

MATHSDIY

GCSE TOPIC BOOKLET

SOLUTIONS

TRANSFORMATIONS OF FUNCTIONS

$$y = f(x) + a$$

Translation a units y direction.

$$y = f(x - a)$$

Translation a units x direction.

$$y = af(x)$$

Stretch along y axis
scale factor a .

$$y = f(ax)$$

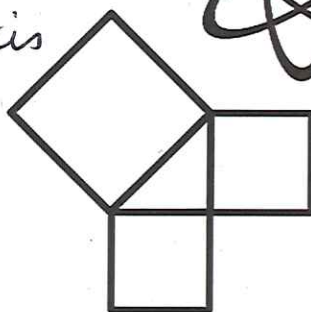
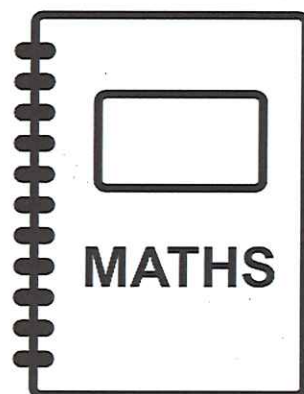
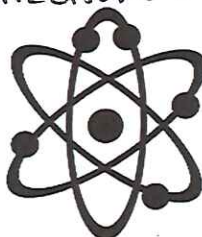
Stretch along x axis
scale factor $\frac{1}{a}$

$$y = -f(x)$$

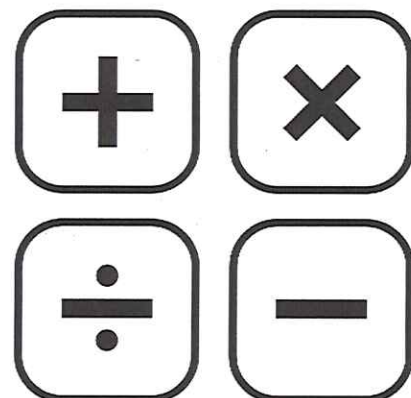
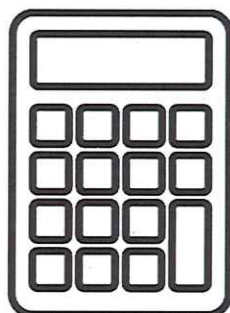
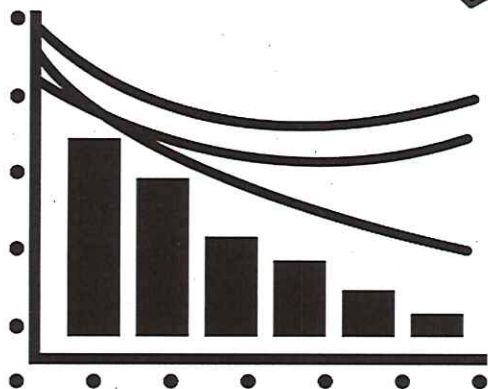
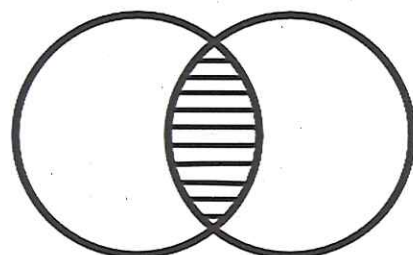
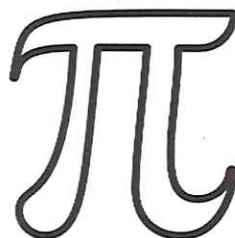
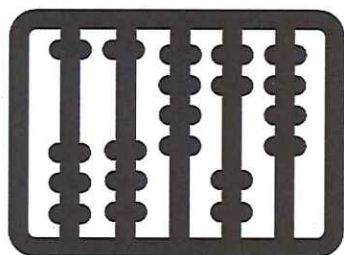
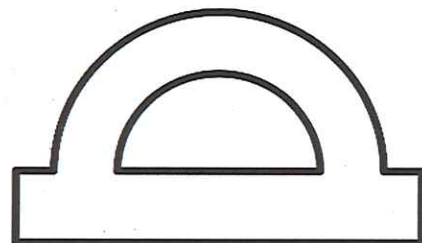
reflection across
 x axis

$$y = f(-x)$$

reflection
across y axis



$$a^2 = b^2 + c^2$$



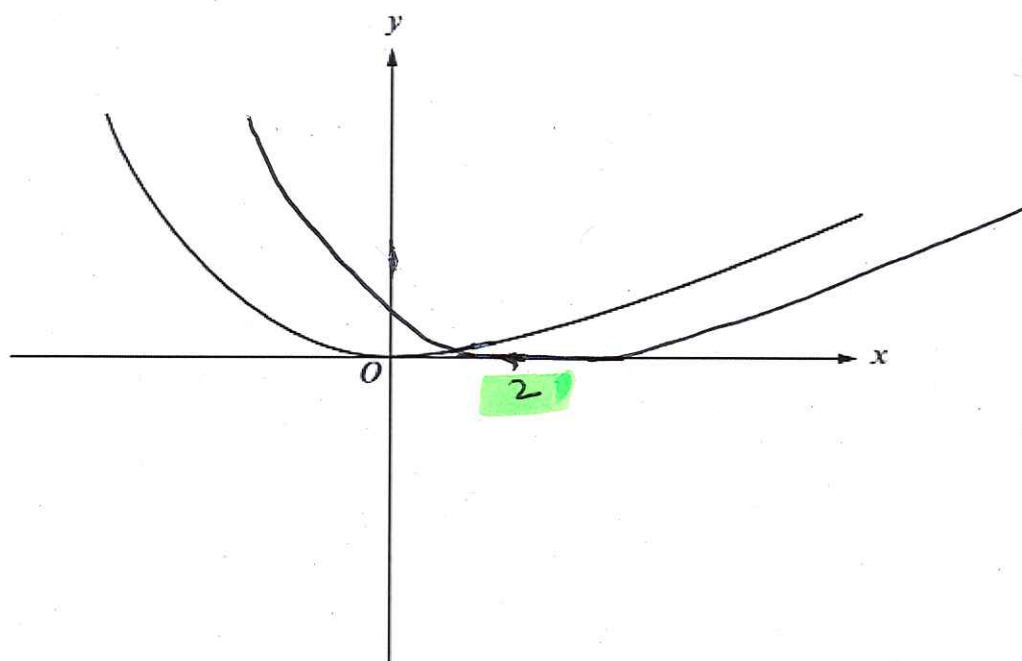
1. (a)

The diagram shows a sketch of $y = f(x)$.

On the same diagram, sketch the curve $y = f(x - 2)$.

Mark clearly the coordinates of the point where this curve touches an axis.

→ Translation, +2
x direction



(b)

The diagram shows another sketch of $y = f(x)$.

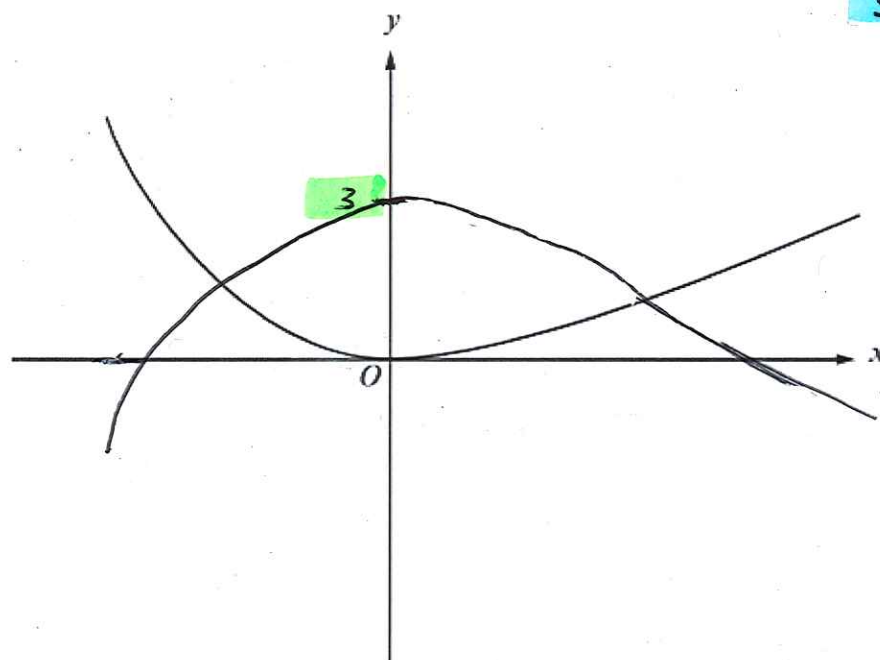
On the same diagram, sketch the curve $y = -f(x) + 3$.

Mark clearly the coordinates of the point where this curve meets the y-axis.

→ reflect across x axis

→ translation, +3

y direction



[3]

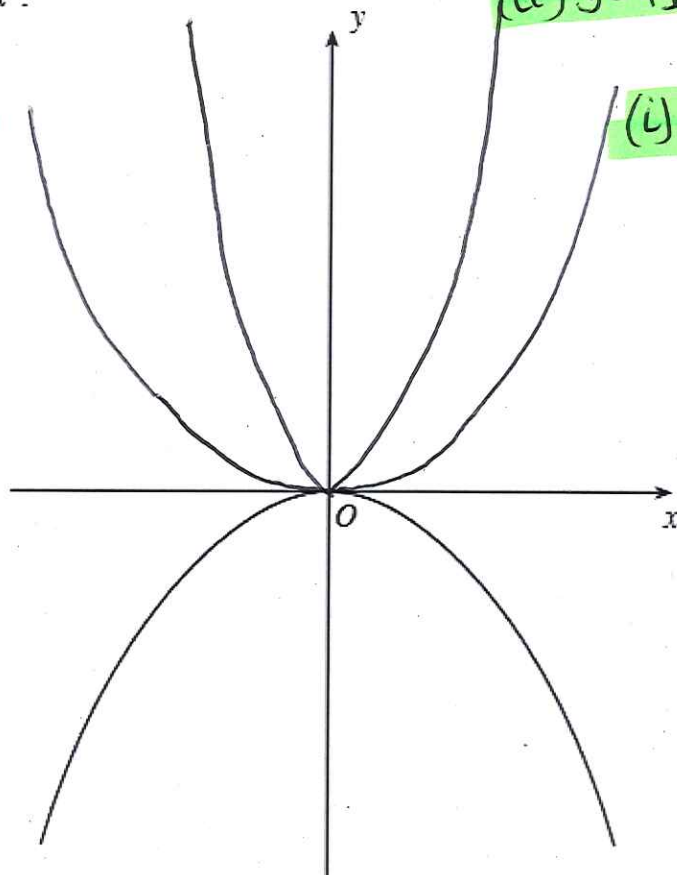
2.

- (a) The diagram shows the sketch of $y = -x^2$.
On the same diagram, sketch the curve

(i) $y = x^2 \rightarrow$ reflect across x axis

(ii) $y = 4x^2$

stretch
 $\times 4$ y direction



[2]

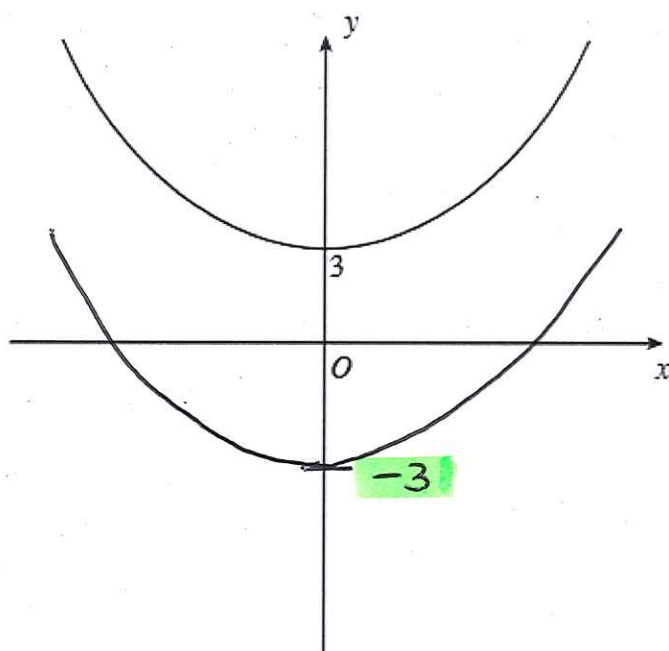
- (b) The diagram shows a sketch of $y = f(x)$.

On the same diagram, sketch the curve $y = f(x) - 6$.

Mark clearly the coordinates of the point where the curve crosses the y-axis.

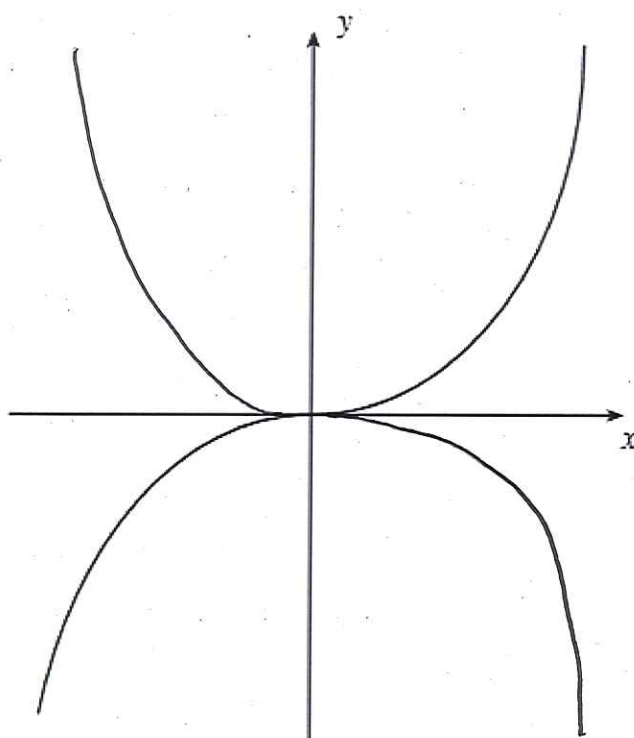
$\rightarrow$ translation, -6, y

direction



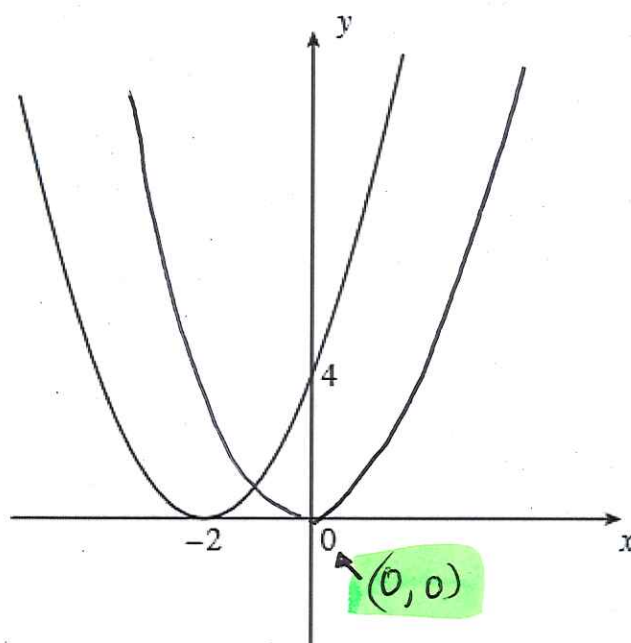
[2]

- 3.(a) The diagram shows the sketch of $y = x^3$. On the same diagram, sketch the curve $y = -x^3$. [1]



↓
reflect across
x axis

- (b) The diagram shows a sketch of $y = f(x)$. On the same diagram, sketch the curve $y = f(x - 2)$. Mark clearly the coordinates of the points where the curve crosses or touches the x-axis or y-axis. [2]

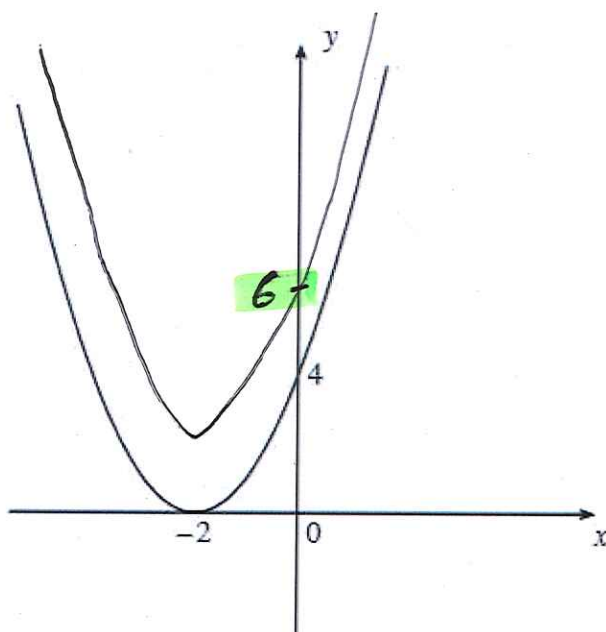


translation
+2, x
direction

Translation, +2

y direction

- (c) The diagram shows a sketch of $y = f(x)$. On the same diagram sketch the curve $y = f(x) + 2$. Mark clearly the coordinates of the points where the curve crosses or touches the x-axis or y-axis. [2]



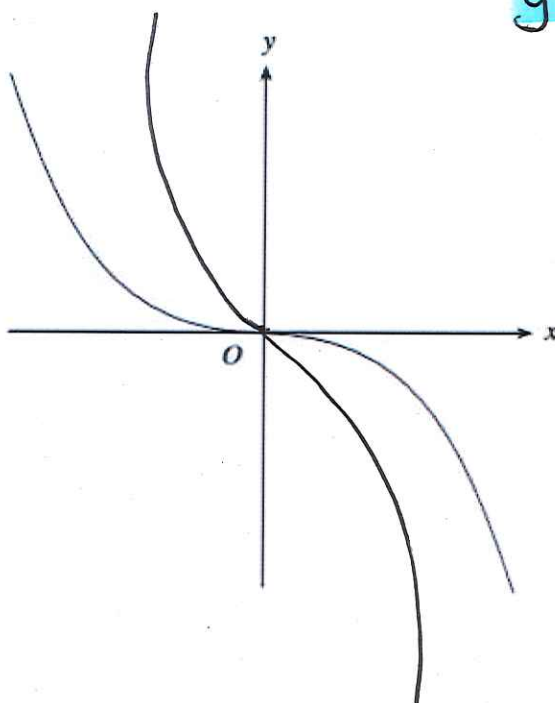
4. (a) The diagram shows a sketch of $y = -x^3$. On the same diagram, sketch the curve $y = -2x^3$.

$y = 2 \times (-x^3)$

stretch $\times 2$

y direction

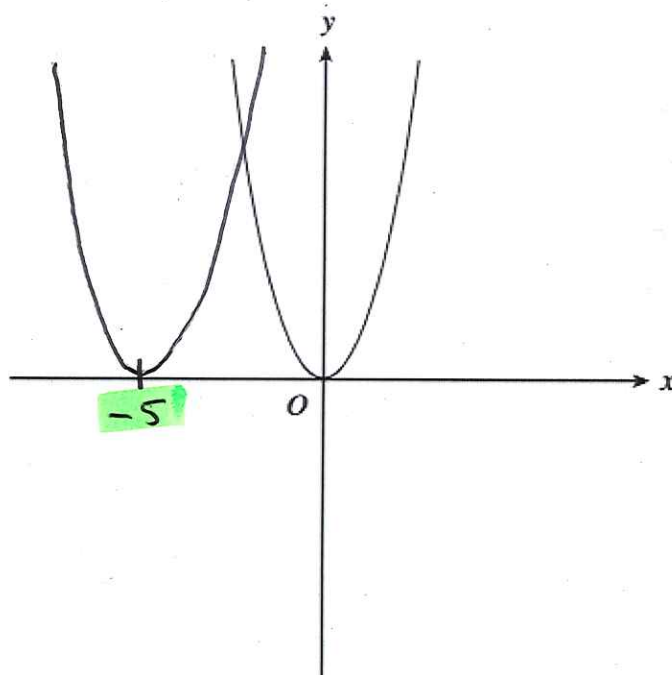
[1]



- (b) The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = f(x + 5)$.
Indicate the coordinates of one point on the curve.

Translation, 5 to the
left, x direction

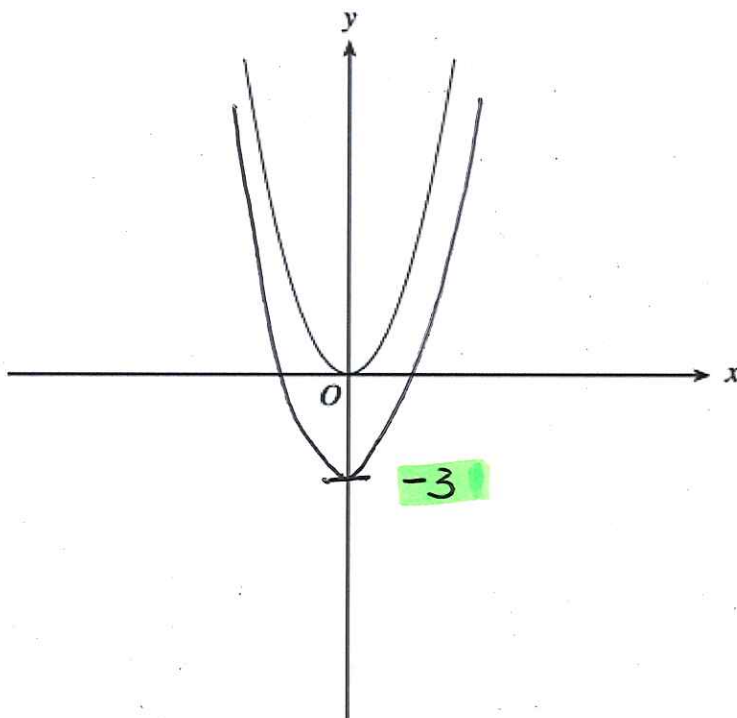
[2]



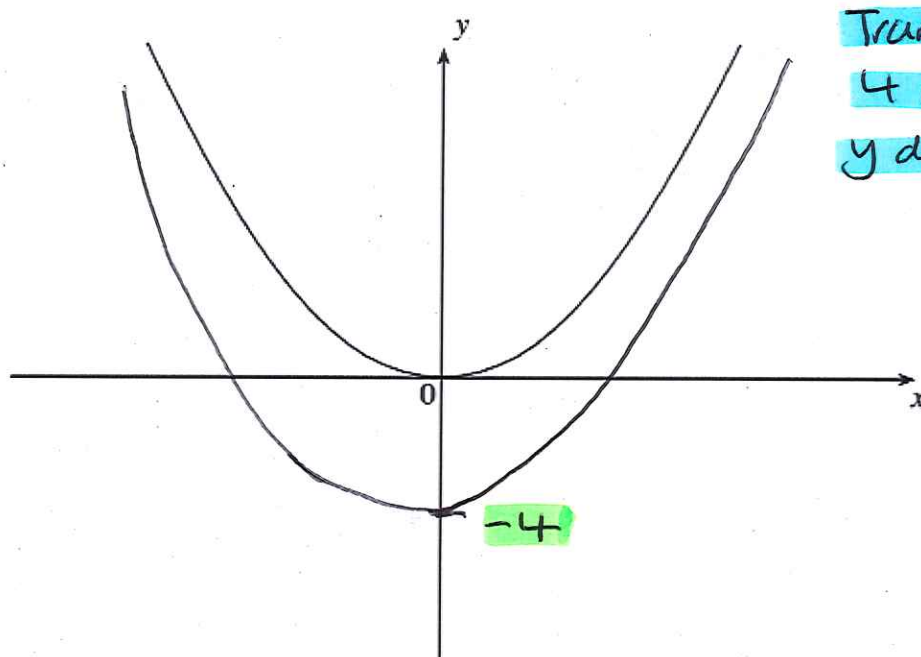
- (c) The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = f(x) - 3$.
Indicate the coordinates of one point on the curve.

Translation, 3 down
 y direction

[2]



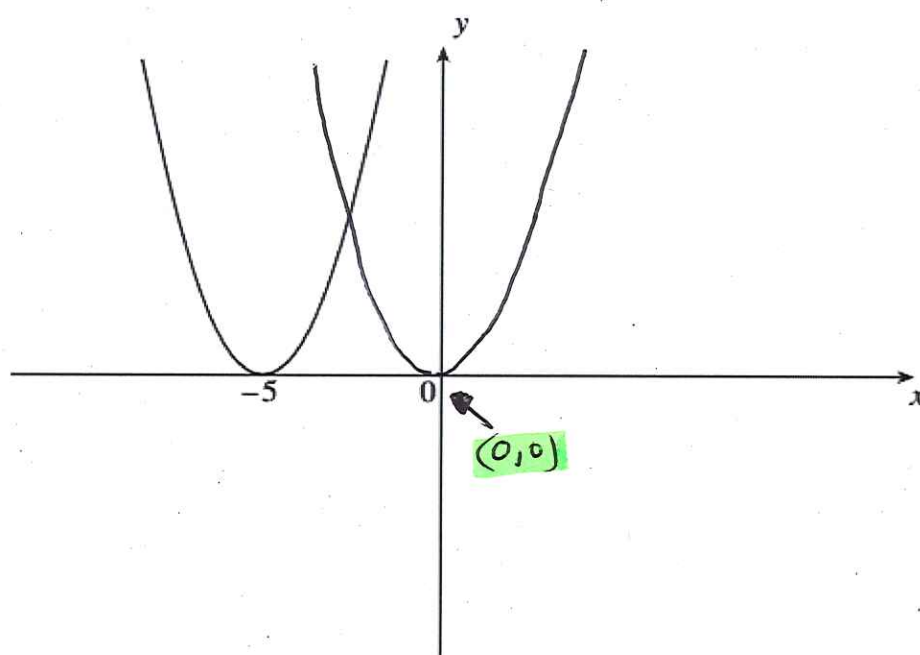
5. (a) The diagram shows a sketch of $y = x^2$.
On the same diagram sketch the curve $y = x^2 - 4$.
Mark clearly the coordinates of the point where the curve meets the y-axis.



[2]

- (b) The diagram shows the sketch of $y = f(x)$.
On the same diagram sketch the curve $y = f(x - 5)$.
Mark clearly the point where the curve meets the x-axis.

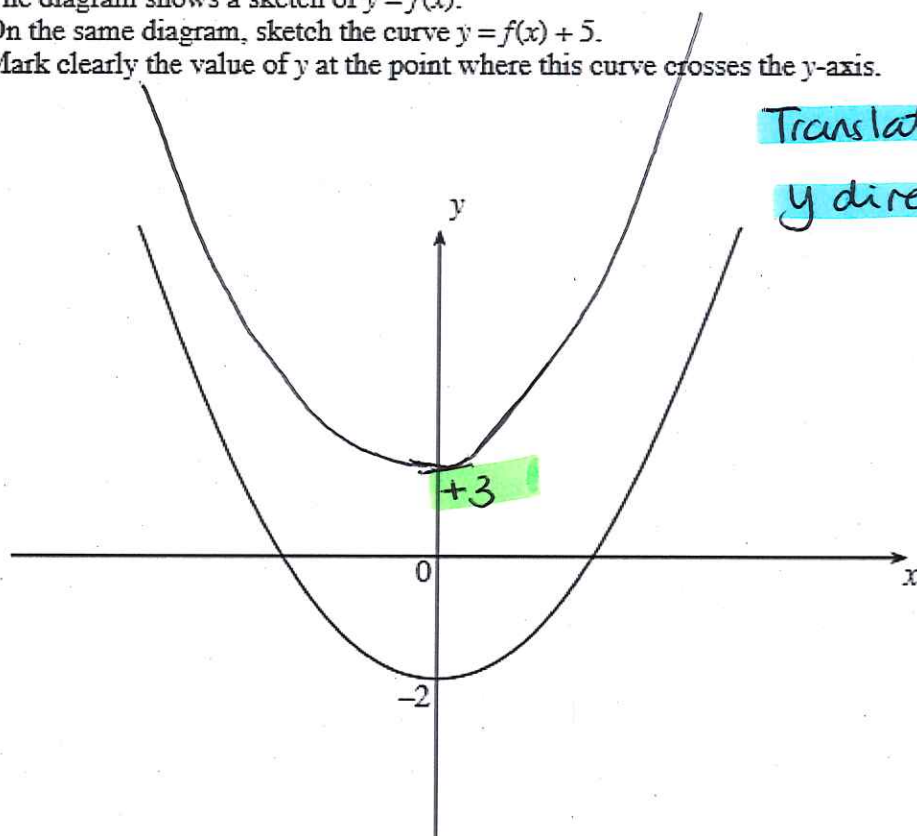
Translation, +5
x direction



[2]

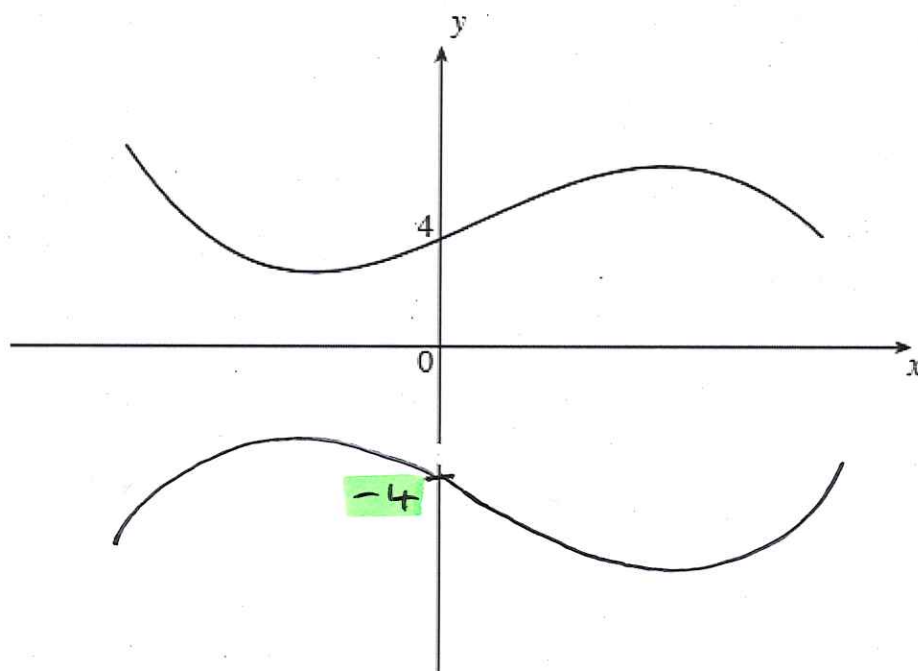
6.

- (a) The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = f(x) + 5$.
Mark clearly the value of y at the point where this curve crosses the y -axis.



[2]

- (b) The diagram shows a sketch of $y = g(x)$.
On the same diagram, sketch the curve $y = -g(x)$.
Mark clearly the value of y at the point where this curve crosses the y -axis.



[2]

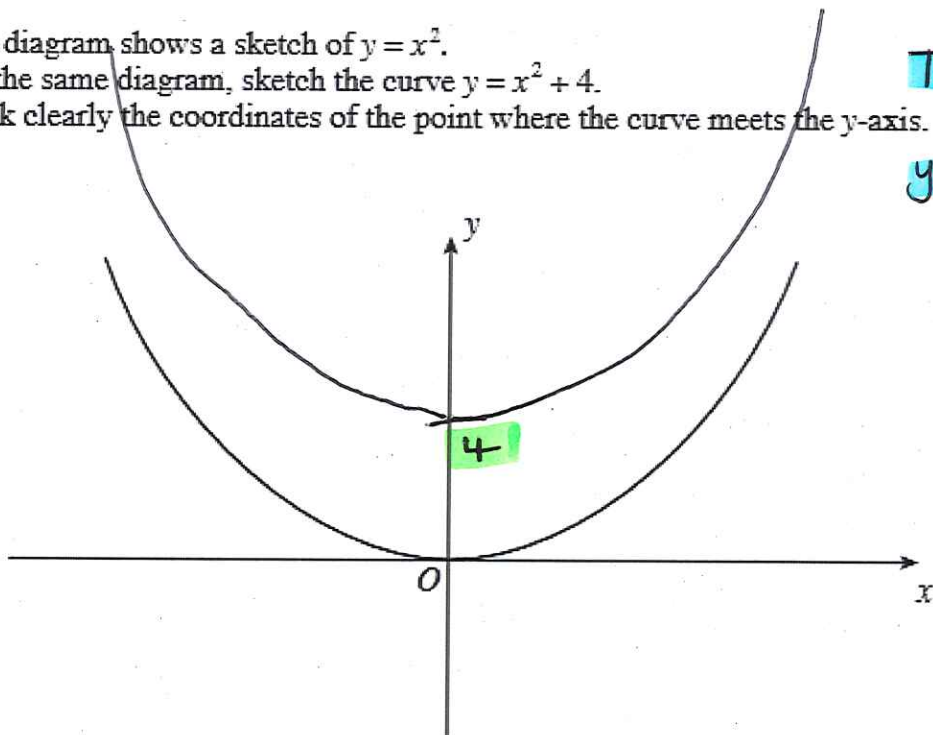
7. (a)

The diagram shows a sketch of $y = x^2$.

On the same diagram, sketch the curve $y = x^2 + 4$.

Mark clearly the coordinates of the point where the curve meets the y-axis.

Translation
+ 4
y direction



[2]

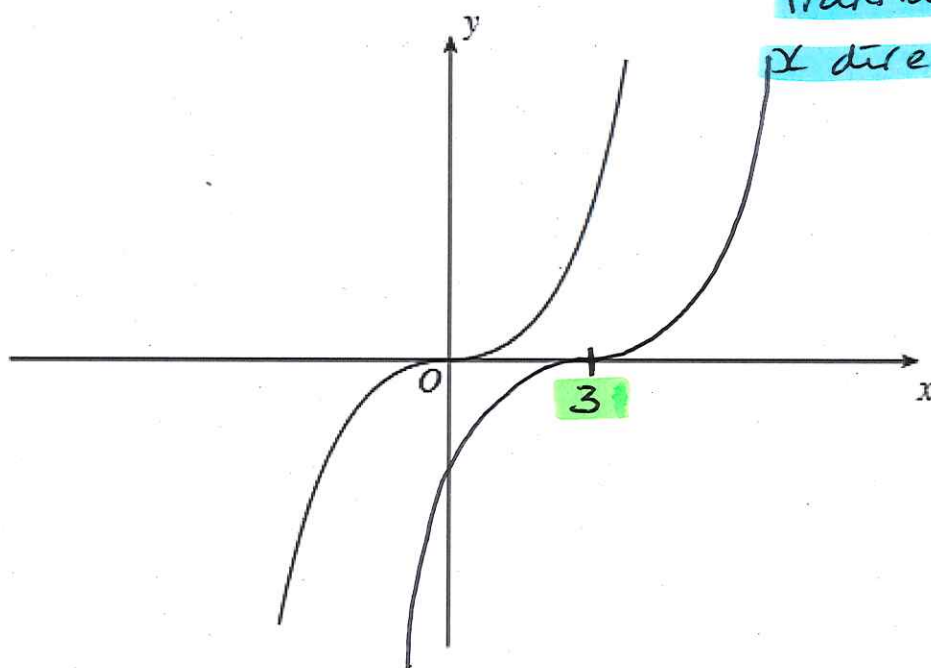
(b)

The diagram shows the sketch of $y = f(x)$.

On the same diagram sketch the curve $y = f(x - 3)$.

Mark clearly the co-ordinates of the point where the curve meets the x-axis.

Translation, + 3
x direction



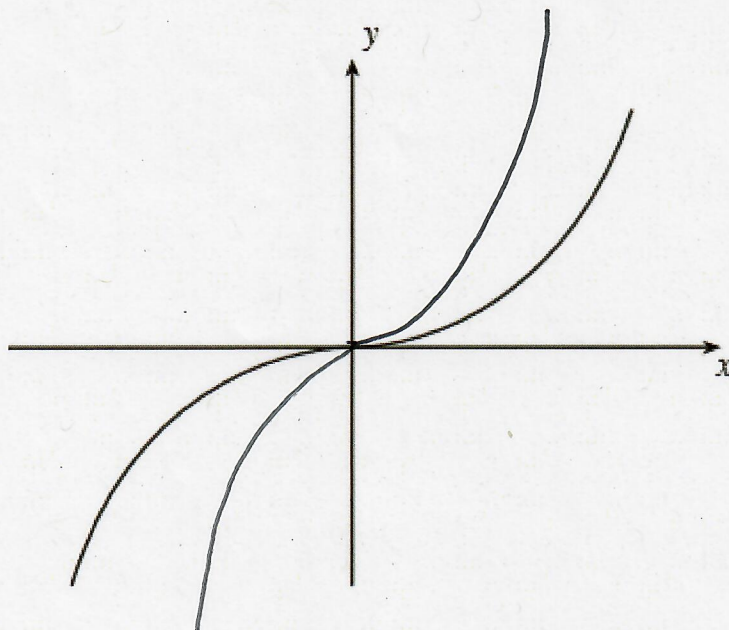
[2]

8. (a) The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = 3f(x)$.

stretch $\times 3$

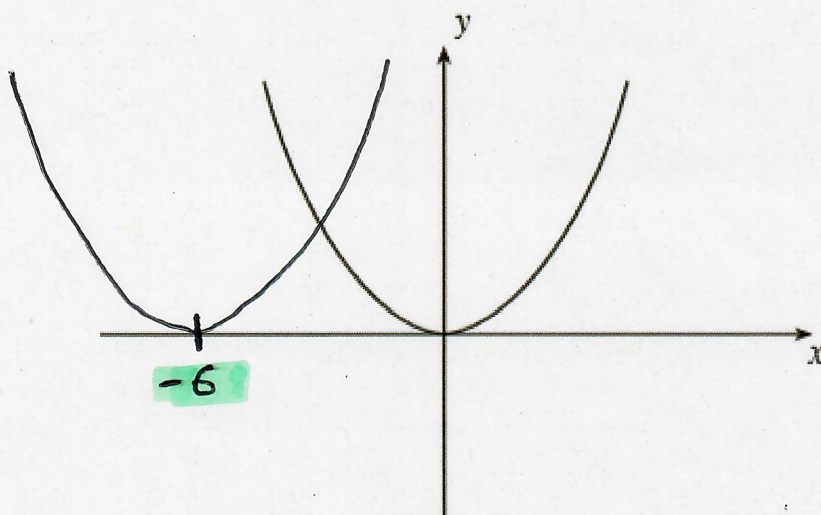
y direction

[1]



- (b) The diagram shows a sketch of $y = g(x)$. Translation, 6 left, x direction
On the same diagram, sketch the curve $y = g(x + 6)$. Mark clearly the coordinates of the point where the curve meets the x-axis.

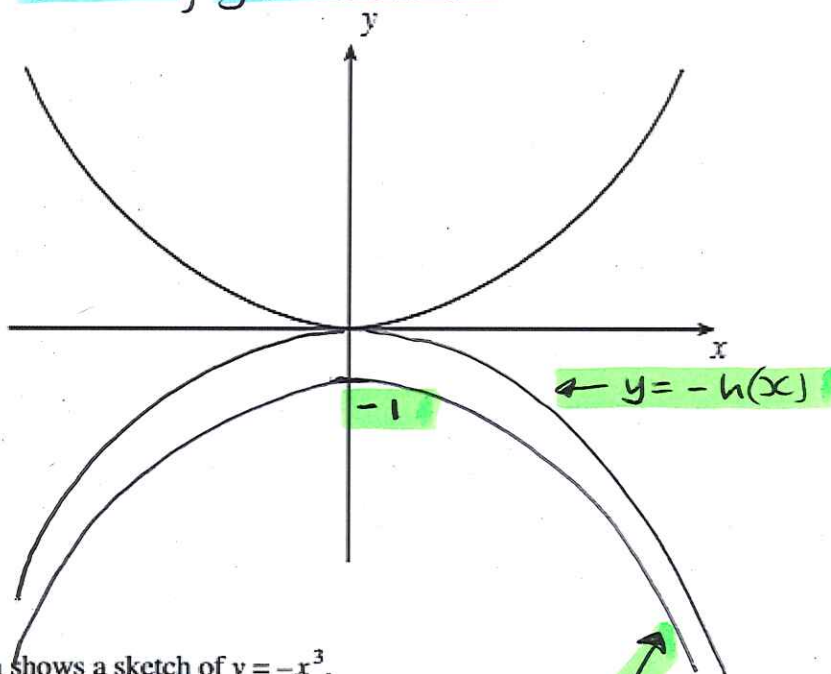
[2]



- (c) The diagram shows the sketch of $y = h(x)$.
On the same diagram sketch the curves

- (i) $y = -h(x)$, and reflection across x axis
(ii) $y = -h(x) - 1$, mark clearly the coordinates of the point where the curve crosses the y -axis. reflection across x axis, then translation down 1, y direction.

[3]



9. The diagram shows a sketch of $y = -x^3$.
On the same diagram, sketch the curve $y = -2x^3$.

$y = -h(x) - 1$

[1]

x2 stretch y direction

