LINEAR EQUATIONS I

In my experience, equations can be one of the easiest topics for students to master and a relatively inexpensive source of marks in the exam.

In this short chapter we restrict our discussion to the simplest GCSE examples, allowing for a *gentle* introduction to this topic.

Consider, for example, the equation $3x + 5 = 17$.

This is easily understood to be asking:

"*Which number, call it x, when multiplied by 3 and subsequently increased by 5, gives an answer of 17 ?*"

and easily seen to have the solution $x = 4$.

Simple!

However, not all solutions are such nice whole numbers.

Consider the equation $4x + 3 = 21$.

"*Which number, call it x, when multiplied by 4 and subsequently increased by 3, gives an answer of 21 ?*"

Is it so obvious that the solution is given by $x = 4.5$?

The following example leads us towards an algebraic method of solution.

Example 1.
Solve the equation $5x + 4 = 19$.

Solution.
Focus upon the quantity $5x$.

The equation $\mathbf{5x} + 4 = 19$ states that when the quantity $5x$ is increased by 4, we get a value of 19.

This means that the quantity $5x$ must have a value of 15.

Thus, we have $5x = 15$

from which we easily get that $x = 3$.

Let's see this again, but without the annoying *waffle*!

$$\begin{aligned} 5x + 4 &= 19 \\ 5x &= 15 \qquad \text{\{after subtracting 4\}} \\ x &= 3. \end{aligned}$$

Let's try another.

Example 2.
Solve the equation $4x + 7 = 27$.

Solution.
We have $4x + 7 = 27$.

Which means that $4x = 20$ {after subtracting 7}

and hence $x = 5$.

The *trick* to solving equations is to keep things simple, avoid the unnecessary complications associated with trying to be too clever, too flash! Stick to what you know best.

Example 3.
Solve the equation $3x - 5 = 22$.

Solution.
We have $3x - 5 = 22$.

Which means that $3x = 27$ {think about it!}

and hence $x = 9$.

Example 4.
Solve the equation $11 = 2x - 9$.

Solution.
We have $11 = 2x - 9$.

Which means that $20 = 2x$ {after adding 9}

and hence $10 = x$.

NOTICE how, in the previous example, the unknown quantity, x, remained on the right-hand side of the equals. I am certainly not in the habit of '*forcing*' the x onto the left side as this can cause problems later on.

One more for good measure!

Our final example involves some simple brackets, but we discussed these within the chapter on simplifying expressions.

Example 5.

Solve the equation $3(x + 5) = 36.$

Solution.

We have	$3(x + 5) = 36.$	
Remove brackets	$3x + 15 = 36$	{see the chapter on simplifying expressions}
Which means that	$3x = 21$	{after subtracting 15}
and hence	$x = 7.$	

FINAL NOTE.

The follow on chapter "*LINEAR EQUATIONS II*" follows nicely (if I say so myself!) from this short chapter and moves quite swiftly into the most complicated equations to be encountered at GCSE. There really is nothing to fear, however, as the basic steps detailed here will serve us very well with the more complex examples.

It is just a question of practice and perseverance.

And getting the right answers of course!

Speaking of which ……

Exercise 1.

Solve the following equations.

1)	$3x + 1 = 4$	2)	$3x - 2 = 4$
3)	$5x + 3 = 18$	4)	$5x - 2 = 18$
5)	$4x + 1 = 21$	6)	$4x - 3 = 21$
7)	$10x + 1 = 71$	8)	$10x - 9 = 71$
9)	$2x + 1 = 19$	10)	$2x - 1 = 19$
11)	$7x + 3 = 80$	12)	$7x - 4 = 80$
13)	$3x + 1 = 40$	14)	$3x - 2 = 40$
15)	$3x + 2 = 47$	16)	$3x - 1 = 47$
17)	$3(x + 10) = 60$	18)	$3(x - 10) = 60$
19)	$5(x + 1) = 20$	20)	$5(x - 1) = 20$
21)	$2(3x + 4) = 20$	22)	$3(3x - 2) = 21.$
23)	$5(3x - 4) = 10$	24)	$10(3x + 1) = 100.$

ANSWERS / SOLUTIONS.

1)	$x = 1$	2)	$x = 2$	3)	$x = 3$	4)	$x = 4$
5)	$x = 5$	6)	$x = 6$	7)	$x = 7$	8)	$x = 8$
9)	$x = 9$	10)	$x = 10$	11)	$x = 11$	12)	$x = 12$
13)	$x = 13$	14)	$x = 14$	15)	$x = 15$	16)	$x = 16$
17)	$x = 10$	18)	$x = 30$	19)	$x = 3$	20)	$x = 5$
21)	$x = 2$	22)	$x = 3$	23)	$x = 2$	24)	$x = 3.$

Solution to 21).

We have	$2(3x + 4) = 20.$	
Remove brackets	$6x + 8 = 20$	{careful with the $6x$}
subtract 8	$6x = 12$	
and thus	$x = 2.$	