

There are 6 transformations.

How many can you remember?

Of those, for how many could you write the appropriate formula?

$$y = 2x - 3$$

$$y = 2\left(\frac{x}{3}\right) - 3$$

Handwritten notes: "H st" above the equation, and "3" with a pink bracket to its right.

Vertical translation

$$f(x) + k$$

x-axis

refl

$$-f(x)$$

Horiz trans

$$f(x-h)$$

Vert stretch

$$a \cdot f(x)$$

y-axis

refl

$$f(-x)$$

Horiz stretch

$$f\left(\frac{x}{b}\right)$$

Today's learning objective:

By the end of class, I will be able to solve problems with all 6 transformations.

Today's language objective:

Vertical translation

Horizontal translation

X-axis reflection

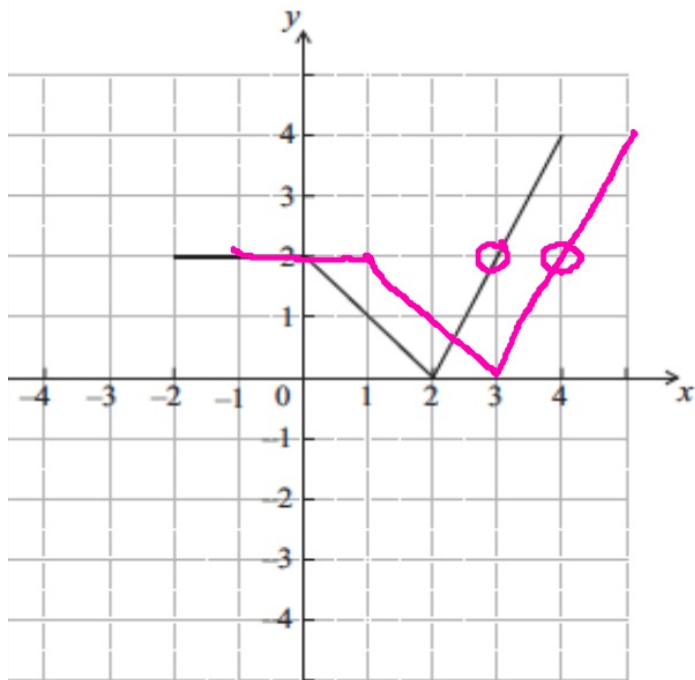
Y-axis reflection

Vertical stretch

Horizontal stretch

5]

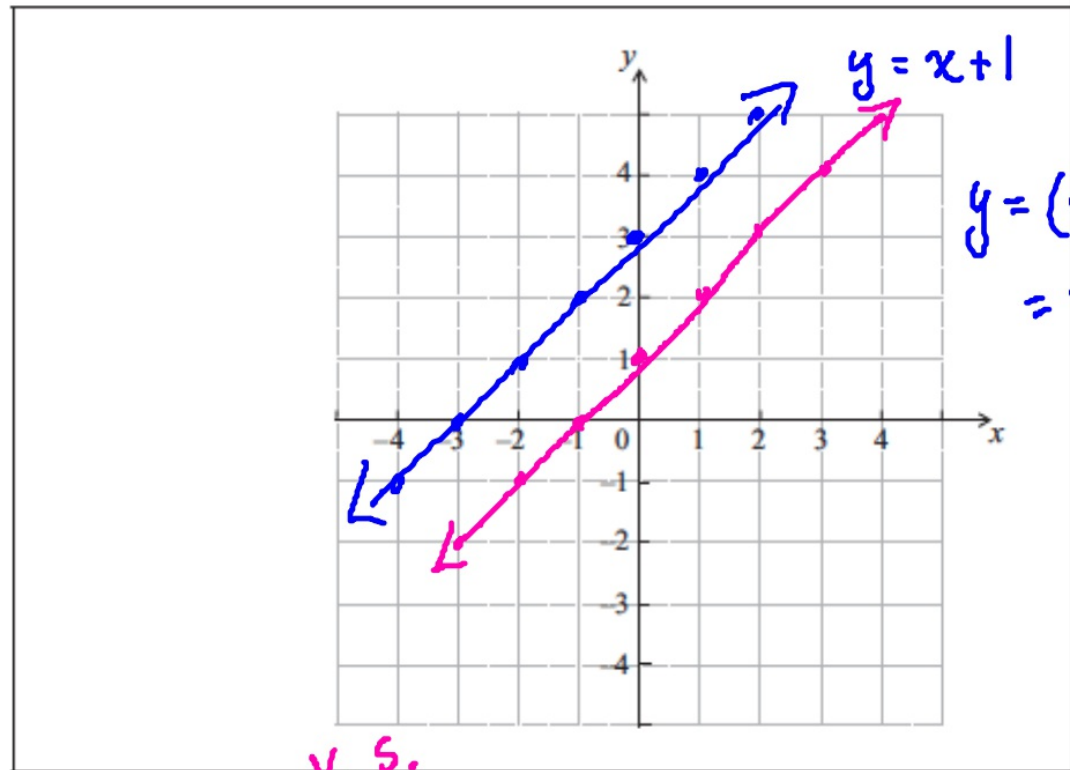
v shows the graph of a function $f(x)$, for $-2 \leq x \leq 4$.



(This question continu

39.)

(a) Let $h(x) = f(-x)$. Sketch the graph of h on the grid below.



v. s.

(b) Let $g(x) = \frac{1}{2}f(x-1)$. The point A(3, 2) on the graph of f is transformed to the point P on the graph of g . Find the coordinates of P.

(4, 1)

.....

.....

.....

25.) Let $f(x) = x^2 + 4$ and $g(x) = x - 1$.

(a) Find $(f \circ g)(x)$.

$$(x-1)^2 + 4 \quad \begin{matrix} 1, 4 \\ \rightarrow 3 \end{matrix} \quad \begin{matrix} -1 \\ (4, 3) \end{matrix} \quad (2)$$

$$\boxed{x^2 - 2x + 5}$$

The vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ translates the graph of $(f \circ g)$ to the graph of h .

b: translated $h(x)$?

(b) Find the coordinates of the vertex of the graph of h .

$$(x-3)^2 - 2(x-3) + 5 - 1$$

$$x^2 - 8x + 19 \quad (3)$$

(c) Show that $h(x) = x^2 - 8x + 19$.

$$(4, 3) \quad \frac{-b}{2a} \quad (2)$$

$$h'(x) = 2x - 8 = 2$$

(d) The line $y = 2x - 6$ is a tangent to the graph of h at the point P. Find the x -coordinate of P.

$$(5, \quad \boxed{x=5})$$

(5)

(Total 12 marks)

6.) Let $f(x) = 3x^2$. The graph of f is translated 1 unit to the right and 2 units down.
The graph of g is the image of the graph of f after this translation.

(a) Write down the coordinates of the vertex of the graph of g .

$$3(x-1)^2 - 2$$

(2)

(b) Express g in the form $g(x) = 3(x-p)^2 + q$.

$$(1, -2)$$

(2)

The graph of h is the reflection of the graph of g in the x -axis.

(c) Write down the coordinates of the vertex of the graph of h .

$$(1, 2)$$

(2)

(Total 6 marks)



28.) Let $f(x) = x^2$ and $g(x) = 2(x-1)^2$.

- (a) The graph of g can be obtained from the graph of f using two transformations. Give a full geometric description of each of the two transformations.

Horiz transl 1 unit right; Vst of 2

- (b) The graph of g is translated by the vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ to give the graph of h .

The point $(-1, 1)$ on the graph of f is translated to the point P on the graph of h . Find the coordinates of P .

$$h = 2(x-4)^2 - 2$$
$$(3, 0)$$

(Total

44.) Let $f(x) = 3(x + 1)^2 - 12$.

(a) Show that $f(x) = 3x^2 + 6x - 9$.

(2)

(b) For the graph of f

(i) write down the coordinates of the vertex;

(ii) write down the **equation** of the axis of symmetry;

(iii) write down the y-intercept;

(iv) find both x-intercepts.

(8)

(c) **Hence** sketch the graph of f .

(2)

(d) Let $g(x) = x^2$. The graph of f may be obtained from the graph of g by the two transformations:

a stretch of scale factor t in the y-direction

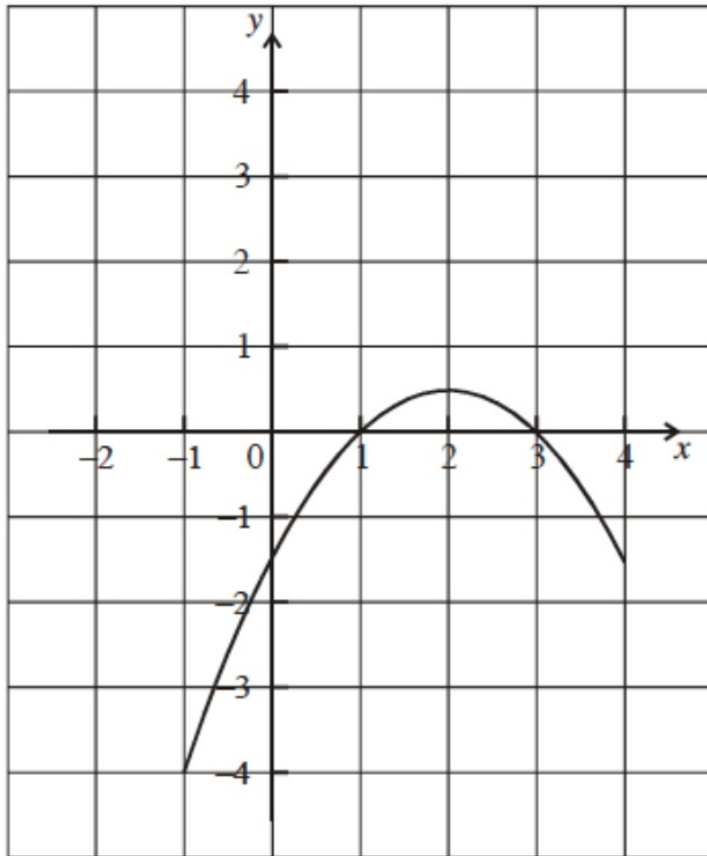
followed by

a translation of $\begin{pmatrix} p \\ q \end{pmatrix}$.

Find $\begin{pmatrix} p \\ q \end{pmatrix}$ and the value of t . = 3

(3)

46.) Part of the graph of a function f is shown in the diagram below.



(a) On the same diagram sketch the graph of $y = -f(x)$.

(2)

(b) Let $g(x) = f(x + 3)$.

(i) Find $g(-3)$.

(ii) Describe **fully** the transformation that maps the graph of f to the graph of g .

(4)

(Total 6 marks)

55.) The quadratic function f is defined by $f(x) = 3x^2 - 12x + 11$.

(a) Write f in the form $f(x) = 3(x - h)^2 - k$.

(3)

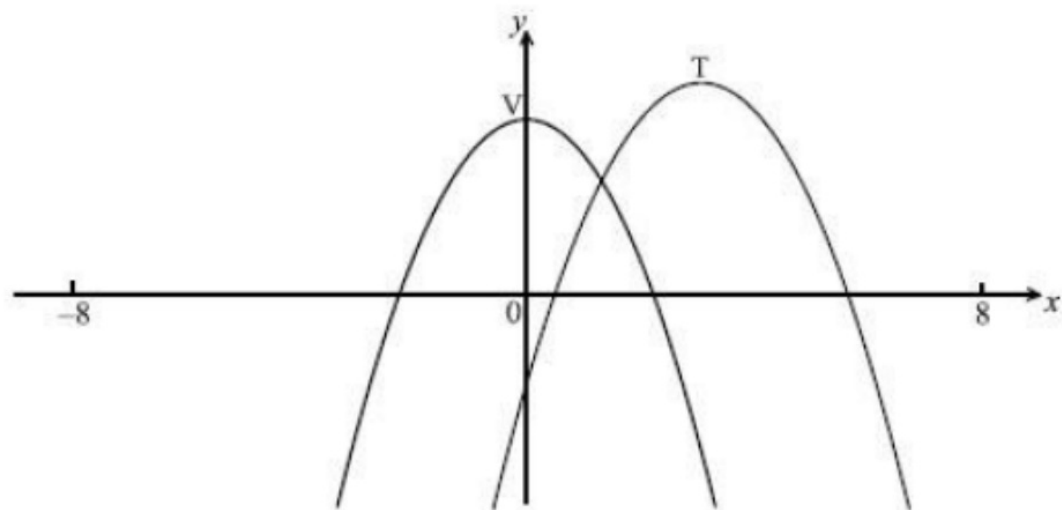
(b) The graph of f is translated 3 units in the positive x -direction and 5 units in the positive y -direction. Find the function g for the translated graph, giving your answer in the form $g(x) = 3(x - p)^2 + q$.

(3)

(Total 6 marks)

75.) The following diagram shows part of the graph of $f(x) = 5 - x^2$ with vertex V (0, 5).

Its image $y = g(x)$ after a translation with vector $\begin{pmatrix} h \\ k \end{pmatrix}$ has vertex T (3, 6).



(a) Write down the value of

(i) h ;

(ii) k .

(2)

(b) Write down an expression for $g(x)$.

(2)

(c) On the same diagram, sketch the graph of $y = g(-x)$.

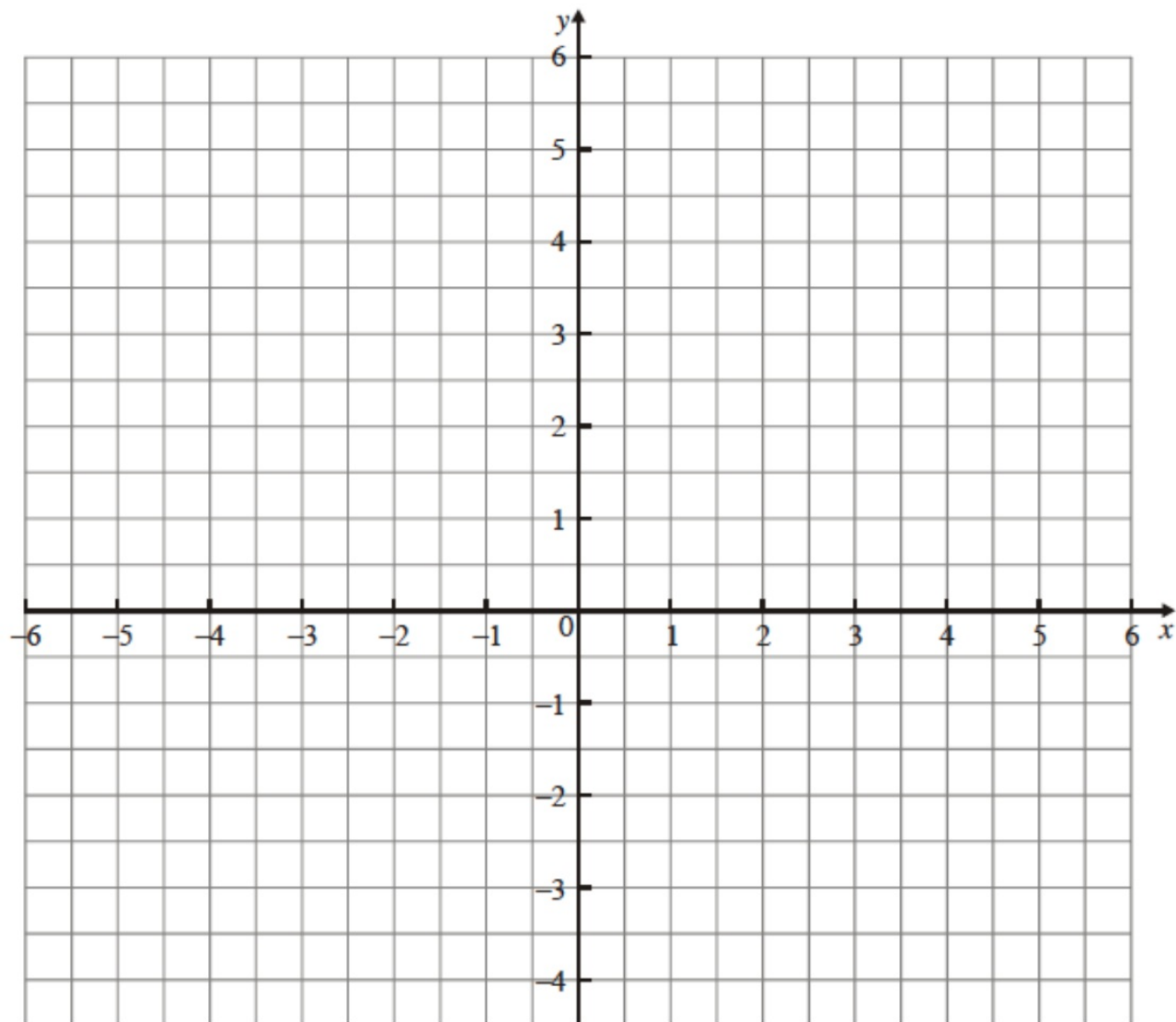
(2)

(Total 6 marks)

107.) Let $f(x) = 2x + 1$.

(a) On the grid below draw the graph of $f(x)$ for $0 \leq x \leq 2$.

(b) Let $g(x) = f(x+3) - 2$. On the grid below draw the graph of $g(x)$ for $-3 \leq x \leq -1$.



Let $g(x) = \frac{1}{2}f(x-1)$. The point $A(3, 2)$ on the graph of f is transformed to the point P on the graph of g . Find the coordinates of P .

[Maximum mark: 14]

Let $f(x) = \frac{1}{x}$, $x \neq 0$.

(a) Sketch the graph of f .

[2 marks]

The graph of f is transformed to the graph of g by a translation of $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

(b) Find an expression for $g(x)$.

[2 marks]

(c) (i) Find the intercepts of g .

(ii) Write down the equations of the asymptotes of g .

(iii) Sketch the graph of g .

[10 marks]