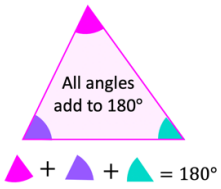
We can form linear equations based on the following:

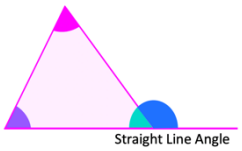
Triangles

Angles

Any Triangle



Any Triangle

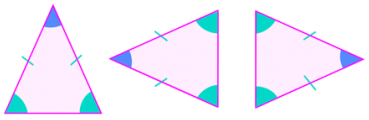


+ = 180°

We also know that

+ + = 180°

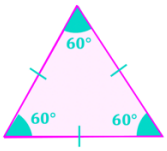
Isosceles Triangle



base angles are equal

each $= \frac{180 - \blacktriangle}{2}$

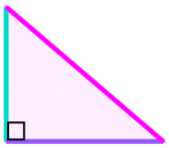
Equilateral Triangle



each = 60°

Side Lengths

Right-Angled Triangle



Area= $\frac{1}{2}$ × | × —

Pythagoras: $|^2 + —^2 = \diagdown^2$

Squares and Rectangles

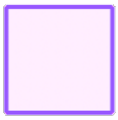
Angles

Square

Rectangle

Side Lengths

Square



All sides are equal

Rectangle

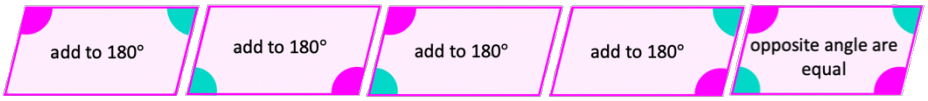
Opposite sides are equal

— = —

| = |

Parallelograms

Angles

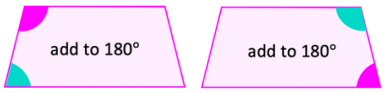


Side Lengths

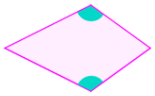
Opposite sides are equal

Trapezia and Kites

Isosceles Trapezium



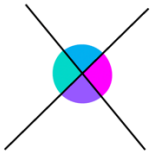
Only 2 pairs add to 180°, unlike for parallelograms since a trapezium has only 1 pair of parallel sides



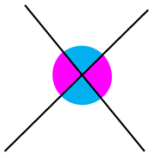
1 pair of opposite angles are equal

=

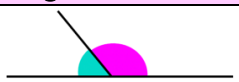
Angles and Parallel Lines



Angles at a point add to 360°

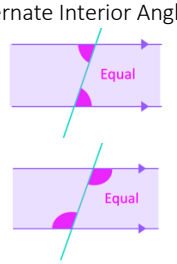


Opposite angles are equal

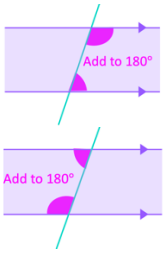


Angles add to 180°

Alternate Interior Angles

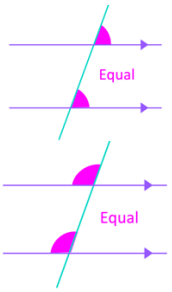


Same Side/ Co-Interior Angles

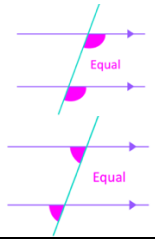


Corresponding Angles

Both above:



Both below:



How To Solve Linear Equations

Example: Solve $2x - 3 = 5$

Way 1: Turn into words and work backwards

Step 1: Turn it into words

$$2x - 3 = 5$$

I am thinking of a number
I multiply it by 2
I subtract 3
The answer is 5

What is my original number?

Step 2: Work backwards and do the opposite

Start with 5
Add 3
Divide by 2

Answer is 4

This method is limited when the equations become harder such as when we x terms on each side.

Way 2: Systematic steps

Our goal is to get x on one side completely its own. We want to get the letter (x) on the left and the numbers on the right.
i.e. our goal is to get $x =$ a number

Some hints:

- If we have brackets, we expand them (we don't have any brackets here, so this doesn't apply)
- If we have fractions, we get rid of them (we don't have any fractions here, so this doesn't apply)
- Collect 'like' terms

Always remember that anytime we move a term to the other side of the equals sign we do the opposite.

$$2x - 3 = 5$$

-3 means subtract 3 so we do the opposite and add $(+)$ it when we move it to the other side

$$2x = 5 + 3$$

$$2x = 8$$

The 2 is multiplied with x so we do the opposite and divide $(\div 2)$ when we move it to the other side

$$x = \frac{8}{2}$$

$$x = 4$$

Now we have reached our goal of getting x on its own and we are done

Basics

$2x + 5 = 9$

$2x + 5 = 9$

$2x = 9 - 5$

$2x = 4$

$x = \frac{4}{2}$

$x = 2$

$2x + 8 = -6$

$2x + 8 = -6$

$2x = -6 - 8$

$2x = -14$

$x = -\frac{14}{2}$

Let's colour code to explain how to deal with the negatives

$x = \frac{-14}{+2}$

We know a negative with a positive is a negative, so we take care of the signs first and then do the numbers which is 7

$x = -7$

$3x + 14 = 5$

$3x + 14 = 5$

$3x = 5 - 14$

$3x = -9$

$x = -\frac{9}{3}$

Let's colour code to explain how to deal with the negatives

$x = \frac{-9}{+3}$

We know a negative with a positive is a negative, so we take care of the signs first and then do the numbers which is 7

$x = -3$

$10 - 3x = 1$

$10 - 3x = 1$

$-3x = 1 - 10$

$-3x = -9$

$x = \frac{-9}{-3}$

Let's colour code to explain how to deal with the negatives

$x = \frac{-9}{-3}$

We know a negative with a negative is a positive, so we take care of the signs first and then do the numbers which is 3

$x = +3$

$21 = 7 + 4y$

$21 = 7 + 4y$

Let's re-write this with the letter we want which is x on the left-hand side so it looks familiar to how we solve equations. It is fine to swap the order of what is on the equals sign. Why? $2 = x$ is the same as writing $x = 2$

$7 + 4y = 21$

$7 + 4y = 21$

$4y = 21 - 7$

$4y = 14$

$y = \frac{14}{4}$

$y = \frac{7}{2}$

Note: It is fine to leave this as a fraction if the number doesn't fit in

Brackets and Fractions

$2(x+2)=5$

Recall
- Expand brackets

$2(x+2)=3$

$2x+4=3$

$2x=3-4$

$2x=-1$

$x=-\frac{1}{2}$

$3(2x-1)=5$

Recall
- Expand brackets

$3(2x-1)=5$

$6x-3=5$

$6x=5+3$

$6x=8$

$x=\frac{8}{6}=\frac{4}{3}$

$\frac{2x+5}{3}=7$

$\frac{2x+5}{3}=7$

$2x+5=7(3)$

$2x+5=21$

$2x=21-5$

$2x=16$

$x=\frac{16}{2}$

$x=8$

$\frac{2(x-1)}{5}=3$

- Expand brackets
- Clear fractions
- Collect 'like' terms

$\frac{2(x-1)}{5}=3$

$\frac{2x-2}{5}=3$

$2x-2=3(5)$

$2x-2=15$

$2x=17$

$x=\frac{17}{2}$

$\frac{2x}{5}-1=7$

Way 1:	Way 2: Get rid of the fraction straight away
$\frac{2x}{5}-1=7$	$\frac{2x}{5}-1=7$
$\frac{2x}{5}=7+1$	Important: We have an extra term here which needs to also be multiplied by 5
$\frac{2x}{5}=8$	$2x-1(5)=7(5)$
$2x=8(5)$	$2x-5=35$
$2x=40$	$2x=40$
$x=\frac{40}{2}$	$x=20$
$x=20$	

More than one x term on one side

$2x+5x+3x=100$

Group any common algebra terms first

$2x+5x+3x=100$

$10x=100$

$x=10$

$2x+30+3x+50=180$

Group any common algebra terms
Group any common number terms

$2x+30+3x+50=180$

$5x+80=180$

$5x=100$

$x=20$

$2x+30+3x+50+5x+80=180$

Group any common algebra terms
Group any common number terms

$2x+30+3x+50+5x+80=180$

$10x+160=180$

$10x=20$

$x=2$

An x term on each side

$2x-4=-3x+5$

Group any common algebra terms
Group any common number terms

$2x-4=-3x+5$

Move and then group common terms

$2x+3x=5+4$

Now continue as usual

$5x=9$

$x=\frac{9}{5}$

$5(x+3)=2(x+6)$

- Expand brackets
- Clear fractions
- Collect 'like' terms (there may be two pairs)

$5(x+3)=2(x+6)$

$5x+15=2x+12$

$5x+15=2x+12$

$5x-2x=12-15$

$3x=-3$

$x=-1$

$2(x-1)+3(x-4)=6$

- Expand brackets
- Clear fractions
- Collect 'like' terms (there may be two pairs)

$2(x-1)+3(x-4)=6$

$2x-2+3x-12=6$

$2x-2+3x-12=6$

$2x+3x=6+2+12$

$5x=20$

$x=4$

$5(2x+9)+2(x+11)=3(3x+4)+46$

$5(2x+9)+2(x+11)=3(3x+4)+46$

$10x+45+2x+22=9x+12+46$

We need to collect like terms (orange and green colour pairs)

$10x+45+2x+22=9x+12+46$

$10x+2x-9x=12+46-45-22$

$3x=-9$

$x=\frac{-9}{3}$

$x=-3$