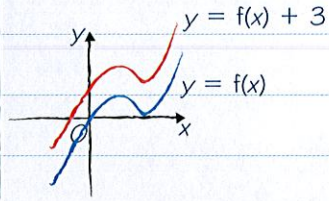
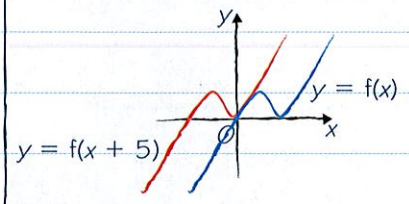
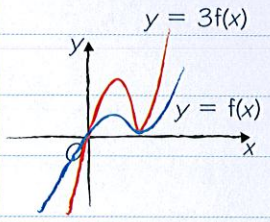
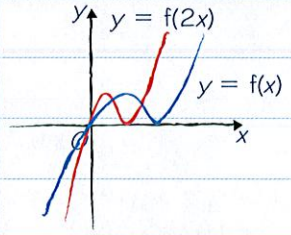
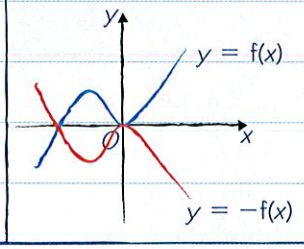
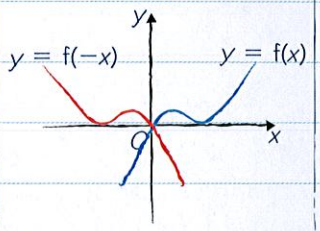
A* A B C D

Transformations 1

You can change the equation of a graph to translate it, stretch it or reflect it.
In the exam you might have to use functions to describe these transformations.

Function	$y = f(x) + a$	$y = f(x + a)$	$y = af(x)$
Transformation of graph	Translation $\begin{pmatrix} 0 \\ a \end{pmatrix}$	Translation $\begin{pmatrix} -a \\ 0 \end{pmatrix}$	Stretch in the vertical direction, scale factor a
Useful to know	$f(x) + a \rightarrow$ move UP a units $f(x) - a \rightarrow$ move DOWN a units	$f(x + a) \rightarrow$ move LEFT a units $f(x - a) \rightarrow$ move RIGHT a units	x-values stay the same
Example			

Function	$y = f(ax)$	$y = -f(x)$	$y = f(-x)$
Transformation of graph	Stretch in the horizontal direction, scale factor $\frac{1}{a}$	Reflection in the x-axis	Reflection in the y-axis
Useful to know	y-values stay the same	'$-$' outside the bracket	'$-$' inside the bracket
Example			

Worked example

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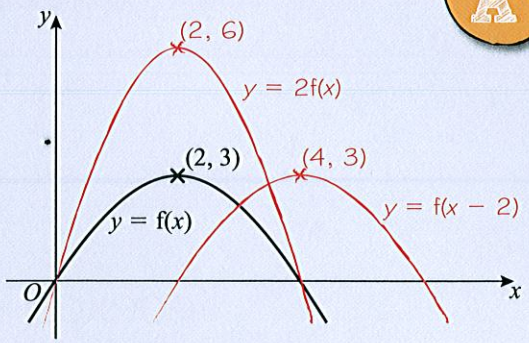


The curve $y = f(x)$ has a vertex at $(2, 3)$.
Write down the coordinates of the vertex of the curve with equation

(a) $y = f(x - 2)$ $(4, 3)$

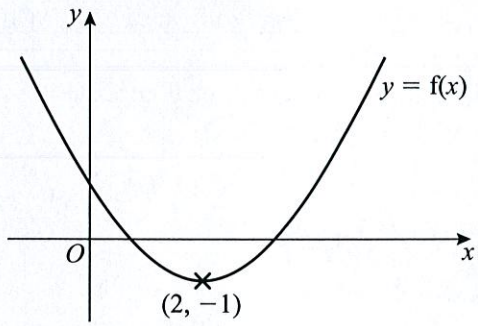
(b) $y = 2f(x)$ $(2, 6)$

$y = f(x - 2)$ is a translation 2 units right along the x-axis.
$y = 2f(x)$ is a stretch in the vertical direction, scale factor 2.

Now try this

edexcel

grade A*



The curve $y = f(x)$ has a minimum point at $(2, -1)$.

(a) Write down the coordinates of the minimum point of the curve with equation
(i) $y = f(x + 2)$
(ii) $y = 3f(x)$
(iii) $y = f(2x)$ **(3 marks)**

The curve $y = f(x)$ is reflected in the y-axis.

(b) Find the equation of the curve following this transformation. **(1 mark)**