſher*, &c. and he will be more particularly informed therein; for my Intention is to be as brief as poſſible, until I come to the Thing propoſed, namely, Surveying made completely eaſy.

CHAP.

CHAP. II.

Containing ſo much Geometry as Surveying requires.

See Plate I.

GEOMETRICAL DEFINITIONS.

I.

A Point is that which hath no Parts, as A, *fig.* 1.

II.

A Line, is a Length without Breadth, not having any commenſurable Thickneſs, as AB, *fig.* 1, and being generated from a Point, admits of only three Varieties, which follow.

III.

A right Line lieth evenly between its Extremes, and is the ſhorteſt Diſtance between two Points, as the Line AB, being ſhadowed by its Extremes; but if a Point be moved, or carried in an uniform Motion, and equally diſtanced from a certain Point, it is called a circular Line, as CD; but if it moves unevenly, to wit, ſome places higher, and others lower, ſo that the Extremes cannot ſhadow all the middle Parts thereof, it is then called a Curve, or compound Line. *See fig.* 1.

IV.

The Extremes, Limits, Terms, or Ends of a Line, are Points.

V.

A Superficies hath Length and Breadth only.

VI. The

VI.

The Extremes of a plane Superficies, are right Lines.

VII.

An Angle is formed by the Inclination of two Lines, AB and AC, one towards another, meeting in a Point A, and forming the Angle A. *fig.* 2.

VIII.

And that Point A, is called the angular Point.

IX.

When a right Line AB, ſtandeth upon a right Line DC, making the Angles CAB and DAB on each ſide equal, the Line AB ſo ſtanding, is perpendicular to the Line CD upon which it ſtandeth. *fig.* 3.

X.

Otherwiſe, if the Line AB, inclined to either C or D, it would then form both an acute and an obtuſe Angle.

XI.

A Right-Angle contains 90°. as DAB in the third Figure.

XII.

An Acute-Angle leſs than 90, as CAB. *fig.* 4.

XIII.

And an Obtuſe-Angle, more, as DAB. *fig.* 4.

XIV.

A plane Triangle, is a Figure comprehended under three right Lines, as ABC. *fig.* 5.

XV.

There are three Sorts or Kinds of plane Triangles, *viz.* An Iſoceles, a Scalenum, and an equilateral Triangle. *See fig.* 6, 7, 8.

XVI.

A Square, is a plane Figure, comprehended under four equal Right-lines, containing four Right-angles, as ABCD. *fig.* 9.

XVII.

A Rect-angle, is vulgarly called an oblong, or long Square, whoſe oppoſite Sides are equal and parallel, but longer than it is broad, containing four Right-angles. *See fig.* 10.

XVIII.

A Rhombus, is a Square out of Form, whoſe Sides are equal and parallel, containing no Right-Angle. *See fig.* 11.

XIX.

A Rhomboides, is a Rect-angle out of Form, whoſe oppoſite Sides are equal and parallel, but longer than it is broad, containing no Right-angle. *See fig.* 12.

XX.

All other four-ſided Figures, are called Trapeziums. *fig.* 13.

XXI.

A Diagonal Line, is a Right-line drawn from or between the oppoſite Angles in all quadrangle Figures, as the Line I. G. *fig.* 28.

XXII.

Multangular, multilateral, and polygonical Figures, are ſuch as are comprehended under many Lines. *fig.* 14.

A Circle, is a plain Figure comprehended under one Line, called a Periphery, or Circumference, into which all Right-lines drawn from a Point within the Circle, are equal. *fig.* 15.

XXIII.

And that Point is called the Centre of the Circle, as A. *fig.* 15.

XXIV.

The Diameter of a Circle, is a Right-line paſſing through the Centre, and terminated on both Sides by the Periphery, as CB. *fig.* 15.

XXV.

A Semi-circle, is that Part of Circle that is comprehended under the Diameter, as CFB. *fig.* 15.

XXVI.

A Quadrant is the fourth Part of a Circle, or 90 Degrees, as CFA. *fig.* 15.

XXVII.

An Arch of a Circle, is any Part of the Periphery, as EB in the ſame Figure.

Geometrical Problems.

PROBLEM I.

TO biſect a given Line into two equal Parts.

Example.

Suppoſe the given Line be AB, *fig.* 16, it is required to biſect the ſame.

Open the Compaſſes, or Dividers, to any thing more than half the given Line, and then with one Leg or Foot in the Point B, deſcribe the Arch D e, above the Line AB, and alſo below it; then ſhift your Dividers, and, with one Leg in the Point A, deſcribe two Arches with the ſame Extent as before, that ſhall

croſs or interſect the two former Arches in the Points F and C, from which draw a Line, and it will biſect the Line AB in the Middle thereof. *fig.* 16.

PROB. II.

To erect a Perpendicular at the End of a given Line.

Example.

Let DC, *fig.* 17, be the Line, and at the Point C, it is required to erect the Perpendicular CB.

Open the Compaſſes to any ordinary Extent, and ſetting one Foot in the Point C, let the other fall at Pleaſure (its not material where) above the ſaid Line DC, as at the Point o; then, without altering the Extent of the Compaſſes, one Foot being in the Point o, deſcribe the Arch LL, and alſo an other Arch that will croſs the Line DC in I; point the Interſection, then lay a Ruler to the Point I and o, and draw the pricked Line IG. Laſtly, from the Point C, through the Interſection G, draw the Line CGB, which will be perpendicular to the Line DC.

PROB. III.

To erect a Perpendicular at a Point in a given Line.

Example.

The Line given is AB, *fig.* 18, and at the Point F, it is required to erect a Line which ſhall be perpendicular to AB.

Open the Compaſſes to any convenient Width, ſetting one Foot in the given Point F, with the other make a Mark in the Line AB, as at EE, then take up your Compaſſes and open them ſomething wider than before, fixing one Foot in either of theſe Points E, deſcribe an Arch above the Line; then remove your Compaſſes to the other Point with the ſame Extent, and deſcribe an Arch that ſhall interſect the former Arch, through the Point of Interſection and the given Point F, draw a Line, and it will be perpendicular to the given Line AB.

PROB.

PROB. IV.

To let fall a Perpendicular from a Point that is not in a given Line.

Example.

The given Line is AB, *fig.* 19, and the Point is at C, from which it is required to let fall the Line C, that ſhall be perpendicular to AB.

In the given Point C, ſet one Foot of the Compaſſes, and with the other Foot deſcribe an Arch that ſhall croſs the Line AB, in the Point *c* and *e*, and, by the firſt Problem, biſect the Diſtance between *c* and *e*, through which Point of Biſection, and the Point *c*, draw a Line, and it will be perpendicular to the given Line AB.

PROB. V.

To draw a Line parallel to a given Line, through a Point given.

Example.

AB, *fig.* 20, is the given Line, and it is required to draw the Line CD, through the Point E, that ſhall be parallel to the Line AB.

From any Part of the Line AB, (ſuppoſe at F) take the Diſtance in the Compaſſes between F and B, then ſetting one Foot in the Point E, with the Diſtance FB, deſcribe the Arch GG; then take in your Compaſſes the Diſtance between F and E, and ſetting one Foot in the Point B, croſs the Arch GG, in the Point *i*, through which, and the Point E, draw the Line CD, and it will be parallel to AB.

N. B. There are ſeveral other Ways to draw parallel Lines, but none ſo correct as the above.

The foregoing Problems come in continual Uſe and Practice in any thing that relates to planning, and therefore ought to be ready to, and well underſtood by, every Learner, ſince very little can be performed in the following emblematical Schemes, without having Recourſe to one or more of theſe five preceding.

PROB.

PROB. VI.

To make a Triangle of three given Lines, provided any two taken together be greater than the third. 22 *Euclid*, Book I.

Suppoſe the given Lines were 6, 7, and 8. *See fig.* 21.

Explanation.

To conſtruct this, or any triangular Figure (when three Sides are given) you muſt firſt draw a Line with Scale and Compaſſes parallel to your Breaſt, and lay thereon one of your given Lines, as from A to B.

Secondly, Take in your Compaſſes another given Side, and fixing one Foot in A, deſcribe an Arch above the Line; then remove your Compaſſes to the Point B, with the Extent of the third given Line, deſcribe an Arch that ſhall interſect the former in the Point C. And,

Laſtly, Draw Lines from A to C, and from B. to C. ſo ſhall you have the Triangle conſtructed.

PROB. VII.

To make a Geometrical Square.

Suppoſe AB, *fig.* 22, be a Line given, and it is required to conſtruct a Square whoſe Side ſhall be equal to the Line AB.

Construction.

Firſt, Draw a Line equal to the given Line, as from A to B; at the Point B, by *Prob.* II. erect the Perpendicular BC, making BC equal to AB; then with one Foot of your Compaſſes in A, with the Diſtance AB, deſcribe the Arch D. Secondly, with the ſame Extent in your Compaſſes as before, and one Foot in C, deſcribe an Arch that ſhall interſect the former Arch in the Point D. And laſtly, draw Lines from the Point D, to A and C, and the Square is compleated.

PROB.

PROB. VIII.

To make a Rect-angle, or Long-ſquare.

This Problem is not much unlike the former; admit then, that two Lines be given, *viz.* 3 and 6, and it be required to make a Rect-angle of them.

Construction.

Firſt, Lay down the longeſt Line, to wit, 6, and at the end thereof, *viz.* B, erect the perpendicular Line BC, by *Prob.* II. equal to 3 (your ſhorteſt Line) then placing one Foot of your Compaſſes in C, with the Diſtance AB, or 6, deſcribe an Arch, then remove your Dividers, and placing one Foot in A, with the Diſtance BC, or 3, deſcribe another Arch that ſhall interſect the former in the Point D. And laſtly, draw Lines from D to A and C, which forms the Rect-angle ABCD.

PROB. IX.

To conſtruct or make a Rhombus, or an equilateral Parallelogram.

Example.

Let it be required to make a Rhombus whoſe Sides ſhall be equal to the Line AB. *fig.* 24.

Construction.

Firſt, make an Angle at A or B (by *Defi.* 7, *fig.* 2.) it is not material how ſmall or great the Angle is; and make the Line BC, equal to AB, then placing one Foot of your Compaſſes in C, with the Diſtance CB, deſcribe an Arch, and with the ſame Extent place one Foot of the Compaſſes in the Point A, deſcribe another Arch that ſhall interſect the former Arch in the Point D, and draw Lines from D. to A, and it is done.

PROB. X.

To make a Rhomboides, or a Rect-angle out of Form. The Conſtruction of this Figure, differs but little from Problem the IXth.

Let then the Lines AB, and CD, *fig.* 25, be given to conſtitute a Rhomboides.

Con-

CONSTRUCTION.

First lay down AB, and at the End thereof make an obtuse Angle at Pleasure, by drawing a Line = DC, then proceed as you were directed in Problem VIII.

PROB. XI.

To construct a quadrilateral Figure, containing one obtuse, one acute, and two right Angles, three Lines only being given, *viz.* the Base and the two Perpendiculars, which contain the Right-angles.

Example.

Let the Lines given be 2, 3, and 4, *fig.* 26, and it be required, with them, to construct a quadrilateral, or four-sided Figure, together with a fourth unknown Line.

CONSTRUCTION.

Let the Line AB be laid down equal to the given Line 4, and at the Points A and B, erect the Perpendiculars AD and BC, by the second Problem, making AD equal to the Line 2, and BC equal to 3; and lastly draw a Line from D to C, and it is done.

PROB. XII.

To construct a Trapezium two different Ways.

First, with four given Lines, *viz.* 3, 4, 5, 6, the Sides of the Trapezium.

Secondly, with three given Lines, *viz.* the Diagonal and the two Perpendiculars.

The first Way.

Let it be required to make a Trapezium of the four following Lines. *fig.* 27.

viz. 6, 5, 5, 3

CON-

CONSTRUCTION.

First, lay down any one of the Lines from A to B, suppose the Line 6, then, at the Point B, make an acute Angle at Pleasure, by drawing the Line BL, equal to the Line 5; then placing one Foot of your Compasses in the Point L, with the Distance of the Line 4, describe the Arch *nn*; take up your Compasses and place one Foot in the Point A, with the Distance of the Line 3, describe another Arch that shall intersect the former in the Point O; draw the Lines AO, and LO, and it compleats the Trapezium AB LO.

Note, A Trapezium made after, or by this Method, may be variously or differently represented, provided the Angles are not given.

By the foregoing Method of constructing or planning a Trapezium, the Learner (if he chuses to make Experiments) will find, that not only the Form thereof will each Time change, but the Area differ also; though, notwithstanding, some modern Authors are pleased to affirm that the Area would be unalterably the same.

However probable this Assertion may appear to some, I will not pretend to say, but shall beg Leave to observe what is universally granted, *viz.* any geometrical Square is allowed to be more spacious than a Rhombus constructed upon the same Base; and differs therefrom more or less, according as the Angles in a Rhombus are more or less acute or obtuse. Hence it follows, that the remoter the several Angles (in any quadrilateral Figure) are from 90 Degrees, the Areas of all such decrease more and more; and the nearer each Angle in a Trapezium is to a right one, the greater the Area thereof; therefore the Area of all such Figures increaseth or decreaseth, according as the Angles are therein more or less acute. Q, E, D.

But to prevent all such Consequences, the Dimensions of a Trapezium must be particularly taken, and entered as follows:

Method the Second.

Placed in Figures thus: *See fig.* 28.

At 0——————0 no Breadth.
4——————2 Left-hand.
6——————4 Right-hand.
9——————0 no Breadth.

In Words thus:

First, At the Beginning, that is no Length, it is no Breadth. Secondly, at 4, it is 2 on the Left-hand. Thirdly, at 6, (that is upon the Diagonal) it is 4 to the Right-hand. And lastly, at 9, it is nothing, to wit, no Breadth. From these Dimensions, a Trapezium may be constructed with Expedition and Correctness, without regarding the Angles, which must be considered in the first Method, otherwise the Result will admit of unlimited Variety.

CONSTRUCTION.

First, At Pleasure draw a Line with your Compasses, and lay thereon your Diagonal IG = 9.

Secondly, At 4, or *n*, (your Diagonal being perpendicular to your Breast, or how you will, upon the Left-hand Side lay down the Perpendicular *n* E = 2; and at 6, or *m*, lay down the Perpendicular 4 = *m* P, to the Right-hand.

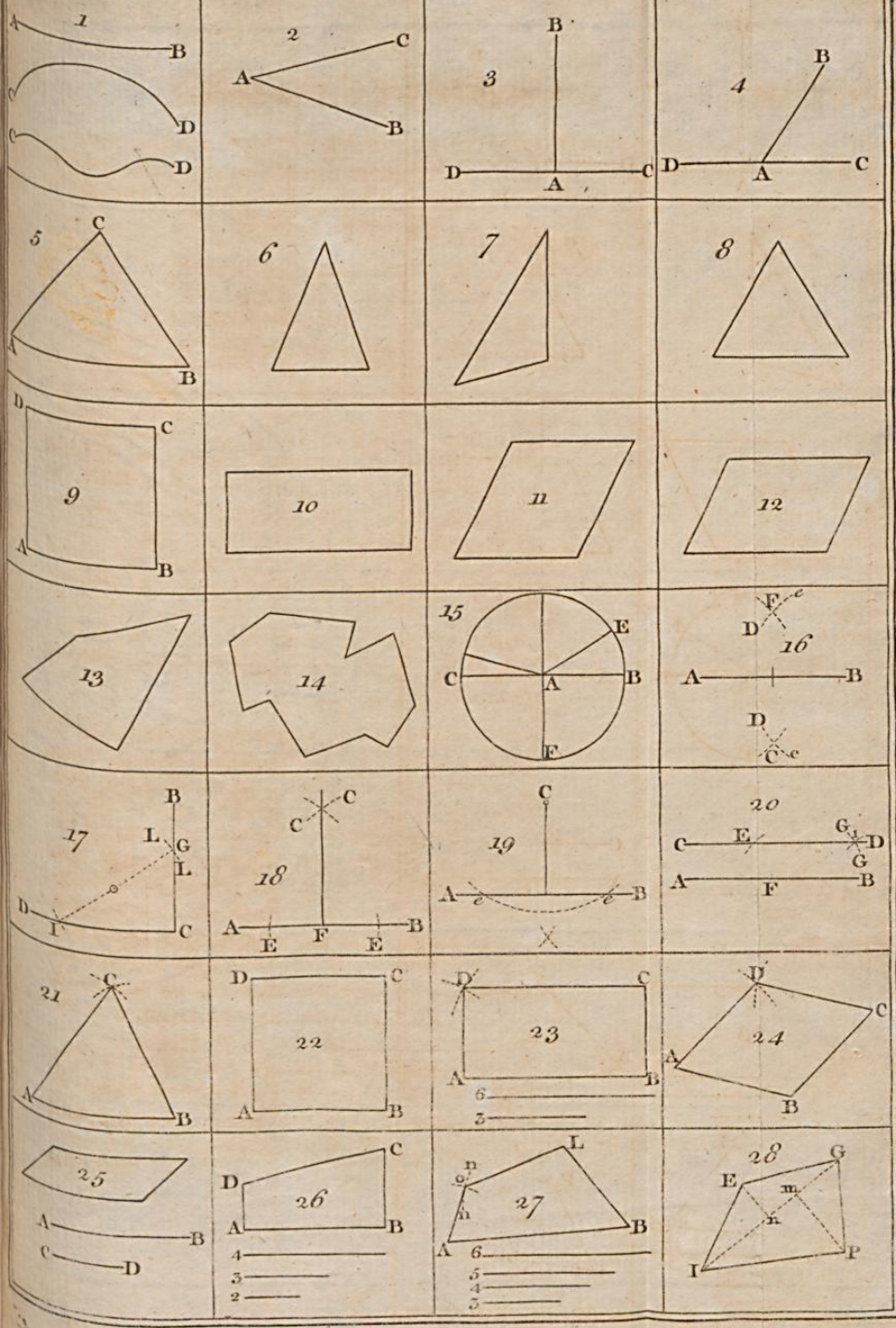
Lastly, join the Points IE, EG, GP, and PI, together, and it is done.

Note, The above Dimensions are more briefly entered,

Thus:
0——————0
4——————2 L. Hand.
6——————4 R. Hand.
9——————0

This Method saves much trouble in Writing, though as fully expressed.

Thus


1
A
B
D
D
2
C
A
B
3
B
D
A
C
4
B
D
A
C
5
C
A
B
6
7
8
9
D
C
A
B
10
11
12
13
14
15
E
C
A
B
F
16
F
e
D
A
B
D
C
e
17
B
L
G
L
D
I
C
18
C
C
A
E
F
E
B
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C
A
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B
20
C
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6
5
24
D
C
A
B
25
A
B
C
D
26
C
D
A
B
4
3
2
27
L
B
n
A
6
B
5
4
3
28
G
E
m
n
I
P

Thus have I given my Reader a Deſcription of ſuch right-lined geometrical Figures as are neceſſary to be underſtood, before he can (with any Grounds of Certainty) enter the Fields, in order to practiſe which, I propoſe ſhall be the Subject of the ſucceeding Chapter; but, in the mean Time, muſt intreat the Learner to advance no farther herein, until he be expert and ready in conſtructing all the foregoing Problems; otherways his Hopes of becoming a compleat Meaſurer will moſt certainly be fruſtrated, ſeeing he learns by Halves, and therefore can have but an imperfect Idea, or a confuſed Notion thereof; for, as in common Arithmetic, ſo in all the Branches of the Mathematics, comparatively ſpeaking, for whoever is a Stranger to Multiplication, of courſe muſt be a Stranger to the next ſucceeding Rule (Diviſion) alſo.

I hope the above Hint will have the deſired Effect upon all thoſe that would reap any Benefit from this Book.

CHAP. III.

Containing the Nature of long and ſuperficial Meaſure, the Chain deſcribed; with uſeful Directions and Cautions to young Practitioners in the Fields, &c.

SECTION I.

Of MEASURE.

AND firſt of *Long-Meaſure*, which is either Inches, Feet, Yards, Perches, or Chains, *&c.* A Table of what is neceſſary you have in the Introduction. But as Land is generally meaſured by Chains, I ſhall chiefly inſiſt upon, and recommend that Inſtrument, it being not only moſt in Uſe among Surveyors, but alſo the very beſt for ſuch like Purpoſes; though there are ſeveral Sorts of Wheels, or Machines, lately conſtructed to meaſure Land, as well as Diſtances: However correct thoſe Wheels may ſeem to the Gentlemen that encourage them (with regard to Surveying) I will not pretend to ſay, but ſhall appeal firſt to any Farmer in *Great-Britain*, whether it is poſſible for ſuch Wheels, in meaſuring plow'd Land wherein the Ridges are very high, and Furrows deep, (ſuch as I have often met with in low and wet Lands) to aſcertain the true Length and Breadth thereof, excluſive of the Errors that will unavoidably occur when the Bounds are irregular. I dare affirm, that any ſuch Machine, in ſome uneven Ground, would meaſure a Field to 13 or 14 Acres, that is no more than 10. I'll grant you, that the meaſuring Wheel is exceeding ready, and indifferently exact in meaſuring Roads that are horizontal (though ſuch are not often met with) to which Purpoſe alone it is properly adapted; wherein if it ſhould (as moſt certainly it does) make ſome Lines longer (by reaſon of the Earth's uneven Surface) than others, the Conſequence

ſequence is trifling in Compariſon to what a Tenant muſt ſuffer who pays a great Rent for Land (the Wheel meaſured to him) which he hath not.

There are ſeveral Sorts of Chains, as a four Pole, a two Pole, and a one Pole Chain, *&c.* but that which I would recommend as the moſt expeditious, is the four Pole Chain; it is univerſally allowed to be preferable to all others, being decimally divided into 100 Links, but the Length of the Link differs according to the eſtabliſhed Meaſure of the ſeveral reſpective Counties wherein it is uſed: For inſtance, in *England* the Statute Chain (commonly called *Gunter*'s) contains 22 Yards, divided into 100 Links, each Link 7 $\frac{92}{100}$ Inches; and though this Chain is by Law eſtabliſhed the Standard for Engliſh Meaſurement, notwithſtanding, there are other four Pole Chains adapted reſpectively to the cuſtomary Meaſure of ſeveral Counties therein, to wit, in *Cheſhire* the Chain is 32 Yards divided into 100 Links. In ſome Parts of *England* the Chain is 24 Yards; and in other Parts the Chain is 28 Yards, each divided into 100 Links; and though the above Chains all differ in Length, the Reſult of their reſpective Dimenſion, is commonly reduced to the Statute-Meaſure of *Great-Britain*, when the Dimenſions are therein taken, namely, 5 $\frac{1}{2}$ Yards, one Pole or Perch; four Poles one Chain, as above.

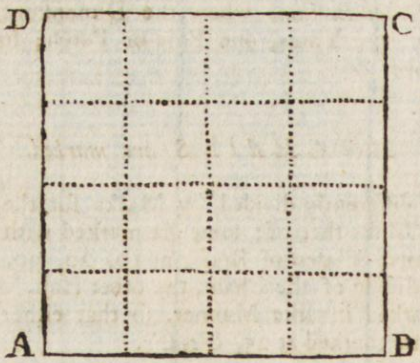
How CHAINS are marked.

Chains are differently divided by Marks for the more ready reckoning the Links thereof; ſome are marked with Braſs Rings, others with ſmall Plates of Braſs, at 10, 20, 30, 45, and 50 Links; the Middle of the Chain, the other Half, or Part of the Chain, is marked in like Manner, ſo that either End may go firſt. Some are marked at 25, *&c*, *&c.*

Planometry, or Superficial Meaſure.

BY the Definition of a Superficies, it appears to have Length and Breadth only, without any commenſurable Thickneſs; and therefore, to find the Area of all ſuperficial Spaces (whether comprehended under curved, circular, or right-lined Extremes or Boundaries) is the Point in Queſtion. And, in order to effect this, though the Space or Superficies be ever ſo irregular, it muſt be reduced to a Number of ſmall Squares (according to the Tenor of the Caſe) as a ſquare Foot, Pole or Chain, *&c.* and the Contents of all ſuch Superficies are known when the Number of the Squares it containeth are diſcovered.

As for Example: Suppoſe ABCD was a ſquare Piece of Land, and the Side AB thereof, was 4 Poles, or 1 Chain; I ſay that Piece of Land contains 16 ſquare Perches, as appears in the following Figure, every ſmall Square being one Perch or Pole, that is, having a Pole or Perch for its Length, and alſo for its Breadth.



Now Land, with regard to the general or common Meaſure, is ſurveyed and returned in Acres, Roods and Poles, or Perches. An Acre contains 160 ſquare Perches, ſuch as the above little Squares, and therefore it is not material in what Form the Acre lies, provided it contains juſt 160 Perches, as in a rect-angular Paral-

Parallelogram, 16 Perches long, and 10 broad, contains an Acre; alſo 20 long and 8 broad, and 40 long, and 4 broad, contain an Acre; by which it appears, that having the Length of any Field, you may readily find the Breadth for an Acre, or any other Quantity, thus: Divide the given Quantity of Land, by the Length of the Field, and the Quotient will be the true Breadth for ſuch a Quantity.

Example.

Suppoſe it were required to find the Breadth of an Acre, or any other Quantity, in a Field whoſe Length is 13 Chains, 56 Links; the Anſwer would be nearly 74 Links. *See the Table, Chap.* VIII. *Part 1ſt.*

SECT. II.

Of MEASURE.

HAving introduced the Chain, I ſhall, in this Place, give ſome neceſſary Directions how to uſe it in meaſuring Lines.

Let the Chain-Leader be provided with ten ſmall Arrows about a Foot long; though ten ſmall Wire Pins (made ſharp at one End, to enter the Ground readily, and a Nooſe at the other End, to which a ſmall Piece of red Cloth ſhould be faſtened, that it may thereby be more eaſily found in Graſs, *&c.*) would be much better in many Reſpects: Let them be ten Inches long, and let him that follows the Chain, ſee that the Leader always puts down his Arrow perpendicular, and in a direct Line with the Object he is going to, or bound for, which he may do by making him, at the End of every Chain (before he puts down the Arrow) cover or intercept the Mark he is going to; for if he ſwerves from a right Line, it will makes the Diſtance longer than it really is, a right Line being the ſhorteſt Diſtance between two Points.

The Chain-Leader, and Follower cannot be two careful in reckoning their Arrows to each other at the End of every Line, and every Change; that is to ſay, the Meaſurer, or Chain-Follower, muſt count ten Arrows to the Leader at the End of every Change; but if any ſhould be miſſing, it is impoſſible to know who loſt it, and therefore they muſt not only go back and find

find the loſt Arrow or Arrows, but alſo meaſure the ſame Line over again.

Mr. *John Love*, in his Treatiſe, very juſtly obſerves the dangerous Conſequence of ſuch Miſtakes, thus: "Be ſure that they "who carry the Chain, miſtake not a Chain either over or "under, for if they ſhould, the Error would be very conſi-"derable; as ſuppoſe you were to meaſure a Field that you "you knew to be exactly ſquare *(though ſuch is ſeldom met with)* "and therefore need meaſure but one Side of it; if the Chain-"Carriers ſhould miſtake but one Chain, and tell you the Side "was but 9 Chains, when it was really 10, you would make "of the Field but 8 Acres and 16 Perches, when it ſhould be "10 Acres juſt: And if in ſo ſmall a Line ſo great an Error "does ariſe, what may be in a greater you may eaſily imagine." But to prevent all ſuch Miſtakes, let him that leads the Chain, take all the Arrows in his Left-hand, and the Chain upon the two firſt Fingers of his Right-hand; then let him take one of the Arrows into his Right-hand with the Chain, and proceed to the Place directed; and at the End of the Chain let him ſtick the Arrow down he held in his Right-hand, and take another out of his Left hand; thus proceed until all the Arrows are done; then the Meaſurer, or Chain-Follower muſt carefully count the Arrows to the Leader, and if the Line be any longer, proceed as above directed, always remembering the Changes you have in each Line, and at every Change count the Arrows, as above directed. If it be Roads you meaſure, *note*, that 80 Statute Chains, make 1 Mile.

SECT. III.

Directions and Cautions to Chain-Followers, and young Practitioners in the Fields.

FIRST, Upon the Chain-Follower depends all the Care of meaſuring, remarking, and noting down Dimenſions, *&c. &c.* and therefore it abſolutely behoves every one that would be a Surveyor, to be not only particularly careful in his Entries, and correct in his Dimenſions, but alſo very circumſpect in his Obſervations, with regard to the Situation of Buildings, Timber, Water-

Water-ponds, Brooks and Dingles, whereby he may draw a perfect Plan from the Field-Notes, if required, when in his Chamber: And that all ſeeming Difficulties herein may be removed, I have recommended, in the following Chapter, ſuch a familiar, eaſy Method, as doubtleſs the weakeſt Capacity may immediately comprehend.

Secondly, When the young Practitioner enters the Field or Incloſure that he intends to meaſure, let him carefully obſerve thoſe Hedges or Fences that are next, if they are ſtrait, curved, or circular, and proceed as directed in the fifth Chapter; always remembering to leave a Mark, at the Beginning, in the Fence or Hedge, that will appear, if required, at a ſufficient Diſtance: Direct your Chain-Leader to obſerve the Motion of your Left-hand, which is to guide him in a right Line, to the Place bound for, by moving your Hand to the Right or Left, according as he is wide of the Mark you are going to; and when you have got him in a right Line, that is, directly between you and the Mark, ſtoop down inſtantly and take up the Arrow that your Foreman or Leader put down, with the ſame Hand that you hold the Chain in, laying hold of the Arrow cloſe to the Ground; and let the Chain-Leader ſtick down an Arrow at the ſame Time that you take up your's, with the Chain at full Stretch: Obſerve (when you direct your Leader, or Chainman, to keep in a right Line with your Mark) to place your Eye and Chain-Hand directly over the Arrow that ſticks in the Ground; and as ſoon as he has put his Arrow down, let him fix his Eye upon the Mark he is going to as he moves forward, which will ſave you a vaſt deal of Trouble in keeping him ſtraight; for it is not very poſſible for him to ſwerve from a right Line, provided he keeps the Mark in View as he moves forward. In hilly Ground, if the Meaſurer loſes Sight of the Mark he is to go to, he muſt ſtand over his Arrow, and the Leader muſt turn and move himſelf till he gets the Meaſurer between him and the Mark departed from.

Thirdly, At your Peril never attempt to draw or form a Balancing-Line, upon any Conſideration whatſoever, for it is moſt certainly attended with notorious Errors, notwithſtanding ſuch random Work, for Ages paſt, has been too much practiſed; which affords us one Reaſon for the general Diſcord amongſt old Practitioners.

Note, A Balancing-Line is either real or imaginary, to wit, real in the Chamber, and imaginary in the Fields; in each Caſe, this Line is inſtituted by the Practitioner to avoid Trouble, and conſequently Accuracy alſo. *See the Explanation thereof in the laſt Article of this Chapter.*

Fourthly, Obſerve (in the Boundaries of the Eſtate you are to meaſure and map) the Hedges and Ditches, that is, to whom they belong: And here note, that if the Ditch is between the Field you muſt meaſure and the Hedge, that Ditch belongs to the neighbouring Gentleman's Land, and therefore you muſt allow 4 Feet, or 6 Links, from the quick Roots in the Hedge, that is to ſay, you muſt not meaſure within 6 Links off the Hedge; but if the Hedge is between the Field you are meaſuring and the Ditch, then it muſt be meaſured therewith. The Allowances for Ditches differ in many Countries, *viz.* ſome allow but 3, ſome 4, ſome 5, and ſome 6 Feet; however, I think 4 Feet ſufficient, (except where Lands are joined by Commonings) for which ſee the Directions at the End of the Chapter. And as for the Hedges and Ditches within the Eſtate, meaſure the Ditch to one Field, and the Hedge to the other, when you are to map.

Fifthly, Let all the Off-ſets you take up, be as near the Fence, and as ſmall or narrow, as poſſible; and when (or before) you begin to take up an Off-ſet, remember always to look along the Fence or Hedge that it lies up to, and remark where abouts in the Fence your firſt Perpendicular ſhould riſe to; and when you have taken the ſame, ſtand at the End thereof, and look again along the Fence where the ſecond ſhould riſe to; and in this Manner you muſt do at the End of every one that you erect. Be careful that you take your Perpendiculars ſo, that if a right Line was drawn from the End of any one, to the next, that Line would neither include the Neighbour's Ground, nor exclude any Part of that you are about to meaſure.

Sixthly, See that you don't go with your Chain into the Fields to meaſure, without a Staff about 5 Feet 4 Inches long, made ſharp at one End to enter the Ground readily; and a ſmall round Braſs Plate, or Wood, between 5 and 6 Inches Diameter, fixt on the Top thereof with a Screw, or how you will. If the

the Head of your Staff be Braſs, let there be put thereon 4 ſmall Studs at the End of the Diameters: So that if two Lines were drawn from the oppoſite Stud or Points, they would paſs through the Centre of the Plate, and croſs each other at right Angles. But if the Head thereof be Wood, two Saw-nicks, a quarter of an Inch deep in the Board, at right Angles, will anſwer the ſame End.

The Uſe of the above Staff, is as follows: When chaining in the Field, if you have Occaſion to raiſe a Perpendicular to any aſſigned Point or Corner, your Eye can inform you if you are near the Place it ſhould be; then ſtick down your Staff perpendicularly, that is, upright, and fixing one of the Lines that are thereon, directly over your Chain, and parallel thereto, as it lies on the Ground; apply your Eye to the End of the other Line (on the Staff-head) and looking along the ſame, if you perceive the aſſigned Point in a direct Line with that which you look along, you have found the Place; but if the Mark lies to the Left or Right, you muſt remove your Staff, and place it accordingly.

Having explained the Chain, and Croſs-Staff, it follows next to ſay ſomething of the Field-Book.

SECT. IV.

Of the FIELD-BOOK, and Directions in the Fields, &c.

HAving now particularly deſcribed the Chain, Meaſuring-pins, Croſs ſtaff, *&c.* I propoſe here to ſhew how to prepare the Field-Book, and alſo the Method of entering the Field Notes or Dimenſions, with all imaginable Exactneſs, by a Pen, and not with black or red Pencils, leſt the ſame ſhould be effaced by the rubbing of the Leaves, which often happens.

Firſt, Of the Field-Book.

1. Let your Field-Book reſemble that of a common Pocket-one, with a Claſp on one Side of the Cover; which, when you have made an Entry, being placed between the Leaves, the Book may be returned to the Pocket, without Obliteration.

2. Each Page therein muſt be divided into two equal Parts or Columns, by a black Line; and if you are to map the Field which you are about to meaſure, let the firſt Column in each Page, have wrote on the Top thereof, the Field's Name; under which the Dimenſions of the ſame muſt be inſerted, as hereafter: The Right-hand Column muſt be reſerved to contain neceſſary Remarks, which frequently occur, ſuch as Timber, Ponds, Pits, Plantations, Buildings, Gates, and Styles; together with the Bearing of remote Objects remarkable, as Steeples, Windmills, Towns, Cities, *&c.* which being properly repreſented (if Room permit) in a Map, will be an additional Embelliſhment thereto. But if the Land which you are about to meaſure, is not to be mapped, then there will be no Neceſſity for appropriating the Right-hand Column to any ſuch Remarks.

OBSERVATIONS.

1. Remember to expreſs therein the Owner's Name, *&c.* of the Eſtate that you are to ſurvey, thus:

' Dimenſions of an Eſtate (Demeſne or Manor, *&c.)* in the Pariſh of———, in the County of——— belonging to C—— D——, Eſq; and now held by———. Here mention the Tenant or Tenants Names, if more than one; and where you begin, enter the Tenant's Name above your Dimenſions; do ſo in each diſtinct Tenement.

2. The Reader will find the Form of this Book claims the Preference to all others uſed in this Science; as it is not only plain and conciſe, but abſolutely compleat alſo, and is intirely new to any thing of the Kind ever attempted before. However, I am not inſenſible, that there are ſcarcely three Surveyors in the Kingdom that have exactly the ſame Method of entering their Field Notes: Some that I have ſeen were not only intricate, but confuſed alſo; whilſt others were both numerous, tedious, and full of writing, which induces me to recommend to Practice, the Uſe of the following Form, as it is peculiarly adapted to Dimenſions taken by the Chain.

The

The FORM of a FIELD-BOOK.

John Ancker's holding

Dairy-Field.

South Off-ſet, &c.

At	0	0
	3.67	17
	4 90	1.62
	7.84	74

East Off-ſet, &c.

Note, This Method of entertering Dimenſions, ſhall be more fully explained in a proper Place.

REMARKS.

A Pond of Water on 6 Chains, Right-hand Perpendicular.

15 Timber Trees on South Side *Dairy-Field*, equal Diſtance.

Thus expreſſed, 15 T.T. eq. D.

Note, If you would diſtinguiſh the Timber, you may obſerve the following Characters, *viz.*

a — Aſh, A, large Aſh.
o — ſmall Oak; O, large ditto.
p — poplar, &c.

A few Days Practice in the Fields will render ſuch Remarks both familiar and eaſy.

More Directions to young Practitioners in the Fields.

Firſt, In meaſuring by the Chain only, or taking exactly the Dimenſions of any Field, or encloſed Piece of Ground, it is moſt methodical to begin at ſome remarkable Place, *viz.* Houſe, Gate, Style, Tree, &c. and for want of ſuch, fix a Mark at your ſtarting Place, as directed in the firſt Section of this Chapter; and from thence proceed orderly according to the Situation of the Field, *viz.* If a four-ſided irregular Field, firſt ſtraighten the Boundaries thereof, by taking up the Off-ſets, as hereafter taught; and the Body of the Field you may take up in a Trapezium, or Rect-angle, whichever ſeems convenient.

Secondly, It is not material in meaſuring with the Chain, whether you go to the Right-hand or Left, that is to ſay, with or againſt the Sun.

Thirdly,

Thirdly, It will not be amiſs for the young Tyro (ere he is perfect in Field Practice) at his Entrance into the Field, to obſerve, if poſſible, its Form, and with a Pen or Pencil draw (at Adventure) a Figure that may ſomewhat reſemble the ſame, which will enable him to plan, when in his Chamber, the Dimenſions thereof with leſs Heſitation: But when he is ready in the practical Part of Surveying, ſuch Delineations will be unneceſſary.

Fourthly, When you are accidentally obſtructed in meaſuring any Line by the Interpoſition of Pits, Ponds, or any thing elſe, you may, at the Brink of the Pond, or Pit, ſtretch the Chain to the Right or Left (which ever is moſt convenient) at right Angles to the Line you are meaſuring; and at the End of that Chain, &c. you may proceed parallel to your firſt Line, until you are paſt the Pond; then one Chain, &c. at right Angles, on the Side the Pond lies, will bring you in a Direction with your firſt Line.

Fifthly, When the Field contains a great Number of Sides and Angles, and being bounded on one Side by a Brook, or River, your firſt Care muſt be to ſtreighten the Hedges, Brook, &c. as directed in Chapter VI and VII, then meaſure the Body of the Field as therein directed.

Note, In mapping old Brooks, which generally have numberleſs Turnings, and curved Windings, it is extremely difficult (I might have ſaid impoſſible) to expreſs the ſame when taken from a ſmall Scale; notwithſtanding, you muſt, in taking the Dimenſions thereof, always be very particular (*ſee Example* II. *Chap.* VII.) howſoever all Brooks, and whatever Branches of Rivers which you meet with in your Survey, ſhould be expreſſed, and particularly where they run into the main River, provided the Eſtate you are meaſuring conjoins, or is ſituated near the ſame.

Sixthly, If you chuſe, you may remark in your Map (provided the Size of your Vellum will admit thereof) all contiguous Edifices, *i. e.* Caſtles, Halls, Houſes, Mills, Churches, and Objects of Note; which, if well finiſhed, will be a great Addition

dition to its Beauty, to perform which, you have Directions in the ſecond Part of this Book.

Note, If any thing of the above occurs in the Eſtate you are ſurveying, ſee that you neglect not to notify the ſame, and place it in your Map accordingly.

Seventhly, In meaſuring a Baſe-line adjoining a Hedge, it ſometimes happens that you are prevented chaining ſo near the ſame as you ſhould, by the Obſtructions of Briars, Thorns, Pits, Buſhes, or other Things intercepting; in this Caſe you muſt meaſure a ſtraight Line at ſome convenient Diſtance parallel (if you think proper) to the Hedge; and from thence erect Perpendiculars to each Turning, (as directed in *Problem* I. *Chap.* VII.) noting the ſame down as an Off-ſet; whether on the Right-hand or Left-hand, it matters not with its Situation, as ſuppoſe a South-Eaſt Off-ſet, Left-hand, (with the Field's Name right over it) thus:

Dairy Field,
S.E. Off. L. h.

The Notes in the foregoing Field-Book explained.

Firſt, At 0, that is, at no Length, it is the firſt Perpendicular, provided you don't begin in the Corner of the Field, otherways it would be at 0, it is 0, that is to ſay, at no Length, to wit, the Beginning it is no Breadth, &c. This is effectually explained in the following Chapter; but herein carefully obſerve, that when you come to the Hedge where the Mark is fixt to which you meaſured, if the Ditch be in the Field, ſuffer your Chain-Leader to go no farther than the nearer Side of the Ditch, elſe allow four Feet, or ſix Links, *(ſee the following Section)* for a Ditch, the Ditch being the Property of the next Field: And if it ſhould happen, as it often does, that there is not quite a Chain between the laſt Arrow, or Pin, and the Hedge or Ditch you are to meaſure to, let the Chain-Leader fix the Chain End at the Ditch Side, and hold it there till the Meaſurer (laying down the Chain ſtraight) comes to the laſt Arrow, and laying hold of the Chain thereat, take it up, and count the Links by the Help of the Braſs Marks before-mentioned, which muſt be inſerted with the

the Chains that the ſaid Lines meaſure to: As for Inſtance, ſuppoſe you are ſtanding at the laſt Arrow, and diſcover it to be one, two, or three Tens, and ſome odd Links paſt, or more than 50, which muſt be reckoned to 50, and the Sum will make 60, 70, or 80, together with the odd Links.

The like is to be obſerved in all other Examples of this Kind in Chaining: One Day's Practice in the Fields with the Chain, will render you much more perfect in counting the odd or ſurplus Links, than ſeveral Pages filled with Explanations thereof.

Secondly, As you are chaining your Baſe-line, and a Turn or Bend in the Hedges appears, which you find directly oppoſite to 3 Chains 67 Links, you then meaſure with your Staff, being 8 Links in Length, (the Chain lying on the Ground at full Length) the Diſtance between 67 Links and the Corner, being juſt 17 Links, which you muſt thus enter in Figures: At 3.67——.17, and then proceed with your main Line, and oppoſite 4 Chains 90 Links, another Turn appears in the Hedge, which you muſt alſo meaſure as above directed, and enter it likewiſe down thus: at 4.90————————1.62. When ſtanding at this laſt Corner, you obſerve the Hedge to be ſtreight to the End, and therefore there will be no Neceſſity for any more Perpendiculars till you finiſh the Line, and then you take up the laſt, *viz.* at 7.84————————.74.

Here note, The Word *at*, is always underſtood, but never expreſſed for Brevity ſake.

An Off-ſet, and how taken, explained.

Thirdly, An Off-ſet is an irregular Space of Land, intercepted between a Baſe Line, and the ſubtending Limits of an Incloſure, to every Corner of which, Perpendiculars are, or ſhould be, raiſed. *See Example the 2d, Chap.* V.

Fourthly, The Situation of an Off-ſet, reſpects the cardinal or chief Points of the Compaſs, by ſome called the Mariners Compaſs, *i. e.* Eaſt, Weſt, North and South; but when Land is to be meaſured only, and not mapped, there will be no Neceſſity to regard the Bearing or Plan thereof; and as there are Numbers of Country People whoſe Ambition aſpire no higher than to meaſure

meaſure a Field or ſo, I therefore would adviſe all ſuch, unleſs they chuſe it, not to burthen their Memory with this Article: However, for the Edification of the young Tyro whoſe Inclination is fully bent to become a complete Surveyor, I ſhall endeavour to gratify his craving Deſires, by a thorough Explanation of every Thing that appertains to Field Practice. And,

Firſt of the Compaſs, which contains 32 Points with regard to Navigation, but in Surveying they are reduced to 8, namely, the 4 cardinal or chief Points, as Eaſt, Weſt, North and South; and four compound, *viz.* North Eaſt, North Weſt, South Eaſt, South Weſt; which are abbreviated in the Field-Book, and may be expreſſed by their initial Letters, to wit, E. W. N. S. NE. NW. SE. SW. *See Example 1ſt, Chap.* VI.

And that the Learner may not be at a Loſs, when in the Field, how to adjudge the Bearing of each Off-ſet therein, let him call that Side of the Field next the Sun's riſing Eaſt, the oppoſite Side will be Weſt; and in chaining from the Weſt towards the Eaſt, he'll have the North on the Left-hand, and South on the Right: But if he ſhould chain any how between the above-mentioned chief Points, that is to ſay, between the North and Eaſt, *(See the Field* O, *Example 5th, Chap.* VI *)* and an Off-ſet ſhould occur on either the Right or Left-hand, that upon the Right will be a South Eaſt one; and the Left-hand Side muſt be called, or entered, a North Weſt Off-ſet. As this Method of Entry with regard to Off-ſets, is moſt uſeful and new to any thing heretofore publiſhed, I ſhall beg Leave to be ſomething more particular, ſince the Progreſs or Proceeding in the Field hath an abſolute Dependence thereon.

Firſt then, When the young Tyro enters a Field, let him obſerve, with Care, the Situation, with regard to the Eaſt, Weſt, North or South Sides thereof; and whatever Lines he meaſures when ſtraightening the Sides, or otherwiſe, he muſt enter the ſame as above directed; i. e. if an Off-ſet occurs to the Right or Left-hand of the Baſe Line, (then in chaining) the Side that ſubtends to the North, is called a North Off-ſet; if the Weſt, it is called a Weſt one; if the South, a South one; and if it ſubtends any how to the North Weſt, it muſt be called, or entered a North-Weſt Off-ſet, *&c. &c.* as already above directed.

Secondly, But if, in his Conjecture of the Field's Situation, he ſhould vary a Point or two, it is not very material; however he muſt be careful to correct the Miſtake ere he leaves the Field, or returns a Map thereof, which he may perform thus:

Let him obſerve when the Sun is full South, that is, when it is Noon or Mid-day; and whatever Line he has taken in the Fields that points thereto, is a Meridian Line, by which the Situation may be accurately corrected: But if any of the Lines be at right Angles thereto, it is then an Eaſt and Weſt Line, by which alſo the Meridian is found.

Thirdly, It happens ſometimes in hazy Weather, when the Sun don't appear, that a Surveyor will be at a Loſs to form an Idea of the Land's Situation; in thoſe Caſes an Opportunity muſt be embraced when the Sun ſhines at Noon, to obſerve what Hedge or Line points thereto, which when found will be a Meridian Line.

Fourthly, Here note, you'll have no Occaſion to regard the Variation of the Compaſs, when you have obtained the Meridian Line by the Help of the Sun.

Note alſo, If you cannot obtain the true Situation by Reaſon of the Sun's Obſcurity, or otherwiſe, and a horizontal or direct Sun-Dial be erected in any Part of the Premiſes, the Gnomon, or Style thereof, always (if truly erected) points to one or other of the above-mentioned chief or cardinal Points, by which the true Situation may be found.

Fifthly, *An Off-ſet upon an Off-ſet*, is when on a Perpendicular an Off-ſet occurs, in *Example* 2*d*, *Chap.* VII. On the third Perpendicular to the Brook an Off-ſet preſents itſelf, which ſee; and alſo the Method of Entry.

Sixthly, In mountainous or hilly Grounds, meaſure the Superficies thereof, and return the ſame, being repreſented as ſuch in your Map, as directed hereafter; but be careful not to encroach into, or upon the adjacent Incloſures, but fix the Hill or Mountain on its true Foundation, which you may do by the Help of

plane

plane Trigonometry, by taking the Hill's Altitude. *See the ſecond Part of this Treatiſe.*

Seventhly, If your Orders be to return an Account of the Timber in the Survey, firſt plan the Whole; and if you think proper you may take the Plan into the Fields afterwards, and note down, with a lead Pencil, not only the Number of Trees as they grow in the Hedges reſpectively, but alſo whatever elſe is remarkable, as Pits, Ponds, Roughs, Gates, Styles, or any notable or remarkable Thing omitted in your Dimenſions, by which Means you'll have a perfect Plan to compleat a Map by.

Eighthly, When you have meaſured the Timber according to the Directions given in the Appendix, if the Land is to be ſold, you ſhould prefix an Account thereof in ſome vacant Place of your Map; or rather give an Account of the ſame upon a Slip of Paper to your Employer, which will enable him, if neceſſary, to diſpoſe of the ſame, perhaps, to better Advantage.

Ninthly, If a woody, marſhy, watry, or other inacceſſible Piece of Ground be encloſed on each Side with open and clear Land, you need only meaſure and plan the circumjacent Land, and the incloſed will appear. *Otherwiſe ſee Problem* II. *Chap.* X. *Part the firſt.*

Tenthly, When you are to ſurvey a Manor or Lordſhip, where there are Houſes, Yards, Gardens, Orchards and Folds, or other ſmall Incloſures, it is beſt to begin with the large open Fields; and if you chuſe your mean Line may paſs near the ſame, by which Means you may take up the ſame between two adjacent Perpendiculars; *(See Plate the Second*, wherein you'll find an Inſtance given for your Improvement) for it often happens, by Reaſon of Dunghills, Ponds, Buildings, &c. you cannot conveniently come at or to them to meaſure; but when you have got the ſame between any two Perpendiculars, by taking up the Off-ſets herein after explained, you'll have them repreſented in their proper Place.

Eleventhly, And although the Cautions and Directions to young Practitioners now recited, ſeem to open a Sluice to Explanations peculiar to Field Practice, yet, nevertheleſs, all the

ſucceeding Examples muſt be carefully conſidered, and duly regarded, otherwiſe the young Learner will find himſelf greatly deficient when he comes to real Practice.

Thus, Having compleated the Dimenſions, Remarks on Timber, Situation, Woods, Bogs, Hills, Rocks, Fountains, Moors and Marſhes, with every other Material proper to be remarked or noticed; the next Care will be to draw a fair Map of the Whole, according to the Directions laid down in the laſt Chapter, *Part the firſt.*

Note, Here follows a few more Directions to young Practitioners in the Fields, very neceſſary to be underſtood, concerning the Boundaries of Land, and what Breadth is generally allowed for Ditches, &c.

But here obſerve, All Countries differ ſome little in theſe following Articles, and conſequently the prevailing Law of Cuſtom muſt take Place; nevertheleſs, I hope it will not be taken amiſs to lay down a few Directions whereby the young Learner may be enabled to uſe ſuch diſcretionary Means as correſponds with the peculiar Cuſtom of each Place: In many Places the Surveyor meaſures the Boundaries no farther (for their own Eaſe) than where the Quicks are or ſhould be planted: I'll admit this Rule within the Bounds very proper, otherwiſe very uncertain.

Of the Boundaries of Land, and what Breadth is commonly allowed for Ditches adjoining Commoning, &c.

Firſt, When any Part of the Eſtate you are to meaſure lies contiguous or adjoining to Foreſts, Commons, or waſte Land, you muſt allow four Feet and a Half, or ſeven Links, for all Ditches adjoining thereto; and four Feet between Gentleman and Gentleman.

Secondly, All Roads, whether private or public (Foot Paths excepted) ſhould not be meaſured upon any Tenant who pays for his Holding by the Acre. There is no Gentleman will inſiſt upon Payment from a Tenant for Land that is promiſcouſly the

the Property of the Public: I look upon it as the moſt unreaſonable Thing in Life,

A Tenant to pay for what others poſſeſs!

(the Caſe in *Ireland*) which undoubtedly is owing to an Error in the Judgment of the Surveyor. This Miſtake, I imagine, has been firſt introduced in that Country through the Cheapneſs of Land, perhaps ſome hundred Years ago, when good Land was let at Eighteen pence or two Shillings an Acre, ſo that the King's Road *(as they call it, though in Fact it is the poor Tenants who pay for it)* paſſing through a Farm, could not amount to an extraordinary Sum at ſo ſmall a Trifle per Acre; but now-a-days, as Land *there* ſets for between 20 and 30 Shillings, it would be very hard upon a poor Tenant to find the Public a Road which coſts him yearly, perhaps, ſix, eight, ten, or twelve Pounds. I am poſitively certain, that if every Meaſurer *in that Country* would repreſent the Unreaſonableneſs of the above Cuſtom to the Gentlemen who employ them, the ſame would be immediately redreſſed, and that ſevere Practice would be utterly aboliſhed, to the great Comfort and Satisfaction of the poor Pains-taking Tenant, who, perhaps, labours under the heavy Burden of a Rack-rent, and a helpleſs growing Family, whoſe Prayers would undoubtedly attend every Surveyor by whoſe intereſting Means ſuch Grievances were removed.

I would not be underſtood, that Roads ſhould not be meaſured: No, my Intention is foreign to any ſuch Thing; for I would have them meaſured and mapped accurately, and returned as ſuch, and not as arable Land, *&c.* which is too often the Caſe.

Thirdly, When the Eſtate, or any Part thereof, is bounded by a River or running Brook, meaſure no farther upon the Tenant than to the Water Side; but in your Map be careful to repreſent the Brook, or River, as before-mentioned, *(See the 4th Section of this Chapter)* and half the Area thereof ſhould be returned with the Roads, *&c.* thus: Roads, Brooks, *&c.* contains————————

Fourthly, when the Boundaries are Stone, or Brick Walls, meaſure no farther than the Outſide thereof.

Fifthly,

Fifthly, If a Turnpike-Road ſhould paſs through any Part of the Eſtate, allow 30 Feet for the Breadth thereof, that is, meaſure within five Yards of the Road's Centre, unleſs the Fence on either Side proves cloſer together, and then you muſt meaſure up thereto.

Sixthly, If Moors, Marſhes, Bogs, Heaths, Shallows, Pools of Water, Shrubs or Rocks, belong to, and adjoin the Eſtate, meaſure what is improveable firſt; and if any of the rejected Part will admit of Improvement, meaſure and return it as ſuch; the Remainder ſhould appear in your Map as unprofitable Ground.

Seventhly, In the Map it will be proper to ſhew to whom the Land belongs that ſurround the Eſtate; which muſt likewiſe be obſerved when taking up the Dimenſions; but if you ſhould happen to omit ſuch neceſſary Remarks in the Field-Book, the Tenant or Perſon who occupies the Eſtate can inform you, by the Plan, where ſuch and ſuch a Gentleman's Land commences, and alſo how far it continues, which you may accordingly enter in your Plan as effectually as if you was directed by your Field Notes. Many more uſeful Directions might herein be given with regard to Mapping, but as they don't relate to Field Practice, I do not think proper to recite them, although there are Numbers in *Great-Britain* that pretend to map, who are abſolute Strangers to the Field Occurrences; for the Surveyor draws the Plan from his Dimenſions, by which any Perſon ſkilled in Drawing may form an accurate Map therefrom.

And laſtly, of *Balancing-Lines*.—Having already obſerved that thoſe Lines were either real or imaginary, which ſome Practitioners groſsly ſuppoſed to give and take equally; however probable or abſurd this may ſeem to the unprejudiced Reader, I'll not pretend to determine, but ſhall appeal to the diſcretionary Judgment of the Public.

Of Balancing-Lines in the Fields.

Firſt, The Practitioner inſtitutes theſe Lines to avoid ſome Fatigue in chaining, *i. e.* when a curved or circular Hedge or Brook occurs in the Survey, he fixes upon a Place in or near the Corner or Fence thereof; and then (if not before) muſt have Recourſe

courſe to his darling Aſſiſtant *Eſtimation*, by fixing on a Place or Object at the other End of the Fence, within or without the Incloſure, as his judgmatical Eye directs; and then ſuppoſes that if a right Line was meaſured between theſe two Places, it would croſs the intercepting curvilineal Fence in ſuch a Manner, that if the excluded Land on the one Hand were accurately ſurveyed, it would be equal to the included Land on the other, to wit, the Land *this random Balancing-Line* meaſured which belonged to the adjaced Field: I would not be underſtood in this Place to affirm, that ALL modern Practitioners are guilty of this abominable, this erroneous Practice; but am afraid too many are. However, this will readily be granted, *When once a Man's Name is up, he may lie in Bed*, comparatively ſpeaking of thoſe indulgent Practitioners.

Of a Balancing-Line in the Chamber.

Secondly, This is what I term a real Line, it being really drawn upon Paper. In the 430th Page of *Whiſton's Survey*, you'll meet with the Uſe and Application of this fictitious Line, deſignedly illuſtrated, as I ſuppoſe, to prejudice the Unlearned.

Alſo, in the Works of our modern Mathematician, the famous Mr. *Hutton* very ingeniouſly recommends a Horſe-hair to be applied to the irregular Bounds of an Incloſure when planned; by which Means he (Mr. *Hutton*) aſſerts, that the Eye can accurately determine the Equality of all ſuch curvilineal Spaces. I am very ſorry that this Gentleman ſhould trace not only the Footſteps of others, but alſo ſlip into their Errors too. My Sincerity to the Public hath induced, or rather prevailed on me to point out this Sand-bank of Deſtruction, where undoubtly thouſands were hitherto bewildered and loſt.

Doubtleſs, the above Remarks will give ſome little Diſguſt to thoſe who have heretofore relied on the Authenticity of antient and modern Authors. I am not a little concerned that it proved not the Lot of ſome abler Pen-man to explain the Conſequence that muſt unavoidably attend ſuch gueſs Work; however, I muſt confeſs that all ſuch are leſs blameable, than thoſe Authors from whence they learned.

CHAP.

CHAP. IV.

In this Chapter, and the three ſucceedings ones, I have given plain eaſy Rules and Directions to meaſure with the Chain only, and caſt up by the Pen, all Manner of Incloſures (though bounded with old Brooks, curved or circular Hedges, &c.) with a full Deſcription of not only the Earth's Superficies, but alſo Field Occurrences; with both uſeful and neceſſary Cautions to young Practitioners therein.

OBSERVATION.

IN ſurveying of Land by the Help of an Inſtrument, the Surface of the Earth, though uneven, is conſidered as a Plane: The Meridians (with regard thereto) are ſuppoſed to be parallel; but it being obvious to the naked Eye that the Superficies of the terraqueous Globe is both irregular and uneven; hence ariſes the chiefeſt Cauſe of a Diſcloſe and a general Diſcord, between the Northings and Southings, Eaſtings and Weſtings, which too frequently attend the Practice of the Needle: And yet where is the Practitioner that does not impute theſe Differences to either the Imperfection of the Needle, the Variation of the Compaſs, or Incorrectneſs in Chaining, *&c.* However, in a proper Place in this Treatiſe, I ſhall endeavour to prove, that the above-mentioned Differences proceed more from the Unevenneſs of the Earth's Surface, than any thing elſe, when Care be taken in chaining, *&c.* and here ſhew plain and eaſy Rules. Firſt,

To meaſure and find the Content of any regular Incloſure by the Chain and Pen.

Having in the laſt Chapter obſerved, that my Intention was to avoid all Prolixity, if poſſible, that I might thereby prepoſſeſs the young Learner in Favour of ſo healthy and delightful a Study, I come now to ſhew and teach him how to meaſure with the Chain, *and caſt up with the Pen*, the Dimenſions of any regular Field, that is to ſay, to diſcover how many Acres, Roods and Perches, are contained therein. And firſt of

SQUARE FIELDS.

Though ſuch are ſeldom met with; and if by Chance one meets with an Incloſure, that is, a geometrical Square, yet there is a Hazard in taking the Dimenſions thereof, and caſting them up according to that well-known Rule of multiplying the Side into or by itſelf, and therefore I ſhall recommend a more ſatisfactory (though perhaps in this Caſe not ſo expeditious) a Method: And that is, when you come to meaſure a Field that is ſuppoſed to be ſquare, fix your Staff in a Corner thereof; and if the two next Sides are at right Angles, erect a Perpendicular on one Side, leaving your Staff in the Corner ſtanding; and when you have meaſured the Side, enter it down, and come back to your Staff; then meaſure the other Side (which if it be a Square, will be equal to the former) and at the End thereof (if the third Side be perpendicular to the Baſe or laſt meaſured Side) meaſure its Length alſo: Now if the Baſe and each of the Perpendiculars be equal, the Field is a true Square, otherways not. If ſquare, you may either multiply the Side by itſelf, or caſt it up, as is taught in the ſecond Problem of this Chapter.

PROB. I.

Let it be required to find the Content of a ſquare Piece of Land.

N. B. The ſuperficial Figures in the four next ſucceeding Chapters, repreſent Incloſures laid down by a Scale of 40 Statute Poles, or 10 Chains to an Inch.

Example. I.

Let the Figure ABCD, repreſent a ſquare Piece of Land, I demand the Content thereof in Statute Meaſure.

Here note, When the Dimenſions of Land (taken by a four-pole Chain) are caſt up, the Reſult is either ſquare or half ſquare Chains, according as the following Rules direct. But if the Dimenſions were taken by a one Pole Chain, the Reſult would be ſquare or half ſquare Poles; and ſo of any other Dimenſions.

Firſt, When you come into the Field ABCD, make for the Corner A (though any Corner in the Field would anſwer the ſame End) and there place your Croſs-Staff, by which the Side AD will be found to ſtand or lie perpendicular to AB; then meaſure the Side AD, and you'll find it to be 16 C. 82 L. which enter as below; come back to the Staff, take it up, and meaſure the Side AB, which you'll find to be 16 C. 82 L. Alſo, laſtly, fix your Staff in the Corner B, and you'll find that the Side BC is likewiſe perpendicular to AB, which being chained, will be found to agree with the former, *viz.* 16 C. 82 L. Dubious of the above Figure being a geometrical Square, I thought it expedient to make Entry as follows, *viz.*

The

The Dimenſions.

	C. L.
At 0	16.82
At 16.82	16.82

In Words thus expreſſed:

At the Beginning, that is, at no Length, it is the firſt Perpendicular AD = 16.82. And at the End of the Side AB = 16.82, it is the ſecond Perpendicular BC = 10.82. Now as the Sides are equal, and the Angles equal alſo, it is therefore evident, by the 46th *Prop.* 1 *Euclid*, that it is a geometrical Square.

RULE.

16.82 } The Side multiplied by itſelf,
16.82 } gives the Content.

3364
13456
10092
1682

28.29124
4

1.16496
40

6.59840

	A.	R.	P.
Anſwer	28	1	6⅕

Point off the fifth Figure, the Remainder to the Left-hand are Acres; and the Right-hand Figures are decimal Parts of an Acre.

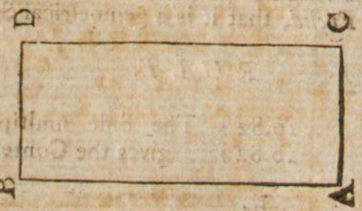
The Learner may perceive, that to caſt up the Dimenſions of a ſquare Piece of Land, is attended with no Sort of Difficulty, provided the Dimenſions be carefully taken: The Method of working them is ſo eaſy, that I think a ſecond Example would be needleſs.

PROB. II.

Let it be required to find the Content of a rect-angular Piece of Land, commonly called an Oblong, or long Square.

Example.

Let the rect-angular Figure ABDC, repreſent a Piece of Land, I demand the Content thereof.



Note, Fields of this Kind are oftner met with than the former; ſo that in meaſuring this, and all ſuch like Incloſures, you muſt proceed as you were taught in the laſt Problem; and if you find the Side AC and BD to be perpendicular to the Side AB, and both equal, you may venture to uſe the old general Rule in ſuch Caſes; to wit, the Length multiplied by the Breadth, gives the Content; but to prevent any Doubts of it's Regularity, fix your Croſs Staff in the Point or Corner A, perpendicular, as before directed, by which you'll diſcover if the Side AB be at right Angles to AC; then chain the Side AC firſt; when done, return to the Corner A, and chain AB alſo. In like Manner you muſt examine if the Line or Side BD, be likewiſe at right Angles to AB, which you may know by the Help of your Croſs-Staff, chain BD alſo; and having found the Field rect-angular, enter the Dimenſions thereof, thus:

C. L.

At 0 —————— = 9.54 The firſt Perpendicular AC.
At 21.78, or Baſe = 9.54 The ſecond Perpendicular BD.

The

The foregoing Dimenſions more briefly entered thus:

0——————9·54
21.78——————9·54

This Method, I preſume, is preferable to any other hitherto publiſhed, as there is little or no Time loſt in noting down the Dimenſions; and yet notwithſtanding, the Field Notes are as fully comprehended as if there were ever ſo much writing made uſe of therein.

To find the Content of the above, or any ſuch Figure, obſerve this Rule.—*Multiply the Length by the Breadth, and the Product is the Content.*

21.78				
9·54				
8712				
10890				
19602				
20.77812	A.	R.	P.	
4	20	3	4½	Content.
3.11248				
40				
4.49920				

This Problem is not much unlike the former, both in the Dimenſions and Work, and therefore it is quite unneceſſary to give any more Examples. Seeing then, that the Report of ſuch or ſuch a Field being ſquare, ſhould not have the leaſt Influence upon a Surveyor; and though any one Angle in a Field may appear to contain 90 Degrees, yet, notwithſtanding, the remaining Angles may be either acute or obtuſe; however, the Croſs-Staff will remove all ſeeming Doubts in regard to Angles therein; and the Chain will diſcover if the oppoſite Sides of an Incloſure be equal.

Hence,

Hence, if two equal and parallel Lines, or Sides of a Field, as AD and AC, *(see Example the first)* or as AC and BD, *Example the second*, be joined by two others, thoſe are equal and parallel alſo, by 33 *Prop.* 1 *Euclid.*

And, by the Corollaries derived from the 32*d* and 34*th* Prop. *Euclid*, 1*ſt Book*, it is manifeſt, that if one Angle in a Parallelogram be a right Angle, the remaining Angles are right alſo; conſequently the Areas of Squares or Rect-Angles (by the Rules foregoing) are obtained. *See firſt Definition, Euclid* 2*d Book*, &c. wherein you'll find rect-angular Parallelograms defined.

PROB. III.

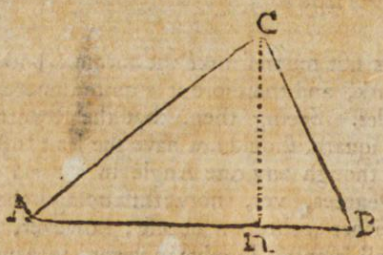
Of Triangles.

Let it be required to find the Content of any plane triangular Piece of Land.

Note, the Area or Content of every Triangle, is equal to half the Rectangle contained under the Baſe and Perpendicular of the ſame; that is, the Baſe multiplied by the Perpendicular, half the Product is the Content. There are ſeveral other Methods of finding the Area of Triangles, but this is ſufficient for our Purpoſe.

Example.

Suppoſe the Triangle ABC repreſents a Piece or Parcel of Land, I demand the Content thereof.



Now, in order to meaſure this Triangle, begin at A, and chain towards B; when you come to n, that is, 9 Chains 24 Links,

Links, upon the baſe Line, you'll find by your Staff, that the Perpendicular n C, will riſe at the Point n, which you muſt chain or meaſure ere you proceed farther, and you'll find it to be 21 Chains, 36 Links; then return to, and meaſure from the Staff to the End of the Line or Corner B, always remembering to leave the Arrows with the Staff which belonged to the Side or Baſe AB, that is to ſay, thoſe Arrows that you took up before you engaged the Perpendicular; and the Arrows that belong to the Perpendicular return to your Aſſiſtant at the End thereof: When you come back to the Staff, retake the former Arrows, and then proceed till you have chained to the End of the Baſe.

The Dimenſions are thus entered:

	Chains.
At o	0.0
9.24	21.36
33 60	00

See the Work.

The Baſe AB = 33 60
The Perpendicular n C = 21 36

20160
10080
3360
6720

2)717.6960

35.88480
4

3.53920
40

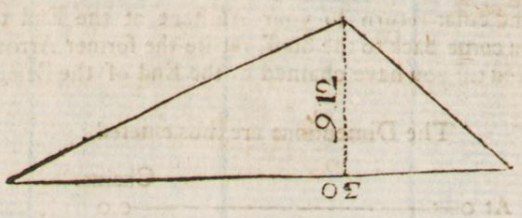
21.56800

Take half the Product, otherwiſe when you uſe a four-pole Chain, multiply the Product by 8, and that laſt Product will be ſquare

ſquare Perches, which being divided by 40 and by 4, gives the Content. See the following Examples.

Example II.

Let the annexed Figure repreſent a triangular Piece of Land, I demand the Content thereof.



Dimenſions.

2188¾

0 —— 0.0

30.00 —— 9.12

9 12
30.

273.60
8

40)2181 8.8

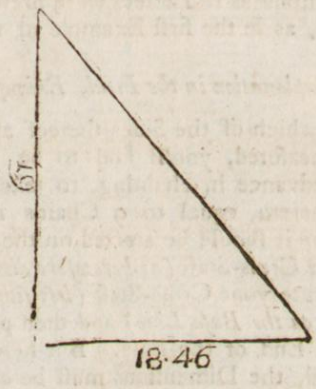
4)54 28

Anſwer 13 2 28¾

Example III.

Let the following Figure repreſent a triangular Field, I demand the Content thereof.

Dimenſions



Dimenſions.

0 ——— 0

19.05 ——— 18.46

18.46
19.05

9230
166140
1846

2)35.16630

17.58315
4

2.33260
40

13.30400

	A.	R.	P.
Anſwer	17	2	14¼

I hope, that the placing the Dimenſions of the two laſt Examples upon their Baſes and Perpendiculars reſpectively, will be

as readily underſtood as if Letters were prefixed to each angular Point or Corner, as in the firſt Example of this Problem.

Explanation in the Field, Example II.

Firſt obſerve which of the Sides thereof appear to be longeſt, which, when meaſured, you'll find to be 30 Chains; but be careful as you advance in chaining, to take up or meaſure the Perpendicular thereto, equal to 9 Chains 12 Links, the particular Place where it ſhould be erected on the Baſe, you'll find by the Help of your Croſs-Staff *(as heretofore directed;)* which when meaſured, return to your Croſs-Staff *(left ſtanding where the Perpendicular aroſe on the Baſe Line)* and then proceed till you have meaſured to the End of the Baſe. But here note, if the Field ſhould be planned, the Dimenſions muſt be entered thus:

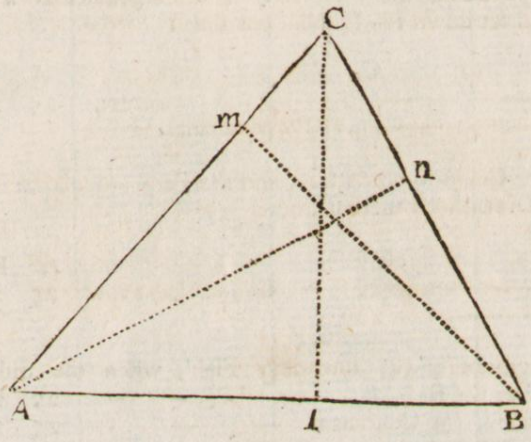
0	0
12.	9.12
30	00

Otherwiſe it would be impoſſible to form an accurate Plan from the Dimenſions, as the Surveyor could not, with any Certainty, pretend to erect the Perpendicular in the identical Place on the Baſe where the ſame was found. But when the Field is not to be planned, it is not material whether or no you take Notice thereof in your Field-Book, and though you did, the Trouble is but trifling; however, I'll leave you to your own Diſcretion in this Particular; but in all other Caſes (as is hereafter taught) you muſt be exceeding careful to note or enter down every particular Place where you erect ſuch Lines.

Note, That any Side of a Triangle may be meaſured for its Baſe, and erect a Perpendicular therefrom to the oppoſite or ſubtending Corner, and the Content of the Triangle will be equally the ſame, as for Inſtance:

Suppoſe it were required to meaſure the Figure ABC, which repreſents a triangular Field.

Firſt,



First, then, chain the Side AB, and at the Point I erect the Perpendicular IC, and enter it thus:

0 ——————— 0.00
26.51 ——————— 19.40

See the Work.

26.51
19. 4

10604
23859
2651

2)51.4294

25.7147
4

2.8588
40

34.3520

 You'll

Secondly, Chain the Side BC, and Perpendicular *n* A, as before, and ſet down the Dimenſions thus:

C.	C.		A.	R.	P.
0	0 0	The Content	25	2	34
22.00¾	23.37	Perpendicular.			

Thirdly, Chain the Side CA, alſo the Perpendicular *m* B, and enter the Dimenſions thereof thus:

C. L.	C.		A.	R.	P.
0	00 0	Content, as above	25	2	34
25 08¾	20 50				

The Content of the foregoing Field, when the Side AB is chained for the Baſe, is — — — — 25 2 34
BC chained, the Content is — — — 25 2 34
And the Side CA chained, the Content is — 25 2 34

Now, I hope the Learner is ſatisfied that it matters not which Side of a triangular Field he chains for a baſe Line, always remembering to raiſe a Perpendicular thereon, that ſhall fall into the ſubtending Corner directly. However, I would recommend to the Practitioner, always to meaſure the longeſt Side of any ſuch Field, as the Work is performed with leſs Trouble, and the Place where the Perpendicular ſhould riſe ſooner diſcovered or found, though the contrary has been approved of, and recommended to the Public notwithſtanding.

PROB. IV.

Of a Trapezium.

Let it be required to find the Content of a Field that is comprehended under four unequal Sides.

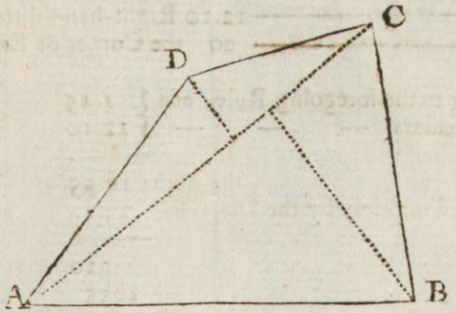
In all ſuch Fields, when the Hedges are ſtraight, I would only recommend two Methods to ſurvey the ſame; but in this Problem can only mention or ſhew one; however, my Reader ſhall have the other before I cloſe this Chapter; and in the mean Time I'll venture to aſſure him, that it is preferable to this, ſince it

it is done with leſs Trouble and as correctly as the common Way; but we are not come to that yet.

The common Way then, of meaſuring a Field of four unequal Sides, is by meaſuring or chaining from any one Corner to the oppoſite one, which divides the Field into two Triangles: And in chaining this Line (generally called the Diagonal) you muſt erect Perpendiculars ſeverally to the other Corners of the Field, as taught in the laſt Problem; ſo that as the Diagonal is a Baſe-Line common to both Perpendiculars, you may add the Perpendiculars together, and multiplying their Sum by the Diagonal, half the Product is the Content.

Example.

Let the Trapezium ABCD, repreſent a four-ſided Field, I demand the Content thereof.



Now to meaſure the above Field by this common Method, begin at the Corner A, and chain to the oppoſite Corner, namely, C; and as you proceed you'll find (as before taught) the Perpendicular D to riſe firſt, which meaſure and enter as below; and where the Perpendicular ariſes, meaſure it alſo, always remembering to leave the diagonal Arrows with the Staff ſtanding where you find the Perpendicular to riſe, which will help you to diſcover where the laſt Arrow in the Diagonal or Baſe Line ſticks; as alſo the Arrows that belong to that Line, which muſt not be mixt with the perpendicular Arrows; (otherways a Miſtake may enſue)

enſue) retake the diagonal Arrows and Staff; come up to the ſtanding Arrow, and then proceed; in like Manner you muſt find the other Perpendicular; return and chain the Line to the End or Corner C, which you'll find to be 23 Chains 12 Links.

Note, *You muſt not forget, at the End of any Perpendicular, to return the Arrows to your Leader.*

The above Dimenſions ſhould be entered in the Field-Book, thus:

At 0	it is	4.45 the firſt Perpendicular.
23.12		12.10 the ſecond Perpendicular.

Note alſo, If the above Trapezium was to be planned, it muſt be thus entered:

0		0.0
14.0		4.45 Left-hand Perpendicular.
15.35		12.10 Right-hand ditto.
23.12		00 the Corner or End.

According to the foregoing Rule, add the Perpendiculars — — — } 4.45 / 12.10

the Sum 16.55

And multiply by the Diagonal 23.12

3310
1655
4965
3310

2)382.6360

Half the Product is — 191.3180 Acres.

4

.52720

40

21.08800

And

A. R. P.
And the Content, as appears by the Work, is 19 0 21
The remaining Decimals are insignificant.

PROB. V.

To find the Content of any four-sided Field, having two of its Sides parallel though unequal, and a third perpendicular thereto.

SCHOLIUM.

The Area of every such Figure, is equal to half the Rectangle contained under the Perpendicular, and the Sum of the parallel Sides.

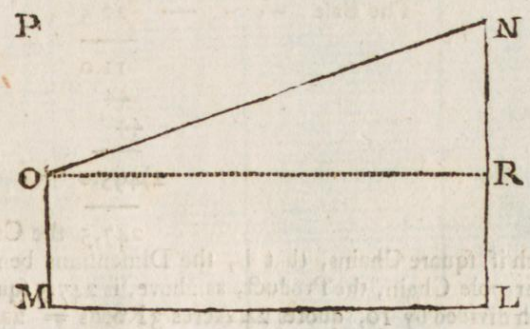
Example.

Let the Figure MLNO represent a Field bounded by four unequal Sides, containing two adjacent right Angles, *viz.* the Angle M, and the Angle L, I demand the Content thereof.

First, By the Cross-Staff you'll find the Line MO to be perpendicular to ML, which measure and enter down thus:

At the Beginning, that is, at no Length, it is the first Perpendicular MO = 7.00 Chains; then chain the Base ML, and the Side LN, which you'll find to be perpendicular to ML also, and enter the Dimensions as before directed, thus:

	C.
0	7.0 or MO.
22.5	15 0 or LN.



A general Rule to find the Content of all ſuch geometrical Figures.

Multiply the Baſe by the Semi-Sum, to wit, half the Sum of the Perpendiculars, and the Product is the Content.

Otherwiſe, the Baſe multiplied by the Sum of the Perpendiculars, half the Product is the Content; I would recommend the latter for its Expedition in this new Method.

See the Work both Ways.

First Method:

Firſt Perpendicular =	7
Second ditto — =	15
	2)22.
Half the Sum —	11
The Baſe — —	22.5
The Product	247.5 Anſwer.

Second Method:

	C.
The fitſt Perpendicular =	7
The ſecond ditto —	15
Sum of the Perpendiculars	22
The Baſe — —	22.5
	11.0
	44
	44
	2)495.0
	247.5 the Content,

which if ſquare Chains, that is, the Dimenſions being taken by a four-pole Chain, the Product, as above, is 247.5 ſquare Chains, which divided by 10, quotes 24 Acres 3 Roods = 24.75.

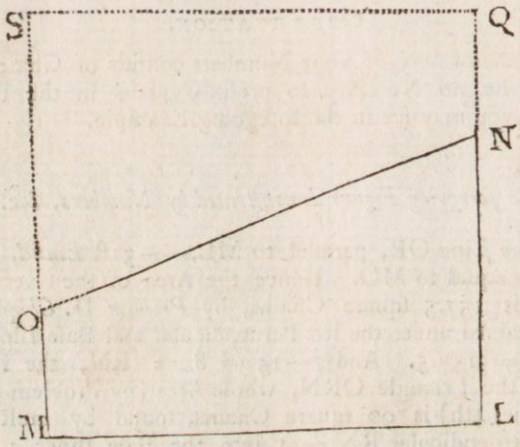
OBSER-

OBSERVATION.

When one or any of your Numbers confiſts of Chains only, there will be no Neceſſity to prefix Cyphers in the Place of Links, as you may ſee in the foregoing Example.

The foregoing Figure demonſtrated by Numbers, &c.

Draw the Line OR, parallel to ML,——31ſt *Euclid*, *Book* I. LR being equal to MO. Hence the Area of the Rect-angle MLRO, is 157.5 ſquare Chains, by *Problem* II. *Chapter* IV, being contained under the leſs Perpendicular and Baſe Line, *viz.* 7 x 22.5 = 157.5. And 7—15 = 8 = RN, the Perpendicular to the Triangle ORN, whoſe Area (by Problem the 3d, Chapter the 4th) is 90 ſquare Chains, found by multiplying half the Perpendicular RN = 4 into the Baſe thus: 4 x 22.5 = 90, which being added to the Area of the Rect-angle ML RO = 157.5, the Sum will be 247.5 ſquare Chains equal to 24 Acres, 3 Roods, as before.



CONSTRUCTION.

First Produce LN to Q, and MO to S, making NQ equal to MO, and OS equal to LN join SQ. Hence the four-ſided Figure MLNO, is equal to the four-ſided Figure ONQS; for ſeeing that LN is equal to OS, and NQ equal to MO, by Conſtruction: Alſo ML equal to SQ, and the Line ON being common to both, it is likewiſe manifeſt, that the Angle OML, is equal to the Angles MLN; and if one Angle in a Parallelogram be a right Angle, the remaining Angles are right alſo; conſequently the four Angles M, L, Q, S, are equal the one to the other, each being a right Angle.

Hence the Area of the Rect-angle MLQS, is comprehended under the Baſe ML; and the Sum of the Perpendiculars, to wit, MO and LN equal by the Conſtruction to LQ, which appears to be double in Area to the Figure propoſed, namely MLNO.

I hope the above demonſtrated Explanations on the foregoing Figure (with regard to the Rect-angle contained under the Baſe and Sum of the Perpendiculars) are evidently manifeſt to every Capacity; but that nothing may be wanting herein to clear up this uſeful Problem for the Benefit of the ingenious Learner, I ſhall beg Leave to introduce another Method of proving the ſame.

DEMON-

DEMONSTRATION.

Let then the Point L be applied to the Point S, the Line ML will coincide with SQ, and the Point O will agree with the Point N. Seeing that MO and QN are equal, and alſo the Line LN, will coincide with the Line OS, hence, if any quadrilateral Figure correſponds in every Reſpect with another, *viz.* when the reſpective angular Points are applied, and the ſeveral Sides coincid reſpectively; thoſe Figures are equal one to the other. For it is granted by the 8th *Axiom*, 1 *Euclid*, that Things which mutually agree, are equal the one to the other. Foraſmuch then as the whole Rect-angle MLQS is contained under the Sum of the Perpendiculars and their intermediate Diſtance: I ſay it is not only equal to the two Figures MLNO, and ONQS, by the 19th *Axiom*, 1 *Euclid*, but alſo double to either one; conſequently half the Rect-angle contained under the Perpendiculars and the intercepting Baſe Line is equal to the Area of all ſuch like quadrilateral Figures, to wit, The Baſe multiplied by the Sum of the Perpendiculars, half the Product is the Content Q, E, D.

I muſt here beg Pardon for treſpaſſing ſo very long *(in this Problem)* upon my Reader's Patience; but as the major Part of the following Work hath an entire Dependence thereon, I therefore thought it an indiſpenſible Duty to be very particular therein.

CHAP. V.

Containing plain and eaſy Rules to meaſure with the Chain, and by the Pen to caſt up the Dimenſions of all Manner of Incloſures that are bounded by right-lined though irregular Hedges.

DEFINITION.

Any Field comprehended under more than four Sides may, with great Propriety be underſtood by the Term Polygon.

HAving in the foregoing Chapter explained and defined all ſuch Fields as are contained under three or four Sides or Hedges, with ſuitable Directions how to meaſure and know the Contents of the ſame, I come, in the next Place, to treat of Fields containing more than four, by ſome called irregular Polygons or Polygrams, but in the geometrical Definitions of this Treatiſe, term'd multilateral or multangular Figures, I have no Objections to the Propriety of the above Appellations, ſince Names are but diſtinguiſhing Characteriſtics *(for the Roſe will ſmell as ſweet by any other Name.)*

And as I have endeavoured to avoid hitherto, every Thing that does not immediately relate to Field Practice, I therefore hope to be excuſed in not giving particular Rules concerning regular Polygons, as they are called: Thoſe Figures are innumerable, being formed by any Number of equal Chord-Lines conjoined in a Circle. They are never met with in practical ſurveying, unleſs in ſome Gentleman's Garden, where Surveyors are ſeldom employed; and though they are, Dimenſions may be taken therein of the moſt regular or irregular Figure, without reſpecting the ſame as a Polygon, which are particularized by ſignificant

ficant Names, according to the Number of Sides that are therein: For Inſtance, a regular Pentagon contains five equal Sides, and as many equal Angles; a Hexagon contains ſix equal Sides, *&c.* a Heptagon ſeven; an Octagon eight; a Nonagon nine; a Decagon ten; an Undecagon eleven; and a Duodecagon twelve. So that in meaſuring any of thoſe Figures with a Chain, the foregoing Method of reducing the ſame into Triangles and Trapeziums, whereby the Area may be obtained, is ſufficient to be underſtood; and therefore it would be great Prolixity to recommend Rules for finding the Content of all ſuch Figures which more properly belongs to another Branch. Though I muſt confeſs, that both ancient and modern Authors have made it their particular Care to treat with great Circumſpection and Formality upon not only Polygons, but Circles, Segments of Circles, and Ellipſis's alſo, *cum multis aliis*, as if ſuch geometrical Figures frequently occured in Field Practice: But let me appeal to the *modern Practitioners*, whether they, during the whole Courſe of their Practice, ever met with any ſuch? If not, conſequently it is unneceſſary to recite any Rules relating thereto, ſeeing the ſame, in this Place, would be looked upon as Tautology in a very great Degree.

Secondly, To meaſure an Incloſure of any Number of Sides more than four, whether a Pentagonal, Hexagonal, or other Form, to wit, of five, ſix, ſeven, eight, or more unequal Sides, the ſame may be performed by diagonal and perpendicular Lines, without having Reſpect to the Equality of the Angles in the Field: To effect which, you are, as before directed, to begin at ſome Corner thereof, always remembering to leave a Mark at the Place of ſtarting, if it be not otherways remarkable by either Houſe, Tree, Gate, Style, *&c.* and from thence proceed to take up the ſame in Triangles or Trapeziums, which ever appear moſt convenient (provided the Hedges be ſtraight, otherways they muſt be ſtraightened by meaſuring a Baſe Line near the ſaid curved Hedge, and erect thereon perpendicular Lines to each and every Turn, or In's and Out's, in the Fence or Hedge contiguous thereto); but be careful to find the Areas of each Triangle and Trapezium reſpectively by the Pen, and not by Scale and Dividers, (the general Method hitherto made uſe of by Practitioners) which Method is moſt certainly attended with the unavoidable Errors of Eſtimation; for, as the Truth of proceeding

ing by Scale and Dividers, to know the Area of an Incloſure, depends upon the Niceneſs of *Eſtimation*, it therefore greatly behoveth every one that thus caſts up his Dimenſions, to be particularly careful and very circumſpect in ſuch random Work. However, as meaſuring by Scale and Dividers is allowed (by the beſt Judges) to be productive of many different Anſwers when planned from ſundry Scales, (the Reſult being undeniably falſe or uncertain). Hence the Neceſſity of exploding ſuch Practice, is abſolutely neceſſary, when, inſtead thereof, here is recommended a correct and expeditious Method performed by the Pen, and conſequently freed from the apparent, the unavoidable Errors or *Eſtimation*, which you'll find in the following Chapters.

Thirdly, In planning or mapping, ſome may have a Deſire to take ſeverally the Quantity of the interpoſing Angles made by every two adjacent Sides in a Field, in this Caſe you are always to meaſure regularly round the Field both Sides and Angles, thus: If the Field's Superficies be horizontal, you muſt place in the Corner where you intend your firſt angular Point to be, one of your Arrows or meaſuring Pins perpendicular, and from thence meaſure two Chains in a right Line with the Mark that you intend to go firſt to by the Hedge Side; and at the End of the ſaid two Chains ſtick down another Pin; in like Manner meaſure two Chains in a right Line with your laſt Station, or the Hedge which you are to meaſure laſt, and there place another meaſuring Pin likewiſe, which muſt be always entered in your Field Book, as hereafter directed; then the neareſt Diſtance between theſe two meaſuring Pins being meaſured exactly in Chains, Links and Inches, and nearer if poſſible, this laſt Line is a Chord-line to the Angle ſought, and muſt be accordingly noted down in your Field-Book ere you proceed to meaſure the Length of the next Side or Hedge. Thus ſhall you proceed in meaſuring the intercepting Angles, and the Length of each Side reſpectively, until you have ſurrounded and compleated the Field. The particular Manner of effecting the ſame, will be met with in its peculiar or proper Place in this Chapter, which ſee.

Observation.

Note, If you are unacquainted with the ſecond Part of this Book, the Contents of thoſe Fields which you meaſure (as above directed)

directed) by Sides or Lines and Angles, cannot eaſily be obtained by the Pen, and therefore you muſt reduce the ſame to Triangles and Trapeziums in the Field, and meaſure them accordingly, which is attended with a great Deal of unneceſſary Trouble.

Note alſo, As you are meaſuring the Length of the Sides in a Field, and the Fence being curved or circular, you muſt take up the ſame as directed in Chapter the 6th (which ſee) and thus enter the Off-ſet:

An Off. Right or Left-hand — (according as you ſhall think proper to go round the Field, for it is not material whether you leave the Fence on the Right or Left-hand) firſt, ſecond, or third Side, *&c.*

PROBLEM I.

Of irregular Fields, conſiſting of any Number of Sides and Angles.

How to meaſure and caſt up by the Pen, any Cloſe or Field whoſe Sides and Angles are both many and irregular.

RULE.

Reduce the Field to Trapeziums and Triangles, and meaſure each ſeparately; caſt up the ſeveral Dimenſions thereof, and collect their reſpective Areas, the Sum of which is the ſuperficial Content of the Field.

Example I.

Admit a Field conſiſting of 7 unequal Sides, *viz.* MNOPQ RS, whoſe Dimenſions in Chains and Links are as follow, to know the ſuperficial Content is required.

In this Problem my Reader might have been taught two different Methods of meaſuring all ſuch-like irregular Fields, *viz.*

Firſt, By Triangles and Trapeziums.
Secondly, By Sides and Angles.

But

But this laſt Method is more properly adapted to mapping, and ſhall be introduced in its proper Place.

Observation.

1. As Surveying admits of an unlimitted Variety of Figures, it is therefore neceſſary to obſerve, that any multilateral Figure of what Number of Sides ſoever, the ſame may be divided into a Number of Triangles leſs by two than there are Sides in the Figure, and conſequently requires ſo many Diagonals leſs by three than the Number of Sides are.

For Inſtance, a five-ſided Figure will have 2 Trapeziums and 3 Triangles; a ſix-ſided, 3 Trapeziums and 4 Triangles; a ſeven-ſided, 4 Trapeziums and 5 Triangles, *&c.* Hence it is, that two being taken from the Number of Sides the Field contains, the Number of Triangles therein remains. And likewiſe 3 being taken from the ſame Number of Sides, the Remainder will always be equal to the Number of Diagonals or croſs Lines therein contained.

2. In meaſuring in a Field by Diagonals, *&c.* it is requiſite to chuſe the longeſt Baſe Line, or Diagonal, for they are not only ſooneſt meaſured, but leſs liable to Error; for the longer the Baſe Line of a Triangle is, the more abtuſe the ſubtending Angle will be, and leſs ſubject to Miſtake, ſince the Perpendicular is ſhorter, and the Place it ſhould riſe much readier found; but, on the contrary, the more remote that Angle is which ſubtends the Baſe, there is more Difficulty in obtaining the identical Place where the Perpendicular ſhould riſe, and the leſs Certainty, which every Practitioner can teſtify; and if you be but one Yard wide of the true Place, you'll certainly make the Land more than it is.

3. It is likewiſe remarkable, in practical Surveying, that a Field or Parcel of Ground (encompaſſed by Hedges) being never ſo often meaſured, will always differ ſomewhat (more or leſs) in the Reſult, for theſe two Reaſons:

1. If any one Practitioner ſhould go nearer the Boundaries than another, or ſink a Link deeper (as we phraſe it) his Dimenſions

ſions will of courſe be greater than the other; hence a ſmall Difference may ariſe.

2. The Chain, in taking Lengths, *&c.* may, more or leſs, (though ever ſo little) deviate from a ſtraight Line to the Right or Left-hand; and otherwiſe by the Unevenneſs of the Earth's Surface, may be more or leſs contracted, *&c.* However, theſe Differences (with Care in chaining) prove ſo inſignificantly ſmall that they are ſeldom regarded.

Theſe Remarks conſidered as an eſſential Preparative to Field Practice, let us then proceed to work the foregoing Examples, the Dimenſions thereof are as follow.

Dimenſions.

The Trapezium MQRS.

1704.48 C. L.

0 ——— 4.45

20.10 ——— 6.15

The Triangle MNQ.

262.4

0 ——— 0

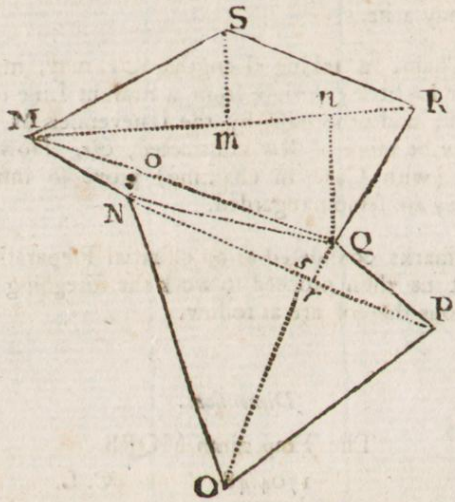
16.0 ——— 2.05

The Trapezium NOPQ.

1919.8

0 ——— 2.30

16.55 ——— 12.20



See the Work.

Trapezium MQRS.

1st Perpendicular	4.45
2d Perpendiculars	6.15
Sum of the Perpendicular	10.60
The Diagonal	20.10
	10600
	212000
The double Area	213.0600
	8.
Poles	1704.48

Trapezium

The Triangle MNQ

Perpendicular 2.05
16.

1230
205

32.80
8.

262.40

Trapezium NOPQ

1ſt Perpendicular 2.3
2d ditto — — 12.2

14.5
Diagonal — 16.55

725
725
870
145

239.975
8

1919.800

Trapeziums } 1704.48
1919.8
Triangle MNQ 262.4

410)38816.68

4)97 6.68

24 1 6.68

The foregoing Figure (which repreſents a multilateral Field) is thus ſurveyed:

Firſt, Enter the Field at the Corner M, (though at any other would anſwer the ſame Purpoſe); but remember, as before obſerved, always to leave a Mark of Paper at the Place of ſtarting, and then take up the Trapezium MQRS, as you were taught in Problem the 4th, Chapter IV, and enter the Dimenſions accordingly.

Secondly, Come to the Corner at Q, chain the Line QM, and, by the Directions in Problem 3d, Chapter IV, meaſure the Triangle MNQ, whoſe Dimenſions muſt be entered alſo.

Laſtly, Meaſure the Trapezium NOPQ, as above, which enter in your Field-Book, and then you have compleated your Dimenſions.

Note, If any Part of the Boundaries ſhould be curved or circular, you have Directions in Chapter VII to meaſure the ſame: And if the Hedge be irregularly right-lined, to wit, neither curved nor circular, you'll meet with Directions in the following Example to meaſure and caſt up the ſame; but be careful always to obſerve thoſe laid down for the Benefit of young Practitioners.

Thus, Reader, may any Field be meaſured by Triangles and Trapeziums, provided the Hedges thereof be ſtraight. But here note, when you propoſe to meaſure any ſuch multilateral or many-ſided Field by Triangles, *&c.* ſee that you omit not (as you advance) to leave Marks of white Paper at thoſe angular Points which you have ſurveyed, otherwiſe you'll probably commit a Miſtake by meaſuring ſome Part thereof twice over, or perhaps make ſome Omiſſion therein, whereof the Conſequence will be equally bad.

I ſhall, in the next Example, introduce a right-line Off-ſet, wherein I propoſe to give plain and eaſy Rules to find the true Content thereof, with ſome comparative Remarks between this and the Method hitherto uſed in caſting up Off-ſets by the Pen: But here, gentle Reader, miſtake me not, when I ſay Off-ſets being

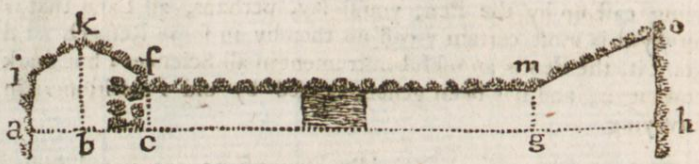
being caſt up by the Pen, you'll ſay, perhaps, all Land that is ſurveyed is moſt certainly caſt up thereby in ſome Reſpect. I'll grant it, the Pen is an uſeful Inſtrument in all Sciences; but mark how it is, and has been generally uſed by old Practitioners in ſurveying.

Firſt then, when the Field's Dimenſions are noted down, before the Content thereof (by the common Method) can be obtained, provided it be any how irregular, ſo that it cannot totally be taken up in Triangles or Trapeziums, thoſe Dimenſions muſt be plann'd on Paper by Scale and Dividers; and if any of the Sides prove irregularly curved, our modern Authors recommend a Hair to be laid upon the curved Part, to point out a balancing Line, to wit, a Line that (they ſuppoſe) will give and take equally; but alas! where is that Eye? where is the Mathematician that can atteſt or prove ſuch *Eſtimation*? I muſt confeſs that there are Numbers of People concerned in Agriculture who will affirm they can tell the Content of any Field by looking or walking over the ſame; how abſurd ſuch an Opinion or bigotted Notion will appear, I'll not pretend to ſay, but ſuffer me to aſk this Queſtion: Has not any Man the ſame Privilege of gueſſing in the Field, that another may have of gueſſing in his Chamber? He certainly has. Now when theſe ſuppoſed balancing Lines are drawn, the Field is thereby reduced on Paper ſo that it may be *(as they imagine)* meaſured by Triangles, and then, but not before, the Pen is engaged to caſt the ſame up, which at beſt is but random Work. Indeed I am afraid this erroneous Practice is too much uſed by many of our modern Practitioners, who are more excuſable, as nothing has appeared before in print to correct this unwarrantable Practice. There is another Method of caſting up Off-ſets, which is actually perſormed by the Pen, *viz.* the Sum of the Perpendiculars divided by the Number thereof for a Mean; but this is as palpable as the balancing Line, which will evidently appear in the two ſucceeding Examples.

Example II.

Let the following Figure repreſent the Side of a large Field, being a right-lined Off-ſet, I demand the Content thereof.

Dimen-



Dimenſions.

No.	C.	C. L.
1	0	2.31
2	1.	4.17
3	3.	1.12
4	25.	.54
5	30.28	4.86

In order to meaſure this Off-ſet, place yourſelf at a, and fix upon a Mark in the oppoſite Hedge at h, then meaſure the Perpendicular a i, and note it down as hereafter taught, return to the Point a, and, as you are chaining the baſe Line ah, take up the ſeveral Perpendiculars b k, c f, g m and h o, by the Help of your Croſs-ſtaff, and enter the ſame in your Field-Book: Obſerve to enter not only the Length of each Perpendicular, but alſo the particular Place on the baſe Line where each was erected, as appears in the above Dimenſions.

Note, the Reaſon of the foregoing Off-ſet being ſo broad, is owing to a large Pit, and a ſmall Plantation on the Left, near the End of the baſe Line, which prevent the Meaſurer coming any nearer the Hedge.

To find the true Area *by the Pen* of all Off-ſets thus taken up, obſerve this general

RULE.

Multiply the Sum of every two adjacent Perpendiculars, by the intermediate Diſtance upon the baſe Line, and half the Product is the Content.

Note,

Note, The intermediate Diſtance upon a baſe Line, is found by ſubducting the foregoing Length or Diſtance from the following; for Inſtance, if it were required to know the intermediate Diſtance between the third and fourth Perpendiculars in this Example.

Firſt, The third Perpendicular riſes on the baſe Line at 3 Chains; and the fourth ditto, riſes at 25 Chains, that is to ſay, 25 Chains from the Beginning at a: Then ſay 3 from 25, and 22 remains for the intermediate Diſtance between the third and fourth Perpendiculars; and in like Manner proceed to find the intermediate Diſtance between every two adjacent Perpendiculars in any Off-ſet whatever.

See the Work.

1ſt } Perpendiculars	—	2.31	2d } Perpendiculars	—	4.17
2d }	—	4 17	3d }	—	1.12
Their Sum ——		6.48	Their Sum ——		5.19
Intermediate Diſtance -		1.	Intermediate Diſtance -		2.
		6.48			10.58

3d } Perpendiculars	--	1.12	4th } Perpendiculars	-	.54
4th }	--	.54	5th }	-	4 86
Their Sum ——		1.66	Their Sum ——		5.40
Intermediate Diſtance -		22	Intermediate Diſtance		5 28
		332			4320
		332			1080
					2700
		36.52			28.5120

I —

1 ——	6.48	The several Products collected.
2 ——	10.58	
3 ——	36.52	
4 ——	28 51	
The Sum	2)82.09	which being thus divided by 2
	41.045	quotes 41 square Chains, *&c.*
	4	equal to 4 Acres, 16 Perches
	.4180	and a half, or nearly three
	40.	Quarters of a Perch.
	16.7200	

Of the Proof of this Method.

Every Whole being equal to all its Parts taken together: Hence the Area's of the several quadrilateral Figures, *viz.* a b k i + b c f k + c g m f + g h o m = a h o m f k i c equal to 4 Acres, 0 Roods, 16 ½ Perches. Now, according to the old Method of casting up Off-sets by the Pen already observed, you'll find the Content of the foregoing Example to vary or differ extremely from what it should be.

See the Work according to the old Method.

Perpendiculars.

1	2.31	The Perpendiculars in the foregoing Example ſummed up.
2	4.17	
3	1.12	
4	0.54	
5	4.86	
	5)13.00	

The ſuppoſed Mean 2.6
The Baſe Line 30.28

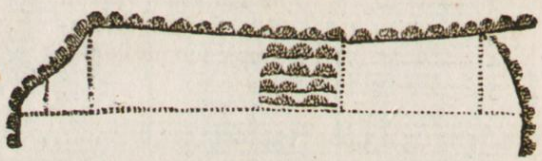
20 8
7852

			A.	R.	P.
Anſwer	7.8728	ſquare Chains, equal to	7	3	19½
	4.	The Off-ſet contains no more as per other Side, than	4	0	16½
	3.4912				
	40	being too much by	3	3	3
	19.6480	*What an Error in about* 4 *Acres of Land! nearly as much again.*			

Now to convince the incredulous Reader (provided this Treatiſe ſhould ever meet with any ſuch) I'll beg Leave to give an Example wherein this old Method of caſting up Dimenſions will render an Off-ſet almoſt as much ſhort of what it really is, as the above is over or more than what it ought to be, whereby my Reader will have an Opportunity of making ſuch Reflections upon the Occaſion as ſhall ſeem good or meet unto him.

Example. III.

Let the following Figure repreſent an Off ſet in the Side of a Field, I demand the Content thereof.



Dimenſions of the above Off-ſet.

		C.
At	0	0.25
	2.0	.55
	4.0	4.10
	18.0	3.65
	25.0	3.40
	26.30	.35

See the Work.

.8	4.65	7.75	7.05	3.75	1.60
2.	2.	14.	7.	1.3	9.30
					108.50
1.6	9.30	31.00	49 35	1125	49.35
		77.5		375	.87
		108.50		4.875	2)173.62
				Acres	8.681
					4
					2.724
					40
					28.960

The

The old Method:

6)12.30

Mean Breadth — 2.05
Length — — 2630

6150
1230
410

Acres 5.39150
4.

1.56600
40.

22.64000

	A.	R.	P.
The *true* Content of this Off-set is —	8	2	29
And by the *old Method* it is — —	5	1	22½
being too little by —	3	1	6½

From hence, kind Reader, you may infer, that the Incorrectneſs of the old Method, is not only certain, but unavoidable alſo, beyond all Manner of Diſpute.

OBSERVATION.

Perhaps ſome of my Readers that are not clear in this Method, may obſerve, that the Difference between the new and old Method is very extraordinary.

And that it is, almoſt impoſſible *(if this new Method be right)* there can be ſuch Difference in ſo ſmall a Compaſs as 4 Acres. Now, to remove Suggeſtions of this Kind, I muſt, (in Vindication of the Truth) implore the Favour of all ſuch (for their

own Good) to return to Problem the 5th in Chapter IV, and ſtrictly conſider the ſame.

Some there are, no doubt, being prepoſſeſſed in Favour of the old, will, at firſt Sight of the aforeſaid Difference *(in Example the firſt)* condemn the new, eſpecially the Gentleman of a ſmall Eſtate, ſaying, *Away with it, away with it!* mine was always accounted ſo much; and if it was now meaſured by this Method, doubtleſs I ſhould loſe near one half of it.

If this Book ſhould ever fall into the Hands of ſuch haſty inconſiderate Gentlemen, let me once more intreat them to examine and ponder over Problem the 5th before mentioned; and when they have well conſidered the Purport thereof, they may then proceed to the ſecond Example, wherein they will meet with ſomething that will, undoubtedly, eradicate their Chagrine, and at the ſame Time afford them an Opportunity of changing their Sentiments.

And then, with greater Reaſon, they may reflect on their Eſtates, ſaying, "Mine were meaſured and mapped ſuch a Time, when the old Method was univerſally practiſed, which now appears in the moſt gloomy, unfavourable, and worſt of Colours." What! to make an Off-ſet in a Field-ſide near 8 Acres, that ſhould be but 4 A. 0 R. 16½ P! without Diſpute, if the whole Field was meaſured, the Miſtake would be very conſiderable.

And again, to meaſure another Off-ſet in a Field, to only 5 Acres, 1 Rood and 6 ½ Perches, that ſhould be 8 Acres, 2 Roods, and 29 Perches. Well may old Practitioners diſagree in their Meaſurement, their Method being ſo incorrect.

However, though I have rendered the Errors in the two foregoing Examples not only conſiderably great, but likewiſe made it appear, that the old Method is as liable to make an Incloſure too much, as too little; yet, notwithſtanding, I would not ſeem thereby to indicate, that the Errors in general (which of Courſe muſt appertain to ſuch Proceedings) are always ſo extraordinary: No, no, my Buſineſs is to point out the Miſtakes its liable to; and alſo to convince my Readers, that there is no Certainty in, nor depending upon the Truth of ſuch Work. And therefore

fore I flatter myſelf that I am intitled to the Favour of the candid Reader's good Opinion in behalf of this Treatiſe, as it claims the Preference to all others for Truth, Correctneſs, and Expedition.

Note, In all the following Examples, in this firſt Part, I ſhall enter the Content of each Off-ſet at the Top of the Dimenſions in Perches, except the next Example, and ſhall leave the reſt for the Learner's Practice.

Note alſo, Inſtead of taking half the Product of the Off-ſet in ſquare Chains, as heretofore taught, multiply the Sum of your Products by 8, and place that Product at the Top of the Off-ſet to which it belongs: And when you have caſt up all the Dimenſions belonging to the Field, collect the ſeveral Products, and divide that Sum by 160, otherwiſe by 40, and by 4, and the Quotient will ſhew the Area in Acres, Roods and Perches.

CHAP.

CHAP. VI.

To meaſure and find the true Content of any Incloſure, whoſe Bounds are comprehended under irregular right-lined Hedges.

OBſerve the Directions laid down in the three foregoing Chapters, and then you may meaſure the propoſed Field either in Triangles, Trapeziums, Rect-angles, *&c.* as you ſhall think moſt convenient; but always remember, wherever you begin to meaſure, leave or place ſome conſpicuous Mark, as Paper, white Linen, Cloth, Handkerchief, *&c.* *Here note*, your firſt Care muſt be to go ſtraight to the Fence, by taking up the Off-ſets as already directed, and afterwards proceed as above. But if the Superficies thereof be very uneven or hilly, ſo that you cannot poſſibly behold the Boundaries of the ſame from any one Place, nor the Marks which you may have therein placed or ſet up, when the right-lined Off-ſets were taken; in all ſuch Caſes, firſt meaſure what you can conveniently ſee on any Side of the Hill or Mountain; which, when done, you may, perhaps, meaſure the Remainder in one Figure, if you can behold the Marks prefixed when the Off ſets were meaſured, otherwiſe you are not confined to one or more.

Moſt Surveyors, when they have meaſured a mountainous or hilly Field, return the Foundation * thereof for the Superficial Area, alledging, at the ſame Time, that no more Trees, Corn, &c. can be planted upon a Hill or Dale than if the ſame Space were horizontal, and confined to the ſame

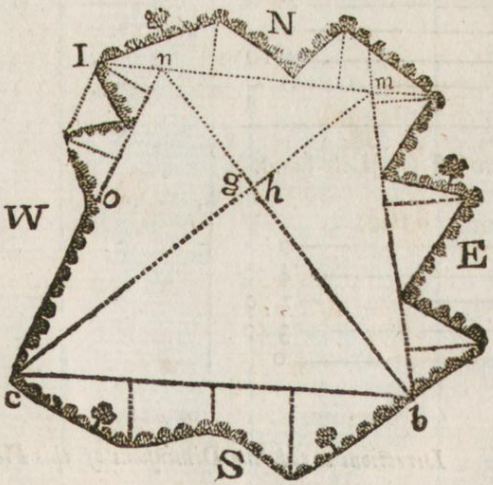
* The Foundation of a Hill is horizontally parallel to the adjoining Valley.

Foun-

Foundation; I'll readily grant the Juſtneſs of this Obſervation with regard to Plantations; but Graſs being of another Quality, very ſeldom hath one Blade in a thouſand vertical. I hope it will be as readily granted, that (as the ſpontaneous Production of Vegetables reſpects not one particular Poſition, as ſome grow up, ſome down, and ſome parallel to the Horizon, &c.) arable Hills or Dales ſhould be meaſured, and the ſuperficial Content thereof returned. In Part the ſecond I have been ſomething more particular upon this Head, which ſee.

Example.

Let it be required to meaſure and caſt up the Content of the following Figure, which repreſents an Incloſure comprehended under unequal, though many right-line Sides.



The

The Dimenſions.

North Off-ſet, Left-hand.

441.¼

0	0
5.40	3
9.80	.40
12.25	3.20
17.	0

East Off-ſet, Left-hand.

464.

0	0
.70	3.
4.50	0
5.80	4.
10.80	0
14.80	4.10
16.	0

South Off-ſet, Left-hand.

831.¾

0	0
6.20	4.50
10.40	2.70
14.60	3.40
20.55	0

Weſt Off-ſet, Left-hand.

209.½

0	0
9.	0
12.70	2.90
15.	.20
16.20	3.0
17.70	0

Trapezium.

4000.½

00	0.0
7.70 — L.H. —	7.60
790 — R. H. —	16.10
21.10	00

Directions to take the Dimenſions of this Field.

Firſt, Fix a Mark at I, in the Weſt Side of the Field, and then begin with, and take up the North Off-ſet, by chaining the baſe Line I *m*; and when you come to the Place *n*, ſet up a Mark or Stake, but be careful to take up the Perpendiculars that ariſe

ariſe from this Baſe to the ſubtending Corners. When you have chained as far as *m*, you may perceive two of the Eaſt Corners of the Field to lie in a right Line with the Place *m*, there leave a Mark or Stake ſtanding, to which Place return after you have finiſhed this Off-ſet.

Secondly, ſtraighten the Eaſt Side thereof, which you may do by fixing upon a Mark in the South Side of the Field at b: But here note, If there is nothing remarkable in the Hedge at or near that Place, you may ſend your Chain man to fix or ſet up a Mark thereat, otherwiſe, if you can perceive a Tree, Houſe, or any other Thing remarkable and immoveable, behind, and in a right Line with the two Corners *(already mentioned)* in the Eaſt Side, though at a Mile or ten Miles Diſtance, by fixing upon the ſame as a Mark of Direction, *(in this and all other Caſes of the Kind)* will prove as effectual as if a Mark was actually ſet up at b, and will ſave not only a deal of Trouble, but alſo enable you to proceed with greater Expedition, having taken up the Eaſt Off-ſet as you chained the baſe Line m b, by raiſing Perpendiculars to the ſubtending Corners. *See the Dimenſions E. Off. L.H.*

Thirdly, As the South Side is likewiſe irregular, chain from b to the Corner c, and meaſure the South Off-ſet alſo; but forget not to leave a Mark in the Hedge at b.

Fourthly, Straighten the Weſt Side by chaining from the Corner c, to the Mark left ſtanding at n: And as there is no Off-ſet upon this laſt baſe Line till you have meaſured to o, to wit, 9 Chains from c: Thus at o——————————o, and at 9.——————————o alſo; *(See the Dimenſions, W. Off. L. H.)* and proceed as before till you have finiſhed the ſame; then is the Body of this irregular Field reduced to four unequal Sides, which meaſure as you were directed in Problem the 4th, Chap. IV.

Laſtly, having finiſhed the Weſt Off-ſet at n, chain the Mark at b, for a diagonal Line, to the Trapezium n m b c, and as you advance omit not to take the Perpendiculars on the Right and Left-hand found by your Staff, that is to ſay, the Place where they ſhould be raiſed, namely, at 7 Chains, 70 Links upon the baſe Line at g; a Perpendicular will fall into,

or upon the Mark at m, which being meaſured, return to your Staff, and 20 Links farther, upon the ſame Chain-line, another Perpendicular muſt be likewiſe raiſed to the Corner or Mark left in the Hedge at c, which being meaſured and entered *(as already directed)* return to the Staff, and finiſh the diagonal Line n b, then are your Dimenſions compleated, and the Field ſurveyed. But here ſuffer me to remind the young Practitioner, that Care and Correctneſs muſt be his conſtant Guide or Attendant not only in the Fields, but when he caſts up his Dimenſions alſo. As no Perſon is allowed to be infallible, conſequently the moſt judicious and complete Surveyor may as inadvertently commit a Miſtake *(if Care be neglected)* as the greateſt Stranger to Field Practice. But from what I have already obſerved in the foregoing Chapters, I hope this Caution will not be forgot by the Learner, who having prepared the Dimenſions of this Field for the Pen, the Content thereof may be found as follow.

See the Work of each Off-ſet, and the Trapezium alſo.

North Off-ſet, Left-hand.

5.4	4.4	2.4	4.8
3.	3.4	3.6	3.2
16.2	176	144	96
	132	72	144
	14.96	8.64	15.36
	16 20		
	8.64		
	15 36		
	55.16	half ſquare Chains.	
	8		
	441.28	Perches.	

East

East Off-set, Left-hand.

.70	3.8	1.3	5.	4.	1.2
3.	3.	4.	4.	4.1	4.1
.21	11.4	5 2	20	16.4	12
11.4					48
5 2					4.92
20.0					
16.4					
4 92					
58.02					
8					
464.16					

half ſquare Chains.

Perches.

South Off-ſet, Left-hand.

4.5	7.2	6.1	3.95
6.2	4.2	4.2	3.4
90	144	122	2380
270	288	244	1785
27.90	30.24	25.62	20.230
30.24			
25.62			
20.23			
103 99			
8.			
831.92			

half ſquare Chains.

Perches.

West Off-set, Left-hand.

2.9	3.1	3.2	1.5
3.7	2.3	1.2	3.
203	93	3.84	4.5
87	62		
10 73			
7.13			
3 84			
4.5			

26.20 half square Chains.
8.

209.60 Perches.

The Trapezium.

23.7 the Sum of the Perpendiculars.
21.1 the Base.

237
237
474

500.07 Half square Chains.
8.

4000.56 Perches.

Note, The above Dimensions are cast up according to the Directions laid down in the last Chapter, to wit, in each Off-set respectively every two adjacent Perpendiculars are added together, and their several Sums are multiplied by the intermediate Distance found by deducting or subtracting every foregoing Length on the base Line, from the next succeeding one, for a Multiplier.

See the North Off-set cast up as follows.

0	0.0
5.40	3 0
9.80	.40
12.20	3.20
17.0	0

First, Add 3 (the Perpendicular) to 0, which being multiplied by 5 Chains 40 thus: 3. × 5.40 = 16.20, the Product set apart.

Secondly, Add .40, the second Perpendicular, and 3. the first together, the Sum is 3.40, then subtract 540. (the foregoing Length on the base Line) from 9.80, thus:

9.80 — 5.40 = 4.40, which multiply by 3.40, the Product is 14.96; set this also under the former Product.	16.20 14.96
Thirdly, Add 3.20 (the third Perpendicular) to .40, the Sum is 3.60; and take 9.80 (the preceding Length on the base Line) from 12.20, there remains 2.40, which multiply by 3.60 (the Sum of the two adjacent Perpendiculars) and the Product is 8.64, which place under the former Products.	8.64 15.36 55.16 8. 441.28

Lastly, Add 0 to 3.20 (the third Perpendicular;) then take 12.20 (the foregoing Length on the base Line) from 17, the whole Line, and there will remain 4.88, which being multiplied by 3.20, the Product will be 15.36; place this under the former Products, and collect their Sum, then have you the double Area of the Off-set in square Chains, which being multiplied by 8, gives the Content in Perches, *viz.* 441. $\frac{1}{4}$, as Top of the Dimensions: But as you proceed in casting up the Dimensions, draw a Dash with the Pen across each of those Lines that are between the Base and Perpendiculars, when or before you add the adjacent Perpendiculars, which will prevent your casting the same up twice over. Hence the Area of the Field is obtained *viz.*

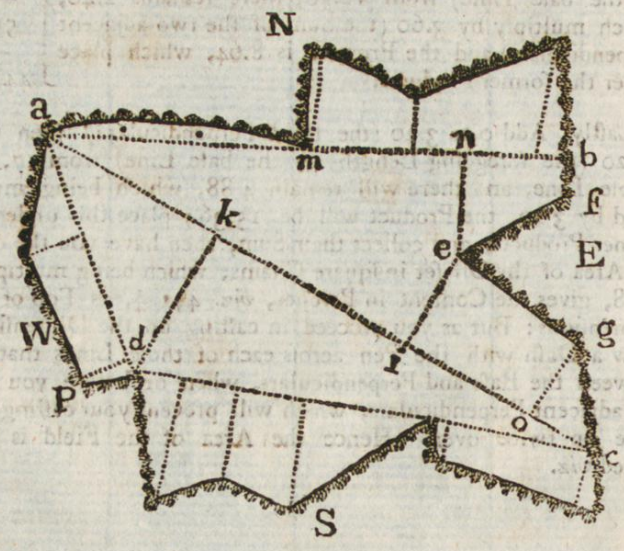
N. Off-set

		A.	R.	P.
N. Off-set	441¼			
E. do.	464			
S. do.	831¼	37	0	27
W. do.	209½			
Trapezium	4000½			

Here ſuffer me to acquaint the young Surveyor, that as all the following Examples of this Kind relating to Off-ſets, *&c.* are meaſured and caſt up as above directed, I therefore think it needleſs to inſert the different Operations that follow, ſince it will give my ingenious Reader an Opportunity *(if he chuſes)* of becoming very perfect and ready in caſting up the ſame; ſo that if the Reſult of his Work ſhould happen to diſagree with the Reſult at the Top of the Dimenſions, he may then take it for granted that a Miſtake is oommitted in his Proceedings, and therefore ſhould re-examine his Figures.

Example II.

Let the following Figure repreſent an irregular Incloſure, I demand the Content or Area thereof.



To

To determine which way the aforeſaid Field could be moſt expeditiouſly ſurveyed, would be to little Purpoſe; for ſeeing that any irregular Field will admit of great Variety (with regard to taking the Dimenſions thereof;) it therefore matters not how the ſame be ſurveyed, provided Care be taken not to omit or meaſure any Part twice: However, I would recommend to the Learner, if the Field or Land be horizontal, to take the largeſt Trapezium or Rect-angle, *&c.* poſſible, and let the Off-ſets be as ſmall as the Boundaries will conveniently admit of; but in curvilineal Superficies, or mountainous Ground, the Surveyor cannot be his own Carver. Field Practice in ſuch Caſes, will more effectually edify, than if whole Sheets were herein delivered concerning the practical Occurrences of Surveying.

Perhaps it may be obſerved, that the foregoing Figure or Field might as readily be ſurveyed by taking up three or four Trapezinms therein, and afterwards, *(if any Off-ſets be omitted)* to meaſure them as heretofore directed. I'll not deny it; but as I propoſe in this and all the following Examples, to recommend a Method which in moſt Caſes wll claim the Preference *(with regard to Expedition and Correctneſs)* to any thing relating hereto ever publiſhed; hence I preſume to hope *(as I don't trace the Fooſteps of others)* that this will meet with the Approbation of the Geometrician, and give general Satisfaction, the whole being founded upon Geometry.

Directions to take the Dimenſions of the foregoing Field.

Firſt, Suppoſe you entered the Incloſure at the Corner a, *(though it mattere not where you enter, or where you begin)* looking along the North Side thereof, the Irregularity of the Fence tells you it muſt be ſtraightened, which you effect by chaining the baſe Line a b, and taking up the North Off-ſet on the Left-hand, as directed in the foregoing Example; and when you are at right Angles to the Corner e on your Right-hand, meaſure the Perpendicular n e, enter the ſame as a Right-hand Off-ſet, and leave a Mark at e; then return and finiſh the baſe Line, at the End of which *(the Hedge being at right Angles thereto)* chain that Part on the Left firſt, which when entered, you may chain, and enter the Right-hand Perpendicular. Thus you have meaſured the North Off-ſet.

Secondly,

Secondly, Walk round the Hedge or Eaſt Side of the Field till you come to the Point c, there leave a Mark, and caſting your Eye towards d on the Weſt Side thereof, you perceive it in a Line with a Corner in the South Side; then chain to the Corner a, where you firſt began, and take up the Perpendiculars on the Right and Left-hand, thus: When you come to o, that is 4 Chains on the Baſe c a, meaſure the Perpendicular o g; and when you come to I, to wit, 11 Chains, 10 Links, meaſure the Perpendicular i e = 5.40, then proceed till you are at right Angles with the Mark left at d; meaſure the Perpendicular k d likewiſe, which enter as a Left-hand Off-ſet, return and finiſh the baſe Line c a, which alſo enter. *See the Dimenſions following.*

Thirdly, Chain the baſe Line a d, and take up the Weſt Off-ſet as you were directed in the Weſt Off-ſet in the laſt Example.

Fourthly and laſtly, Standing at the Corner d, look towards the Mark formerly ſet up in the Hedge at c, to which Place chain for a baſe Line to the South Off-ſet, and take up the ſame, which when done, your Dimenſions are compleated.

Here note, When you were meaſuring the North Off-ſet, an Off-ſet on an Off-ſet occurred on 4.94, the third Perpendicular, which ſee how entered, and alſo another on the laſt Perpendicular you took in the South Off-ſet, which ſee likewiſe.

Mr.

Mr. *Greenfield*'s Land,

Marl-Field Dimenſions,
21ſt *June*, 1770.

North Off-ſet, Left-hand.

1036 ¼

0	0
3 80	1.10
8.10	1.10
13.	.00
13.	4.94
18.40	3.0
26.18	5.82

An Off-ſet on ditto W.

53 ¼.

0	0.
4.94	1.35.

Left-hand Off-ſet, S. W.

2074. ¾

0	0
22.40	8.20
31 63	.00

Right-hand Off-ſet, N. E.

1581 ½

0	0
4.0	4 35
11 10	5.40
31.63	00

Weſt Off-ſet, Right-hand.

534 ½

00	0
5.32	33.0
13.18	2 84
13.50	0

South Off ſet, L. H.

1330.

0	0
2.60	7.10
5.20	5.10
8.88	5 65
1.520	.00
16.20	2 0
23.96	3.0

An Off. on laſt Perpendicular.

24.

0	0
30	1.

A B

Herein the young Practitioner may meet with Matter ſufficient to exerciſe his Pen, by caſting up the foregoing Dimenſions.

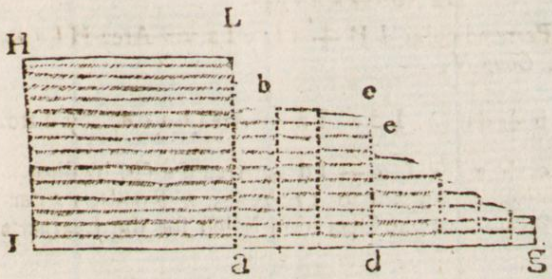
Here note, When the Dimenſions of a Field are finiſhed, draw a double Line under the ſame; *(ſee the double Line* A B *at the End of the foregoing Dimenſions)* which will prevent both Confuſion and Miſtakes, when the Dimenſions of ſeveral Fields ſucceed each other.

Note alſo, When you are to map your Dimenſions, obſerve not to enter any thing in the Right-hand Column except Remarks, and an Off-ſet upon an Off-ſet when it occurs; ſee the North Off-ſet in the laſt Example, wherein on Off ſet upon an Off-ſet is met with, and properly entered at, and upon the Perpendicular where it lies, with a daſh or ſmall Line drawn between the Perpendicular and the Place where the ſame is entered.

Here followeth an Example which will enable the young Practitioner to form a more clear Notion of two unequal Perpendiculars being entered at the ſame Length upon a baſe Line. See the North Off-ſet in the laſt Example at 13 Chains in the baſe Line, there is no Perpendicular; and alſo at the ſame Length there are 4 Chains 94 Links of a Perpendicular.

Example. III.

Let the following Figure repreſent a Parcel of Land in a Town Field, I demand the Area or Content thereof.



The Dimenſions.

	2821¼	C. L.
0		10.05
10.35		10.00
10.35		7.24
17.10		6.85
17.10		3.90
26.10		1.55

The Dimenſions of the above Figure are taken thus: You are ſuppoſed to begin at I, chain I H = 10. Chains, 05 Links: And as I g is at right Angles to I H, chain or meaſure it for a baſe Line: When you come to a, you'll have two Perpendiculars to enter, to wit, a L and a b, but be careful to enter a L before a b, as it reſpects the Land already meaſured, *i. e.* H I, L a. Theſe Figures being entered, return to a, and chain till you come to d, where you likewiſe have two unequal Perpendiculars, namely d c and d e, which being entered as above directed, that is, the Perpendicular d c before d e; then proceed in chaining the baſe Line till you come to the End g; meaſure the Perpendicular alſo, and the Dimenſions are compleated.

DEMONSTRATION.

First, The Perpendicular I H + a L x I a = Area H I a L, by *Example* 2d, *Chap.* V.

Secondly, a b + d c x I d — I a = Area b a c d, by ditto.

Thirdly, d e + g f x I g — I d = Area d e f g, by ditto. which being collected, amount to 17 Acres, 2 Roods, 13 Perches $\frac{3}{4}$. The Pleasure of the Operation is left for the Learner's Amusement.

Thus, courteous Reader, have I prepared you, (*I hope*) to enter and measure Inclosures bounded by right Lines or Hedges, though ever so irregular: And in the next succeeding Chapter you'll meet with something more difficult.

CHAP.

CHAP. VII.

Teacheth to measure and find the true Content of a circular or curved line Off set: Also to find the Content of the most irregular Field, &c.

Example. I.

I Demand the Content of the following Figure, which may represent an Off-set taken up in the Side of a Field.

In this and all other Off-sets, you must take as many Perpendiculars upon the base Line to the subtending Hedge or Fence, so that if a right Line was drawn from the End of any one Perpendicular to the next (on either Side) it would neither exclude any Part of the Field or Land you are about to measure, nor include any of the adjacent, as directed in Page 88.

Dimensions

Dimenſions.

1114.

0 ——— .60
2.——— 1.80
2.——— 2.10
4.40 ——— 3.00
6.50 ——— 2.30
7.70 ——— 2.10
9.00 ——— 2 40
11.46 ——— 3.20
13.10 ——— 3.25
15.20 ——— 3.00
20.26 ——— 2.0
22 0 ——— 2.60
24.0——— 2.80
26.0——— 2.80
26.80 ——— 2 50
28.60 ———1.20

This, and all Examples of the Kind, are caſt up according to the Directions laid down in the firſt Example of this Chapter, being founded upon Chapter the 5th, Part the firſt, *viz. The Sum of every two adjacent Perpendiculars multiplied by the intermediate Diſtance upon the baſe Line (found by ſubtracting every foregoing Number from the next ſucceeding) gives the double Area thereof*; (ſee Page 118) then, by collecting or ſumming up all thoſe ſeveral Areas together, their Sum or Amount is the double Area of the Off-ſet in ſquare Chains, which multiply by 8, the Product is the Anſwer in Poles or Perches, and muſt be entered at the Top of the Off-ſet.

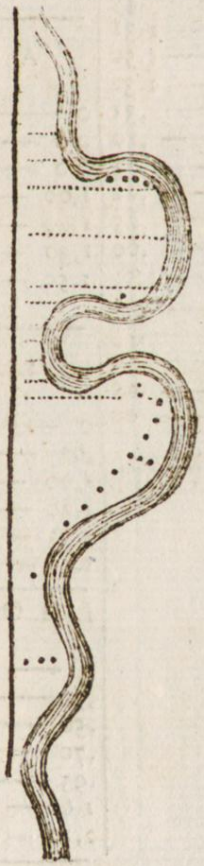
Whoever thus proceeds carefully, may, with the greateſt Certainty, rely upon the Reſult; but, for a farther Proof of the Work, it will be proper to prove the Multiplications; and if the Additions and Subtractions were firſt examined, the Proceedings might with greater Certainty be depended upon.

As my chief Aim is to edify to a Degree of Perfection, the ingenious Youth, I therefore ſhall, in the next Place, give an Example of an Off-ſet adjoining an old Brook; and that the young Learner may more perfectly comprehend the Figure and Dimen-

Dimenſions of this irregular Space, I muſt beg Leave to uſe a larger Scale (in this Example) than that mentioned in Page 103, that the ſame may be thereby rendered more conſpicuous, whereof a clearer Notion will be formed of iti curvelineal Space.

Example.

Let the following Figure repreſent on Off-ſet adjoining an old Brook, laid down by a Scale of 8 Statute Poles to an Inch, I demand the Area thereof.



Dimenſions

Dimensions.

N. Off. L. H.

59 ¾

0	0
,67	,40
1,23	,32
1,42	,45
1,70	1,31
2,30	1,50
2,72	1,32
2,95	,31
3,10	,20
3,20	,22
3,50	,21
3,68	,25
3,90	,60
3,90	1,50
5,55	,21
6,05	,23
6,60	,50
6,90	,45
7,50	00

An Off. on ditto, L. H.

1 ¾

0	0
,60	0
,75	,17
,91	,22
1,10	,21
1,31	0

An Off. on do. R. H.

1 ¾

0	0
,60	0
,80	,10
1,00	,22
1,20	,22
1,30	,14
1,50	0

L. H. an Off. on do.

2 ¼

0	0
,62	0
1,00	,23
1,20	,24
1,33	,21
1,50	,10

L. H. Off. between 1,50 & ,21

6 ½

0	0
,30	,30
,50	,35
,70	,38
,95	,35
1,60	00
2,10	00

Perhaps

Perhaps an Explanation *of the foregoing Dimenſions* would be looked upon by the Reader as Tautology, ſince I have, in all the foregoing Examples, explicitly *performed the ſame reſpectively*; which now induces me not to be guilty of an unpardonable Treſpaſs upon my Reader's Patience.

I am too well convinced, that whoever the Youth is that takes Delight herein, will have no Occaſion for a Finger-poſt to each Example, ſeeing they are all performed alike.

The Off-ſets collected.

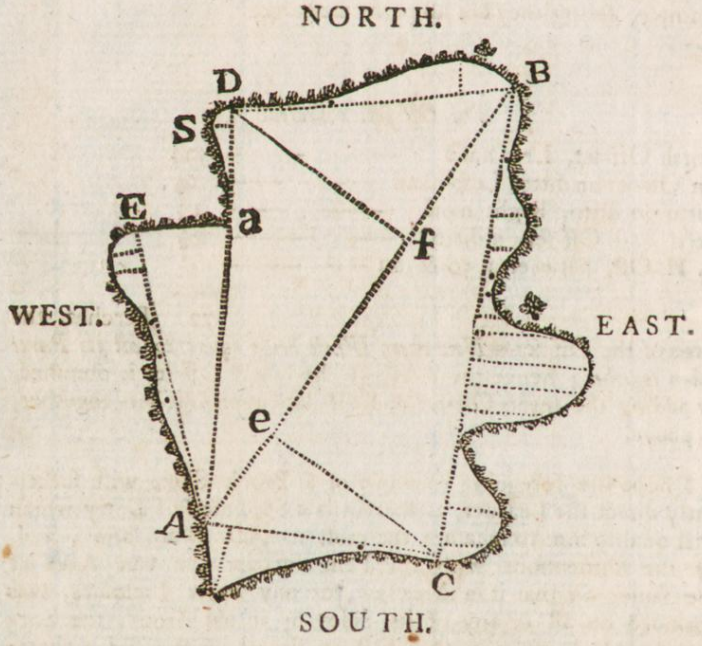
North Off-ſet, Left-hand —— ——	$59\frac{3}{4}$
An Off-ſet on ditto, Left-hand —— ——	$1\frac{3}{4}$
Ditto on ditto, Right-hand —— ——	$1\frac{3}{4}$
Left hand Off-ſet on ditto —— ——	$2\frac{1}{4}$
L. H. Off. between 1,50 & ,21 —— ——	$6\frac{1}{2}$
	72 Perches, the

Area of the Off-ſet—*Now every Whole being equal to all its Parts taken together*; hence the Area of the whole Off-ſet is obtained, by adding the mean Off-ſet and Off ſets upon Off-ſets together, as above.

I hope the foregoing Example of a Brook Side, will ſufficiently direct the Learner, as therein is a Specimen of Entry which will qualify him to meaſure the moſt irregular Boundaries; and, by the Dimenſions with the Pen, diſcover the true Area of the ſame: So that if a Meadow, or any other Incloſure, was bounded on all or any of its Sides by an old Brook, the Surveyor needs do no more than firſt to ſtraighten the Sides thereof according to the Directions in the two laſt Examples; by which Means the ſame is reduced to a Trapezium, or an irregular Polygon, and may be meaſured as directed in Chapter the 5th, Part the 1ſt.

Example. III.

Let the following Figure repreſent a Field, I demand the Content thereof.



The

Dimensions.

1st. W. Off. L. H. on ditto.

189

0	0
6,60	1,00
9,0	,40
11,30	,50
13,40	1,70
14,50	1,60
15,0	1,30

2d W. Off. L. H.

635

0	0
15,10	5,0
15,10	00
17,40	00
20,50	,10
21,10	,30

N. Off. L. H.

192

0	0
5,0	,40
12,0	2,00
14,60	0

E. Off. L. H.

771.

0	0
1,50	,90
3,0	,40
4,60	,50
6,70	1,56
8,30	1,30
9,70	,60
10,20	,60
12,0	3,00
12,	5,50
14,	6,00
15,40	5,80
17,	,30
17,60	,20
18,90	,50
22,0	3,00
23,90	2,00
24,30	1,40

Trapezium.

4795

0		0
5,60	R H	11,0
17,0	L H	11,20
27,		00

Off-ſets, &c. collected.

189
635
192
771
4795

	A.	R.	P.
6582 =	41	0	22

The Field Work of the foregoing Figure explained.

N. B. This Explanation is occaſioned by the two Weſt Off-ſets that appear in the Field-Book, which perhaps may not be ſo immediately underſtood.

Firſt then, you are ſuppoſed to enter the Field at A; chain from A to E, and take up the Weſt Off-ſet to the Left-hand, leaving a Mark at E.

Secondly, Return to A, and chain to D, upon which Line take up the ſecond Weſt Off-ſet. *See the Entry thereof.*

Thirdly, Take up the North Off-ſet as you chain from D to B.

Fourthly, take up the Eaſt Off-ſet as you meaſure the baſe Line from B to C.

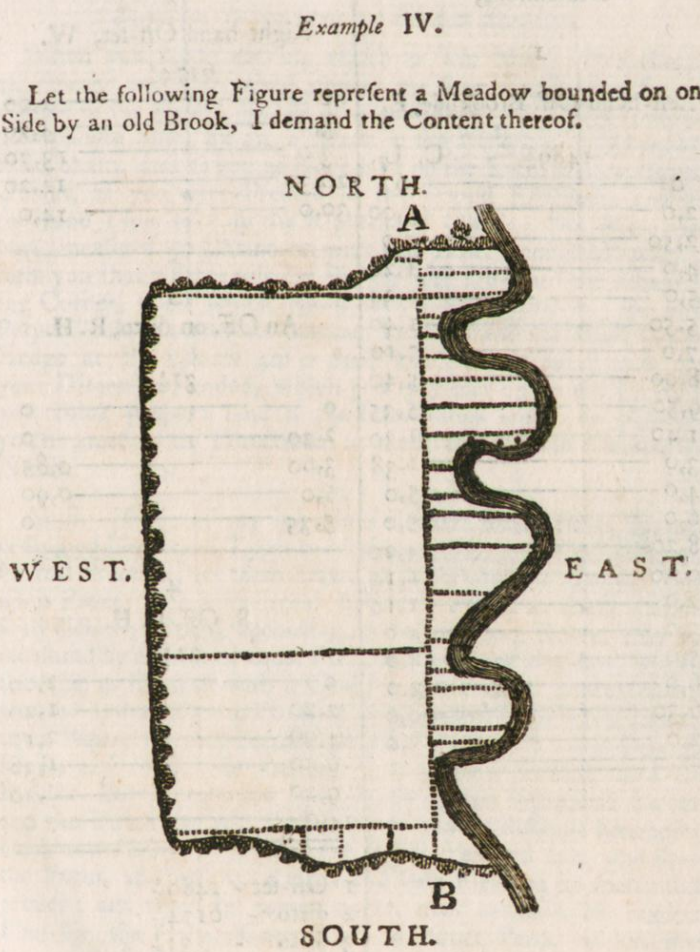
Fifthly, meaſure and take up the South Off-ſet, when chaining from C to A.

And laſtly, meaſure the Trapezium A D B C, as you were taught in Page 115, and 116. *See the Content of each Off-ſet entered at the Top of the ſeveral Dimenſions.*

Example

Example IV.

Let the following Figure represent a Meadow bounded on one Side by an old Brook, I demand the Content thereof.



Dimensions

Dimensions,

1

Left-hand Off. Brookside, E.

1489¾

	C. L.
0	0
2,0	5,00
2,50	4,0
4,0	1,20
5,0	1,20
5,50	1,40
7,0	5,10
8,00	5,40
9,50	5,35
11,40	1,20
13,0	1,38
14,0	5,0
16,0	5,0
18,20	4,20
20,20	1,10
22,0	1,10
23,0	4 0
25,0	4,0
26,0	3,0
26,30	0,0
32,0	3,0

2

Right-hand Off-set, W.

6174¼

0	1,00
3,0	4,20
3,0	13,70
20,30	14,20
30,0	14,0

3

An Off. on ditto, R. H.

31½

0	0
2,20	0
3,60	0,85
5,0	0,90
5,35	0

4

S. Off. L. H.

211¾

0	2,00
2,20	1,20
4,90	2,10
6,40	1,36
9,20	,20
14,0	0

1 Off-set - 1489¾
2 ditto - 6174¼
3 ditto - 31½
4 ditto - 211¾

A. R. P.

7907¼ = 49 1 27¼

the true Content of the Meadow.

Directions

Directions in the foregoing Field or Meadow.

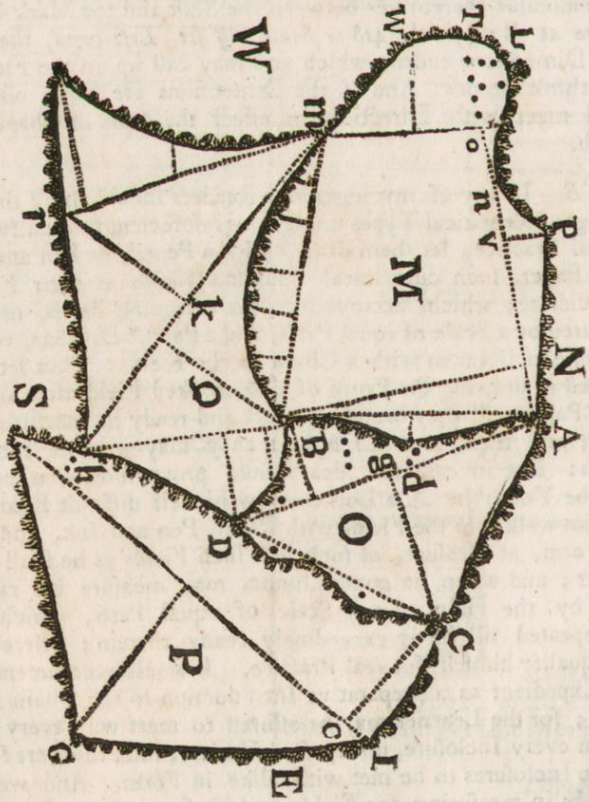
When you come into it, make for the North Side thereof, (*though any Side would anſwer the ſame End*;) then fix on a Place in the Hedge, ſuppoſe at A, and caſting your Eye towards the oppoſite Side, fix on a Mark in the Hedge at B, to which Place chain, and as you advance take up the Left-hand or Brook Off-ſet, as you were directed in the ſecond Example; and at the ſame Time take up the Right-hand Off-ſet; but when you have meaſured 30 Chains on your baſe Line, your Staff will inform you that a Perpendicular thereat doth ariſe into the ſubtending Corner, upon which you'll have a South Off-ſet; the firſt Perpendicular thereto lies between the Staff and the Mark in the Hedge at B; (*ſee the 4th or South Off ſet, Left hand*) then are your Dimenſions ended, which you may caſt up in the Field, if you think proper: And if the Dimenſions are to be planned, you'll meet with Directions to effect the ſame in Chapter the Ninth.

N. B. If any of my ingenious Readers ſhould think the preceding emblematical Types too few, or inſufficient to qualify them for real Practice; let them draw, with a Pencil, or Pen and Ink, upon Paper, ſuch curvelineal bounded Fields as their Fancies ſhall dictate; which, according to the foregoing Rules, may be meaſured by a Scale of equal Parts, and a Pair of Dividers, equally the ſame as if taken with a Chain in the Fields: Thus let them proceed in drawing the Form of one crooked Field after another upon Paper, till they become perfect and ready in meaſuring the ſame; and then, (*but not before*) they may venture into the Fields: But in caſe the Idea ſhould prove ſomewhat barren, and the Youth be at a Loſs to draw himſelf difficult Examples, let him walk into the Fields with Paper, Pen and Ink, and draw the Form, at Pleaſure, of ſuch and ſuch Fields as he ſhall think proper; and when he comes home, may meaſure his random Plan by the Help of any Scale of equal Parts, which may be repeated till he is exceedingly ready therein; whereby he may qualify himſelf for real Practice. I would recommend this laſt Expedient as a preparative Introduction to the Chain in the Field; for the Learner may be aſſured to meet with every Day, and in every Incloſure, unexpected Variety, ſince there are ſcarcely two Incloſures to be met with alike in Form. And when he is ready in meaſuring one Field, let him fix upon another or two adjoin-

adjoining thereto, which he may meaſure and plan, if he chuſes, according to the Directions given in the ſucceeding Chapters; and, for his farther Improvement herein, ſhall introduce an Example of a ſmall Eſtate before I cloſe this Chapter, whereby he may form a clearer Idea of Field Practice.

Example V.

Let it be required to meaſure the following ſmall Eſtate, conſiſting of four Incloſures, ſo that the Dimenſions thereof may be caſt up by the Pen, and afterwards planned if deſired: I demand the Content of the whole, and of each Field ſeverally.



Obser-

OBSERVATION.

In meaſuring this Eſtate, you muſt be very accurate in your Dimenſions, otherwiſe you cannot poſſibly give a juſt Return or Plan of the ſame: But here note, if you meaſure an inner Off-ſet in one Field, there will be no Occaſion to have an Off-ſet up to the ſame Hedge in the adjacent or adjoining Field; (*ſee the South Off-ſet in the Field* M;) and when you come to meaſure the Field Q, there will be no Occaſion to meaſure or ſtraighten the North Side thereof; but obſerve to take the Area of the South Off-ſet in the Field M, from the Area of the Dimenſions of the Field Q, and the Remainder is the true Area thereof. Forget not to leave Marks in the Corners, *&c.* of every Field you come to when meaſuring, to which you muſt meaſure; for Inſtance, when you come to the Corner m, in the Field M, leave a Mark in the Hedge, and alſo one at B, underneath which the Chain muſt come when you are meaſuring thereto in the adjacent Fields. And when you meaſure the Eaſt Off ſet therein, it will be needleſs to take Notice of the Hedge which lies up thereto when you are meaſuring the Field Q, to wit, the North Hedge, having the circular Form thereof in the Field M, the Area of which muſt be taken from the Trapezium m r h B, and the Remainder being added to the Eaſt and Weſt Off-ſets in the Field Q, the Sum will be the true Area thereof. And alſo the Eaſt Off-ſet in the Field O, muſt be taken from the Area of the Dimenſions of the Field P; and there will remain the Area thereof, and ſo of any other, which ſhould appear in the Dimenſions, as follow.

Dimenſions of an Eſtate in the Townſhip of—— in the Pariſh of ———, and County of ———, belonging to *J*———*T*, Eſq; *John Ancker's* Tenant at Will, 9 *June*, 1770.

Field M.

N. Off. L. H.

307,

0	0
1,0	1,20
1,20	2,00
2,30	2,00
6,40	,10
8,0	,10
10,30	2,00
19,50	0

E. Off. L. H.

127,

0	0
6,0	1,50
10,60	00
13,40	00

Field Q.

R. H. Off. W.

486.½

0	0
4,60	,40
7,80	2 00
13,0	6 60
14,	00

R. H. Off. S.

2736.

0	3,00
4,75	8,00
17,	13,0
19,50	0

S. Off. L. H. in Field M.

—— Field Q.

313,½

0	0
3,	2,0
5,60	2,70
7,90	2,45
10,34	1,30

The

Field Q continued.

Trapezium.

2492¼

0		0
11,30	R H	7,70
13,50	L H	7,80
20,10		00

E. Off. R. H.

362¼

0	0
1,70	,60
7,20	4,20
9,10	3,00
10,50	,00

Field O.

L. H. W. Off.

394¼

0	0
2,70	1,30
4,	4,00
6,80	3,00
9,10	1,20
16,0	,0

Right-hand Off-set, E.

1094¼

0	0
8,	8,0
16,	1,10

Field P.

L. H. Off. N. W.

1447.

0	0
4, to S. Corner Fd. Q	2,00
22,80	6,50
24,0	4,40

E. Off. L. H. in Fd. O—Fd. P.

107.¼

0	0
4,0	1,20
7,0	,00
9,0	1,10
11,60	00

R. H. Off S. E.

1996¾

0	0
12,	10,00
24.	,80

The Field Notes explained.

Firſt, you are ſuppoſed to enter into the Field M, at the Mark T, from whence *(after you have ſet up a Mark)* chain to the Corner A, and take up the Right and Left hand Off-ſets. *See the laſt or foregoing Example.* Then chain from the Corner A, to the Corner B, and take up the Eaſt Off ſet alſo; in like Manner chain from B to m, taking up the South Off ſet as you were directed in the firſt Example of this Chapter: But here obſerve, that this Off-ſet projects into the North Side of the Field Q, and therefore you need not ſtraighten the Hedge on both Sides; but take Care to mention at the Top of the Dimenſions *Minus Field* Q; thus abbreviated, ——Fd. Q.

Secondly, Having finiſhed the Field M, at the Corner m, enter into the Field Q thereat; and after you have obſerved the Form thereof, firſt take up the Weſt Off-ſet therein, which lies upon the Line m r; then return to the Corner m, and from thence chain to the oppoſite Corner, to wit, h, for a diagonal Line to the Trapezium m r h B, which, when you meaſure, raiſe Perpendiculars therefrom to r on the Right-hand, and B on the Left-hand. *See Problem* IV, *Chapter* IV; *and alſo Example* I, *Chapter* VI, wherein you have Directions to meaſure any Trapezium whatſoever; which being entered, then take up the Eaſt Off ſet that lies upon the Line h B, by chaining from the Mark in the Hedge at h, to the Mark you left in the Corner at B, then have you compleated the Dimenſions of the Field Q.

Thirdly, Enter into the Field O, and ſtart from the Mark you ſet up at D, to that left in the Corner A, taking up the Right and Left hand Off-ſets, as already taught. *But here obſerve, when you meaſure the Perpendicular on the Left-hand to* B, *you will have no Occaſion to meaſure any other Perpendicular on that Hand till you come to* A.

But then you would have included therein the Eaſt Off-ſet in the Field M, *which ſhould be ſubtracted therefrom; nevertheleſs, it will not be amiſs for the Learner to have as great a Variety as each Example will admit of*; and *(therefore)* as he advances on the baſe Line D A, take up as many Perpendiculars as the Left-hand Hedge requires:

take

See that the Right-Hand Perpendiculars be not neglected, which done, walk to the Corner C, and meaſure the Eaſt Off-ſet alſo that lies between the baſe Line C D and the Hedge on the Left-hand, then is this Field meaſured likewiſe.

Laſtly, ſtep into the Field P, walk to S, the South Corner thereof; and from thence chain to I, the oppoſite Corner, upon which Line take an Off-ſet to the Right and Left-hand, (*ſee the Dimenſions of the ſame*) which when entered you have finiſhed the whole.

Observations.

1. In the foregoing Example I have deſignedly omitted in the Field Notes, Remarks, as Ponds, Pits, Timber, Buildings, *&c.* which perhaps might have occurred, being apprehenſive the ſame would rather confuſe than edify in this Place: Moreover, I have directed to meaſure each Incloſure ſeparately, *though contrary to that correct and expeditious Method of chaining a Main-line acroſs an Eſtate, and meaſuring the Incloſures ſeverally that you paſs through, as they are met with on the Right and Left-hand, whereby a Plan, with leſs Trouble, may be drawn from the Dimenſions ſo taken; an Example of which I have delivered in Chapter* X; *but muſt intreat the young Practitioner not to peruſe or examine the ſame until he is very expert in planning and caſting up this and the foregoing Examples.*

2. And although in the laſt Example, the Right-hand Column contains Part of the Dimenſions of the ſmall Eſtate, yet, notwithſtanding, if the young Practitioner be ready in the preceding Examples, he'll find it no ways difficult to plan the ſame, more eſpecially after he has read the three ſucceeding Chapters.

The Amount of the Dimenſions.

		Perches.
Field M,	North Off ſet, Left-hand —	307.
	South ditto, Right-Hand —	2736.
	Eaſt ditto, Left-hand ——	127.
	South ditto, Left-hand ——	313·½
		3484
Field Q,	Right-hand Off-ſet, W. —	486½
	Trapezium —— ——	2492¼
	Eaſt Off-ſet, Right-hand —	362¼
		3341
	—S. Off. Left-hand, in Field M.	313½
		3027½
Field O,	Left-hand Off-ſet, W. ——	405¾
	Right-hand ditto, E. ——	1094¼
		1500
Field P,	Left-hand Off-ſet, N. W. —	1447
	Right-hand ditto, S. E. —	1996¾
		3443¾
	— E. Off. L. H. in Field O.	116
		3327¾

The Amount of the whole Eſtate particularized, with the real Name of each Incloſure.——

			A.	R.	P.
M, Dairy Field —	3484	=	21	3	4
Q, Pool's Meadow	3027½	=	18	3	27
O, Horſe Paſture —	1500	=	9	1	20
P, Lady Acre ——	3327¾	=	20	3	7¾
		Total	70	3	18¾

CHAP.

CHAP. VIII.

Diviſion of Land.

LAND (when it becomes the Property of contending Parties, Co-heirs, joint Purchaſers, or Co-partners, &c.) is occaſionally divided into ſuch Shares or Parts as the Co-parties are intitled thereto. And ſince this cannot poſſibly be done or effected without having Recourſe to the Aſſiſtance of a Surveyor, or ſome Perſon equally qualified to perform the ſame, I ſhall, therefore, in this Chapter, lay down ſuch Rules and Directions as will undoubtedly enable any Meaſurer to compleat the ſame when Occaſion offers.

When any Land is to be divided, meaſure the ſame by the Directions before given, ere you divide it, except it is to be divided into two equal Parts; and in ſuch Caſe it may be performed with leſs Trouble. Then proceed by the Rule of Fellowſhip taught in the firſt Chapter; but before you begin, you muſt be informed, by the Parties concerned, where their reſpective Shares ſhould nearly be, namely, whether in the eaſtern, weſtern, or ſouthern Sides of the Land, &c. and if Water be ſcarce therein, it would be proper ſo to divide that each Part may have Communication with, and to that neceſſary Element; otherwiſe the Parties concerned and obſtructed therefrom, will certainly find themſelves aggrieved thereat, ſo as not to acquieſce to, and confirm the Diviſion.

PROPOSITION I.

Shewing how to divide a triangular Piece of Land ſeveral Ways.

Example

Example I.

Let the Triangle A B C, repreſent a Piece of Land to be divided between two Men; firſt equally; ſecondly, unequally; and in both Caſes the Line of Diviſion to proceed from the Angle C. (*plate* 2, *fig.* 1.)

To divide this Field into two equal Parts, you need only chain the Side A B, and lay down the Half thereof, by meaſuring back again from B to D; then a Fence directly drawn or made between D and C, will divide the Field equally. For ſuppoſing a Line was drawn through the Point or Corner C, parallel to the Hedge A B, biſected in D, and D C being joined, reduces the Field to two Triangles ſtanding upon equal Baſes A B and D B; and Triangles ſtanding upon equal Baſes, and between the ſame Parallels, are equal by 38th *Prop.* 1 *Euclid.* Hence the Area of the Triangle A D C, is equal to the Triangle D B C Q E D.

Secondly, Let it be required to divide the ſame triangular Piece of Land into two unequal Parts, that is to ſay, one Man to have 5, 6, or 7 Acres more than the other; or to have two Thirds, or any other Part thereof, in all ſuch Caſes, this is the

RULE.

As the Content of the Field is to the Length of any one of its Sides, ſo is each one's Proportion or Share of the Content, to his exact Length upon the meaſured Side; which muſt be laid down or meaſured from the Corner B towards A, or from A towards B, according as the Parties have agreed concerning the Diviſion.

Now, in the foregoing Example, let it be required to divide the triangular Field A B C, between *John* and *James*, and *John* to have 3 Acres more than *James*, I demand where the Line of Diviſion muſt be drawn to the Hedge A B. By the foregoing Directions you meaſure and find the Content of the Field to be 28 Acres; and as *John* is to have three Acres more than *James*, take

take half the Difference between their Shares, that is to say, one Acre and a Half, and add it to half the Content, *viz.* 14 Acres, the Sum is 15 Acres, 2 Roods, *John*'s Share; and 1 Acre, 2 Roods, taken from 14, there remains 12 Acres, 2 Roods, *James*'s Part.

Then say,

A. C. A.

As 28 27 : : 15.5 to *John*'s Distance upon the Side A B.

27.

1085
310

C. L. Inches.

28) 418.5 (14 94 4
28··
or 14 Chains 94 Links, $\frac{2}{4}$ of a Link, Answer.

138
112

265
252

130
112

18

By the above Operation, you find that *John* must have 14 Chains 94 $\frac{1}{4}$ Links, laid down or measured from the Corner A, towards the Corner B, *viz.* from A to G, and draw the Line E C, which will divide the Field as was required. If it were demanded to divide the same into any other unequal Parts, you must in like Manner proceed.

PROP. II.

Let it be required to measure and divide *fig.* 2, *plate* 2, which represents an Inclosure, into two equal Parts by a Line proceeding from a Pond at A.

The moſt ready Way to do this, is firſt to draw a Line from A that ſhall nearly divide the Field into two equal Parts, as AB, which you may call the ſuppoſed Line of Diviſion; then meaſure the Parts ſeparately, and if the Content of each be alike, you have equally divided the Field; but if unlike, take half the Difference from the greater Part, and join it to the leſſer, thus; divide half the Difference in ſquare Perches, by the Length of the ſuppoſed Line of Diviſion reduced to Poles, and the Quotient will be the Breadth to meaſure or lay down from the greater Part.

Here note, If you meaſure with a four-pole Chain, reduce your Chains and Links into a one Pole Chain, thus; multiply the Chains and Links thereof by 4, and the Product will be Poles, and decimal Parts thereof.

Example.

	C.	L.
I demand how many Poles in	7	19
		4
Anſwer,	28.76	Poles.

	C.	L.
Alſo I demand how many Poles in	14	75
Anſwer, 59 Poles.		4
	4) 59	00
Proof	14	75

And to reduce Poles to Chains, *&c.* divide by 4, as above, and the Quotient will be Chains and Links.

Example.

I demand how many Chains and Links in 13.84 Poles?

4) 13 14

Anſwer 3 Chains, 46 Links. 3.46

In

In the foregoing Example meaſure the Length of the ſuppoſed Line of Diviſion A B, (but remember to begin at the Hedge on the other Side of the Pit, and not at the Point A) and you'll find it to be 15 Chains, 32 Links; then meaſure each Part ſeparately, and caſt up the ſame (as before taught) whilſt in the Field, and you will find each Part to contain as follow:

	A.	R.	P.
The Eaſt Part	14	3	17
The Weſt Part	12	1	34
The Difference	2	2	23
Half ditto —	1	1	11½

4

5.
40

The ſuppos'd Line of Diviſion is 61.28 Perches.

21100
18384

27160
24512

26480
24512

19680

4)
(3.44

.86 Links of a four-pole Chain.

Suppoſed Line of Diviſion — C. 15 L. 32

4

61 28

By the above Proceedings, you ſee the weſtern Part is leſs than the Eaſtern by 2 Acres, 2 Roods, 23 Perches, the Half of which reduced (according to the foregoing Rule) is 211 ſquare Poles, which being divided by 61.28, (the ſuppoſed Line of Diviſion in Poles) gives 3.44 Poles, equal to 86 Links of a four-pole Chain, which muſt be laid down or meaſured from A towards d, and from B towards c, between which Point, a Fence made will divide the Field equally, as was required.

Example III.

Admit *fig.* 3, *plate* 2, to repreſent an Incloſure the Property of three Men, (*viz.* *Joſeph*, *John* and *James*,) containing 21 Acres, 3 Roods, 12 Perches, to be divided equally, that is to ſay, each to have 7 Acres, 1 Rood, and 4 Perches; and the Lines of Diviſion to terminate at, and communicate with a Pond of Water that is therein, ſo that each Perſon may have the Benefit thereof, and not treſpaſs upon one another's Land.

	A.	R.	P.		P.
Joſeph —	7	1	4	=	1164
John —	7	1	4	=	1164
James —	7	1	4	=	1164
	21	3	12	=	3492

To effect this (after having fixt upon the Situation of each Part, by fixing Marks at A and E,) firſt ſtraighten the Hedge A F E, by taking up the Off-ſet (as hath been taught in the firſt Example of the preceding Chapter) A L E F; and, in chaining the Baſe thereof, meaſure the Perpendicular L o: Having finiſhed this Part, caſt up the Dimenſions thereof in the the Field, which amount to 1110 ſquare Perches, being too little by 54, ſeeing each Man's Proportion is 1164 ſquare Perches, as above.

Secondly, Meaſure the Trapezium A B o, and you'll find that it contains 1126 ſquare Perches, being too little alſo by 38 Now, as you know the Field to contain juſt 3492 ſquare Perches, you need only take 38 from the Part unmeaſured, *viz.* G C D E o, and adjoin it to the laſt meaſured Part, namely, the Trapezium A B G o; and alſo take 54 ſquare Perches from the other Side of the unmeaſured Share or Part, and lay it to the firſt meaſured Part, then is the Field divided as required. However, to prove the Work, it will not be amiſs to meaſure the third and laſt Part, as you did the two former, (ere you take any thing therefrom) and finding it to be 1256 ſquare Perches, that is, 92 too much; nevertheleſs, collect thoſe differing Shares together, *viz.* 110 + 1126 + 1256 = 3492,

a

a convincing Proof of your Proceedings. Suppoſing then the firſt Part belonged to *Joſeph*, the ſecond to *John*, and the laſt meaſured Part to *James*, who hath 92 ſquare Perches more than his proportionable Right, which muſt be divided according as *Joſeph* and *John* are deficient in their reſpective Parts, *viz*,

54 ÷ 1110, *Joſeph*'s ſuppoſed Share = 1164 } their true
and 38 ÷ 1126, *John*'s ditto - - - = 1164 } Shares,

which, to lay down properly, you may proceed thus: Firſt meaſure the Diſtance between the Mark in the Hedge at E, and the Mark left or ſet up at the Pond (when the Perpendicular L o was meaſured;) which being 12 Chains, 17 Links, = 48 68 Poles, a Diviſor to 54 Perches, the Area of *Joſeph*'s Deficiency.

See the Operation.

48.68)54.00 (1 109 Poles reduced to the Links of a Statute Chain,
48.68
5320
4868
54200
43812
1388

thus:
4)1.109
.27¾ Links.

Theſe 27¾ Links, lay off from n to a, at the Corner E, and at the Pond alſo, through which Places, to wit, a, a muſt paſs a right-lined Hedge between *Joſeph*'s and *John*'s Land.

Secondly,

Secondly, Meaſure the Diſtance between the Mark at G, and that ſet up at the Pond o = 10 Chains, 56 Links, which being reduced to Poles thus, 10.56 Chains;
in one Chain 4 Poles.

42.24 Poles in 10 Chains, 56 Links, a Diviſor to 38 ſquare Perches, the Land that *John* is ſhort of in the ſuppoſed Share.

42.24)38.000(.899
33792
42080
38016
40640
38016
2624

reduced to Links of a Statute Chain, thus:
4.).899
.22¼ Links.

Then, from the Line o G, lay off 22¼ Links towards d and e, through which Points or Places a right-lined Fence or Hedge muſt paſs between *John* and *James*, and it is done.

Thus have you compleated the Diviſion required: And if the ſame Field were to be divided into three, four, five, or ſix unequal Parts, and every Part or Share to have a Communication to, or with a Pond, Pitt, or Pool, whether in the Middle or one Side of the Field, the ſuppoſed Lines of Diviſion muſt be ſo taken that every Diviſion, Share, or Part, ſhall conjoin with the ſame if required.

Observation.

When Commoning, or any waſte Land is to be incloſed, being the Property of ſeveral joint Lords, Freeholders, *&c.* the whole muſt firſt be meaſured, and then divided into ſuch Proportions amongſt them as their reſpective adjoining Eſtates pay Land-Tax, or as they are otherwiſe reſpectively intitled thereto; ſay-

ſaying, as the Amount of the Land Tax, *&c.* is to the Area of the Common or Ground to be incloſed, ſo is each Man's particular Tax, *&c.* to his reſpective Share of the Common which ſhould be ſo incloſed or laid out; ſo that each Diviſion or Share, may adjoin with its peculiar Eſtate.

PROP. II,

Teacheth to lay out an aſſigned Quantity of Land in a Field wherein, firſt, the Quantity is given: Secondly, the Length or Breadth muſt be found to obtain the other: Thus, if the Area of the given Quantity be divided by the Length of the Field, the Quotient will be the Breadth required; but if you are confined to a particular Breadth, the propoſed Quantity muſt be divided by the ſame, and the Quotient will be the Length thereof.

Example.

Suppoſe a Farmer lets an Acre of Meadowing to be laid out in one Side of a Field that is 24 Chains, 27 Links long, I demand the Breadth of the ſaid Acre therein.

See the Work.

24.27
4

Poles 97.08) 160.00 (1.647
97 08

62920
58248

46720
39832

68880
67956

4)1.647
.41

Anſwer, 41 Links and nearly a Half.

EXPLA-

EXPLANATION.

Though, from what has been already mentioned and taught on this Head, I ſhould think it needleſs to expatiate upon this Example; but perhaps ſome of my Country Readers *(that have Occaſion ſome Times to let Meadowing*, &c.) cannot ſo readily comprehend the ſame; and as I have hitherto with the utmoſt Chearfulneſs, endeavoured to render every Thing herein both plain and beneficial to the honeſt Farmer, I therefore look upon it a Duty indiſpenſible to gratify, and *(if poſſible)* fulfil his Expectations by an explicit thorough Explanation not only in the foregoing Example, but alſo ſhall recommend the following Tables, whereby any Perſon may readily know the Breadth of an Acre, having the Length thereof, and the contrary.

Firſt then, meaſure with a Chain the Field's Side, (which we'll ſuppoſe to be ſtraight) and having found the Length thereof to be 24 Chains and 27 Links, reduce the ſame to Poles, *i. e.* multiply the Chains and Links by 4, the Number of Poles in a Chain, and the Product is 97.08.

Secondly, Divide the given Quantity of Land, *viz.* One Acre, or 160 ſquare Perches, by the above 97 08, (the Poles in the Length of the Field) and the Quotient is 1.647, which being divided by 4 (to bring it into the Links of a four-pole Chain) the Quotient is 41 Links, and nearly one Half, which muſt be laid off, or meaſured from the Hedge or Field Side, in four or five different Places; and at each Place you muſt take 41½ Links in your Hand, the Chain-leader holding the Chain End as near the Field Side as the Mower can cut, and then fix up a Stake that will appear from the next Mark or Stake: Thus do until it be ſufficiently marked out.

And laſtly for a Guide to the Mower, ſtand at the End of 41½ Links, from the Field Side, and tread or beat down a narrow Road of Graſs between each Mark, which you may effectually perform by keeping your Eye upon the next Mark as you advance, till you have got to the other End.

Two TABLES designedly inserted for the Advantage of the honeſt Farmer.

TABLE I.

Sheweth the Number of Chains, Links and decimal Parts of a Link contained in the Length or Breadth of an Acre of Land, when either of the two are given or required.

Breadth.	Length.
C.	C. L.
1	10 00
2	5 00
3	3 33.333
4	2 2.50
5	2 00
6	1 66.6
7	1 42.285
8	1 25.
9	1 11.111
Length.	Breadth.

TABLE II.

Sheweth the Length and Breadth in Perches, Yards, Feet and Inches that compoſe an Acre of Land of a rect-angular, or long-ſquare Form.

Length.	Breadth.			
P.	P.	Y.	F.	I.
10	16	0	0	0
11	14	3	0	0
12	13	1	2	6
13	12	1	2	6
14	11	2	1	1
15	10	3	2	0
16	10	0	0	0
17	9	2	0	9
18	8	4	2	8
19	8	2	0	1
20	8	0	0	0
21	7	3	1	6
22	7	2	1	6
23	6	5	0	9
24	6	3	2	0

The Uſe and Application of the Tables.

It has been already obſerved, that 10 ſquare Chains, (*i. e.* 10 Chains in Length and 1 in Breadth) make 1 Acre, or 5 in Length, and two in Breadth, as appears by the firſt Table. Hence it follows, if the Length or Breadth be given in Chains,

Links, &c. the other may be readily found by Inſpection, to wit, if the Length be given in Chains, look on the contrary Dimenſions, and you'll ſee how many Chains, Links, &c. muſt be meaſured at right Angles, to make or lay down an Acre; for Inſtance, admit a Field Side, when meaſured, to be 6 Chains, then, by the Table, muſt be meaſured for Breadth 1 Chain, 66 Links .66, or ſomething better than half a Link; which being multiplied by 6 Chains (the given Length) the Product will be 10 ſquare Chains, or 1 Acre, the like in both Tables; and all other Examples of this Kind muſt be obſerved; ſo that any farther Illuſtration is needleſs.

Note, The firſt Table will anſwer ſtatute, cuſtomary, and *Iriſh* Chains; but the ſecond Table is calculated for Statute Meaſure only.

Note alſo, If the Side of the Field (up to which you are to lay out an Acre, &c) be curved, or any how irregular, firſt ſtraighten the Hedge, by taking up an Off-ſet thereto; which you muſt immediately after caſt up, and whatever the Area thereof is ſhort, or wants of the propoſed Quantity, muſt be divided by the Length of the baſe Line reduced to Poles, and the Quotient will be the Breadth of the Quantity required.

Likewiſe, As Diviſion, or laying out Land affords much Variety, I muſt therefore adviſe the young Learner *(when he is thoroughly capable to meaſure any Field)* to walk into an Incloſure, and practice therein, by laying out one Parcel of Ground after another, till he is perfect in the ſame.

Before I conclude this Chapter, I ſhall introduce a few more Examples that perhaps may be as ſerviceable to my Reader as any of the former, which may be performed without reducing the Length or Breadth of any Quantity of Land (taken in Chains) into Poles, &c.

And firſt, Having uſed the four-pole Chain *(and none elſe)* in this Treatiſe all along, I ſhall, in this Place, ſhew you how to turn any Number of Chains, into Acres, Roods and Perches, and the contrary.

Note,

Note 1ſt, That 10 Chains long, and 1 broad, *that is*, 10 *ſquare Chains*, make one ſquare Acre; therefore, if any Number of ſquare Chains be given to be turned into Acres, divide them by 10, and the Quotient will be the Number of Acres contained in ſo many Chains: But this Diviſion is abbreviated by cutting or pointing off the laſt Figure; for Inſtance, if 4740 ſquare Chains were given to be turned into Acres, by cutting off the laſt Figure, thus, 474|0, there remains 474 (to the Left-hand) being ſo many Acres, which is equally the ſame as if you had divided 4740, by 10. But if Chains and Links were given to be reduced to Acres, Roods, and Perches, then cut or point off three Figures, *viz.* two for the Links, and one for the Chains; what remains to the Left-hand will be Acres; and to know the Value of the decimal Figures, cut or pointed off, proceed as in the following

Example.

In 1967 ſquare Chains, and 78 ſquare Links, how many Acres, Roods, and Perches?

Acres — 1961|778
4

Roods — 3|112
40

Perches — 4.480

Anſwer, 196 Acres, 3 Roods, 4 Perches, and nearly a Half.

On the contrary, if to any Number of Acres given, you add a Cypher, they will become ſquare Chains, the ſame as if you had multiplied the Acres by 10, (ſince 10 ſquare Chains are one Acre:) And if you would turn ſquare Chains into ſquare Links, add four Cyphers to the Right-hand thereof, thus, 1 ſquare Chain will be 10000 ſquare Links, ſo will 76 ſquare Chains, be 760000 ſquare Links, the ſame as if you had multipled 76 by 10000, the Number of ſquare Links contained in 1 ſquare Chain. So that in caſting up the Content of a Piece of Land whoſe

Dimenſions were taken by a four-pole Chain *(in laying out, or dividing Land)* if you multiply Chains and Links, by Chains and Links, the Product will be ſquare Links; for ſeeing that 1 Chain 24 Links may be thus expreſſed, 1.24 Chains; and by leaving out the decimal Point, it will be thus expreſſed, 124; that is, 124 Links; therefore Links multiplied by Links, produce ſquare Links; ſo that you muſt cut or point off five Figures from the Product, to find the Acres; which is the ſame as if you divided the Product by 10000 (the Number of ſquare Links contained in 1 ſquare Acre;) then, by Reduction, find the Value of the Decimals ſo pointed off, and it is done.

Example.

Admit a rect-angular Field (commonly called a long Square) to be 7 Chains, 38 Links long, and 3.73 Chains broad, I demand the Content in Acres, Roods and Perches.

See the Work.

7.38
3.73

2214
5166
2214

2.75274
4

3.01096
40.

0.43840

Anſwer, 2 Acres, 3 Roods, and nearly half a Perch.

Thus the Learner may lay out, or divide Land equally the ſame as if he had reduced his Chains to Poles, according to the Directions in the firſt Part of this Chapter.

Note,

Note, From the two foregoing Examples may be deduced the following Propoſitions concerning the Tranſmutation of ſuperficial Figures, to wit, to change Land from one Form to another; as alſo their Diviſion, or Separation into any Number of proportional Parts required, which ought to be underſtood by every one that deſireth to attain a competent Proficiency in the Art and Practice of Surveying; but as thoſe Propoſitions tend more to amuſe and divert the Learner, than to advance his Knowledge in the practical Part of Meaſurement, I ſhall not only omit a geometrical Demonſtration thereof, but likewiſe be as brief as poſſible in every Article that doth not immediately relate to Field Practice; and therefore beg Leave to refer my curious Readers to the Works of thoſe Authors who have more copiouſly treated thereon.

PROP. I.

A certain Quantity of Acres being given to know the Side of the ſquare that ſhall be equal thereto.

RULE.

To perform this Propoſition, annex 5 Cyphers to the Right-hand of the Acres propoſed or given, which will turn them into ſquare Links, the ſquare Root whereof, will be the propoſed Square to be protracted or laid down, according to the Directions given in Problem I, Chap. II, which ſee.

Example I.

Let it be required to find the Side of a Square that ſhall be equal in Area to 1 Acre of Land.

See the Work.

```
)1.00000.(316 Anſwer, 3 Chains, 16 Links,
 9 ····         and nearly 1 Quarter of a
 ---            Link.
61) 100
    61
   ---
626 3900
    3756
    ----
    14400
```

But if the Side of a Square be required that ſhall be equal in Area to any Quantity of Acres, Roods and Perches, add the Number of ſquare Links that are contained in the odd Roods and Perches, to the ſquare Links found in the given Quantity of Acres; and the ſquare Root of that Sum, will be the Side ſought.

PROP. II.

How to lay out any given Quantity of Acres, &c. in a Parallelogram, or Rect-angle, whereof one Side is longer than the other.

RULE.

Divide the ſquare Links that are contained in the Acres, &c. by the given Side, and the Quotient will be the Side ſought or required.

A Rect-angle is required, that ſhall contain juſt half an Acre, ſuppoſing the Breadth to be 6 Poles, I demand the Length thereof.

Note, As this Example does not conſiſt of Chains, I ſhall work it two ſeveral Ways, *viz.* firſt by Poles, and after by Chains, or ſquare Links.

See the Work both Ways.

Firſt by Poles.

Breadth 6)80 ſquare Poles in half an Acre,

6

20 — 4)

18 — 13.333 the Length.

20 — 3.333 Anſwer.

18

20

18

20, &c.

Secondly, by Chains.

As 10000 ſquare Links, are 1 Acre, 5000 ſquare Links muſt be half an Acre: therefore 5000 divided by the Breadth (1.50, the Link in 1½ Chain, or 6 Poles) quotes the Length, thus:

1.50)50000(333, &c. ſquare Links, equal to
450 · · 3 Chains, 33 Links,
as before.

500

450

500

450

50

How any Piece of Land in the Form of a Rect-angle, may be ſo laid out, that it ſhall be 4, 5, 6, 7, or 8 Times, &c. longer than it is broad.

RULE.

Firſt let the given Quantity of Acres, &c. be turned into ſquares Links (as before) which Sum divided by the Number given

given for the Proportion between the Length and Breadth, as 4, 5, 6, 7, &c. then the ſquare Root of the Quotient, will be the ſhorteſt Side of ſuch a Rect-angle in Links, which being multiplied by that Number you made your Diviſor, the Product is the longeſt Side.

Example.

Let it be required to lay out 4 Acres in a Field, ſo that its Length may be 7 Times as long as broad.

See the Work.

7)400000.

. . . Links.
) 57142.85 (239 the ſhorteſt Side.
4 ···
7
43) 171
129
1673 the longeſt Side.
460) 4242
18

As the laſt three Examples are more for Amuſement than any real Uſe in practical Surveying, I thought it needleſs to introduce Decimals in the Work, which ſhould be uſed in Practice, if an Example of the Kind ſhould ever offer.

CHAP.

CHAP. IX.

Shewing how to plan (Dimenſions taken by the Chain only) *all Manner of regular and irregular Incloſures, whether bounded by curved or circular Hedges,* &c. *and alſo to map the ſame if required.*

YOU muſt take up your Dimenſions, as hath been already taught in the foregoing Chapters; caſt up the Content, as before directed, by the Pen; and though you have your Dimenſions planned, you muſt not, (as Thouſands have done heretofore) caſt up from the Plan, it being impoſſible to tell the Links under ten, upon any Scale exactly; and of Conſequence your Work would be ſubject to Error, which your Pen is no Ways liable to when your Dimenſions are accurately taken, and the Productions of your Pen in working the ſame proved as you proceed; you then may, with the greateſt Certainty, rely on your Return of the ſame.

Now, when your Dimenſions are taken and caſt up, the next Thing to be done is to lay down the ſame upon Paper, for which Purpoſe the Scale is very neceſſary. There are ſeveral different Sorts of Scales (with regard to Size,) *viz.* Scales of equal Parts, containing 1, 2, 3, 4; or 10, 20, 30, and 40 Chains to an Inch; and theſe are decimally reduced to any other Size, according as the Meaſurer hath Occaſion to uſe them.

Of Scales, and Lines thereon.

There are many Lines upon a Scale beſides the Line of equal Parts, namely, Lines of Proportion; as the Line of Number, Line

of Sines, Tangents, Secants, *&c.* Alſo, for Projection, the Line of Chords (uſed in making and meaſuring of Angles,) Line of Tangents, and Semi-tangents, Rum-lines, &c. Theſe latter we ſhall have no Occaſion for in this firſt Part.

Excluſive of the above-mentioned Scales, there are others whoſe Lines are differently divided; namely, the Inch divided into 11, 12, 16, &c. equal Parts, I don't look upon ſuch Scales to be ſo particularly adapted to the Chain as the firſt mentioned Scale, notwithſtanding a Perſon may plan by, or from any Scale divided into equal (vulgar fractional) Parts. But thoſe which I would recommend, are the Inch, half Inch, &c. decimally divided, as the eaſieſt and moſt ready for a Learner.

Directions to uſe them.

Scales of equal Parts, are for meaſuring or laying down Lines, and are differently made and divided, if the 1, 2, &c. be accounted no more, the Sub-diviſions at the End and Top are 1 decimally divided into Tens, and Hundreds.

But if the 1 be reckoned 10, the 2, 20, &c. whether upon the Inch, half Inch, or quarter Inch, the Sub diviſions are Chains, and tenth of a Chain, that is, 10 Links: And when you call the 1 or 2, &c. 100 or 200, &c. the Sub-diviſions at the Top repreſent ten Chains each; and thoſe at the End 1 Chain; for Inſtance; if it were required to take 370 Chains off the Scale, ſet 1 Foot of the Dividers in 3, (whether Inch, half, or quarter Inch, it is not material, ſo that it be the Scale you propoſe to plot by,) and the other Foot in the ſeventh ſmall Diviſion at Top, and that Extent will contain 370, which is the ſame Diſtance that repreſents either 3 Chains, 70 Links, or 37 Chains: But here every large Diviſion, where the Numbers 1, 2, 3, &c. are placed, are accounted 100, *viz.* 1 is 100, 2 is 200, &c. and then every ſmall Diviſion at Top is 10, and each one at the End, repreſents 1 Chain only; and in this Caſe, if there be any odd Links, you muſt compute them between the Sub-diviſions, as ſuppoſe you muſt ſet off 81 Chains, 38 Links, ſet 1 Foot in 8, and extend the other to the firſt ſmall Diviſion at Top, as if you were to ſet off 81. and that repreſents 81.00, or 81 Chains; then ſhift both Legs of the Dividers almoſt 4 Diviſions at the End

End, that is, between 3 and 4; the 3 repreſents 30 Links, and the 4, 40 Links; ſo that you muſt compute, as near as you can, the 8 odd Links between the ſaid third and 4th Diviſion; and from 8 to that Place, is the Extent 81.38 required.

There are other Scales equally divided to meaſure and plot by, as the diagonal Scales, *Gunter*'s Scale, &c. which are partly the ſame with the common plain Scale, in regard to a Scale of equal Parts.

The common plain Scale is made 6, 9 or 12 Inches long, but *Gunter*'s Scale is two Feet: The plain Scale has the Diagonal, the Line of Chords, Rumbs, Sines, Tangents, and Semi-tangents, &c. on one Side (which are all Scales unequally divided) *Gunter*'s Scale hath all the above-mentioned Lines or Scales on one Side, that the plain Scale has upon both; and on the other Side of it, there are Lines of Proportion, namely, Lines of Numbers, Sines, Tangents, &c.

Firſt of the Line of Chords.

The Line of Chords (marked Cho.) is a Line of unequal Parts, numbered 10, 20, 30, &c. to 90, the Diviſions thereof grow leſs as the Numbers increaſe. There is commonly a Braſs Point at the Beginning, and alſo one at 60; the Chord of 60 being equal to the Radius, or Semi-diameter of a Circle, that Extent called the Chord of 60, is always taken to make or meaſure Angles with, and is applied to no other Purpoſe.— How this Line is made uſe of ſhall be ſhewed in a proper Place.

Of the Line of Numbers.

The Line of Numbers is alſo one of thoſe Lines upon *Gunter*'s Scale, commonly called *Gunter*'s *Line*; and upon the Scale is diſtinguiſhed by the Name of *Line of Numbers*, marked Num. or Numb: It is numbered from the Left hand, with 1, 2, 3, &c. to 10 to the middle of the Scale; and from thence to the Right-hand, with 2, 3, 4, &c. to 10 again; the Diviſions are unequal, decreaſing from the Left to the Right, as the Numbers

increaſe; both Parts from the Middle are alike divided, that is, the Space from 2 to 3 on the Left-hand Half, is equal to the Diſtance between 2 and 3 on the Right-hand Part or Half, and keeps the ſame Order exactly with regard to Space, that is, the Diſtance between 1 and 2 on the Left-hand, is equal to the Space between 1 and 2 on the Right-hand; but the Space between 1 and 2 on either Part, is not equal to the Diſtance between 2 and 3, or 4 and 5, upon the ſame, but larger: But the Space between 1 and 2, is equal to the Space between 2 and 4, or between 5 and 10, &c. becauſe 1 bears the ſame Proportion to 2, as 2 does to 4, or 5 to 10, &c. and every two Numbers that bear the ſame nroportion between themſelves, are equally diſtanced upon this Line. Hence the Proportion of any two Numbers being given, the Proportion of a fourth to a Third, may be obtained by a Pair of Dividers.

So that the greater the Number, the cloſer they are placed upon any Line on the Scale, becauſe every Number included between any two Numbers, (though ever ſo large) are expreſſed between them on the Line, as well as all Numbers included between any two ſmaller, in the ſame Proportion; as for Inſtance, 24 bears the ſame Proportion to 6, as 8 does to 2; therefore all Numbers between 24 and 6, are contained in the ſame Space upon the Line, as the Numbers that are between 8 and 2.

The Figures on the Line of Numbers may be read as the Scale of equal Parts, namely, the 1 may repreſent on the Left-hand 1, 10, 100, &c. and the ſecond Part is always 10 Times the Value of the firſt: Thus, if 2 be called 2 on the Left-hand, the 2 on the Right-hand is 20, 3 is 30, 4 is 40, and 10 at the End of the Line is 100, &c.

The Numbers between 1 and 10, and 10 and 100, are ſupplied by Sub-diviſions; as the next large Sub-diviſion towards the Right-hand of the 1 in the Middle is 11, the ſecond 12 (where a ſmall Braſs Point is fixt for Timber Meaſure, &c.) and the fifth, which for Diſtinction is longer than the reſt, is 15, and ſo on to 16, 17, &c. and then the 2 is 20, and ſo count on 21, 22, 23: Upon the larger Diviſions, betwren 20 and 30, the 3 will be 30, the 4 40, &c.

And

And if your Numbers run higher, the Sub-diviſions increaſe in a ten-fold Proportion accordingly.

This Line is only intended for Proportions; all Numbers equally diſtant upon the Line, bear the ſame Proportion to each other; upon which is grounded the Reaſon why Multiplication, Diviſion, and the Rule of Three, &c. can be performed upon the Scale, or Line of Numbers, by a Pair of Dividers, as effectually as with or by the Pen: Mr. *Gunter* is ſuppoſed to be the Inventor of this uſeful Line, from whom it takes its Name.

Of the Line of Sines.

The Line of Sines upon the Scale is commonly marked *Sin.* or *S*; and is numbered from the Left to the Right-hand, with 1, 2, 3, 4, &c. up to 90 Degrees, where there is a Braſs Center; theſe Diviſions are likewiſe unequal, and are projected from a quarter of a Circle divided into 90 equal Parts: The Perpendiculars let fall from the equal Diviſions of the Quadrant to one Side of it, and parallel to the other, are artificial Sines to that Radius. Directions to uſe this Line ſhall be given in a proper Place.

Of the Line of Targents.

The Line of Targents upon the Scale, is numbered from 1 on the Left-hand, to 45 on the Right-hand (becauſe the Tangent 45 Degrees is Radius,) where there is a Braſs Centre, and marked *Tan*; it is alſo numbered back again with 50, 60, 70, &c. and equally decreaſeth as the Numbers 20, 30, 40, increaſeth towards the Centre, that is, the 40 and 50 are repreſented by one Line; 60 and 30, and 70 and 20, being equally diſtant from the Center or Tangent 45 Degrees.

There are alſo many other Lines upon *Gunter*'s Scale, as Secants, Rumbs, equal Parts, meridional Lines, &c. which I would deſcribe here, but as we ſhall have no Occaſion for ſuch Lines in this Treatiſe, it is needleſs to ſay any thing of them.

Thus

Thus having explained the Scale, it follows next to apply it to Uſe, and being provided with a Pair of Dividers whoſe Legs are of equal Length, and the Points very fine, obſerve the Directions following.

Any Line or Diſtance meaſured by the Chain, how to lay down the ſame upon Paper.

Seeing that vulgar fractional Scales, *viz.* thoſe that contain 11, 12, or 16, equal Diviſions in an Inch, are not ſo convenient as the diagonal Scale, which is more particularly adapted to Chains and Links, and may be increaſed or decreaſed to almoſt any Proportion whatſoever, in laying down or protracting Lines upon Paper; and as the 1 upon the Inch, half Inch, or quarter Inch Scale may repreſent 1, 10, 100, &c. ſo alſo your Chain Line may be increaſed or decreaſed, by halving, doubling, tripling, or quadrupling, &c. to be taken off any of the above Scales, in order to anſwer the intended Limits or Size of the Plan. One Inſtance or two will be ſufficient to illuſtrate the ſame.

Example I.

Let us then ſuppoſe the Line D E to repreſent a Field Side, which being chained, is found to contain 32 Chains, 25 Links.

D————————————————E

Now to lay this down from the Inch, half Inch, or quarter Inch Scale, ſo that the ſame may be laid down upon Paper almoſt to any Size, may be performed as follows:

Firſt, With the Dividers and Scale, draw a right Line at Pleaſure; then fix one Foot of your Dividers at the Figure 3, in the Scale that beſt ſuits your intended Size; but if the Inch Scale be too ſmall, you may double or triple, &c. your Chains and Links in each Line you lay down, and take the ſame off the Inch Scale; and if the quarter Inch Scale be too large, inſtead of multiplying, you muſt divide by 2, or 3, &c. and ſo of any other

other Scale. But to proceed; ſuppoſe the above is required to be laid down from the half Inch Scale, and let the 1 repreſent 10, the 2 20, &c. then fixing one Foot of the Dividers at the Point 3, for 30 Chains, extend the other Foot to two of the ſmall Diviſions at the Top (which repreſent the two odd Chains;) and for the 25 Links, ſhift down two Diviſions and a Half, which are marked at the End with 2, 4, 6, 8, then you will have the whole Extent of 32 Chains, 25 Links, to wit, the Space from 3 of the large Diviſions, on the half Inch Scale, unto 2 of the ſmaller; comprehending alſo, by ſhifting in a right Line, for 25 Links, two and a half of the parallel Lines, from the Left-hand to the Right, at the End, whereby you have the Extent ſought.

Secondly, With the ſaid Extent in your Dividers, place one Foot at the Point A, and with the other croſs the ſaid Line in the Point E; then, with a drawing or writing Pen, blacken the Space between A and E, and you have the Hedge D E, repreſented by the Line A E, equal to 32 Chains, 25 Links, as above.

A——————————E

Thirdly, If you would have the ſame Line ſhorter, or longer, proceed as above directed, by uſing different Scales, or doubling the Chains, &c. as you ſee Occaſion. Hence, each Line will be 32.25 Chains, and be in Proportion one to another, as the Scales from whence they were taken. And in this Manner may any Number of Chains and Links be taken from ſundry Scales, as the Caſe requires. I might, in this Place, give ſome more Examples, but I think it needleſs, as there is no other Variety in taking any Number off the Scale, than what appears above. But be careful to remember, that whatever Scale you begin with in planning or laying down Lines, you muſt make Uſe of the ſame until you have finiſhed your Work; and not lay down one Line by one Scale, and another by another Scale. And if you would have a large Plan reduced to a ſmall Compaſs, then uſe a ſmaller Scale: But on the contrary, if you mean to expreſs every ſmall Particular in your Plan, then you had better uſe a large Scale, as one Chain, or four Poles to an Inch; otherwiſe larger by taking two Poles, or half a Chain to an Inch, &c.

Whoever

Whoever desires to become a Planner of Land, may easily arrive at Perfection therein by practising according to the foregoing Directions.

A right Line being given, to find how many Chains and Links are contained therein, according to a Scale assigned.

AND,

Suppose the foregoing Line D E was given, and it were required to find how many Chains and Links were therein contained according to a Scale of 80 Poles to an Inch, that is, 20 Chains representing an Inch, taken off the half Inch Scale.

RULE.

Take in your Dividers the Length of the Line D E, and apply it to the half Inch Scale, you'll find that Extent to reach from 3, (or 30,) of the great Divisions to 2 Chains, 25 Links, of the lesser ones, as before taught; therefore the Line D E contains 32 Chains, 25 Links; which is the Reverse of the foregoing Example, seeing they interchangeably prove each other.

PROB. I,

Teacheth to protract or plan upon Paper, a Field in Form of a geometrical Square. What a geometrical Square is, hath been explained in the Definitions.

Example.

It is required to plan the following Dimensions *(brought from Page* 105,) from a Scale of 40 Poles to an Inch.

	Dimensions.	C. L.
0		16 82
16.82		16.82

PROTRACTION.

First, Take up in your Dividers, the first Perpendicular, *viz.* 16 Chains, 82 Links, from an Inch, or any other Scale, and lay it from A to B, according to the Directions given in the first Example of this Chapter.

Secondly, at the Point B, erect the Perpendicular B C, and proceed herein as you were taught in *Problem* VII. of practical Geometry (a Repetition thereof in this Place is needless) and the Square will be compleated. *See the Figure* A B C D.

PROB. II.

To plot a Field in Form of a Rect-angle, or long Square.

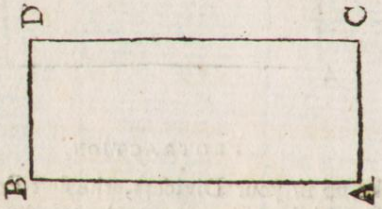
Example.

Let it be required to plan the annexed Dimensions from a Scale of 10 Chains, or 40 Poles to an Inch.

Brought from Page 107.

0 ——————————— 9.54
21.78 ——————————— 9.54

Firſt, then, draw a Line parallel to your Breaſt with the Dividers, upon which lay down 21 Chains, 78 Links, taken from the Inch Scale; and then, upon the extreme Points thereof, at A and B, erect the Perpendiculars as you were taught practical Geometry, and lay thereon 9.54, taken from the ſame Scale, from A to C, and from B to D; draw a Line between D and C, and you will thereby diſcover the exact Form of the Field that contains your Dimenſions wherein they were taken.



PROB. III.

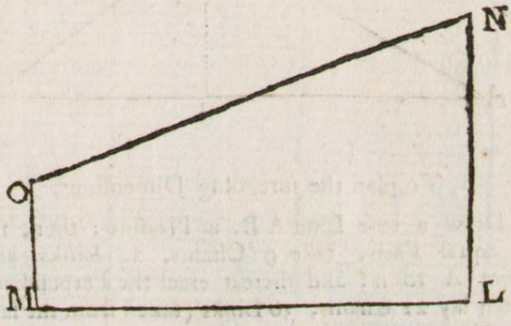
To plan a Field having two of its Sides parallel, and a third perpendicular thereto.

Example.

Let the annexed Dimenſions be planned, taken from a Scale of 40 Poles, or 10 Chains to an Inch.

Brought from Page 117.

C. L.	C. L.
0	7.0
22.50	15.0



To perform this, firſt lay down the baſe Line L M, equal to 22 Chains, 50 Links, taken from the Inch Scale, and at the End thereof, at M, erect a Perpendicular, upon which lay down your firſt Number, *viz.* 7.0, from M to O.

Secondly, erect a Perpendicular at L, and lay thereon 15.0 Chains, from L to N.

Laſtly, Draw a Line from O to N, and you will thereby procure the true Form of your Field.

PROB. IV.

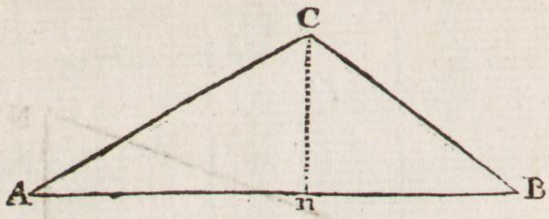
To protract a plane Triangle.

Example.

It is required to plan the annexed Dimenſions from a Scale of 40 Poles to an Inch.

Taken from Page 109.

0	00
9.24	21.36
33.60	00



To plan the foregoing Dimenſions.

Firſt, Draw a baſe Line A B, at Pleaſure; then, from your Scale of equal Parts, take 9 Chains, 24 Links, and lay it down from A to n; and thereat erect the Perpendicular n C, upon which lay 21 Chains, 36 Links (taken from the ſame Scale) from n to C.

Secondly, take 33 Chains, 60 Links, in your Dividers, and lay it down from A to B.

Laſtly, Let there be drawn two Lines from A and B, to the Point C, by which you have compleated the Form of the Triangle ſought, according to the above Dimenſions.

Note, If your Dimenſions had been different to the above, to wit, the Perpendicular at either End of the Baſe A B, you have Directions in practical Geometry to protract the ſame.

PROB. V.

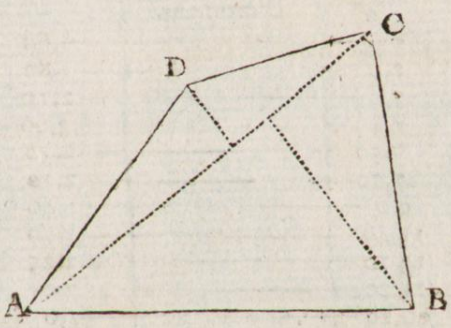
To protract a Trapezium from the Dimenſions in Page 116.

Example.

0——————————0
14.————————————4.45 Left-hand Perpendicular.
15.35————————————12.10 Right-hand ditto.
23.12——————————0

The

The Difficulty of planning the foregoing Dimenſions, vaniſhes when you conſider them as two diſtinct Triangles, having one common Baſe, commonly called the *Diagonal.*



PROTRACTION.

Firſt, At Pleaſure draw the diagonal Line A C, and, by Problem IV, make the Triangle D A C; thus take from your Scale of equal Parts 14 Chains, and ſet it off from A towards C, and there erect a Perpendicular to the Left-hand, upon which lay down 4 Chains, 45 Links, the firſt Perpendicular found or met with in the field.

Secondly, From the ſame Scale take 15 Chains, 35 Links, in your Dividers, and lay it alſo from A towards C, at which Place erect a Perpendicular alſo, and lay thereon 12 Chains, 10 Links, your ſecond Perpendicular. And,

Laſtly, Join the Points A, B, C, and D, together, and it is done.

PROB.

PROB. VI.

Let it be required to plan the following Dimenſions taken from Page 156.

Dimenſions.

0	,60
2,0	1,80
2,0	2,10
4,40	3,00
6,50	2,30
7,70	2,10
9,0	2,40
11,46	3,20
13,10	3,25
15,20	3,0
20,26	2,0
22,0	2,60
24,0	2,80
26,0	2,80
26,80	2,50
28,60	1,20

CONSTRUCTION.

Firſt, At Pleaſure draw the Line A B, and, from any Scale of equal Parts, take 60 Links (as before directed) and lay it down from A, towards B.

Secondly, From the ſame Scale take 2 Chains, and alſo lay them down from A towards B, and thereat lay down 1.80 Links at Right-angles, above the Line A B, and at the ſame Place lay down 2 Chains, 10 Links, likewiſe.

Thirdly, Take 4.40 Chains from the ſame Scale, and lay them down from A, as before, and lay thereon 2.50 at right Angles to A B.

Fourthly, Take in your Dividers 6 Chains, 40 Links, and lay it down from A towards B, upon which ſet off 1.30 at Right-angles as before. Thus proceed in planning the aforeſaid

ſaid Off-ſet, until you have laid down the whole Baſe A B = 28 60, at which Place there is a Perpendicular of 1 Chain, 20 Links.

Laſtly, With a black Lead Pencil (made very ſmall or fine) draw a curved Line through thoſe Points in the ſeveral Perpendiculars, which you may afterwards either blacken with a drawing Pen, by a ſingle Line, otherwiſe make a fine Hedge that ſhall repreſent the ſame, and it is done.

Note, The curved Hedges in each Field that you plan, muſt in like Manner be laid down, and the Boundaries thereof firſt drawn with a lead Pencil, which may be rubbed out with a little white Bread, after you have drawn the ſame with Ink, or made a Hedge, bnt ſee the Bread be not too new.

Note alſo, If you would have your Field placed in a true Situation with regard to the cardinal Points, obſerve the Directions for planning in Part the ſecond, and proceed accordingly.

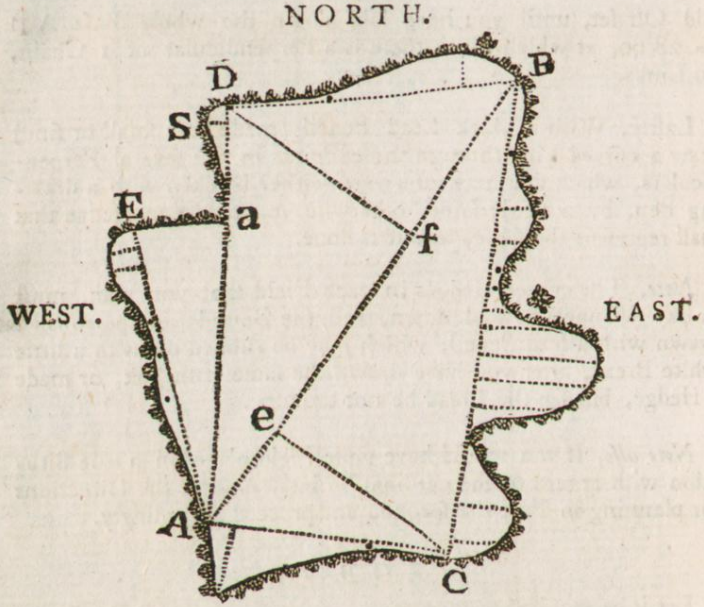
PROB. VII.

Let it be required to plan the irregular Field A C B D, *Example* III, Chap VII, from the Dimenſions as they are there, to which I refer my Reader.

Firſt, Draw the Line A B at Pleaſure, then, from a Scale of 40 Poles to an Inch, to wit, the Inch Scale, take 27 Chains in your Dividers (being equal to two Inches and ſeven Tenths of an Inch,) and lay it from A to B.

Secondly, From the ſame Scale take 5.60 Chains in your Dividers, and lay it from A to e, at the Point e erect a Perpendicular towards the Right-hand (it being the firſt you took in meaſuring the Trapezium) and lay thereon 11 Chains. Alſo take 17 Chains in your Dividers, and lay it from A to f, at which Point erect a Perpendicular to the Left-hand, upon which lay off your ſecond Perpendicular, to wit, 11.20 Chains, then join the ſeveral Points AC, CB, BD, and DA, by drawing the Lines AG, CB, BC, and DA, with your Dividers, upon which Lines plan reſpectively the particular Off-ſets, as you meaſure them in the ſaid Field. *See the following Figure.*

Firſt,



First, By the Directions given in the laſt Problem, plan your ſecond Weſt Off-ſet upon the Line A D, becauſe the firſt Off-ſet you took in the Field depends thereon.

Secondly, From the Point E (the End of the firſt Perpendicular in the ſecond Weſt Off-ſet) draw the Line E A with your Dividers, and thereon lay down your firſt Off-ſet, as before directed.

Thirdly, At the Point D, begin to lay down your North Off-ſet.

Fourthly, Upon the Line B C, lay down your Eaſt Off-ſet.

Laſtly, Upon the Line C A plain your South Off-ſet; and all your Out-lines being drawn with a fine-pointed Lead Pencil, ſhews you a true and exact Repreſentation of the Field.

CHAP.

CHAP. X.

Sheweth how a Manor, Lordſhip, or any Quantity of Land (conſiſting of any Number of Incloſures contiguous to one another) may be accurately ſurveyed by the Chain only, ſo that the Dimenſions thereof may be caſt up by the Pen, and the Area of each Cloſe be truly found; alſo, afterwards (if required) a correct Plan delineated from thoſe Dimenſions, whereby a Map decorated with peculiar and ornamental Embelliſhments, may be obtained. See Plate the 3d, which is a Map of a ſmall Eſtate taken from a Plan of the ſame in Plate 2d.

HAVING, in the preceding Chapters, treated orderly, as well as briefly, of all Manner of Fields, whoſe Sides are not only many, but alſo the Fence or Hedges both curved and circular; wherein I have ſhewn how the ſame may be accurately meaſured, caſt up by the Pen, and planned; I ſhall now obſerve, and direct, how an Eſtate, conſiſting of any Number of Fields, may be accurately meaſured; and, from the Dimenſions thereof, correctly planned.

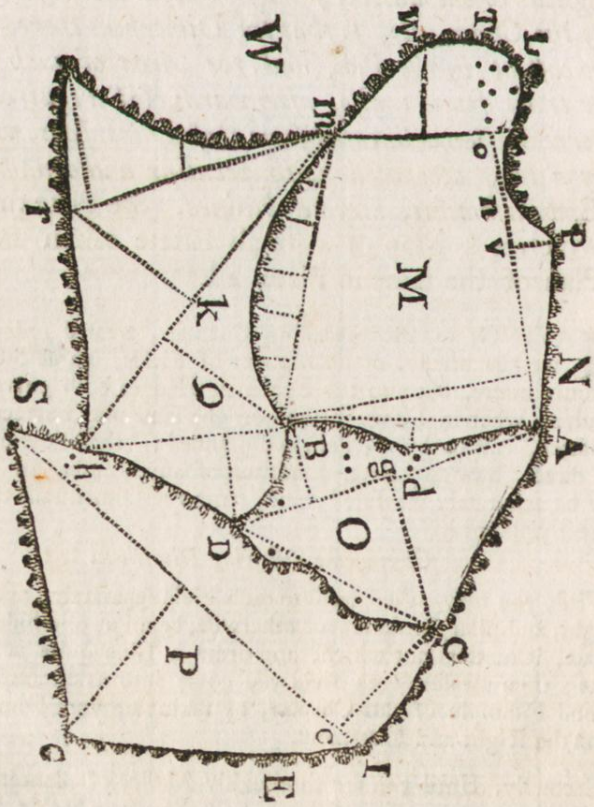
Obſerve the following Directions.

Firſt, you may either meaſure each Field ſeparately, as already taught, and plan the ſame; or otherwiſe, begin at one Side of the Eſtate, it matters not which, and draw a Line quite acroſs the ſame; then meaſure each Field you come into as directed in the ſecond Example of this Chapter, by taking up your Dimenſions upon the Right and Left-hand.

Secondly, Until you are thoroughly Maſter of planning, it is adviſeable not to meaſure more than three or four Fields, 'till you

plan your Dimenſions, otherwiſe your Forenoon Dimenſions may be planned in the Afternoon: However, when you are become pretty tractable in the Fields, every other or third Day will be ſufficient to plan your Dimenſions, or Field Notes.

Thirdly, Having made Choice of a Scale to plan by, you muſt proportion your Paper accordingly, to wit, if you deſign your intended Plan to be ſo large as not to be contained in one Sheet of common white Paper, it will then be neceſſary to paſte a ſufficient Number of Sheets together.



Example

Example I.

Admit it were required to plan the following Dimensions brought from Pages 168, and 169. *See the next preceding Figure.*

Field M.

N. Off. L. H.

307,

0	0
1,0	1,20
1,20	2,00
2,30	2,00
6,40	,10
8,0	,10
10,30	2,00
19,50	0

E. Off. L. H.

127,

0	0
6,0	1,50
10,60	00
13,40	00

Field Q.

R. H. Off. W.

486.½

0	0
4,60	,40
7,80	2,00
13,0	6,60
14,	00

R. H. Off. S.

2736.

0	3,00
4,75	8,00
17,	13,0
19,50	0

S. Off. L. H. in Field M.

— Field Q.

313,½

0	0
3,	2,0
5,60	2,70
7,90	2,45
10,34	1,30

Dimensions of Field Q continued.

Trapezium.

2492¼

0		0
11,30	R H	7,70
13,50	L H	7,80
20,10		00

Field O.

L. H. W. Off.

394¼

0		0
2,70		1,30
4,		4,00
6,80		3,00
9,10		1,20
16,0		,20

Field P.

L. H. Off. N. W.

1447.

0		0
4, to S. Corner Fd. Q		2,00
22,80		6,50
24,0		4,40

E. Off. R. H.

362¼

0		0
1,70		,60
7,20		4,20
9,10		3,00
10,50		,00

Right-hand Off-set, E.

1094¼

0		0
8,		8,0
16,		1,10

E. Off. L. H. in Fd. O—Fd. P.

107.¼

0		0
4,0		1,20
7,0		,00
9,0		1,10
11,60		00

R. H. Off. S. E.

1996¾

0		0
12,		10,00
24,		,80

The

The Field wherein you firſt began, is called the Field M, which you muſt lay down (from any ſuitable Scale of equal Parts) upon Paper, as you took it up, *viz.*

1. Draw a Line with your Dividers of a ſufficient Length, then aſſume a Point therein, as T; from a Scale of equal Parts take 19.50, and lay it from T to A, upon which lay down your Left-hand Off-ſet, as you were directed in the two foregoing Examples, Chapter IX.

2. Having planned this Off-ſet, begin with thoſe Dimenſions that are on the Right-hand Side of the Line T A, and thus proceed:

3. At T erect the Perpendicular C w, and lay thereon 3 Chains for your firſt Perpendicular to the Right-hand; lay down 4 Chains upon the common Baſe T A, from T to o, and thereat lay down, at Right-angles, your ſecond Perpendicular, namely, 8 Chains; alſo 17 Chains from T; lay off your third Perpendicular 13 Chains, which will point out the South-Eaſt Corner of this Field; with your Pencil join T w and m together, which Line will repreſent the Weſt Hedge.

4. Draw a Line from the Corner B, to the Corner A, as a baſe Line for your Eaſt Off-ſet, and lay thereon 6 Chains, at which Place lay off your Perpendicular 15 Chains, then with your Pencil join A d and B, for the Eaſt Side of the Field.

5. Draw a Line from B to m, and in like Manner lay thereon your South Off-ſet, as above directed, and,

Laſtly, with your Pencil draw a Line through m B, and the extreme Points of the ſeveral Perpendiculars raiſed upon that Line, ſo ſhall you have the South Side of the Field repreſented. The Form of the Field being thus plotted, you may eaſily trace the Boundaries thereof with a drawing Pen and Ink.

The next you entered was Q, Pool's Meadow, which to plan, proceed thus:

1. With 20.10 Chains in your Dividers, and ſetting one Leg in m, deſcribe an Arch, and from your Scale take 10.50 Chains alſo

in your Dividers, and ſetting one Leg thereof in the Point B, deſcribe an Arch that ſhall interſect the former in the Point h, through which, and the Point m, draw a Line for a Diagonal to your Trapezium.

2. Take in your Dividers 11 30 Chains, and lay it from m to k, at which Place erect your Right-hand Perpendicular 7.70 Chains to T; alſo lay down your Diagonal, to wit, 21 Chains from m to h.

3. Join m, r, r h, and h B, with your Dividers; and upon the Line m r, lay down your Weſt Off ſet as above directed; alſo, upon the Line h B, your Eaſt Off-ſet to the Right-hand, which ſee. Thus have you the true Form of the ſecond Field.

The third Field you entered was O, the Horſe Paſture, and after having ſtraightened the North Side thereof, you proceed to take up the Trapezium, which muſt be planned ere you can lay down the reſpective Off-ſets.

1. Then draw a Line from A to D, and take in your Dividers 8 Chains, and lay it thereon to the Point g, and there erect your Right-hand Perpendicular 8 Chains; join A C and C D, and lay down your South-Eaſt Off-ſet, as heretofore taught.

Note, If you chuſe to lay down your Left-hand Perpendicular, you'll find it will riſe to the Corner B 4 Chains exactly: The Boundaries of this Pingot being traced out with a Pencil, you have an exact Plot or Form of this Field.

And laſtly, You entered P, the Lady Acre, and walk to the Corner S; from thence begin to plan the Trapezium S G I C, which may be effected thus:

1. Take between your Dividers 22.80 Chains, and with one Foot in the Point S (found by continuing the Line D h 4.36 Chains, according to the Dimenſions) deſcribe an Arch.

2. Remove the Dividers to the Point C; with 6.50 Chains extended thereon; deſcribe an Arch that ſhall interſect the former in

in the Point O, through which draw a diagonal Line, and thereon lay down your Right hand Perpendiculars, as above directed.

And laſtly, with your Lead Pencil join the Points S G, G I, and I C, which compleats a Repreſentation, or true Form of the fourth and laſt Field.

Note, If you would chuſe to repreſent large Incloſures in a little Compaſs, you muſt uſe a ſmall Scale, as one of 40, 60, or 80 Chains to an Inch; but on the contrary, if you propoſe to expreſs every ſmall Particular, or Incident, a large Scale is then more ſuitable, *viz.* 1, 2, 4, or 10, 20, Chains to an Inch, there being always more Room in a large Plan to expreſs remarkable Things which cannot be contained in a ſmall one.

Thus having obtained (upon Paper) an accurate and particular Plan of the Eſtate, your next Care will be to reduce or tranſmit the ſame to Vellum, or Royal Imperial Paper; ſome Gentlemen chuſe Parchment, becauſe, as I ſuppoſe, it is both durable and cheap; but let not any ſuch expect a well-finiſhed Map, ſince it is not in the Power of Man to embelliſh, draw, or write well thereon; however, it is every Surveyor's Buſineſs to conform with, and obey his Employer's Orders in this Reſpect; nevertheleſs the Surveyor may recommend Vellum if he chuſes, which at all Events can only be rejected.

PROB. II.

Admit it were required to meaſure (with the Chain only) any Quantity of Land, the Number of the Cloſes ever ſo many, and the Form of them ever ſo irregular, by that conciſe and expeditious Method of taking a Main-line, and afterwards to plan the ſame, from which a Map may be obtained.

Directions to be obſerved when Main Lines are uſed, ſome of which Directions reſpect Meaſuring, and the others Mapping.

Firſt, Meaſure or chain a Main-Line ſome Way a-croſs the Eſtate you are to meaſure whereon Perpendiculars may or can be erected,

erected on the Right and Left-hand, to the ſubtending Corners or Angles in each and every Incloſure you meet with when chaining or advancing through the ſame; but if you ſhould happen to be obſtructed by Pond, River, Building, *&c.* in that Caſe, proceed according to the Directions given in Page 92.

Secondly, At Pleaſure you may fix in any Part of the Boundaries, and from thence chain the above-mentioned Line quite acroſs the Eſtate (it matters not whether a meridian, parallel, or compound Line) which, when you are chaining, or meaſuring, carefully obſerve to take the Dimenſions of each Incloſure that you paſs through, according to the foregoing Directions.

Thirdly, Having finiſhed this main or chief Line, and the Dimenſions of each Field, caſt up the ſame (as hereafter directed) the whole Proceedings being founded upon Problem V, Chap. IV, foregoing; and afterwards with Scale and Dividers plan the Field Notes, which done, repair to that Part of the Eſtate unmeaſured (whether on the Right or Left-hand of your Main-line) and meaſure it alſo, either by another Main-line, or otherwiſe, as appears moſt convenient; caſt up and plan thoſe Dimenſions with the former; and in like Manner proceed until the Dimenſions of the Whole be compleated. But in meaſuring any Line (perpendicular to your Main-line) which excludes a Part of the Field wherein the ſame is taken, whether to the Right or Left-hand thereof, the ſame muſt be taken up as an Off-ſet upon an Off-ſet, (*ſee Article 5th, Page* 96) and entered as already directed in its proper Place: This being done, and you perceive any other Part or Parts of the Field which thoſe Lines that are perpendicular to the Main-line cannot comprehend or include, in that Caſe meaſure the ſame diſtinctly, as Off-ſets upon Off-ſets, or otherwiſe, till there is no Part omitted or left out.

Fourthly, It matters not whether you caſt up the Dimenſions before or after they are planned, but ſee that you leave not the Premiſes ere the Plan is accurately finiſhed, *I mean before you have noted and inſerted every Thing remarkable therein*, otherwiſe the Map thereof (of Courſe) will be as imperfect as the Plan, for from the Plan the Map is obtained.

Fifthly,

Fifthly, Return the Ground Plot (only) of all Edifices, Buildings, &c. except you have Orders to ſhew the Elevation of ſome beautiful Edifice, ſuch as the Manor Houſe, Hall, &c. which ſhould not appear in the identical Place where the ſame ſtands, but in ſome vacant Corner or Place of the Map laid down from as large a Scale as that Vacancy will admit of; for if erected, or drawn upon the Foundation or Ground Plot, according to its real Size, that is to ſay, projected from the ſame Scale, the Beauty of the Edifice will be rendered thereby almoſt inconſpicuous; and if it be drawn or laid down (where its real Foundation is) from a larger Scale, the adjoining Gardens, Folds, Cloſes, &c. will conſequently be concealed or covered thereby, which induce me to recommend Vacancies to repreſent the Elevation of Buildings in.

Sixthly, Having heretofore given ample Directions and Cautions to young Practitioners concerning the true Method of meaſuring and planning, I ſhall now proceed to Example the 2d, wherein, inſtead of unneceſſary Repetitions, I ſhall refer to ſuch Pages as will ſufficiently direct the young Learner; but obſerve, in the ſucceeding Example, there are not only ſingle Fields to be meaſured, but Care muſt be taken how they adjoin to the adjacent Incloſures, ſo that the ſame may be accurately planned: However, the Surveyor hath this Advantage (when many conjoined Fields are to be ſurveyed;) for having meaſured any, or all the Sides of one Field, though extremely irregular, thoſe Hedges that intercept the adjacent Incloſures, will appear when that Field which he has meaſured is planned, ſo that it will be needleſs to meaſure or ſtraighten the ſame over again. *See Example* V, *Chap.* VII, wherein there are Directions to caſt up all ſuch Dimenſions.

Seventhly, If your Orders be to return a Map wherein the Contents muſt not appear, which often happens, and eſpecially when large Demeſnes, Manors, &c. are to be ſurveyed; in that Caſe get a Reference Book with as many Leaves therein, as the Size of the Eſtate ſhall require, and place a different Letter, or Number in each Field that is repreſented in the Map, which will refer to the Name and Quantity thereof in the Reference Book, the ſame Letters or Numbers being put therein; and if the Manor, &c. conſiſt of ſeveral Tenements, the ſhading in the Map

ſhould diſcover the ſame at firſt Sight; and in Part the ſecond there are Directions for that Purpoſe.

Eighthly, When Buildings, Gardens, Folds, Ponds, Wood, or whatever elſe that are inacceſſible, do occur, or interpoſe between any two Perpendiculars, the true Area of the ſame may be thus obtained. From the Area of the Space that thoſe two Perpendiculars include, or comprehend, deduct the Area of the circumjacent Off-ſets that lie between the Main-line, thoſe Perpendiculars, and the Buildings, Gardens, Folds, *&c.* the Remainder will be the Area of the inacceſſible Ground, Water, *&c.* An Inſtance of this Kind you'll meet with in the following Example, *viz.* Between the Perpendiculars 15 Chains, 12 Links, in Dairy Field; and 20 Chains, 75 Links in Pleaſure Ground, the Buildings, Garden, Orchard, and Fold, are included therein; and alſo two ſmall Triangles, *i. e.* one in Dairy Field, between the Perpendicular and the Orchard Hedge; and the other in Pleaſure Ground, between the Wall, and the firſt Perpendicular therein.

Ninthly, When ever any two Perpendiculars are met with at the ſame Place, one of which is occaſioned by a Road or Lane; in caſting up the Dimenſions, that which reſpects the Lane, muſt not be noticed, as it is deſignedly taken to plan the ſame by; but in calculating the Area of the Road, it is then conſidered, if the ſame hath not been before particularly and diſtinctly meaſured.

Laſtly, In drawing or forming a Plan, let all thoſe Lines that denote Boundaries and Fence, be drawn with a black Lead Pencil; and ſee that all other Lines therein be drawn with one of the Points of your Dividers (guided by your Scale,) which laſt mentioned Lines, I term or call by the Names of *obſcure*, *occult*, or *dry* Lines: And if a Miſtake ſhoud happen to be committed in drawing the Plan, a little white Bread will take out the Fence or penciled Lines; but if you find the Boundaries correct, then draw or trace them off with Pen and Ink.

Example

Example II.

Let *fig.* 4 *plate* 2, repreſent the ground Plot of an Eſtate belonging to *John Tod*, Eſq; and it be required to meaſure the ſame with the Chain only, ſo that the Dimenſions thereof may be caſt up by the Pen, and afterwards an accurate Plan delineated therefrom, whereby a Map properly embelliſhed, and the true Content of each Field inſerted therein, may be obtained. *See the Map Plate the* 3*d.*

Dimenſions of an Eſtate in *Tarpoley*, in the County of *Cheſter* belonging to *John Tod*, Eſq; 12th *July*, 1770.

Sandy Field, L. H. Off. W.

201¼.

0 —— 00

3,70 —— 4,40

5,72 —— —— 0,

5,72 ⊣ h Damſels —— 5,64

457½

9 40 to N E ◁ Ox-paſt. 7,11

10,84 ⊣ h Ox-paſture — 0,

953¾ — 167¾ = 786

10,84 —— —— 7,04

26

11,00 ⊣ h Dairy Field - 00

30

16,36 ⊣ Pond in Fold — ,61

Remarks and Off-ſets on ditto.

N. E. Off. L. H.

27.

0 —— —— —— 00

3,46 —— —— —— ,00

6,0 —— —— —— ,71

6,13 —— —— —— ,52

—N. E. Off. on ditto, L. H.

73½

0 —— —— —— 00

4,91 —— —— —— 1,63

5,64 —— —— —— ,00

E. Off. L. H. in Damſels.

55¼

0 —— —— —— 00

1,03 —— —— —— 1,71

2,24 —— —— —— ,52

3,82 —— —— —— ,34

5,93 —— —— —— ,18

—N. E. Off. on ditto, Ox-paſt.

63.

0 —— —— —— 0

7,04 —— —— —— 1,12

323

20,10 ┼ Wall Plea. Gd. ,40

20,10 ┼ Road —— 1,00

23,80 —— —— 1,42

23,80 ┼ Road to mark in South
< Ox-paſt. —— 2,16

24,0 ┼ ſunk Fence —

27,12 —— —— 2,68

30,04 Main-line ended - 2,92

30,04 to the Fur. Side Road 3,53

S. E. Off. in Ox-paſture.

219½

0	00
,80	,65
2,21	1,22
6,00	,55
7,54	,90
9,80	2,62
10,84	2,10
10,95	1,21
11,00	,42
11,60	,00
12,50	,50
13,00	,72
13,80	,80

— An Off. on ditto, R. H.

26

0	0
2,92	1,12

An Off. on laſt Perpendicular in Ox-paſture.

6.

0	0
80,	,96

Sandy

Sandy Field, R. H. Off. E.

$238\frac{1}{4}$

0 —— —— —— 00
,44 —— —— —— 1,71
1,00 to N. ◁ Quiſtil Fd. 3,52

$82\frac{1}{2}$

5,72 ┼ h Damſels — 2,02
10,84 ┼ h Ox-paſture — 00

$543\frac{1}{2}$

11,00 ┼ h Dairy Field — 6,40
15,12 —— —— —— 7,50
15,12 —— —— —— 8,62

$635\frac{3}{4} - 85\frac{1}{2} \div 28\frac{1}{2} = 521\frac{3}{4}$

16,36 ┼ h Po. Bu. Fold, &c. 00

$710\frac{1}{2}$

20,10 ┼ Wall Pleaſure Gd. 00
20,75 to S.W. ◁ Garden 5,50
24 ┼ ſunk Fence. *Here draw the Form of the Gate, &c.*
25,23 S. ◁ Pleaſure Gard. 4,61
29,30 —— —— 4,22
30,04 Main line ended — 00

13 T, T, in N. E. Sides of Damſels, O.
3 A, Aſh, in ditto.
9 P, Poplar at the Water-ſide.
72 0, Oak Trees in Ox-paſt.

N. Off. on ditto, R. H.

$252\frac{1}{4}$

0 —— —— —— 00
1,92 —— —— —— 4,05
6,12 —— —— —— 1,51
6,40 —— —— —— 00

26 T. T. 0, eq. d. in Dairy Field, with a Pond or Water in the Middle.

N. Off. R. H. Pleaſure Ground.

$28\frac{1}{2}$

0 —— —— —— ,65
5,50 —— —— —— 00

W. Off. in Pleaſure Ground, Left-hand.

5.

0 —— —— —— 0
1,40 —— —— —— 0
2,20 —— —— —— ,30
3,50 —— —— —— 0
4,69 —— —— —— 0

Here note, If the Learner be unready in Field Practice, ſuffer me to adviſe and prevail on him not to make any farther Progreſs in the Survey of this Eſtate, until he has caſt up and planned the above Dimenſions; and then, with greater Chearfulneſs and Certainty, he will perform the Reſidue.

Bridge

Bridge Meadow,

L. H. Off. W.

$328\frac{1}{4}$

0 —— —— —— 0
1,10 —— —— —— 2,72
1,30 ┼ Road or Lane— 3,30
6,12 —— —— —— 3,60
6,12 ┼ Road —— 4,00

$99\frac{1}{2}$

6,12 ┼ Fence Popl. Mea. 00
6,60 —— —— 1,53
13,88 —— —— — 00

$149\frac{1}{2}$

13,88 ┼ Fen. Lawn Pluds 1,60
15,30 —— —— —— 2,03
17,0 —— —— —— 1,74
19,96 2d Main line ended 00

S. W. End of Lawn Pluds.

L. H. Off. S. E.

145.

0 —— —— —— 00
6,84 —— —— 2,42
7.50 —— —— —— 00

14 p, Poplar Trees in this Meadow, and twice that Number in Poplar Meadow.

An Off. on ditto.

$29\frac{1}{4}$

0 —— —— —— 00
4,00 —— —— —— ,92

29 p, Poplar in Lawn Pluds.

17 Willows and 32 A, Aſh Trees, equal Diſtance, in the North Weſt Side of Lawn-pluds; and the North End thereof is full of Shrubs and Mire.

Bridge

Bridge Meadow, R. H. Off. W.

$102\frac{1}{2}$

0 —— —— ——00
2,72 —— —— 1,50
4,34 —— —— 1,17
5,54 —— —— 1,72

$279\frac{1}{4}$

6,09 ┼ H. in Pop. Mea. 00
6,09 —— —— 2,08
7,65 —— —— ,94
8,90 —— —— 8,90
9,82 —— —— — 3,21
13,52 —— —— —— 2,23
13,88 —— —— — 3,07

$62\frac{1}{4}$

13,88 ┼ Fence, Lawnpl. ,00
17,00 — — — — ,80
18,47 — — — — 1,19
19,50 — — — — ,81
19,96 — — — — 00

S. W. End of Lawnpluds, R H

$92\frac{3}{4}$

0 — — — — — 00
1,00 —— —— —— 1,11
1,80 — — — — ,10
2,50 — — — — ,08
3,13 — — — — ,20
3,50 — — — — ,91
4,00 — — — — 2,09
4,70 — — — — 1,50
5,52 — — — — 1,23
7,50 — — — — ,00

An Off. on Ditto.

$12\frac{1}{2}$

--0 —— —— —— 0
2,08 — — — — ,76

An Off. on ditto, L. H.

$60\frac{1}{2}$

--0 — — — — — 00
,72 —— —— 2,44
3,07 —— —— 00

Cracadony

Cracadony, L. H. Off. W.

730.

0	—— ——	00
2,20	—— —— ——	5,40
8,55	—— —— ——	4,00
10,40	—— — — ——	4,32
10,87	— — — —	4,81
10,87	¼ H. Ash Field —	0

402½

12,60	— — — —	5,32
14,58	— — — —	4,85
14,58	— — — —	3,70
16,30	— — — —	2,20
21,23	Main-line ended --	00

Quistil Field.

L. H. Off. N. W.

21.

0	— — — — —	,10
80,	— — — —	,22
2,65	— — — —	,08
9,00	— — — —	,16
11,00	—— — —	0

An Off. on ditto, R. H.

43.

0	— — — — —	00
-4,81	— — — —	1,12

An Off. on 1,12 Perpen. L. H.

10¼

0	— — — — —	0
1,12	— — — —	1,20

A good Deal of young Timber in the Boundaries of this Field.

Cracadony, R. H. Off. E.

158¼

⊙	00
1,00	,20
2,20	,15
2,42	,21
3,40	,72
4,81 to ◁ Plea. Ground	1,10
9,00 to N. W. ◁ ditto	1,48
10,87 ┼ h Aſh Field --	1,10

313.

14,30	00
15,00	00
15,00	1,20
19,41	4,50
20,80	2,56
20,80	1,00
21,23	00

This Field in Tillage.

A ſmall Plantation in the Weſt Corner thereof. *Here draw the Figure or Form of the ſame with your Pen.*

26 T T O.

2 Rect-angular Ponds in Pleaſure Ground, *i. e.* 1 on either Side of the middle Gate. Various Kinds of Trees to and fro diſperſed, which greatly add to the Beauty thereof.

Quiſtil Field, R. H. Off. S. E.

549¾

0	00
,70	,70
2,03	1,65
3,10	3,65
7,62	5,30
11,90	00

This Field is of a ſandy Quality, in Tillage, with a Pond of Water near the Middle. *Here draw with your Pen the Form thereof.*

To meaſure this Eſtate, let the Surveyor repair to any Part of the Boundaries; ſuppoſe at A in the North Side of Sandy Field, and there fix a Mark in the Hedge; and being furniſhed with Croſs-ſtaff, meaſuring Pins, Chain, and a Perſon (who ſhould know the Name of each Incloſure) to lead the ſame; then fixing on a Mark on the oppoſite Side of the Eſtate *(ſee the Directions in Page* 143,) as at B, to which Place chain for a Main-line, and raiſe Perpendiculars therefrom to the ſubtending Angles or Corners in every Field the Main-line paſſeth through; but always remember, when you meaſure any Perpendicular, to leave the Meaſuring-pins *that pertain to the Main-line* ſtanding with the laſt Pin your Foreman ſtuck down therein, otherwiſe a Miſtake in counting your Pins or Arrows may inadvertently be committed. Your Field-Book being prepared and ruled, (according to the Directions in Page 90,) in the firſt Column thereof, Page the firſt, enter thoſe Dimenſions that are on the Left-hand Side of the Main-line: And in the firſt Column of the next Page inſert the Right hand Dimenſions thereof; the two remaining Columns reſerve for Remarks, and Off-ſets upon Off-ſets, as heretofore directed in Page 91. And, for the young Learner's thorough Information herein, permit me to hand him Step by Step through all the Dimenſions taken on the Right and Left-hand Side of the firſt Main-line in this Eſtate, which will, I hope, enable him to advance with greater Chearfulneſs.

1. Having inſerted the Owner's and Tenant's Names, alſo the Townſhip, Pariſh, County, and the Name of the firſt Field, *(ſee Field Book, Page* 90,) with L H in the firſt Column firſt Page, and R H in the firſt Column ſecond Page: If the Sun appears, the Situation and Bearing of the Main-line may be diſcovered *(ſee Pages* 95 *and* 96.) Whilſt you are thus preparing the Field-Book, you may direct your Foreman (if you have no other Aſſiſtant) to go and ſet up occaſional Marks; this done, begin and ſtraighten the Eaſt Side of Sandy Field, by taking up the North Eaſt Off-ſet therein, which enter; but throughout your Field Proceedings, carefully obſerve all the foregoing Directions.

2. Return to A, and direct your Foreman ſtraight towards B, then, on the firſt Chain of the Main-line, that is to ſay,

44 Links from the Start, Right-hand Side, a Perpendicular = 1 Chain, 71 Links, muſt be raiſed, which enter: Alſo at the End of the Chain another on the ſame Side will riſe to b, into the North Corner of Quiſtil Field, meaſure and enter it likewiſe; then return to the Pin left ſtanding in the Main-line; and when you have meaſured 3 Chains, 70 Links thereon, a Perpendicular will ariſe on the Left-hand to the Mark left in the Hedge at t, when you took up the North Eaſt Off-ſet therein, which meaſure, enter, and return to the Pins ſtanding in the Main-line, wherein advance, and upon the 6th Chain, the Hedge that divides or ſeparates this Field from Damſels, occurs, to wit, at 5 Chains, 72 Links: But here obſerve, your Foreman muſt put the Chain through the Hedge, and croſſing the ſame, let him ſtretch the Chain as though there was no Hedge or Fence between the Fields, whilſt you remain at the ſtanding Pin in Sandy Field; lay down your Chain; come and ſee where it croſſeth the Hedge, *viz.* at 5 Chains, 72 Links, which being entered thus; in Left-hand Column at 5.72 croſs Hedge, Damſels, it is —0; and in Right-hand Column at 5.72 croſs Hedge Damſels, it is 2.02, the Length of the Hedge on the right Side, and which is found (by the croſs Staff) to be at Right-angles to the Main-line, abbreviated thus:

5 72 ⊹ h Dam ——————00; and in Right-hand Column
5.72 ⊹ h Dam.——————2.02.

3. Being in Damſels, meaſure a Perpendicular from the Hedge on the Left-hand Side, which is equal to 5 Chains, 64 Links; and upon this Perpendicular you have a Left-hand Off-ſet upon an Off-ſet, which being meaſured and entered, ſtraighten the Eaſt Side of this Field by taking up the Off-ſet that lies upon the Baſe f, g, *(ſee the Entry thereof in the Field Book, viz.* E. Off. L. H. Dam.) Leave a Mark in the Hedge at g, and then return to the 6 Pins left ſtanding together in the Main-line, wherein proceed till you come to 9 Chains, 40 Links, whereat a Perpendicular = 7 Chains, 11 Links, will ariſe to the Mark left in the North Corner of the next Field at g, meaſure and enter this alſo, then return to, and purſue the Main-line; and at 10 Chains, 84 Links, another Hedge is met with in the South Corner of this Field, and then, with regard to the Dimenſions thereof, the Entry in both the Right and Left-hand Columns muſt be thus:

10.84——————00

And now, admit it were required to know the true Content of this Field, the Dimenſions are as follow:

L. H. Off. E.

457¼

5,72	5,64
9,40	7,11
10,84	00

R. H. Off. W.

82 ½

5,72	2,02
10,84	00

N. Off. on ditto, L. H.

73 ½

0	00
4,91	1,63
5,64	00

E. Off. L. H. in Damſels.

55 ¼

0	00
1,03	1,71
2,24	,52
3,82	,34
5,93	,18

Perches

Collected { 457¼ / 73½ / 82½ / 55¼

Area 668½ = 4 Acres, 28½ Perches.

By which it appears that the true Content of the Field is 4 Acres, 28½ Perches; and ſo of any other Incloſure herein. It would be great Prudence in the young Learner to ſelect the particular Dimenſions of every Field that the Main-line paſſeth through, and caſt up the ſame ſeverally; by which Means their reſpective Areas are obtained; and when he finds that he is expert and ready therein, the Difficulty which at firſt Sight preſents itſelf (in caſting ſuch Dimenſions up by the Pen) will ſoon vaniſh; but

but not to commit a prolix Digreſſion, let us proceed in the Survey.

4. Being in the North Weſt Corner of Ox-paſture, chain a Line from thence on the Left-hand at Right-angles to your Main-line, *i. e.* to D, and take up thereon an Off-ſet upon an Off-ſet, Left-hand; which done, look from the Mark at D, towards the Mark at C, in or near the South Corner of the ſame Field; to which Mark chain, for a baſe Line, to the South Eaſt Off-ſet therein, and as you proceed forget not to fix a Mark at E, that will appear from the Bridge. This Off-ſet being meaſured and entered, leave a Mark at C, and take up a ſmall Off-ſet on the laſt Perpendicular towards the Corner; then return to the Main-line at h, where you left one Arrow ſtanding in the Fence, (*for, as it hath been already obſerved, at the End of* 10 *Chains, you counted and returned the Arrows to your Foreman,*) whereat you enter the Dairy Field, and there erect a Perpendicular to the Weſt Side thereof = 6 Chains, 40 Links, upon which Line you have an Off-ſet upon an Off-ſet thus entered; N. Off-ſet on ditto, R. H. (*ſee the Dimenſions thereof*;) this done, return to the former mentioned Pin or Arrow, and make Entry in both Columns thus: L. H. 11.0 ⅄ h Dairy Fd. —— 0 R. H. 11.0 ⅄ h, Dairy Fd. — 6.40, proceed forward, and at 15 Chains, 12 Links, on the Main-line on the Right-hand thereof, raiſe a Perpendicular to the North Weſt Corner of the Orchard; but ere you come thereto, you meet with the Weſt Corner of Dairy Field, by which there are two different Perpendiculars at the ſame Place (on your Main line,) to be entered thus:

15.12——————————7.50
15.12——————————8.62

This done, return to the ſtanding Arrows, and proceed, and at 16 Chains, 36 Links, the Main-line croſſeth the Hedge into the Fold, &c. thus entered: L. H. 16.36 ⅄ h, Pond, Fold, &c. 61 Links, and R. H. 16.36 ⅄ h, Pond, Fold, &c. — 00: Omit not here to draw with your Pen, in the reſerved Columns, the Form of the Pond, Fold, &c. which will enable you to repreſent the ſame in the Plan accurately, though you may chuſe taking Notice of ſuch Things until your Plan is ready wherein the ſame may be delineated and ſpecified with leſs Trouble, and

more

more Accuracy; the Situation of which being limited, and your Chain at Liberty to execute and perform the particular Dimenſions thereof; Directions for taking up the ſame would be looked upon as Tautology by all thoſe who are perfect in the foregoing Chapters, and therefore whoever is not ready therein, will gain very little by the Peruſal of this Example. *But to proceed.*

5. Having advanced on the Main-line 20 Chains, count and return the meaſuring Pins; and on the next, *viz.* at 20 Chains, 10 Links, a Wall in a right Line with the Houſe Front, is met with, thus entered; L. H. 20.10 ⊣ Wall, Pleaſure Ground .40; and to the further Side of the Road, 1 Chain, which ſhews the Road to be 60 Links broad; ſee the ſame entered in the Field Book, thus, R. H. 20.10————o, with Regard to the Fold, Garden, &c. To find the Area of which, conſult the 8th Article, Page 216.

6. Your Foreman having ſtuck down a Pin in Pleaſure Ground, and ſtanding thereat, let the Chain be ſtretched on the Ground to that Part of the Wall where it croſſed; then at 20 Chains, 75 Links, you'll find a Perpendicular will ariſe to the South Weſt Corner of the Garden, which being meaſured and entered, return to the ſtanding Pin *(but remember you have begun a third Change;)* continue the Main-line, and on 23 Chains, 80 Links, a Perpendicular will ariſe to the Mark left at C, in the South Corner of Ox-paſture; ſee the Field Notes thereof thus entered, L. H. 23.80 ——— 1.42 and 23.80 ⊣ Road to mark in Ox-paſture 2.16; return and proceed at 24 Chains, croſs ſunk Fence, repreſented by o q; and at 27 Chains, 12 Links, on the Main-line, raiſe and meaſure a Perpendicular on the Left-hand Side thereof, which being entered, come back to the ſtanding Pins, and chain forward, and on 29 Chains, 30 Links, raiſe and meaſure a Perpendicular on the Right hand to the Weſt Corner of Pleaſure Ground; this done, continue the Main-line, and at 30 Chains, 4 Links, the ſame is ended, where there is a Perpendicular on the Left-hand = 2 Chains, 92 Links, upon which lies an Off-ſet upon an Off-ſet, *viz.*

o — — — — — o

2.92 — — — — .96

This laſt meaſured and entered, walk to the Weſt Side of Pleaſure Ground, and between the two laſt Right hand Perpendiculars take

take up a ſmall diſtinct Off ſet thus entered: W. Off-ſet in Pleaſure Ground, &c. *See the Field Notes thereof.*

Now admit it were required to find the true Area of the Ox-paſture Field by the foregoing Dimenſions thus ſelected:

L. H.		L. H. in Dairy Field.	
	953 ¾		167 ¾
10,84	7,04	11,00	00
23,80	2,16	16,30	,61
		20,10	1,00
		23,80	2,16

The firſt Perpendicular in Ox-paſture = 7,04 added to 2,16, the Perpendiculars raiſed at 23.80, to the South Mark therein, which being multiplied by the intermediate Diſtance = 12.96, the Product in ſquare Perches will be 953¾, the Area of the Rect angular Figure h D C w; and if from this Sum the Area of the irregular Ligure h C w = 167¾ be taken, the Remainder will be 786 ſquare Perches, which being added to the ſeveral Areas of the North, South and Eaſt Off-ſets, to wit, 786 + 63 + 6 + 219½ = 1074½ ſquare Perches, which are equal to 6 Acres, 2 Roods 34½ Perches, the true Area thereof. The Area of any other of the Fields may likewiſe be obtained by the Pen; ſee the ſeveral Contents entered in the Dimenſions under the Name to which they belong; thus having obtained the true Area of thoſe Incloſures through which the Main-line paſſed, it follows next to plan the ſame, which to effect, Direcions ſhall be given at the End of this Example.

7. Then repair to the unmeaſured Part of the Eſtate, ſuppoſe to the Bridge, and from thence chain to the Mark left at E (on the River Side) for another Main-line, and as you advance therein, omit not the Perpendiculars &c. which ſhall or may occur, and proceed in like Manner as in the former Dimenſions, wherein there are ſo much Variety (with regard to Field Notes) as will ſufficiently enable and qualify any Youth, though of the

ſlendereſt

ſlendereſt Capacity, to proceed therein for Miles upon the like Occaſion; *ſee the Dimenſions of this Main-line in the Field Book*; but obſerve, in croſſing the Fence into Lawn-pluds, to leave a Mark thereat, and when you have finiſhed the Line, return thereto, meaſure and enter the Dimenſions of the South Weſt Part of the ſame. (*See the Directions given in the third Article, Page* 214.)

8. Make for the Eaſt Side of the Eſtate, and chain another Main-line from the South Corner of Cracadony, to the North Weſt Corner of Quiſtil Field, *viz.* from r, to M, whereon take up ſo many Perpendiculars, &c. on the Right and Left-hand Side, as will include the Area of all the Fields which that Main-line paſſeth through, as you may ſee in the Field Book, wherein the Dimenſions of the ſame are carefully entered, and correctly caſt up, according to the foregoing Directions.

Laſtly, Step into Quiſtil Field, which you meaſure by chaining a Line from M in the South Corner thereof, to b, the North Corner, at which Place a Mark was left when Sandy Field was ſurveyed; and upon this Line, take up the Perpendiculars that ſhall occur on the Right and Left-hand Sides, which being finiſhed, concludes the Survey.

Abbreviated Characters in the Field Book explained.

⁺ H, or h,	denotes—	Croſs Hedge,
Plea Gd.		Pleaſure Ground.
Fd. ——		Field.

Bu.	denotes—	Buildings.
<		Corner of a Field.
M.		Mark, &c. &c.

Note, The above Croſs ſhould be made when in the Fields, by two Strokes of the Pen like the Character *Plus*.

Here

Here follows the Area of the foregoing Dimenſions of this Eſtate, reſpectively collected from the Field Book, as they appear therein.

Sandy Field.

L H Off E	201¼
R H Off W	238¼
N E Off L H	27
	466½

Damſels.

L H Off. E	457¼
R H Off. W	82½
N Off. on ditto, L H	73½
E Off. on ditto L H	55¼
	668½

Dairy Field.

L H Off. E	26
R H Off. W	543
R H Off. on ditto	252¼
	821¼

Ox-paſture	1074½

See Page 229.

Pleaſure Ground.

L H Off. E	323
R H ditto, W	710
R H Off on ditto	25½
W Off on ditto	5
	1063½

Bridge Meadow.

L H Off W	328¼
R H ditto E	102½
An Off on ditto R H	29¼
	460

Poplar Meadow.

L H Off W	99½
R H ditto E	279½
R H Off on ditto	12½
L H ditto, N	60½
	452

House, Garden, Fold, &c.

Area between 15,12, and 20,75		635¾
Area of an included Triangle in Dairy Field	85½	114
Area of ditto in Pleasure Ground	28½	
Remains		521¾
An East Off		30
		551¾

Lawn-pluds.

L H Off W	149½
R H Off E	62¼
S W End	
L H Off E	145
R H ditto W	92¾
	449½

Cracadony.

L H Off W	730
R H ditto E	158¼
An Off on Ditto	43
Ditto on ditto	10¾
	942

Ash Field.

L H Off W	402½
R H Off E	313
	715½

Quistel Field.

L H Off W	21
R H ditto E	549¾
	570¾
Lane	134

The

The Whole collected.

	Perches.	A.	R.	P.
Sandy Field —	466½ =	2	3	26½
Damſels —	668½ =	4	0	28½
Ox-paſture —	1074½ =	6	2	34½
Dairy Field —	821¼ =	5	0	21¼
Gardens, Folds, &c.	551¾ =	3	1	31¾
Pleaſure Ground -	1063½ =	6	2	23½
Bridge Meadow -	460 =	2	3	20
Poplar Meadow -	451 =	2	3	11
Lawn Pluds —	429½ =	2	2	29½
Cracadony — —	942 =	5	3	22
Aſh Field — —	715½ =	4	1	35½
Quiſtil Field —	570¾ =	3	2	10¾
Lane ———	134	0	3	14
	8348¾ =	52	0	28¾

Theſe Dimenſions being caſt up, your next Care will be to plan the whole from any Scale of equal Parts that you ſhall think proper, which, when performed, if the Size thereof be either too large or too ſmall for the intended Map, you'll meet with ample Directions in Part the Second to augment or diminiſh the ſame to any Size: The ſmall Compaſs of this Treatiſe induced me to make Choice of the quarter Scale, *i. e.* 16 Statute Poles to an Inch to plan this Eſtate from; but notwithſtanding, would adviſe the Learner to plan the ſame from ſundry Scales, ſuch as the Inch, half Inch, half-quarter Inch, &c. which will greatly edify him in the Art and Practice of Planning; but let him ſtrictly obſerve whether his Plan bear a thorough Similitude to *fig.* 4, *plate* 2; for if not, a Miſtake is committed, which may be readily diſcovered by Compariſon; and that he may the more effectually correct the ſame, here follows certain edifying emblematical Inſtructions for his more immediate Improvement with reſpect to a Plan of this Eſtate.

Directions to plan this Eſtate.

Being accommodated with a Sheet of Paper, Scale and Dividers, draw an obſcure or dry Line quite acroſs the Middle thereof,

perpendicular to your Breaſt, that ſhall repreſent the firſt Main-line in the Fields.

2. Fix upon a Point therein as at A, and from your Scale take 30 Chains, 4 Links (though the 4 Links cannot be adjudged at on this Scale,) and lay it from A to B, which Points limit the Main-line; upon the Left-hand Side thereof lay down thoſe Dimenſions that were taken up on that Side in the Fields; the Right-hand Side is appropriated to all thoſe Dimenſions entered in the Right-hand Column of the Field-Book, which being placed before you, proceed thus:

3. At the Beginning at A, it is no Perpendicular, neither in the Right or Left hand Columns; but at the End of 44 Links, it is 1 Chain, 71 Links of a Perpendicular to the Right-hand, therefore take 44 Links from your Scale, and lay it on the Main-line from A towards B, at which Point erect a Perpendicular to the Right-hand, by *Prob.* 3. *Chap.* 2; otherwiſe apply the End of the Scale upon, and parallel to the Main-line, ſetting or fixing one Corner of the Scale to the Point made with your Dividers in the Main-line, 44 Links from A, the Beginning, and from thence draw a Perpendicular or obſcure Line, whereon lay down 1 Chain, 71 Links, the firſt Perpendicular; then from A to this Point, draw a penciled Line. Alſo lay down one Chain from A in like Manner, at which Point erect another Perpendicular as you did the former, upon which lay off your ſecond Perpendicular = 3.52, to b, and with your Pencil join this to the End of the laſt Perpendicular; then take in your Dividers 3 Chains, 70 Links, and lay it on the Main-line, as before, at which Point draw an obſcure perpendicular Line on the Left-hand Side; upon which lay down 4 Chains, 40 Links to t; with Scale and Dividers draw a Line between t and A, and lay down thereon the N. E. Off-ſet, beginning at A; this being done, take from the Scale 5 Chains, 72 Links, lay it down as before from A towards B, to which Place draw a Line with the Pencil from t, which will repreſent Part of the Hedge between this Field and Damſels; and as the ſame Hedge on the Right-hand is at Right-angles to the Main-line, raiſe a Perpendicular thereat, upon which lay down 2 Chains, 2 Links to e, and then, with a Pencil, draw a right Line between d and e, and alſo one between e and b, the former will repreſent the Remainder of the Hedge between

between this Field and the Damſels; and the latter, the Hedge between this and the Quiſtil Field.

4. At the Point d, draw a Perpendicular, then take 5 Chains, 64 Links, up in your Dividers from off the Scale; lay the ſame down from d to f, and join f c with your Pencil; alſo take 9 Chains, 40 Links, and ſet it off from A upwards, at which Place draw a Line Perpendicular on the Left-hand Side, upon which lay down 7 Chains, 11 Links to g; draw a Line from f to g, and thereon lay down the Eaſt Off-ſet in Damſels, as heretofore taught; which done, take 10 Chains, 84 Links, in your Dividers, and lay it from A to h, to which Point draw two penciled Lines, the one of them from g, to repreſent the Hedge between Damſels and Ox-paſture, and the other from e, for the Hedge, one Part of which ſeparates the Damſels and Dairy Field, and the other Part thereof divides the Damſels from Quiſtil Field.

5. At h erect h D on the Left-hand Perpendicular to the Main-line, and lay thereon 7 Chains, 4 Links; alſo take 11 Chains from the ſame Scale, and on the Main-line, from A, as before, lay it down, and thereat erect a Perpendicular to the Right-hand Side, and lay thereon 6 Chains, 40 Links: Upon this Perpendicular is an Off-ſet upon an Off-ſet, to the Right-hand, which plan, and draw a penciled Line from the End of the Perpendicular therein, and it will repreſent the Hedge between the Quiſtil and Dairy Fields.

6. Take from your Scale 15 Chains, 12 Links, and laying it from A towards B, at this Point draw a Perpendicular on the Right-hand Side; and on this Line firſt lay off 7 Chains, 50 Links, and then 8 Chains, 62 Links; with your Pencil draw a Line between theſe two Points, and alſo draw therewith a right Line from the End of the laſt penciled Line, to wit, from the South Weſt Corner of Quiſtil Field, to the firſt Perpendicular which will repreſent the Hedge between the Aſh and Dairy Fields; Then take 16 Chains, 36 Links off your Scale, which being laid from A towards B, ſhews where the Hedge muſt be drawn between Dairy Field and the Orchard, Fold, &c. ſo that 61 Links being laid off at Right-angles on the Left-hand Side, from this

this Point draw a penciled Line to h and k, which will denote the Fence between Ox-paſture, Fold, Orchard, and Dairy Field.

7. Lay down 20 Chains, 10 Links, as before, from A towards B, to wit, at m, through which a Wall paſſeth in a Line with the Houſe Front thereat; on the Left-hand draw a Line perpendicular, and lay thereon 40 Links, and alſo 1 Chain (the Space between theſe Points, is the Breadth of the Road leading from the Bridge to the Fold and Buildings) from which draw two penciled Lines to either Side of the Pond in the Fold, to ſignify the Road or Lane; which being done, take 20 Chains, 75 Links, and lay it from A (as before;) at this Point erect a Right-hand Perpendicular, upon which lay off 5 Chains, 50 Links, to n; (but here let me once more caution the young Practitioner not to make Uſe of any other Scale in the Plan than that which he began with, for ſhould one Line be taken from this Scale, and another off any other, it would, in that Caſe, be impoſſible for his Plan to cloſe;) through this Point n, and that made where the Wall was met with, draw a penciled Line to repreſent the ſame.

8. From your Scale take 24 Chains, and lay it from A (in like Manner as before) to p, where the ſunk Fence was met with; but before you come to this Point, raiſe a Perpendicular on the Left-hand 20 Links ſhort of p, and lay thereon 1 Chain 40 Links, to ſhew the Point that the Hedge muſt paſs, that is on the near Side of the Lane; and alſo upon the ſame Line lay down 2 Chains, 16 Links, which diſcovers the Mark C in Ox-paſture, according to the Field notes, from which draw an occult Line to the Point D in Ox-paſture, and plan thereon, the South Eaſt Off-ſet therein beginning at D.

9. Lay off from A towards B, 25 Chains, 23 Links, and on the Right-hand Side thereat, raiſe or draw a Perpendicular, upon which lay off to q, 4 Chains, 61 Links, then, with a Pencil, draw a Line from q, through p and o, for the ſunk Fence; omit not to repreſent the arched Fence on each Side of the Gate, which, according to the Figure thereof in your Field-Book, is a Semi-circle: Alſo take 27 Chains, 12 Links, in your Dividers,

and

and ſet it off from A towards B, and on the Left-hand Side draw a Perpendicular, upon which ſet off 2 Chains, 68 Links; then, with your Pencil, continue thoſe Lines that repreſent the Lane, the nearer Line paſſing through this Point, and the Point o, until it meets the former penciled Line; and parallel thereto, draw another Line through C, which will denote the oppoſite Side of the Lane; then take in your Dividers 29 Chains, 30 Links, and lay A down as before, on your Main-Line, whereat draw a Line perpendicular thereto, on which lay 4 Chains, 22 Links to r, the South Weſt Corner of Pleaſure Ground: Here deſcribe the Arch on each Side the Gate, as it appears in the reſerved Columns of your Field Book, and at the Point B, erect a Perpendicular on the Left-hand Side, and lay thereon 2 Chains, 92 Links; upon this Line there is an Off-ſet upon an Off-ſet, which plan; and alſo let thoſe Lines be continued to S and x that repreſent the Lane; lay down a ſmall Weſt Off-ſet that appears in your Book between r and q; then draw a penciled Line likewiſe from r to S, and then delineate the internal Semicircle at the Gate, which concludes a Plan of thoſe Dimenſions that reſpect the firſt Main-line.

Then will the next Step be to plan thoſe Dimenſions taken up on the ſecond Main-line, but ere you can proceed therein, this Main-line muſt firſt be drawn, which being done removes all the Difficulty therein, and is thus effected: Your Field Notes inform you, that a Perpendicular = 3 Chains, 30 Links, was raiſed in the Meadow on the Left-hand at 1 Chain, 30 Links, to the South Corner of Pleaſure Ground, at the Point S, therefore, take 3 Chains, 30 Links in your Dividers, and ſet one Foot in the Point S, deſcribe an Arch with the other Foot. And if 1 Chain, 30 Links, be taken from 19 Chains, 96 Links, there will remain 18 Chains, 66 Links, (the Diſtance between the Place where this Perpendicular was raiſed, and the Point E in Ox-paſture.) Hence 18 Chains, 66 Links, being taken from the Scale with which, (ſetting 1 Foot in the Point E) deſcribe an Arch that ſhall interſect the former, through which Point of Interſection, and the Point E, draw a Line with the Point of the Dividers, for the ſecond Main-line; and then from your Scale take the whole Length of this Main-line = 19 Chains, 96 Links, in the Dividers, which lay down thereon from

from E, and it will point you out the North Corner of Bridge Meadow, whereat you made a Beginning in this Main-line: But here remember that you'll have no Occaſion to take Notice (as you are planning) of thoſe Perpendiculars which were taken up on the Left-hand Side of this Main-line, except the firſt you took in Poplar Meadow, by which the Fence on the North Side thereof, and alſo that between Poplar Meadow and Lawn-pluds, are drawn; for all the other Fences or Hedges between and the former Main-line, are already planned. It is likewiſe needleſs to give any Directions (in this Place) to plan the Right-hand Perpendiculars that are terminated by the River; for whoever is ready in planning the foregoing Examples, cannot poſſibly be at a Loſs to raiſe Perpendiculars from a baſe Line at each reſpective Place the ſame were taken at: However, in joining the Perpendiculars with a Pencil, forget not to draw a Line parallel thereto, between 40 and 50 Links diſtant therefrom, to repreſent the River, which by the Chain, meaſured ſo much; when done, turn over to the Dimenſions of Cracadony, wherein you find that the Main-line taken therein, begins at r, in the South Corner thereof, and paſſeth by k, the Weſt Corner of the Orchard already planned, which limits the Direction of this Main-line.

Here note, All the Difficulty of planning from Main-lines, depends upon drawing them exactly true in their proper Place. This done, the Work will then be found to be exceeding eaſy.

Having drawn the Line, there will be no Occaſion to take Notice of the Perpendiculars on the Right-hand Side (except the three laſt) the Hedge being already planned which is on that Side between this and the Quiſtil Field; therefore, by erecting, on the Right-hand, (according to the Field Notes) Perpendiculars reſpectively, upon which the ſeveral Numbers, as they appear in the Field Book, being laid thereon; then, with the Pencil, join the Ends of the ſame, as heretofore directed. This laſt penciled Line ſhews the Hedge between Aſh Field and Quiſtil. As for the Perpendiculars on the Left-hand Side, plan them as you did thoſe on the Right-hand Side of the laſt Main-line; this being done, and the Boundaries deſcribed by your Pencil, the whole is planned ſave only the North Weſt Side or Fence of Quiſtil Field, wherein the Proof and Truth of all your Proceedings (both in the

facing p. 238.


Fig. 1.
E
C
F
B
D
A
Fig. 3
D
E
C
a
n
L
B
A
Fig. 2.
A
B
W
Westerly
Southerly
M
Ashfield
Quastilfield
Sandyfield
Darryfield
Orchard
Garden
Fold
Cracadony
Courtyard and Pleasure Ground
Ox Pasture
Damsels
Mount Pleasant
Lawn Plats
Poplar Meadow
Bridge Meadow
RIVER PO
Easterly
Northerly
Fig. 5.
Fig. 6.

the Fields and Chamber) will appear, which you discover thus; draw an occult Line from M to b, which being taken between your Dividers, and applied to the Scale, if the Extent corresponds with the same Line in your Field Book, (to wit, 11 Chains,) you have made *a good Close*, which will always be the Case when Care attends each Step; otherwise it would be unreasonable to expect it. However, this Line answering with the Chain-line in the Field-Book, confirms the Accuracy, upon which lay down the Left-hand Off-set thereon, and with the Pencil draw the North East Side of this Field.

Lastly, With Pen and Ink draw or trace off all the penciled Lines in the Plan, then is the same ready to be transferred to a Map on Vellum, or whatever else is intended for that Purpose, which to perform, observe the following

Directions.

To transfer or trace off, upon Vellum, Parchment, or Paper, the Plan of an Estate, and afterwards to embellish the same.

1. The Size of your Vellum, Parchment, or Paper, being adapted to the Plan, wherein if Grease, or any thing else should hinder your Pen to slide freely, a little Pounce rubbed thereon occasionally will greatly help the same, and also prevent the Ink from spreading; some double refined Loaf Sugar dissolved in your Ink will give it an additional Gloss.

2. Lay your Plan carefully upon the Vellum, Parchment, or whatever else you intend to draw your Map upon, and three or four small Nails being stuck into the Table through the Plan and Corners of the Vellum, &c. to prevent the same from shifting or moving (though small Weights, or Books will, with Care, answer the same Purpose:) Then, with the Point of your Dividers, trace off all the Lines in the Plan, pressing the same gently, so that the Impression may appear on the Vellum, &c. Thus having gone or traced over all the Lines exactly, take up the Plan, and you'll see underneath, all those Lines upon the Vellum, &c. that are in the Plan; and then, with a fine Pen, and good *Indian* Ink, make thereon Hedges, &c. such as appear in the following Map.

3 When the Hedges, &c. belonging to each and every Field are finiſhed, it will be a great Addition to the Beauty of the Map, to adorn the Hedges on one Side with proper Shading, or Colours, to repreſent the Ditches; and the Paſture or Meadowing being touched up with a tranſparent Green Colour, in Imitation of Graſs, (but not dawbed on;) arable or ploughed Land with a brown earthen Colour, &c. laid on in ſuch a Manner *(ſee the following Map)* as will render the ſame all thorough a Similitude of Ridges and Furrows. There are many Gentlemen that chuſe to have a Map of their Eſtates ornamented with Colours, but, in my humble Opinion, good Indian Ink is much preferable thereto: However, it greatly behoves every Surveyor to pleaſe, if poſſible, his Employer, and therefore I ſhould think it adviſeable for thoſe who are ſo employed to have a ſmall Specimen of their Performance upon Vellum, curiouſly ornamented, to ſhew their Employers, wherein ſhould appear ſome Cloſes finiſhed with *Indian* Ink, and ſome with Colours.

4. Having compleated the Fields, &c. in the Map, make Choice of a Compartment, or Vacancy therein, at the Top, if poſſible, to draw the Coat of Arms belonging to the Gentleman that owns the Eſtate, with Shield, Creſt, and Supporters; the Shield ſhould be drawn ſo that it may contain the Title, Townſhip, and County, or any thing elſe that is proper to denote the Situation thereof. The Art of drawing ſuch Ornaments, will ſoon be obtained by aſſiduous Application, and ſome Inſtructions therein from a Limner, which the ſmall Size of this Treatiſe prevented me to give in this Place.

5. In another Compartment, or Vacancy, draw the Dividers, drawing Pen, the Scale you laid down the Map by, &c.

Laſtly, Draw the Mariner's Compaſs, with the Flower de Luce therein, pointing to the North exactly, *ſee Page* 96. However, for the young Learner's farther Improvement herein, here follows a Map of the Eſtate mentioned in the foregoing Example, properly embelliſhed, wherein is repreſented Paſture, Meadowing, ploughed Land, and whatever elſe that is neceſſary, which will undoubt-

undoubtedly edify more than if ſeveral Pages were wrote upon the Occaſion. Now, if the Whole be well performed, the Map will be a neat Ornament to hang up in the Owner's Study, or wherever elſe he ſhall chuſe, ſo that at Pleaſure he may ſee his whole Eſtate in his Chamber, and likewiſe the particular Quantity of each and every Incloſure therein, without any Manner of Trouble, but rather a Pleaſure.

Thus having briefly, and particularly taught and directed how an Eſtate (conſiſting of any Number of Incloſures) may be ſurveyed by the Chain *(unaſſiſted by Inſtruments,)* and alſo how the ſame may be accurately planned and mapped, I come, in the next Place, to ſhew how a Pond, Pool, Mere, Wood, or any inacceſſible Ground may be meaſured two different Ways, *i. e.* the one by rect-angular Lines; and the other by ſtationary ones, and in both Caſes this is the

RULE.

From the Area that the rect-angular or ſtationary Lines includes, deduct the Area of the ſeveral Inſets that are between thoſe Lines and the Pond, Pool, &c. the Remainder will be the true Area ſought.

Note, When rect-angular Lines are uſed, the Pen diſcovers the real included Area; but in uſing ſtationary Lines, the Scale and Dividers muſt be engaged for that Purpoſe, and conſequently the Reſult will be ſomewhat doubtful.

Example.

Admit *fig.* 5, *plate* 2, to repreſent a Mere, or Pool of Water, and it be required to know the true Content thereof, to perform which obſerve the following

DIRECTIONS.

1. Set up your Croſs-ſtaff at, or in the Corner A, and there fix upon two Places, or Marks (to wit, at B and D,) at right Angles to each other.

2. Meaſure the Line A D, and take up a Left-hand Inſet thereon, which being entered, return to your Staff, but forget not to leave a Mark at D.

3. Chain the Line A B, upon which take up an Inſet on the Right-hand thereof.

4. Fixt your Staff in B, which will direct you to chain another Line at Right-angles to this laſt meaſured Line, to wit, B C, and take up an Inſet upon this alſo.

Laſtly, Chain from C, to the Mark left at D, and take up the Inſet thereon, and it is done, whereby you have obtained the following

Dimenſions.

N. W. Inſet, L. H.
Taken upon the Line A D.
41½.

0	0
1,40	0
2,30	1,10
3,60	,50
4,00	,10
5,0	,10
5,50	,28
6,20	0
7,10	0
8,40	,80
8,60	0

N. E. Inſet, R. H.
Taken upon the Line B C.
80.

0	0
1,10	0
2,50	1,0
3,80	1,20
7,20	,00
10,0	,50
10,60	00

S. E. Inſet, R. H.
Taken upon the Line B C.
37.

0	0
,30	70
3,40	0
4,20	1,00
4,80	,30
5,70	0

S. W. Inſet, R. H.
Taken upon the Line C D.
146.

0	0
,20	,90
2,50	0
4,70	2,10
6,70	1,10
8,30	1,20
9,40	0
11,0	0

Fig. A B C D.

1212½

0	8,60
10,60	5,70

The Area of the Figure A B C D.

The ſeveral Inſets upon	A D	41	1212½	
	A B	80		
	B C	37	304½	
	C D	146		
				A. R. P.
The true Area			908 =	5 2 28

Here

Here follows an Example wherein a Pond, &c. is meaſured by ſtationary Lines, and exterior Angles, taken partly in like Manner as directed in Page 124, wherein I propoſed to give an Example of a Field meaſured by ſuch Lines, but being adviſed, by a Friend, not to introduce an Example therein (relating to Land) that would admit of many Anſwers, I therefore prudently omitted the ſame, as the Dimenſions ſo taken could not poſſibly be caſt up without having Recourſe to Scale and Compaſs: And I can aſſure my Reader, it is with the utmoſt Reluctance that I am now prevailed on to give an Example *(though of Water)* whereof the ambiguous Reſult will unavoidably admit of unlimited, uncertain Variety; nevertheleſs, as Pools are ſeldom or ever paid for by the Acre, and as *ſmall Waters* are generally allowed to be horizontal, conſequently there will be no Occaſion to make any Allowance for Altitude or Depreſſion; ſo that, with diligent Care, the Errors ariſing from ſuch Dimenſions will be but trifling, as the Off-ſets taken around the ſame are caſt up by the Pen; but, notwithſtanding, permit me to caution the young Practitioner, when he takes an Angle by the Chain, to be very exact, for otherwiſe he'll find it extremely difficult *(I might have ſaid impoſſible)* to obtain, from the Dimenſions ſo taken, a perfect Cloſe; however, my Brevity herein will, I hope, plead my Excuſe for introducing this

Example.

Admit *fig.* 6, *plate* 2, to repreſent a ſmall Pool, or Pond of Water, and it be required to ſurvey the ſame by ſtationary Lines, and Angles taken by the Chain.

Note, The Inſets that occur, are taken up in like Manner as you were directed in Page 155, to take up Off-ſets.

Firſt chain a Line from E to A = 4 Chains, 60 Links, which Station being entered, ſet up a meaſuring Pin at A, and fixing upon a Mark at B, continue the Line E A 2 Chains farther, whereat leave a Pin; return to A, and meaſure towards B 2 Chains; then meaſure the exact Diſtance (with the Chain) between the laſt Pin ſtuck down,

down, and the former = 2 Chains, 82¼ Links, which is a Chord-Line to the Angle A, made by the firſt and ſecond Station, as already obſerved; ſee that you forget not to take up the Inſets upon each Line.

2. Chain the Line or Side A B = 5 Chains, 70 Links, and take, as before, the Angle made by this and the next ſucceeding Station, = 1.81¾ = to the Chord 3, 4.

3. In like Manner Chain B C, for a third Station = 2 Chains, 20 Links, and meaſure the Chord Line 5, 6 = 1.77½.

4. Meaſure C D = 6 Chains, 30 Links, and at the End thereof take up the external Angle, as before, whoſe Chord is 2 Chains, 8 Links.

Laſtly, Meaſure the Side D E, and at the Corner E, take up the laſt Chord Line, *i. e.* 9, 10 = 1 Chain, 69½ Links.

The

The Dimenſions.

1ſt Stat.

St.	Sds.	Di. An.		Chords.
		C. L.		
1	EA	4,60	A	2,82¼
2	AB	5,70	B	1,81¾
3	BC	2,20	C	1,77½
4	CD	6,30	D	2,80
5	DE	5,72	E	169½

2d Stat. Inſet.

35¾

0	0
3,80	,90
4,0	,40
5,70	0

3d Stat. Inſet.

8¾

0	0
,80	,50
2,20	00

5 Stat. on Inſet.

14.

0	0
,40	0
2,50	,30
3,80	,30
5,0	0
7,72	0

1ſt Stat. Inſet.

48.

0	0
1,70	1,36
2,30	1,32
3,90	,00
4,60	00

4 Stat. Inſet.

5.

0	0
1,0	0
1,60	,50
2,30	,44
3,10	,04
3,30	,05
4,60	,40
6,30	00

Trapezium A B D E.

525.

0	2,40
9,00	4,90

Triangle B C D.

87¼

0	0
7,80	1,40

The

		Perches.
The Area of the { Trapezium ABDE	——	525
{ Triangle BCD	——	87¼
Area of ABCDE	——	612¼

Deduct the ſeveral Inſets upon the { 1ſt Stat.	48	
2d ditto	35¾	
3d ditto	8¾	
4th ditto	5	
5th ditto	14	
	——	111½
		500¾

By the above it appears that the Content of the Pool or Pond by Scale and Dividers is 500¾ Perches, which are equal to 3 Acres, 20¾ Perches, of Statute Meaſure.

Now if it were required to reduce the above, or any other Quantity of Statute Acres, into cuſtomary, or Plantation Meaſure, or the contrary, there are Directions for ſo doing in Pages 33 and 34.

Directions to plan the above Dimenſions.

1 Draw an occult Line, and lay thereon your firſt Station = 4 Chains, 60 Links, (taken from any Scale of equal Parts,) as from E to A; let this Line be continued ſomething farther, then take 2 Chains from the Inch Scale, and ſetting one Foot in A, deſcribe the Arch 1, 2; then take your firſt Chord-line = 2.82½, from the Inch Scale alſo, and lay it upon this Arch, from 1 to 2, through the Point A, and this Point 2, draw an obſcure Line for the ſecond Station.

Note, *The larger the Scale is from which you deſcribe your Angles, the more correct will your Plan be.*

2. Upon this laſt Line, from A to B, lay down your ſecond Station = 5.70, from the Scale you firſt made Choice of for

your ſtationary Lines; and take 2 Chains, as before, from the Scale, and ſetting one Foot in B, deſcribe the Arch 3, 4, upon which lay down from 3 to 4, your ſecond Chord-line = $181\frac{3}{4}$, taken from the Inch Scale: and through the Point 4 draw another Line for your third Station.

3. Having laid down from B to C, your third Station Line, = 2 Chains, 20 Links, ſet one Foot of your Dividers in the Point C, and with 2 Chains therein (as before) deſcribe the Arch 4, 5, and lay thereon (in like Manner as you did the former) your third Chord-line = $1.77\frac{1}{2}$; and through the Point C and 5, draw a Line for your 4th Station.

4. Lay down 6 Chains, 30 Links, from C to D, and in the Point C deſcribe the Arch 5, 6; upon which, from C, lay off the 4th Chord-line = 2 Chains, 80 Links, from 5 to 6; and if a Line be drawn from D to E that will paſs through the Point made in the laſt Arch at 6; you may then conclude that your Angles were correctly taken, and as correctly planned; moreover, the Diſtance between D and E ſhould alſo be = 5 Chains, 72 Links, otherwiſe there is a Miſtake committed, which ſeldom happens when the Angles compleat a Cloſe.

Here note, It may happen when you meaſure Ponds, Pools, &c. by ſtationary Lines, that an exterior Angle or Angles may be met with, in which Caſe, if you leave the Pool on the Right-hand in your ſurrounding, thoſe exterior Angles muſt be entered in a Left-hand Column, otherwiſe go howſoever you will round the ſame, wherein you take exterior and interior Angles; the one may be entered in the Left-hand Column of your Field-Book (formerly mentioned,) and the other in the Right-hand Column of the ſame Page.

The Inſets that are taken upon each Line being entered accordingly, may be planned in like Manner as directed in the two foregoing Examples.

Note, If the Eſtate be hilly, or uneven, and the Main-line, or any other meaſured thereon croſſeth the ſame, it will occaſion

a

a Diſcloſe in the Plan, which to prevent, or remedy, in Part the ſecond you are directed, by the Help of an Inſtrument, to take the Depreſſion, or Altidude, of an Hill, and Trigonometry will then find the baſe Line thereof, which muſt be uſed in planning. But here methinks I ſee the honeſt Country Youth aſtoniſhed at the very Sound of both Inſtruments, and Trigonometry, ſaying, *What! cannot Land (both acceſſible and inacceſſible) be accurately ſurveyed by the Chain only, without being troubled with a Number of unneceſſary Inſtruments?* I anſwer in the Affirmative, MOST CERTAINLY. Inſtruments (before a more correct and expeditious Method was found out) were eſteemed very uſeful in this Art, but now-a-days they ſerve old Practitioners (who know no better) to amuſe Country People (that are ignorant thereof) in order to make them pay the Surveyor more freely; nor ſhould I have introduced Inſtruments in this Treatiſe, had I not conſidered the many Artificers who are thereby ſupported; together with a Number of *old Practitioners* whoſe Livelihood hath an abſolute Dependence thereon: However, as I have, in Part the ſecond, not only pointed out ſome of the many Errors the Inſtrument is unavoidably Heir to, but alſo given ample Directions therein to reconcile and correct thoſe Errors as near the Truth as the Caſe will admit of, the whole being caſt up by the Pen ſeveral Ways (and which will not differ one Perch in one thouſand Acres) will undoubtedly atone for the Inſertion thereof.

Directions to the young Surveyor aſcending and deſcending hilly Ground.

When a Hill interpoſes in the Survey, in chaining over the ſame, you may find both the Arch and alſo the Chord-line, *i. e.* the Hill's Foundation, thus:

If the Hill be not very ſteep, let your Foreman, at the End of every aſcending Chain, ſtick down his Arrow, keeping the Chain-End cloſe to the Ground, whilſt you holding up the Chain at full ſtretch, Breaſt high, or higher, until it be parallel to the Horizon, to wit, at Right-angles to a ſuppoſed Line between your Chain-hand ſo poiſed, and the Arrow formerly ſtuck down, the Chain-End being held exactly over the ſame In this Manner proceed until you ſurmount the Hill, by which

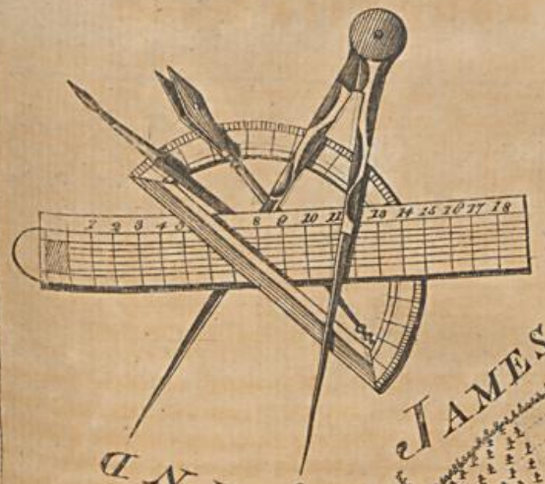
Means you'll have the Foundation-line of the Hill as far as you thus advance thereon; and as you aſcend, you may alſo meaſure the ſlant Line thereof, which will enable you to find the ſuperficial Area and Altitude of the ſame if required. In deſcending a Hill, you muſt perform the Part your Foreman did when aſcending, whilſt he raiſes his Chain hand, &c. as you did before.

But if the Hill be very Steep, your beſt Way then will be to meaſure up and down the ſame by half, or quarter Chains, which, with Care, will more effectually anſwer your End, than all the Inſtruments ever conſtructed for the like Occaſion.

Thus have I finiſhed the firſt Part as propoſed, and therefore whoſoever intend or hope to learn any thing contained therein, muſt not only read the ſame, but alſo apply Pen, &c. to Paper; ſo that by caſting up and planning the ſeveral Examples, together with ſome others of their own propoſing, intermixed with Diligence and Care, will moſt certainly accompliſh their Deſires of becoming compleat Surveyors.

The END of the FIRST PART.

PART



Map and Survey of an Estate

in Tarporley in the County of Chester belonging to J. Tod Esqr.

JAMES JOHNS'S LAND

WILL.M ANNOKE'S LAND

SIR JOHN TILLOTT'S LAND

LITTLETON'S LAND

Mr. AMINADAB

A

B

C

D

E

F

G

H

I

K

L

M

Remarks

175 Timber Trees on the Premises containing 37 12 feet The Land is for the most part dry & good the fields I.K.L. & M will admit of great improvements

Premises

		Quantity		
A	House Garden &c.	3	1	3
B	Pleasure Ground	6	2	23½
C	Gracadmy	5	3	22
D	Assfield	4	1	35½
E	Dairy Field	5	0	21
F	Quisil Field	3	2	10
G	Sandy Field	2	3	30
H	Damsels	4	0	28
I	Ox Pasture	6	2	38
K	Lawn Meade	2	2	29½
L	Bridge Meadow	2	3	20
M	Poplar Meadow	2	3	11
	Lane Roads	0	3	14
	Total Acrs	52	0	28½

A. Burns Delet

R. Murray Sculp. Chester