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Non-linear graphs: quadratic graphs
Recognising and drawing quadratic graphs.

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A quadratic equation is an equation where the highest power of the variable (usually 'x') is a square (^{2}). In other words, the equation will contain an x^2 term and could contain, at most, two other terms – an x term and a constant. It will **not** contain terms with any other powers such as x^3, x^4... or x^{-1}, x^{-2}....

The graph of a quadratic equation is always a U-shape, and when drawing the graph of a quadratic equation, the plotted points should be joined with a smooth curve. The name given to the special shape is a **parabola**.

When the coefficient of x^2 is positive, the curve will look something like this:
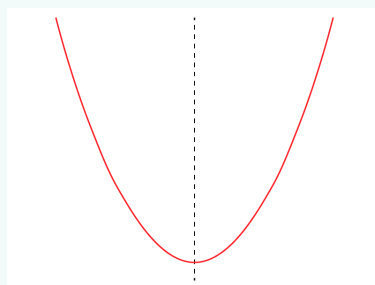
When the coefficient of x^2 is negative, the curve will look something like this:
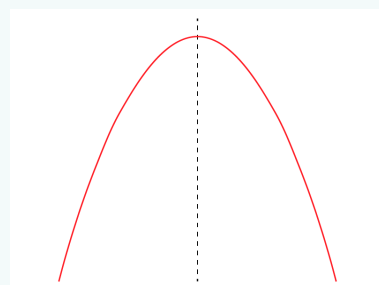
Notice that each curve is symmetrical, and the line of symmetry always goes through the lowest or highest point of the curve.
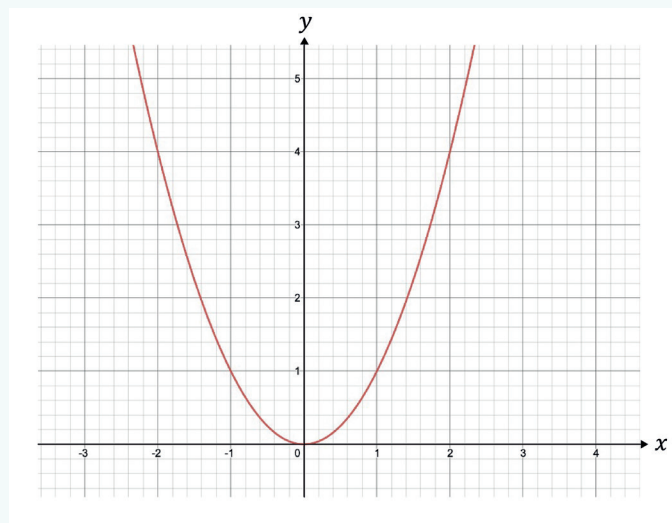
DRAWING QUADRATIC GRAPHS

Follow these steps to draw the graph of $y = x^2$.

1. First, complete a table of values to find the coordinates of the points that lie on $y = x^2$.
2. To calculate the values for the table, substitute the values for x into the equation to find the values of y.

x	−3	−2	−1	0	1	2	3	4
$y = x^2$	9	4	1	0	1	4	9	16

3. Then, draw the graph using these points.

Your graph should look like this:

REMEMBER!

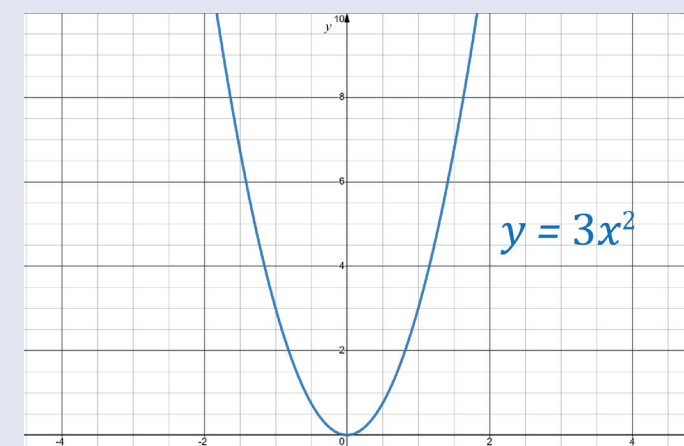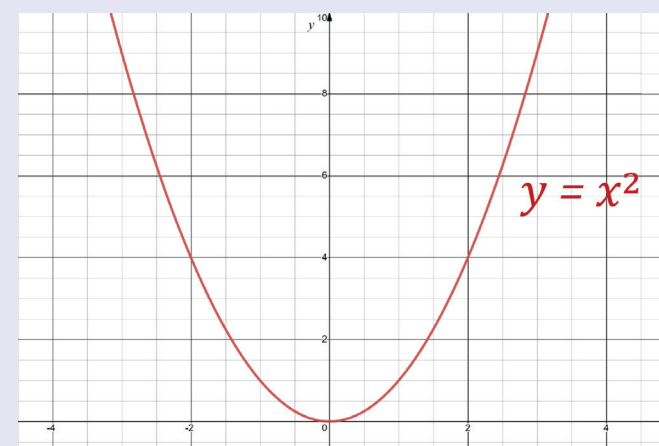Quadratic graphs are always symmetrical.

The solutions are called the roots of the equation and can be found where the graph crosses the x-axis.
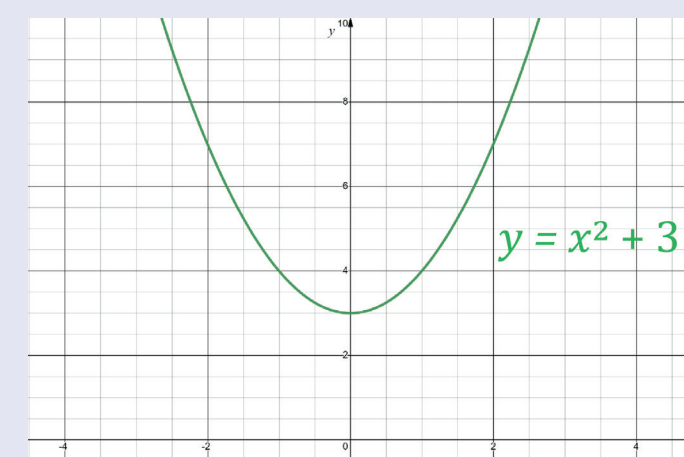
Check that you can:
◆ *substitute values into an equation to find an answer*
◆ *plot a graph given the values of x and y.*

COMPARING QUADRATIC GRAPHS

Compare the graphs for $y = x^2$, $y = 3x^2$, and $y = x^2 + 3$.

$y = x^2 + 3$ has the same shape as $y = x^2$ but its position is different. It has been moved up 3 units. i.e. it crosses the y-axis at (0,3).

$y = 3x^2$ has a similar shape to $y = x^2$, but it is much narrower than $y = x^2$. Both graphs go through the origin (0,0).

USING A GRAPH TO SOLVE A QUADRATIC EQUATION

The solutions to the quadratic equation $ax^2 + bx + c = 0$ are called the roots of the equation. They are the values of x where the curve, $y = ax^2 + bx + c$, crosses the x-axis, since at those points, $y = 0$.

The graph shows $y = x^2 – 9$. Here, you can see that there are two solutions to $x^2 – 9 = 0$ and these are $x = –3$ and $x = 3$.