1. 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.

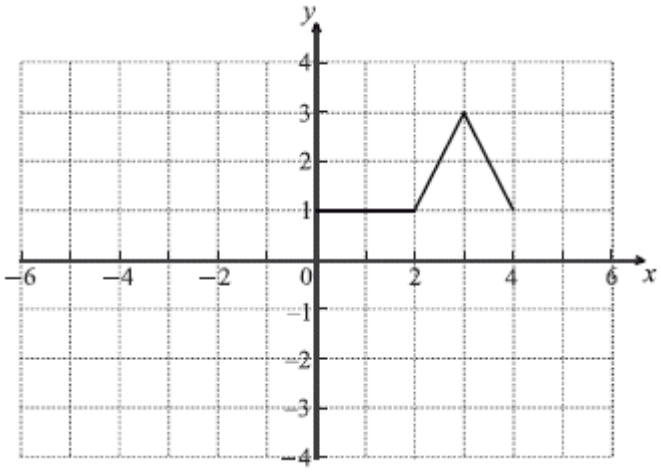
(2)

(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.

(4)
(Total 6 marks)

2. Consider the graph of f shown below.



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

(2)

The following four diagrams show **images** of f under different transformations.

Diagram A

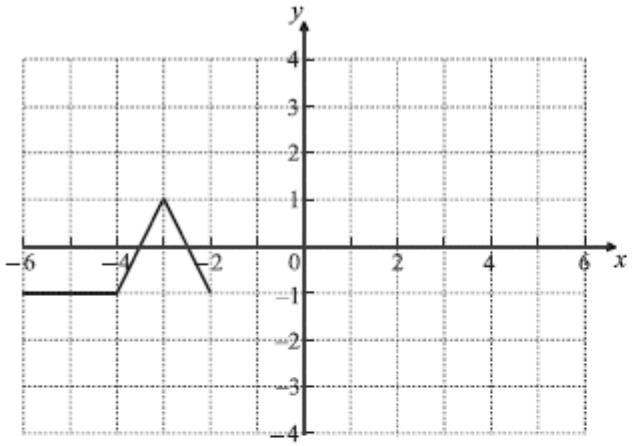


Diagram B

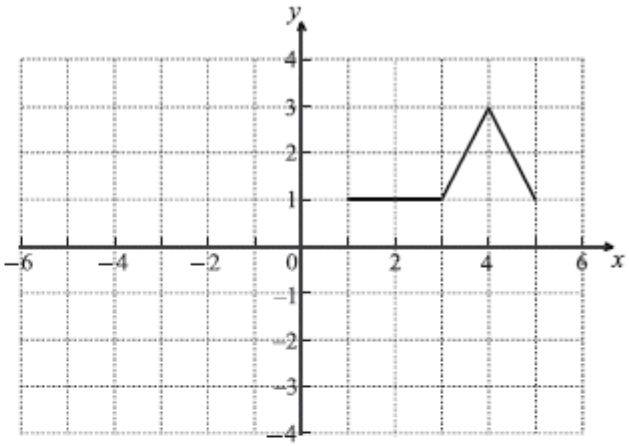


Diagram C

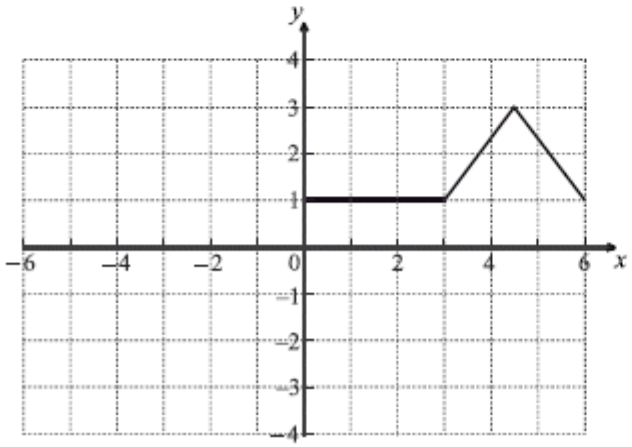
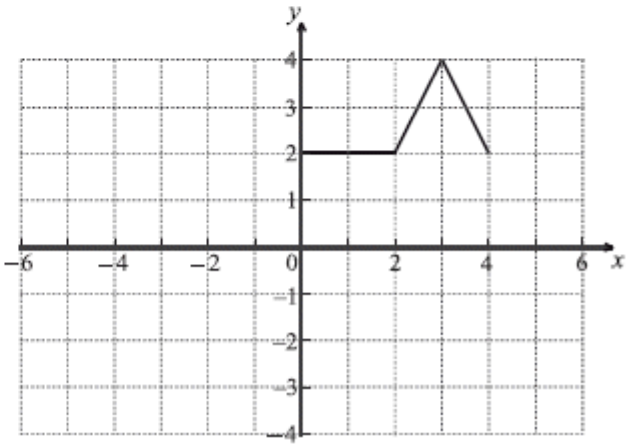


Diagram D



(b) Complete the following table.

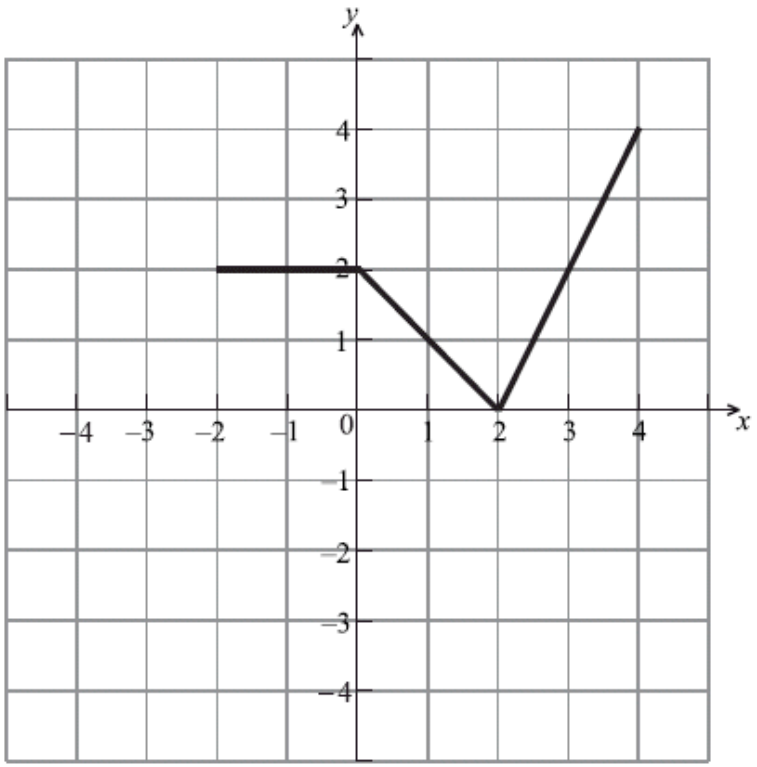
Description of transformation	Diagram letter
Horizontal stretch with scale factor 1.5	
Maps f to $f(x) + 1$	

(2)

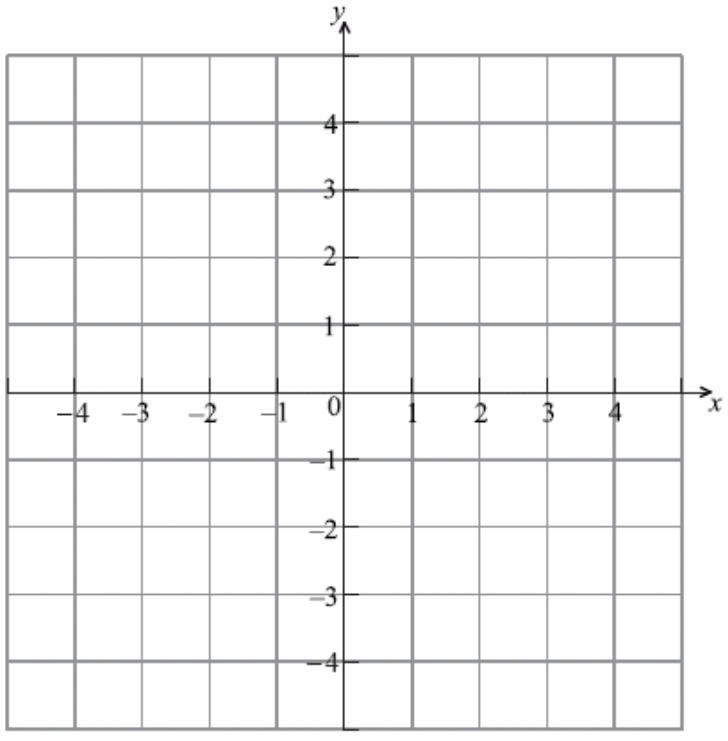
(c) Give a full geometric description of the transformation that gives the image in Diagram A.

(2)
(Total 6 marks)

3. The diagram below shows the graph of a function $f(x)$, for $-2 \leq x \leq 4$.



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



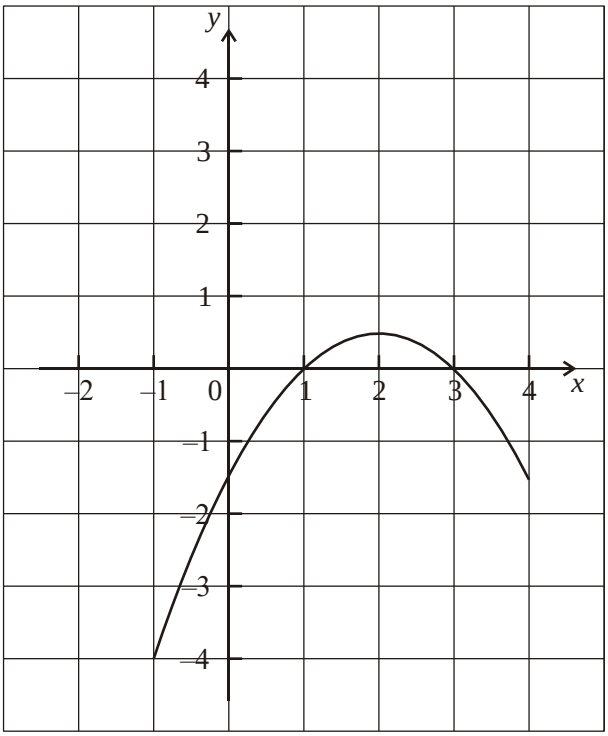
(2)

(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.

(3)

(Total 5 marks)

4. 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)

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

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

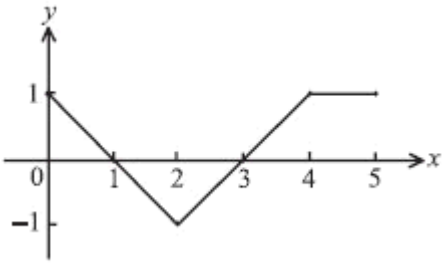
(3)

(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 $g(x) = 3(x - p)^2 + q$.

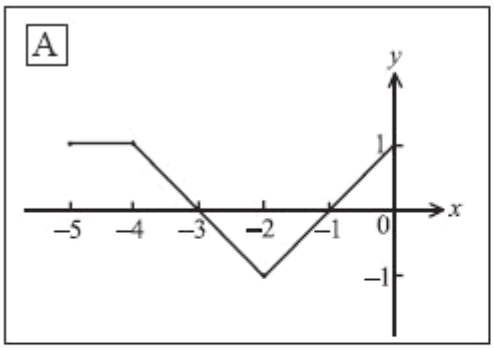
(3)

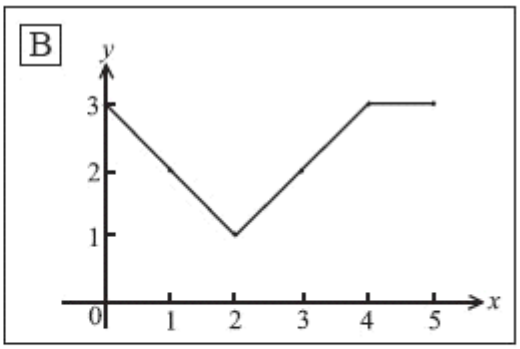
(Total 6 marks)

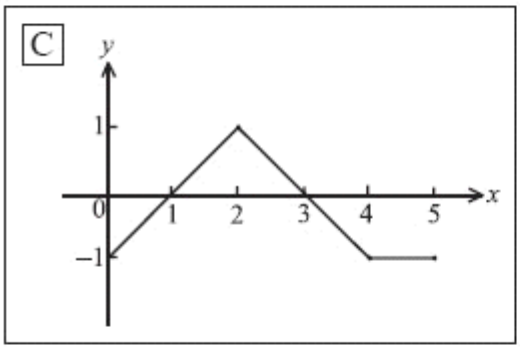
6. The following diagram shows part of the graph of $f(x)$.

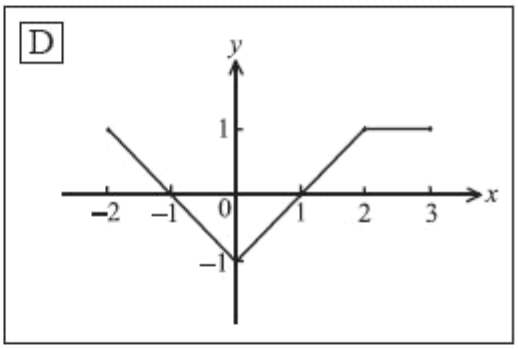


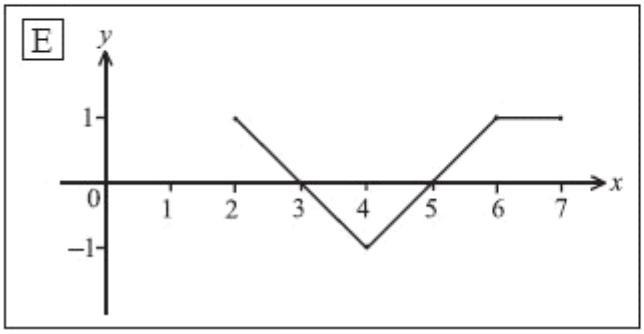
Consider the five graphs in the diagrams labelled A, B, C, D, E below.











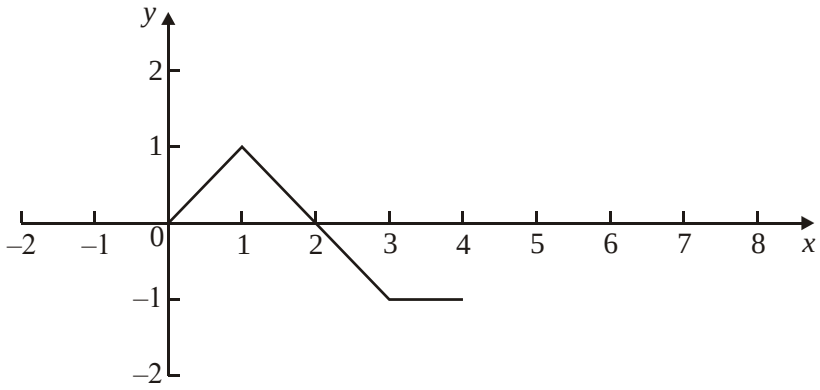
(a) Which diagram is the graph of $f(x + 2)$?

(b) Which diagram is the graph of $-f(x)$?

(c) Which diagram is the graph of $f(-x)$

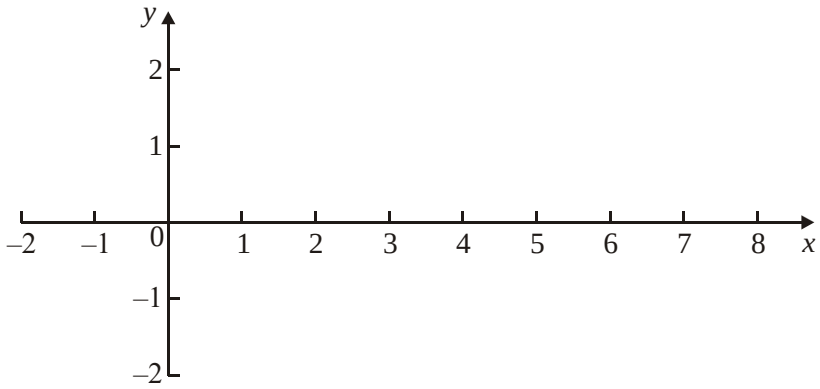
(Total 6 marks)

7. The graph of $y = f(x)$ is shown in the diagram.

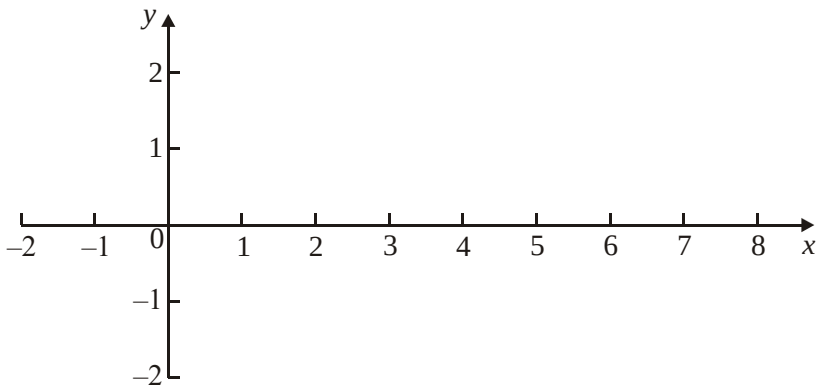


(a) On each of the following diagrams draw the required graph,

(i) $y = 2f(x)$;



(ii) $y = f(x - 3)$.



(b) The point A $(3, -1)$ is on the graph of f. The point A′ is the corresponding point on the graph of $y = -f(x) + 1$. Find the coordinates of A′.