**1.** Consider $f(x) = \sqrt{x-5}$ .

(a) Find

(i) $f(11)$;

(ii) $f(86)$;

(iii) $f(5)$.

**(3)**

(b) Find the values of $x$ for which $f$ is undefined.

**(2)**

(c) Let $g(x) = x^2$. Find $(g \circ f)(x)$.

**(2)**
**(Total 7 marks)**

**2.** Let $f(x) = x^2$ and $g(x) = 2x - 3$.

(a) Find $g^{-1}(x)$.

**(2)**

(b) Find $(f \circ g)(4)$.

**(3)**
**(Total 5 marks)**

**3.** Let $f(x) = x^3 - 4$ and $g(x) = 2x$.

(a) Find $(g \circ f)(-2)$.

(b) Find $f^{-1}(x)$.

**(Total 6 marks)**

**4.** Let $g(x) = 3x - 2$, $h(x) = \frac{5x}{x-4}$, $x \neq 4$.

(a) Find an expression for $(h \circ g)(x)$. Simplify your answer.

(b) Solve the equation $(h \circ g)(x) = 0$.

**(Total 6 marks)**

**5.** Two functions $f$, $g$ are defined as follows:

$$f : x \to 3x + 5$$
$$g : x \to 2(1 - x)$$

Find

(a) $f^{-1}(2)$;

(b) $(g \circ f)(-4)$.

*Working:*

*Answers*:

(a) .....

(b) .....

**(Total 4 marks)**

**6.** 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)**

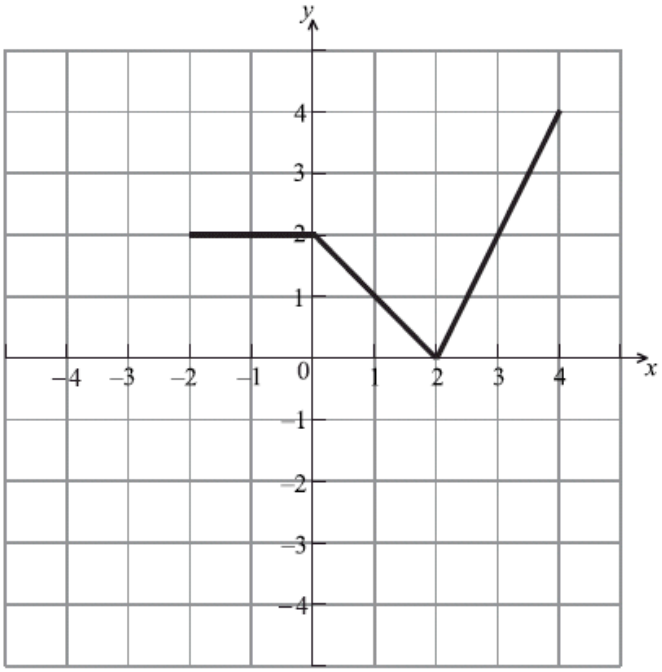
(b) The graph of $g$ is translated by the vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ to give the graph of $h$.

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.

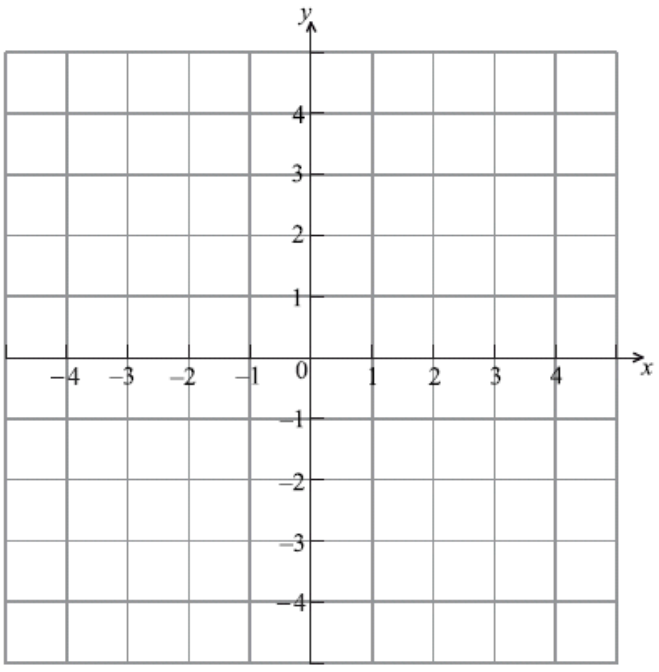
**(4)**

**(Total 6 marks)**

**7.** 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.



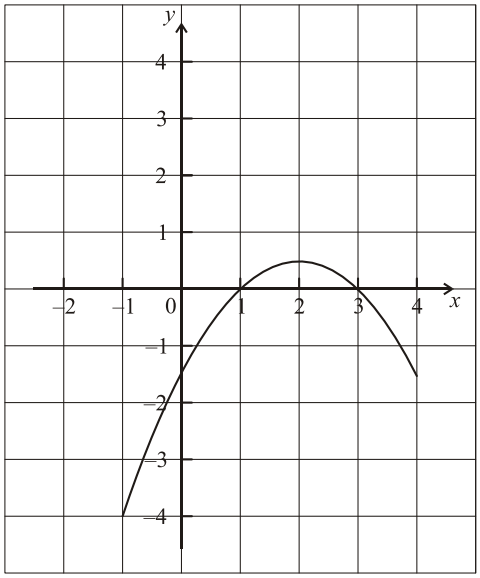

**(2)**

(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)**

**8.** 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 $g(x) = f(x + 3)$.

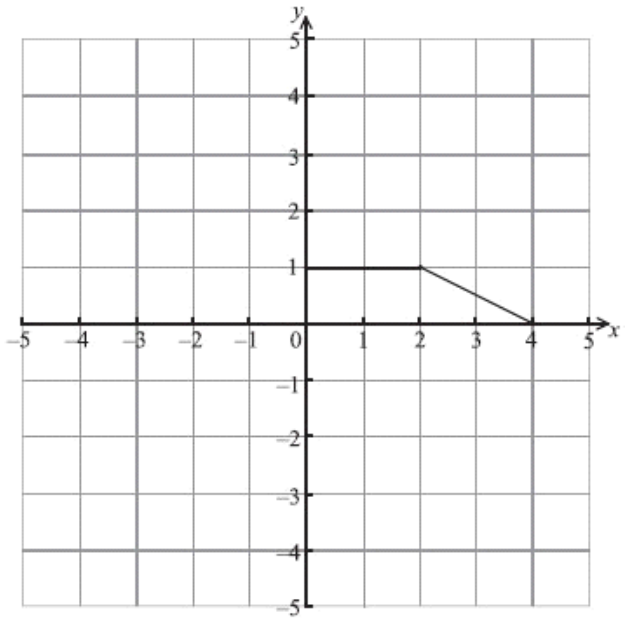
(i) Find $g(-3)$.

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

**(4)**

**(Total 6 marks)**

**9.** The graph of the function $y = f(x)$, $0 \leq x \leq 4$, is shown below.

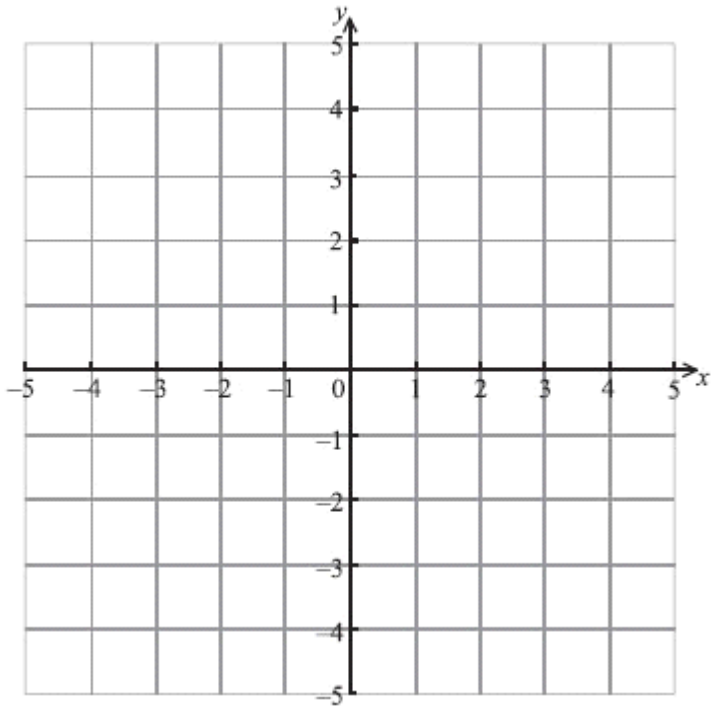



(a) Write down the value of

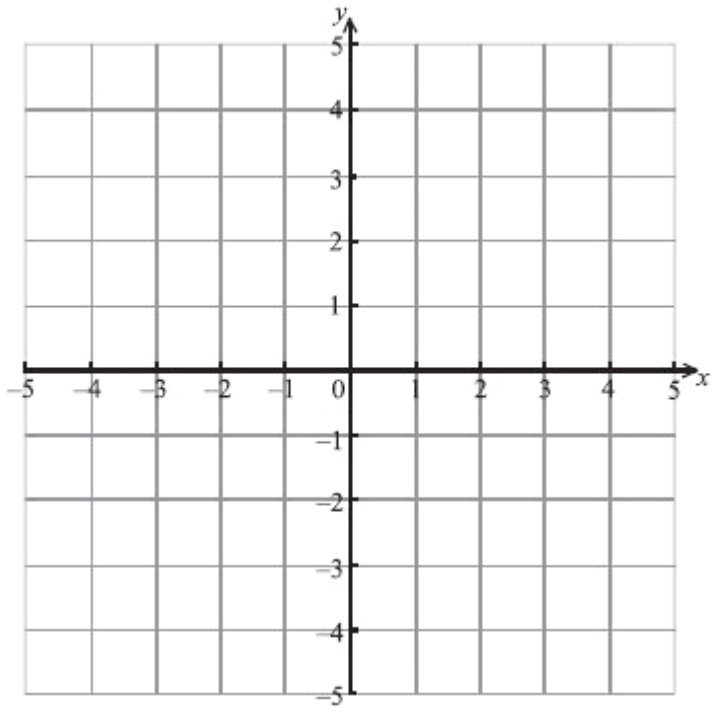
(i) $f^{-1}(0.5)$;

(ii) $f^{-1}(0)$.

(b) On the diagram below, draw the graph of $y = 3f(-x)$.

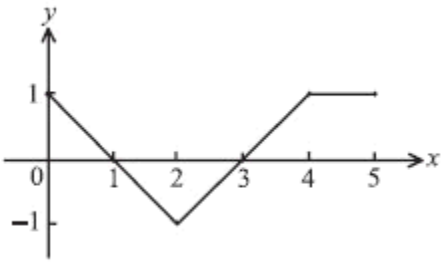



(c) On the diagram below, draw the graph of $y = f(2x)$.

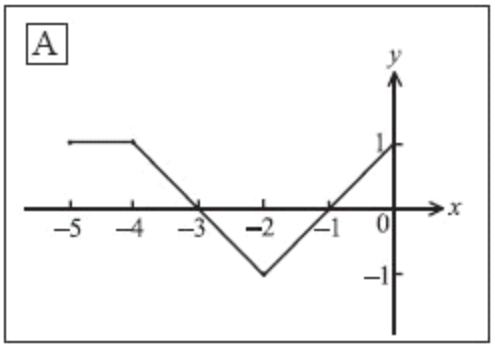


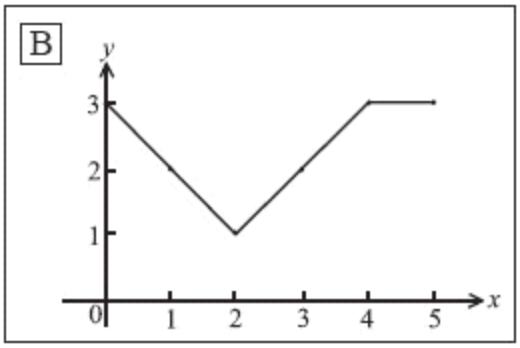

**(Total 6 marks)**

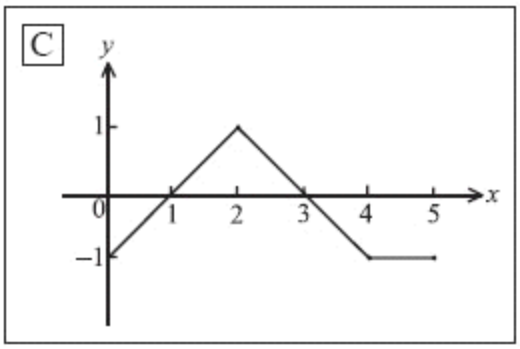
**10.** The following diagram shows part of the graph of $f(x)$.

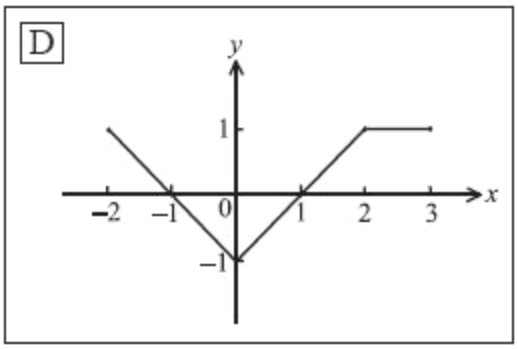


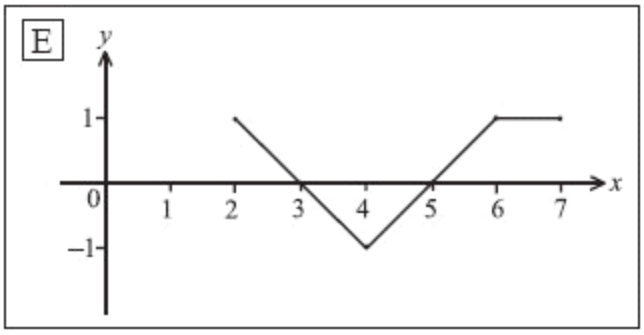

Consider the five graphs in the diagrams labelled A, B, C, D, E below.



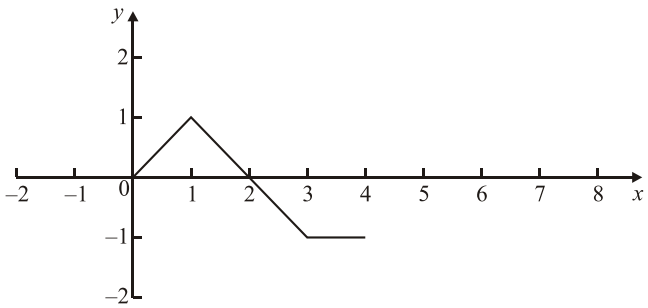

(a) Which diagram is the graph of $f(x+2)$ ?

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

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

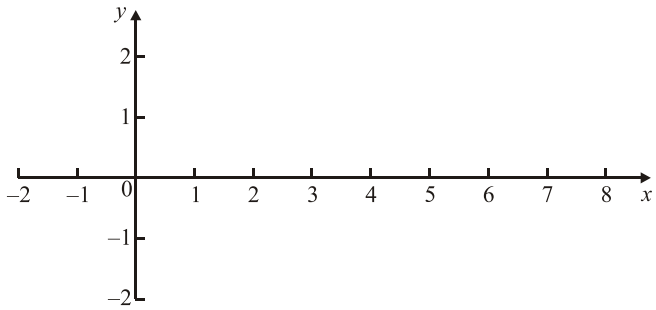
**(Total 6 marks)**

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

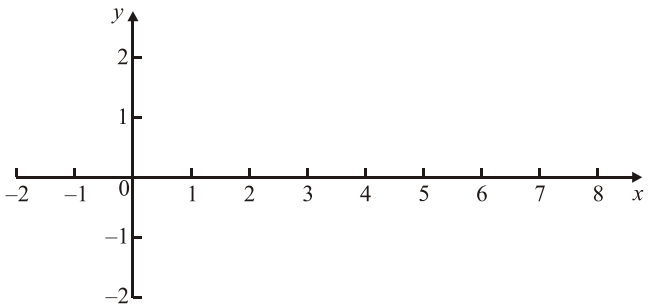



(a) On each of the following diagrams draw the required graph,

(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′.

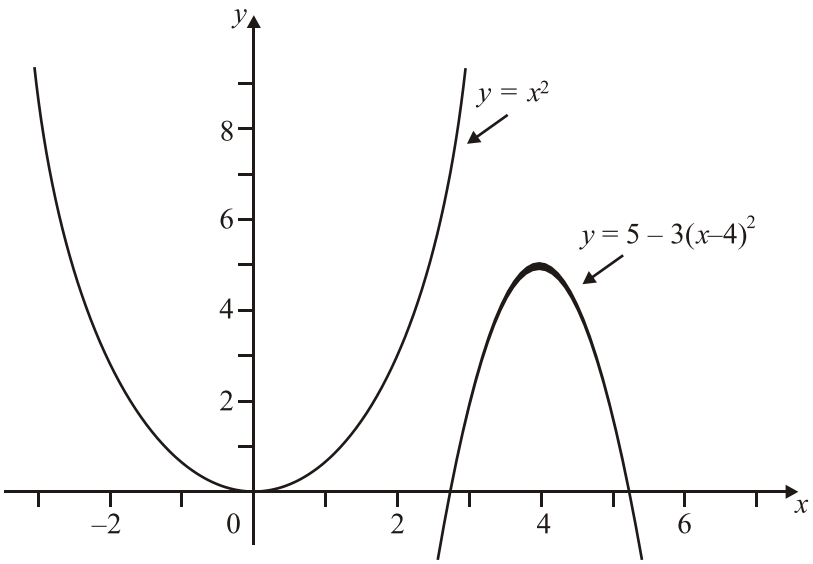
*Working:*

*Answer*:

(b) .....

**(Total 6 marks)**

**12.** The diagram shows parts of the graphs of $y = x^2$ and $y = 5 - 3(x - 4)^2$.




The graph of $y = x^2$ may be transformed into the graph of $y = 5 - 3(x - 4)^2$ by these transformations.

A reflection in the line $y = 0$ **followed by**
a vertical stretch with scale factor $k$ **followed by**
a horizontal translation of $p$ units **followed by**
a vertical translation of $q$ units.

Write down the value of

(a) $k$;

(b) $p$;

(c) $q$.

*Working:*

*Answers*:

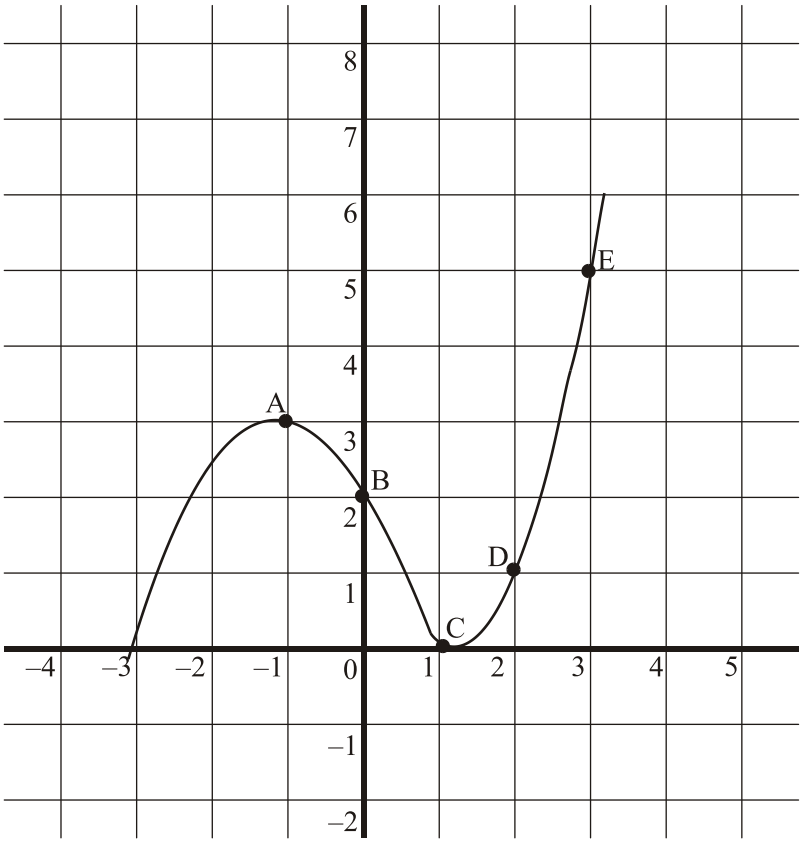
(a) .....

(b) .....

(c) .....

**(Total 4 marks)**

**13.** The sketch shows part of the graph of $y = f(x)$ which passes through the points A(–1, 3), B(0, 2), C(l, 0), D(2, 1) and E(3, 5).




A second function is defined by $g(x) = 2f(x - 1)$.

(a) Calculate $g(0)$, $g(1)$, $g(2)$ and $g(3)$.

(b) On the same axes, sketch the graph of the function $g(x)$.

*Working:*

*Answers*:

(a) .....

.....

**(Total 6 marks)**