4.5) Translating graphs

Worked example	Your turn
Describe the effect on the graph of $y = f(x)$ of:	Describe the effect on the graph of $y = f(x)$ of:
$f(x + 9)$	$f(x + 2)$
	Translation by vector $\begin{pmatrix} -2 \\ 0 \end{pmatrix}$
$f(x - 8)$	$f(x - 3)$
	Translation by vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$
$f(x) + 7$	$f(x) + 4$
	Translation by vector $\begin{pmatrix} 0 \\ 4 \end{pmatrix}$
$f(x) - 6$	$f(x) - 5$
	Translation by vector $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

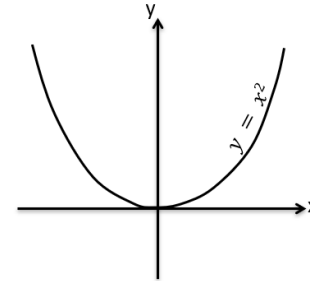| Worked example	Your turn
Sketch:	Sketch:

Worked example

Sketch:

$$y = -x^2$$

$$y = -x^2 - 3$$

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

Your turn

Sketch:

$$y = x^2$$

$$y = x^2 + 2$$
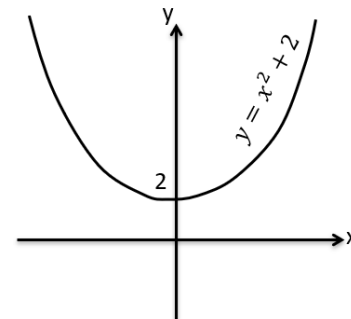
$$y = (x + 2)^2$$
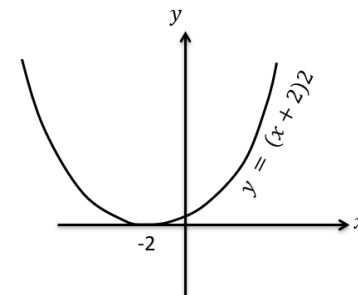
Worked example	Your turn
$$f(x) = -x^3$$	$$g(x) = x^3$$
Sketch:	Sketch:
$$f(x - 3)$$	$$g(x + 2)$$
	$(0, 8)$ $(-2, 0)$
$$f(x) + 2$$	$$g(x) - 3$$
	$(0, -3)$
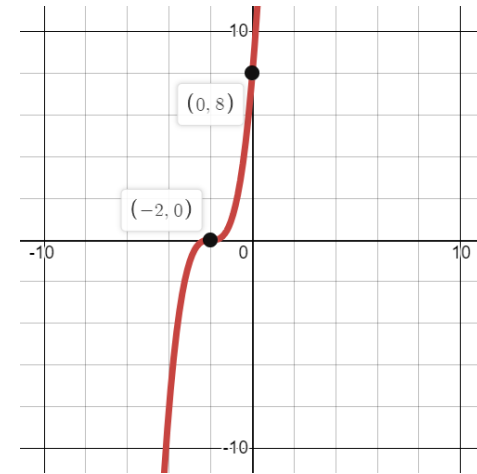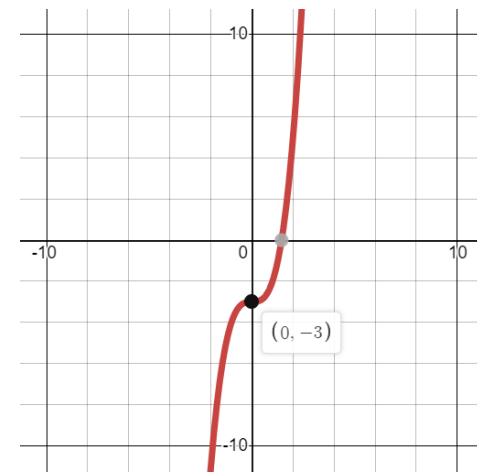
Worked example | Your turn

Worked example	Your turn
$f(x) = x(x + 3)$	$g(x) = x(x - 2)$
Sketch:	Sketch:
$f(x - 3)$	$g(x + 1)$
	(−1, 0) (1, 0) (0, −1)
$f(x) + 2$	$g(x) - 1$
	(0, −1) (1, −2)
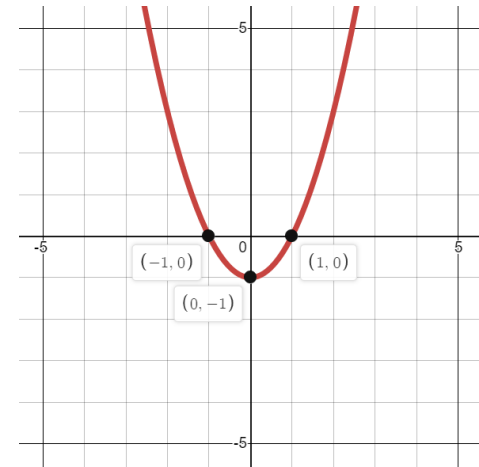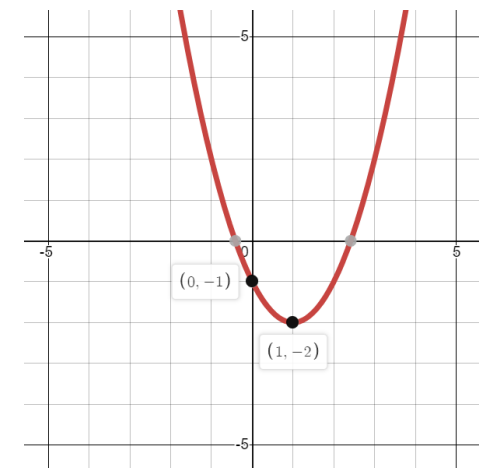
Worked example	Your turn
$$f(x) = -\dfrac{2}{x}$$	$$g(x) = \dfrac{3}{x}$$
Sketch:	Sketch:
$$f(x - 3)$$	$$g(x + 1)$$
	(0, 3)
$$f(x) + 2$$	$$g(x) - 1$$
	(3, 0)
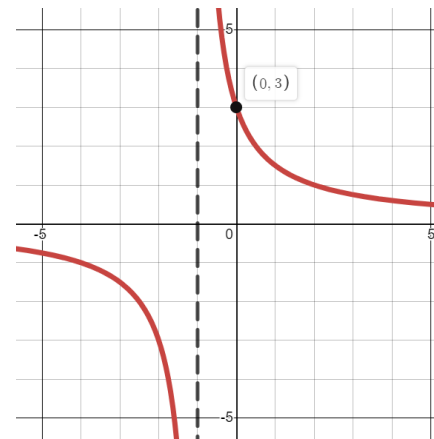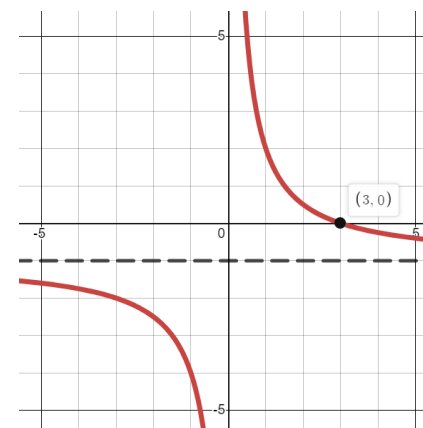
Worked example	Your turn
The point with coordinates $(-1.5, 0)$ lies on the curve with equation $$y = (x + a)^3 + 6(x + a)^2 + 9(x + a)$$ where a is a constant. Find the two possible values of a	The point with coordinates $(-2, 0)$ lies on the curve with equation $$y = (x + a)^3 + 8(x + a)^2 + 16(x + a)$$ where a is a constant. Find the two possible values of a $$a = \pm 2$$

Worked example	Your turn
Sketch $y = x(x - 3)$. On the same axes, sketch $y = (x + a)(x + a - 3)$, where $a > 3$.	Sketch $y = x(x + 2)$. On the same axes, sketch $y = (x - a)(x - a + 2)$, where $a > 2$.