18 The graph of $y = f(x)$ is shown on the grid.
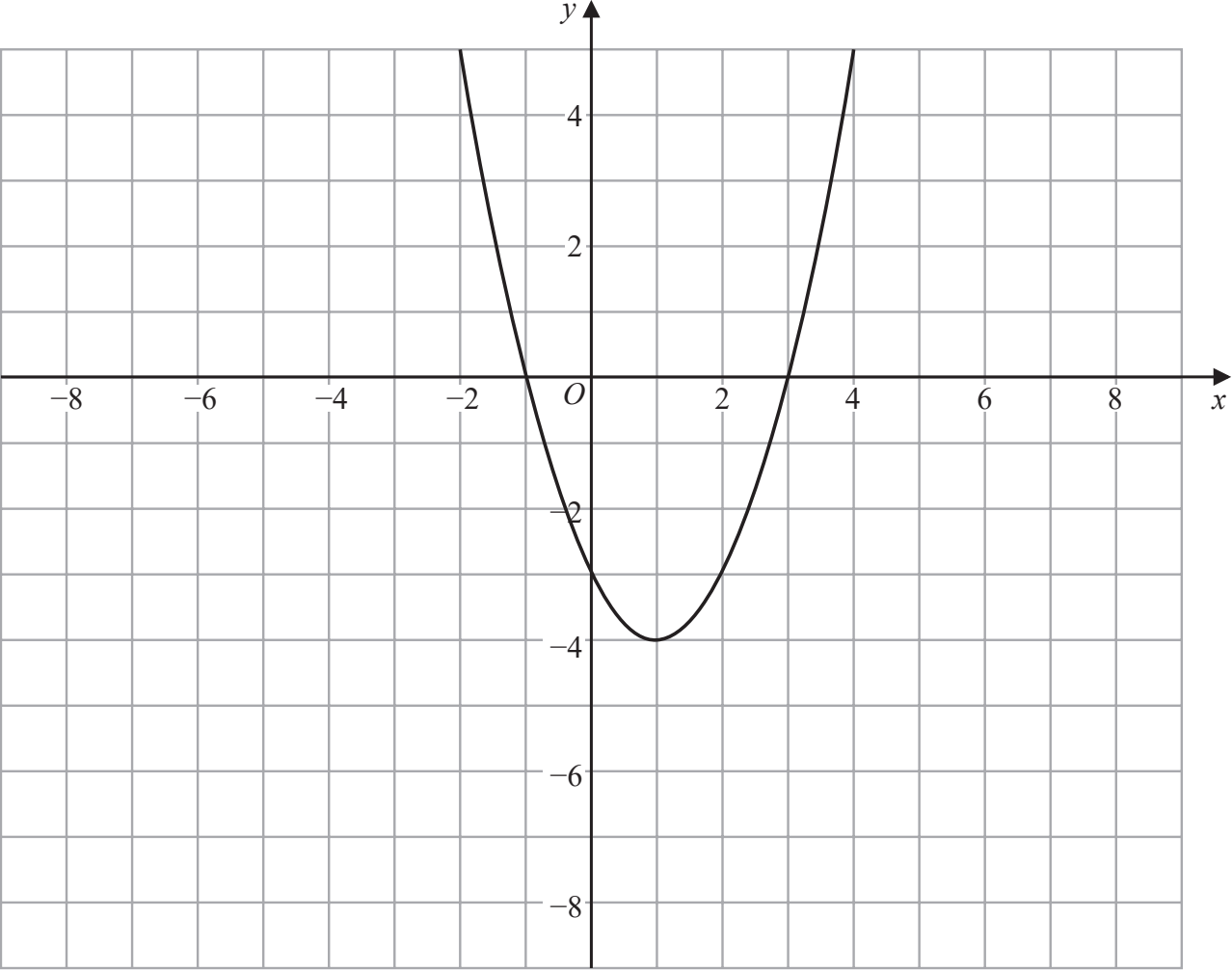

(a) On the grid above, sketch the graph of $y = f\left(\dfrac{1}{2}x\right)$

(2)

The graph of $y = f(x + k)$ is shown on the grid below.
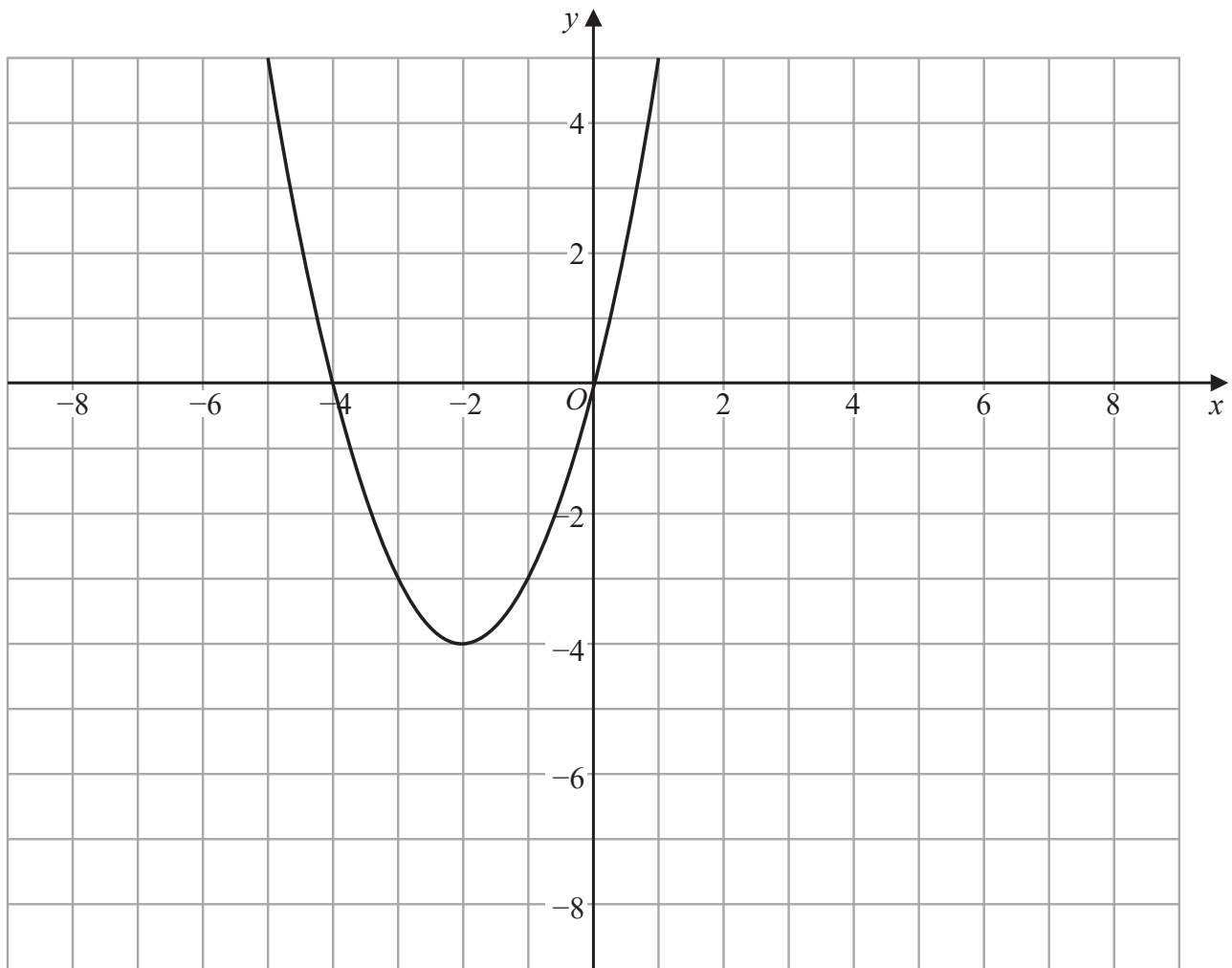
(b) Write down the value of k

....

(1)

(Total for Question 18 is 3 marks)

P 5 9 0 1 7 A 0 2 3 2 8

18
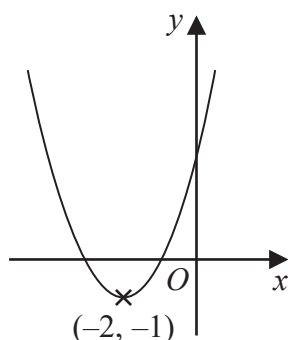
The diagram shows the curve with equation $y = f(x)$
The coordinates of the minimum point of the curve are $(-2, -1)$

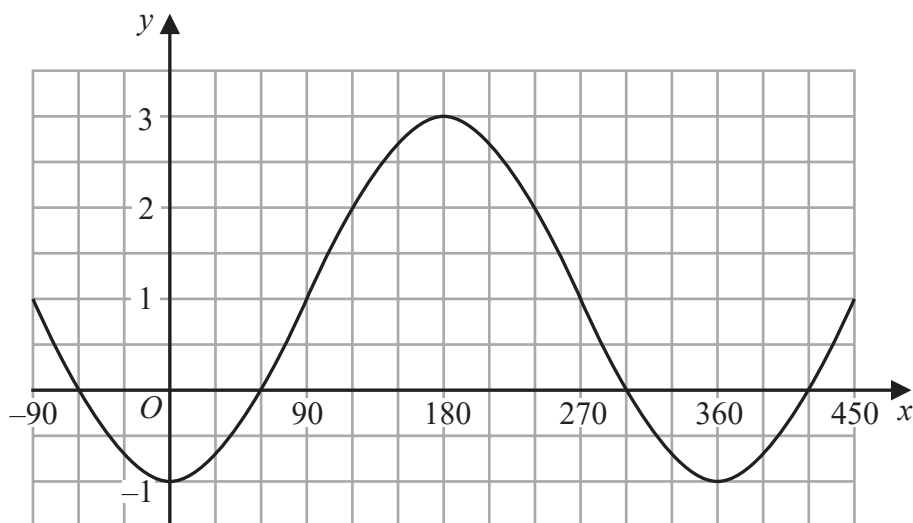(a) Write down the coordinates of the minimum point of the curve with equation

   (i) $y = f(x - 5)$

   (...................., ...)

   (ii) $y = \dfrac{1}{2} f(x)$

   (...................., ...)
   (2)

The graph of $y = a\sin(x - b)° + c$ for $-90 \leqslant x \leqslant 450$ is drawn on the grid below.

(b) Find the value of a, the value of b and the value of c.
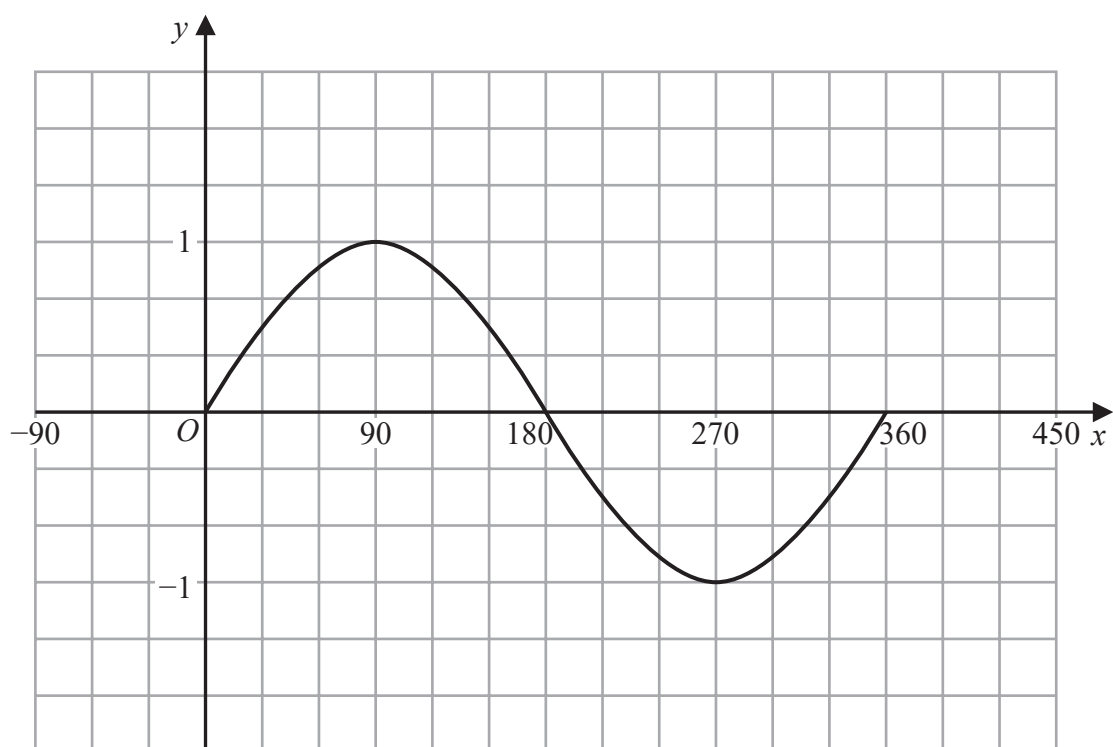
   $a =$ ....

   $b =$ ....

   $c =$ ....
   (3)

(Total for Question 18 is 5 marks)

18 Here is the graph of $y = \sin x°$ for $0 \leqslant x \leqslant 360$

(a) On the grid above, sketch the graph of $y = \sin(x + 90)°$ for $0 \leqslant x \leqslant 360$

(2)

In $0 \leqslant x \leqslant 360$, the graph of $y = \sin\left(\dfrac{x}{2}\right)° + 3$ has a maximum at the point A.

(b) Write down the coordinates of A.

(........................ , ...)

(2)

(Total for Question 18 is 4 marks)

19 A curve has equation $y = f(x)$

There is only one minimum point on the curve.
The coordinates of this minimum point are (5, 4)

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 5)$

(.............................. , ...)
(1)

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

(.............................. , ...)
(1)

(iii) $y = f(x) - 7$

(.............................. , ...)
(1)

(Total for Question 19 is 3 marks)

20 A curve has equation $y = f(x)$

There is only one maximum point on the curve.

The coordinates of this maximum point are $(-3, 4)$

Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x) - 6$

(.......................... , ...)

(ii) $y = f(2x)$

(.......................... , ...)

(Total for Question 20 is 2 marks)

20 The diagram shows a sketch of part of the curve with equation $y = f(x)$
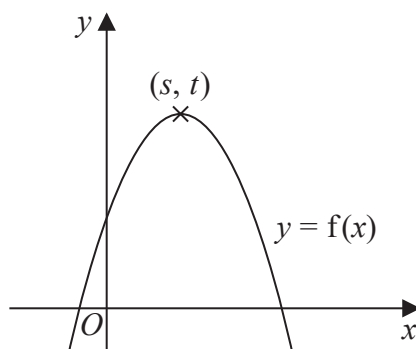
There is one maximum point on this curve.
The coordinates of this maximum point are (s, t)

Find, in terms of s and t, the coordinates of the maximum point on the curve with equation

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

(.......................... , ...)
(1)

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

(.......................... , ...)
(1)

(Total for Question 20 is 2 marks)

20 Curve **C** has equation $y = f(x)$

The graph of curve **C** has one maximum point.

The coordinates of this maximum point are (3, 5)

(a) Write down the coordinates of the maximum point on the curve with equation

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

(............................ , ...)

(1)

(ii) $y = f(x) - 7$

(............................ , ...)

(1)

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

(............................ , ...)

(1)

Curve **L** has equation $y = x^2 + 7x + 20$

Curve **L** is transformed to curve **S** under the translation $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

(b) Find an equation for **S**

Give your answer in the form $y = ax^2 + bx + c$

$y = $ ....

(4)

(Total for Question 20 is 7 marks)

20 The curve with equation $y = f(x)$ has one turning point.

The coordinates of this turning point are $(-6, -4)$

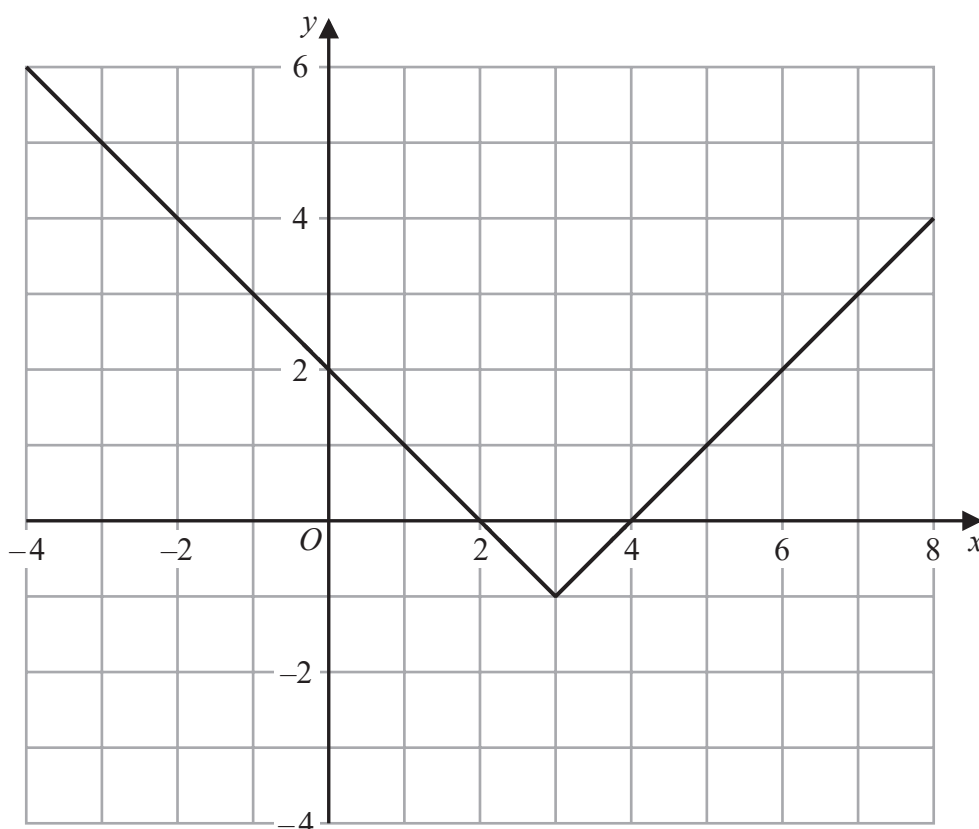(a) Write down the coordinates of the turning point on the curve with equation

(i) $y = f(x) + 5$

(.................... , ...)

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

(.................... , ...)

(2)

The graph of $y = g(x)$ is shown on the grid below.

(b) On the grid, sketch the graph of $y = 2g(x)$ for $-1 \leqslant x \leqslant 7$

(2)

The graph of $y = \mathrm{h}(x)$ intersects the x-axis at two points.
The coordinates of the two points are $(-1, 0)$ and $(6, 0)$

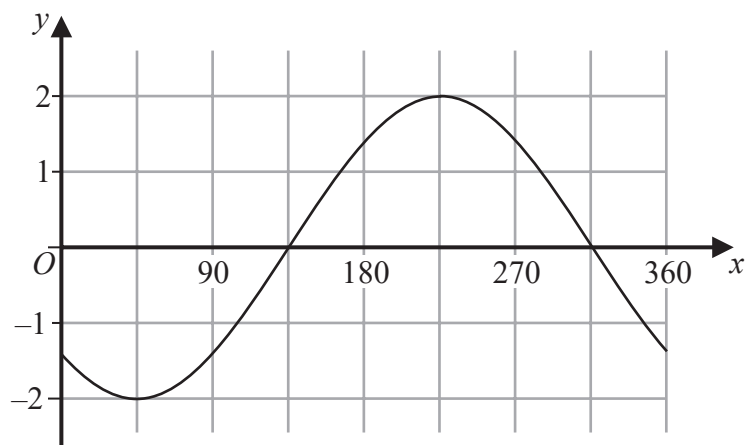The graph of $y = \mathrm{h}(x + a)$ passes through the point with coordinates $(2, 0)$, where a is a constant.

(c) Find the two possible values of a

.... , ...

(2)

(Total for Question 20 is 6 marks)

20 Here is a sketch of the curve $y = a\cos(x + b)°$ for $0 \leqslant x \leqslant 360$

Given that $0 < b < 180$

find the value of a and the value of b

$a = $ ....

$b = $ ....

(Total for Question 20 is 2 marks)

21 A curve has equation $y = f(x)$

There is only one turning point on the curve.
The coordinates of this turning point are (6, 5)

Write down the coordinates of the turning point on the curve with equation

(a) $y = f(x - 4)$

(..................... , ...)
(1)

(b) $y = f(3x)$

(..................... , ...)
(1)

(Total for Question 21 is 2 marks)

P72790A02328

21 A curve has equation $y = f(x)$

There is one minimum point on this curve.
The coordinates of this minimum point are (5, –4)

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 7)$

(......................... , ...)
(1)

(ii) $y = f(x) – 6$

(......................... , ...)
(1)

(Total for Question 21 is 2 marks)

21 A curve has equation $y = f(x)$

There is only one maximum point on the curve.
The coordinates of this maximum point are (4, 3)

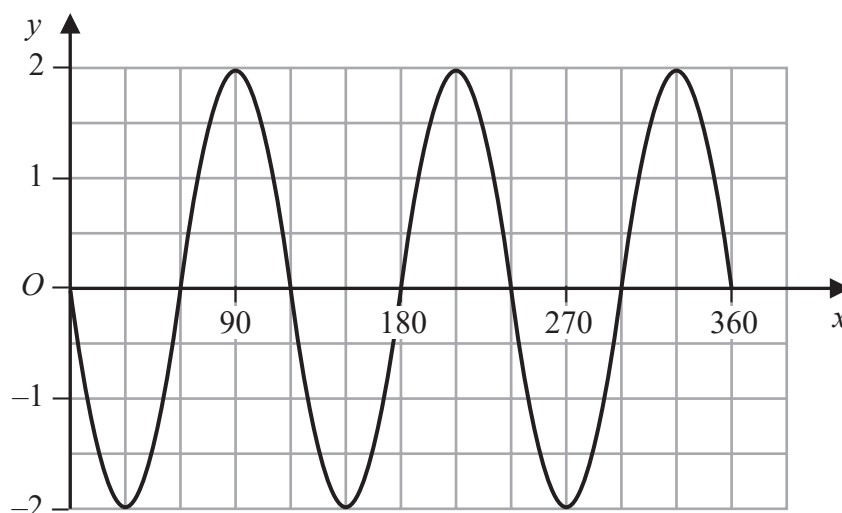(a) Write down the coordinates of the maximum point on the curve with equation

   (i) $y = f(x - 5)$

(........................ , ...)

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

(........................ , ...)

(2)

Here is the graph of $y = a \sin(bx)°$ for $0 \leqslant x \leqslant 360$

(b) Find the value of a and the value of b.

$a = $ ....

$b = $ ....

(2)

(Total for Question 21 is 4 marks)

21 A curve has equation $y = \mathrm{f}(x)$

The coordinates of the minimum point on this curve are $(-9, 15)$

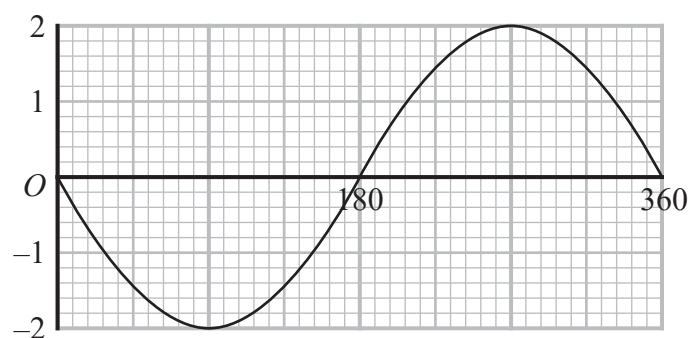(a) Write down the coordinates of the minimum point on the curve with equation

(i) $y = \mathrm{f}(x + 3)$

(.............................. , ...)

(ii) $y = \dfrac{1}{3}\mathrm{f}(x)$

(.............................. , ...)

(2)

The graph of $y = a\cos(x + b)°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.

Given that $a > 0$ and that $0 < b < 360$

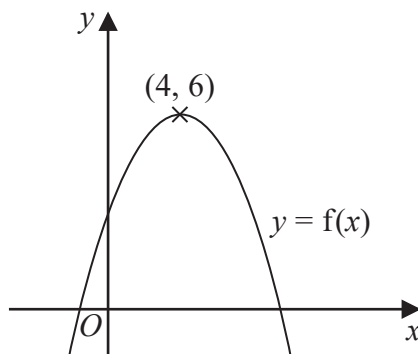(b) find the value of a and the value of b.

$a = $ ....

$b = $ ....

(2)

(Total for Question 21 is 4 marks)

21 The diagram shows a sketch of part of the curve with equation $y = f(x)$

There is one maximum point on this curve.
The coordinates of this maximum point are (4, 6)

(a) Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x + 4)$

(.............................. , ...)

(ii) $y = f(2x)$

(.............................. , ...)

(2)

The equation of a curve **C** is $y = x^2 + 3x + 4$

The curve **C** is transformed to curve **S** under the translation $\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

(b) Find an equation of curve **S**.

You do not need to simplify the equation.

....

(2)

(Total for Question 21 is 4 marks)

21 The curve **C** has equation $y = f(x)$ where $f(x) = 9 - 3(x + 2)^2$
The point A is the maximum point on **C**.

(a) Write down the coordinates of A.

(.............................. , ...)

(1)

The curve **C** is transformed to the curve **S** by a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

(b) Find an equation for the curve **S**.

....

(1)

The curve **C** is transformed to the curve **T**.
The curve **T** has equation $y = 3(x + 2)^2 - 9$

(c) Describe fully the transformation that maps curve **C** onto curve **T**.

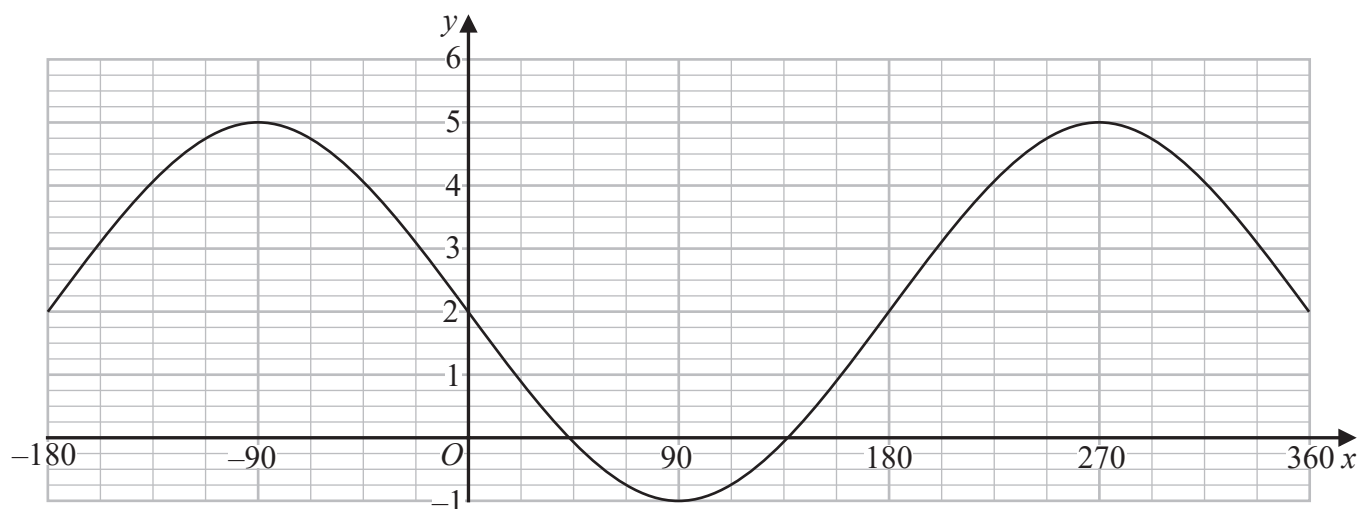..

(1)

The graph of $y = a\cos(x - b)° + c$ for $-180 \leqslant x \leqslant 360$ is drawn on the grid below.

(d) Find the value of a, the value of b and the value of c.

$a = $ ....

$b = $ ....

$c = $ ....
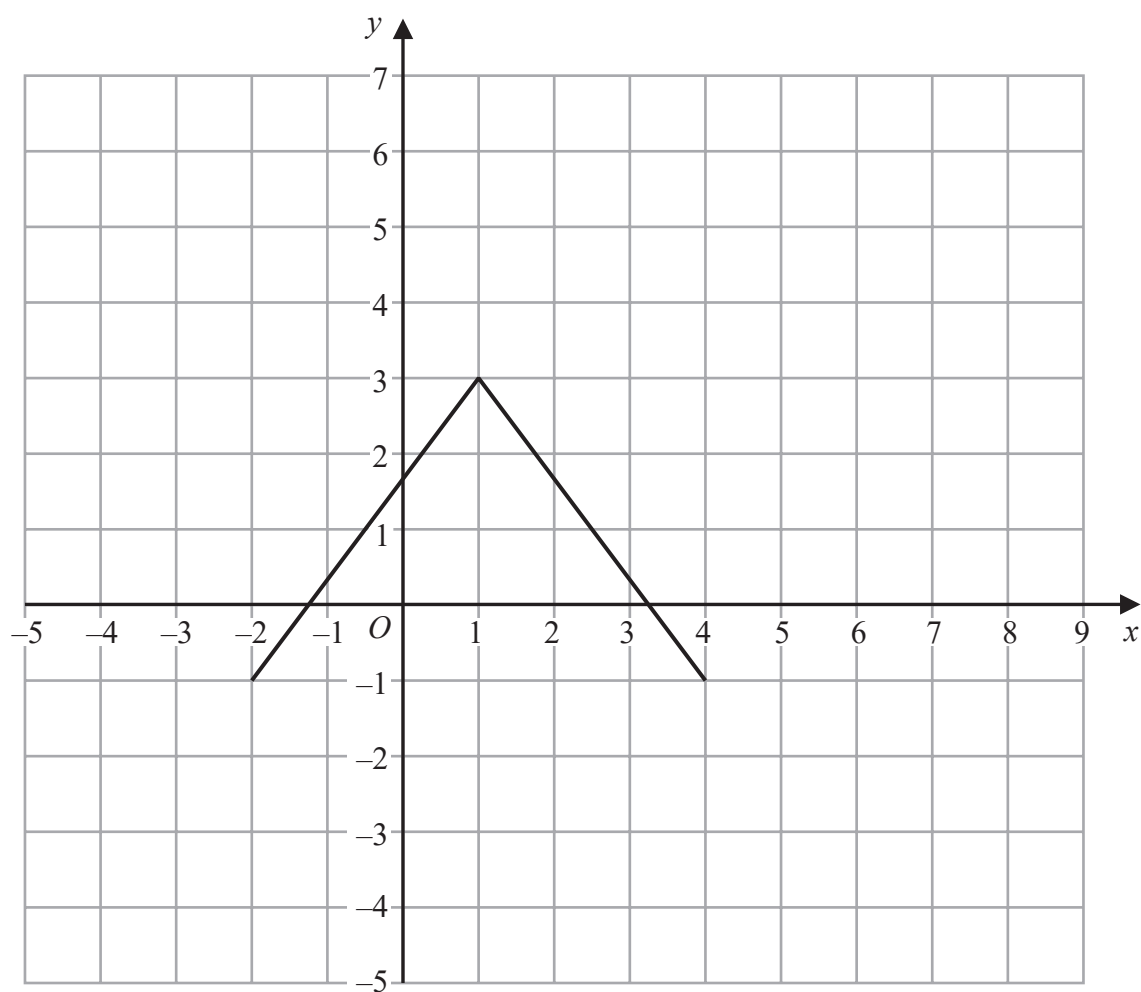
(3)

(Total for Question 21 is 6 marks)

21 Here is the graph of $y = f(x)$

(a) On the grid above, draw the graph of $y = 2f(x)$

(2)
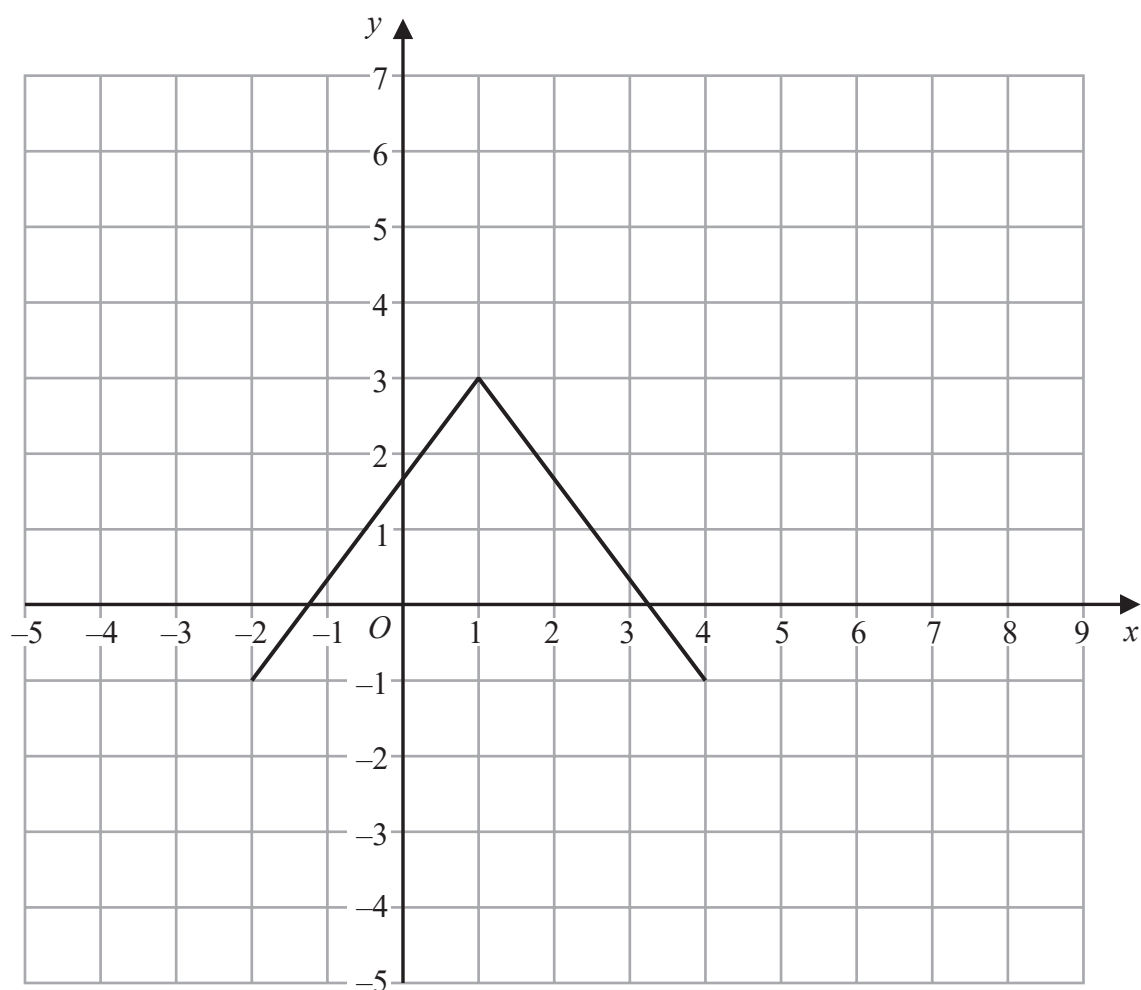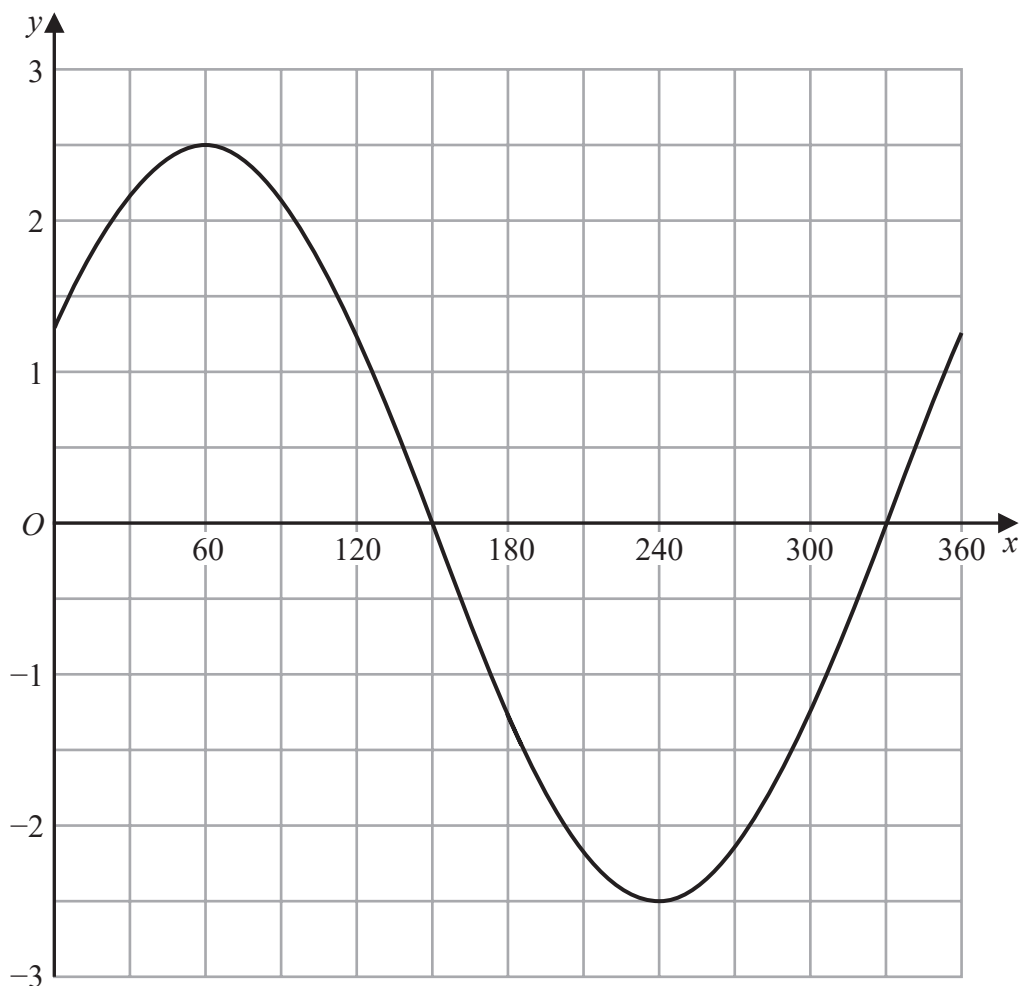
Here is the graph of $y = f(x)$

(b) On the grid above, draw the graph of $y = f(-x)$

(2)

(Total for Question 21 is 4 marks)

22 The graph of $y = a\cos(x + b)°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid.

(a) Find the value of a and the value of b.

$a = $ ....

$b = $ ....

(2)

Another curve C has equation $y = f(x)$
The coordinates of the minimum point of C are (4, 5)

(b) Write down the coordinates of the minimum point of the curve with equation

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

(........................ , ...)

(ii) $y = f(x) - 7$

(........................ , ...)

(2)

(Total for Question 22 is 4 marks)

P 5 8 4 4 3 A 0 2 3 2 4

22 The graph of $y = \sin x°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid.
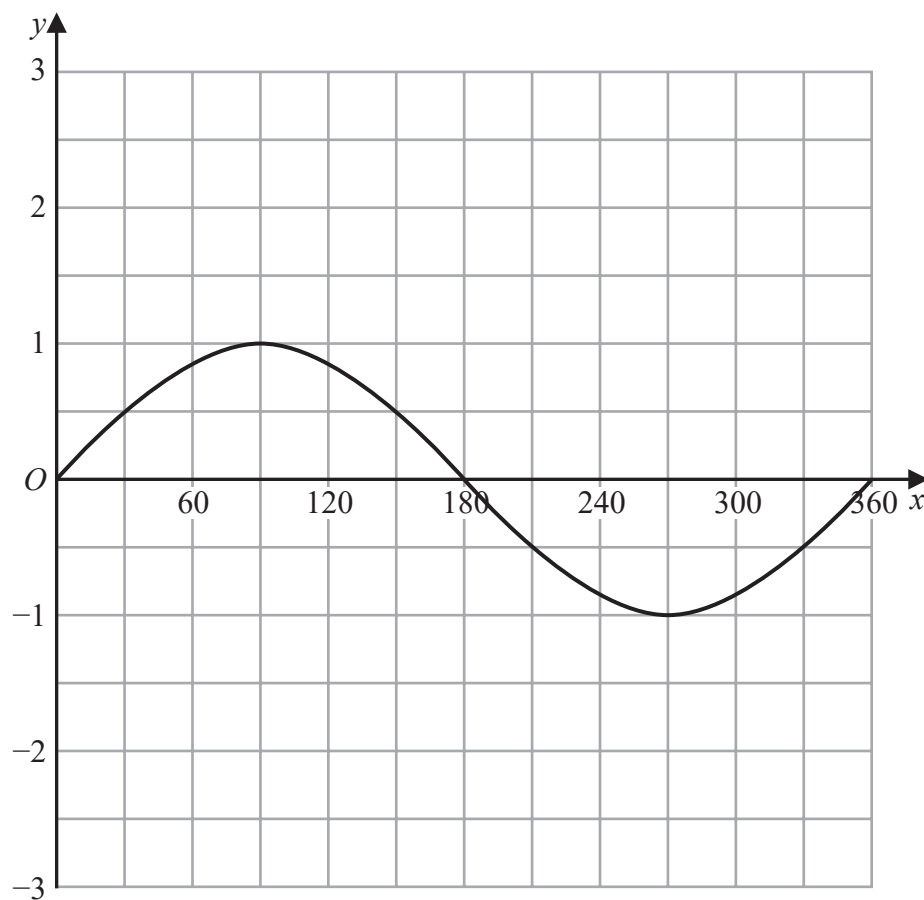
(a) On the grid, draw the graph of $y = 2\sin(x + 30)°$ for $0 \leqslant x \leqslant 360$

(2)

(b) (i) Write $x^2 - 6x + 10$ in the form $(x - a)^2 + b$ where a and b are integers.

....

(2)

(ii) Hence, describe fully the single transformation that maps the curve with equation $y = x^2$ onto the curve with equation $y = x^2 - 6x + 10$

....

....

(2)

(Total for Question 22 is 6 marks)

22 Express $\dfrac{4x^2 - 25}{5x^2 + 2x - 7} \times \left(\dfrac{2}{x - 3} - \dfrac{3}{2x - 5} \right)$ as a single fraction in its simplest form.

....

(Total for Question 22 is 4 marks)

22 The point A with coordinates $(-3, 2)$ lies on the straight line with equation $y = f(x)$

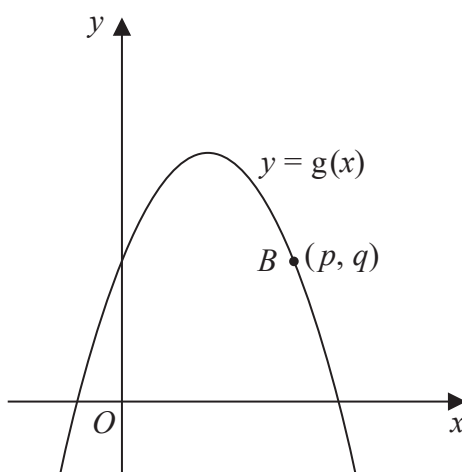(a) Find the coordinates of the image of the point A on the straight line with equation

(i) $y = f(x) - 3$

(.......................... , ...)
(1)

(ii) $y = f\left(\dfrac{x}{2}\right)$

(.........................., ...)
(1)

Here is a sketch of part of the curve with equation $y = g(x)$

The point B with coordinates (p, q) lies on the curve.

(b) Find the coordinates of the image of the point B on the curve with equation
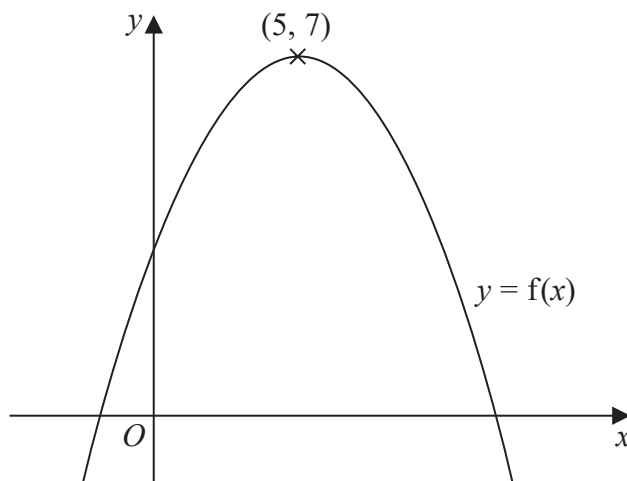
$$y = -g(x - c)$$

where c is a constant.

(.........................., ...)
(2)

(Total for Question 22 is 4 marks)

23 The diagram shows a sketch of the curve with equation $y = f(x)$

There is only one maximum point on the curve.
The coordinates of this maximum point are (5, 7)

Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x + 9)$

(.................. , ...)

(ii) $y = f(x) + 3$

(.................. , ...)

(Total for Question 23 is 2 marks)

23 The diagram shows a sketch of the graph of $y = \cos\left(\dfrac{x}{2}\right)^{\circ}$

(i) Find the coordinates of the point A

(........................ , ...)
(1)

(ii) Find the coordinates of the point B

(........................ , ...)
(1)

(Total for Question 23 is 2 marks)

Turn over ▶
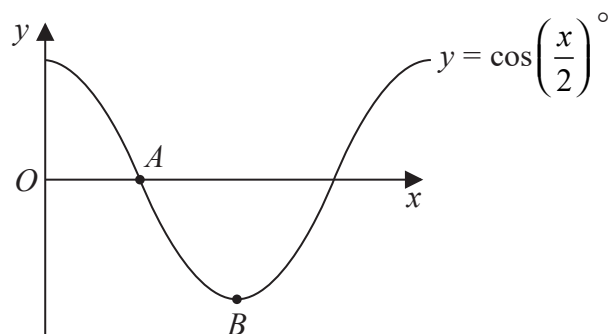
23 A curve has equation $y = f(x)$
The coordinates of the minimum point on this curve are $(6, -3)$

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x) + 10$

(.............................. , ...)
(1)

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

(.............................. , ...)
(1)

(Total for Question 23 is 2 marks)

24 The curve with equation $f(x) = 5x^2 + 9x + 2$ is transformed to the curve with equation

$g(x) = 5(x+4)^2 + 9(x+4) + 8$ by the translation $\begin{pmatrix} a \\ b \end{pmatrix}$

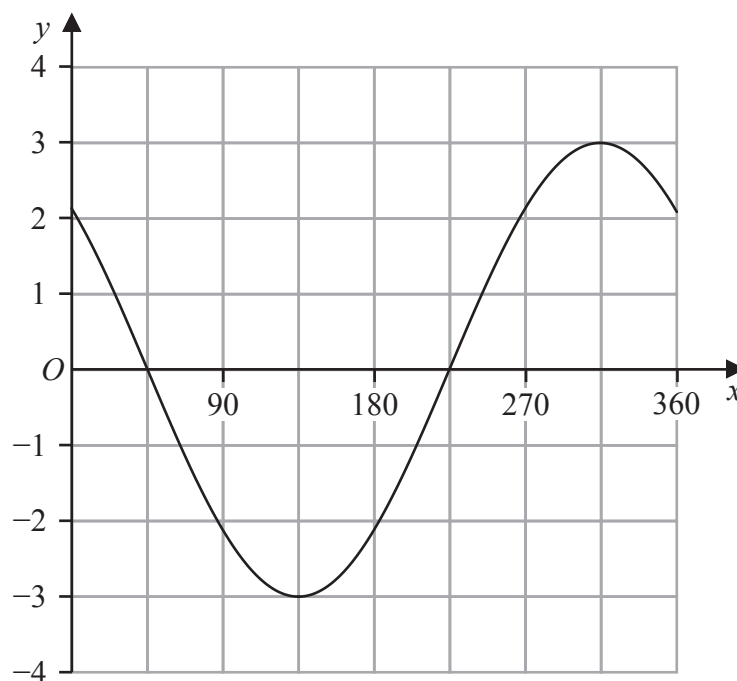(a) Write down the value of a and the value of b

$a =$ ....

$b =$ ....

(2)

The graph of $y = p\cos(x+q)^\circ$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.

Given that $p > 0$ and $0 < q < 360$

(b) find the value of p and the value of q

$p =$ ....

$q =$ ....
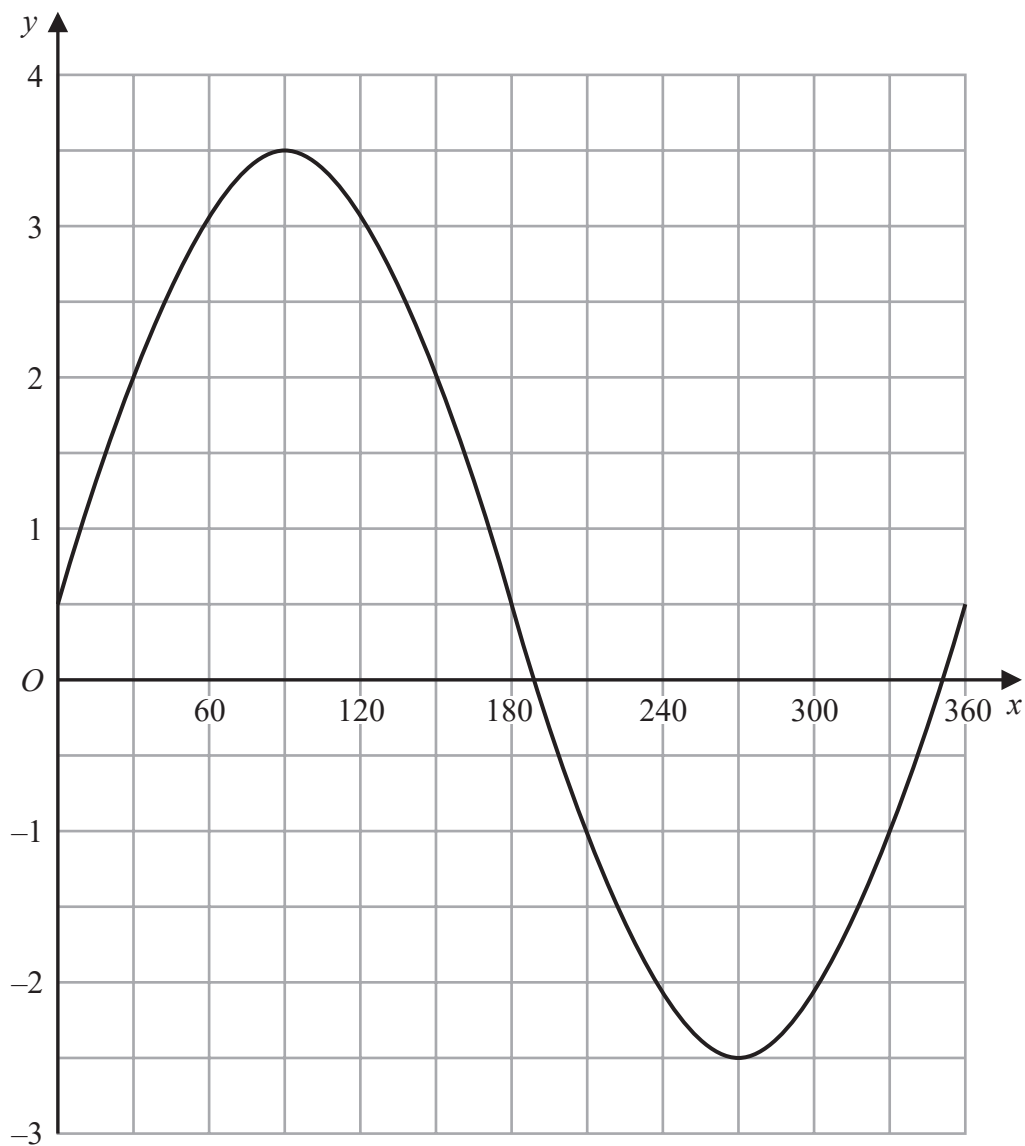
(2)

(Total for Question 24 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

24 The graph of $y = a \sin x° + b$ is drawn on the grid.

Find the value of a and the value of b

$a = $ ....

$b = $ ....
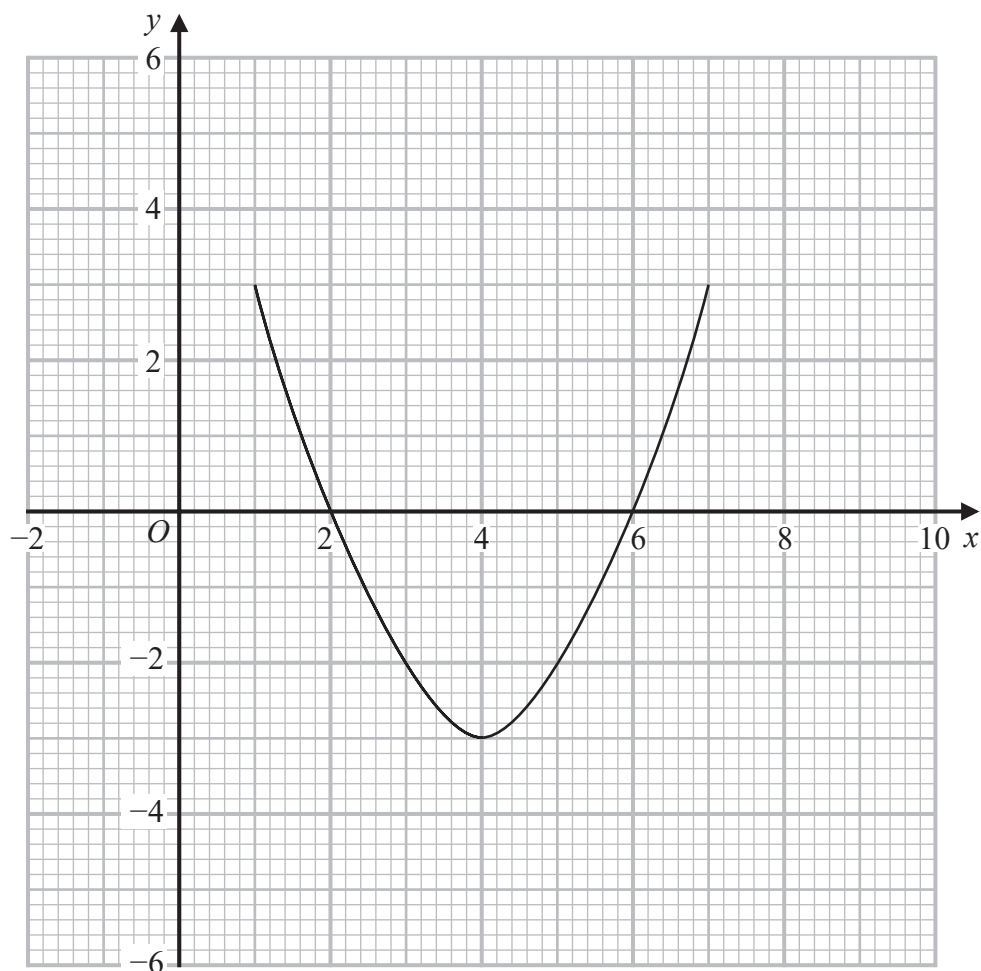
(Total for Question 24 is 2 marks)

25 The curve with equation $y = g(x)$ is transformed to the curve with equation $y = -g(x)$ by the single transformation **T**.

(a) Describe fully the transformation **T**.

....

(1)

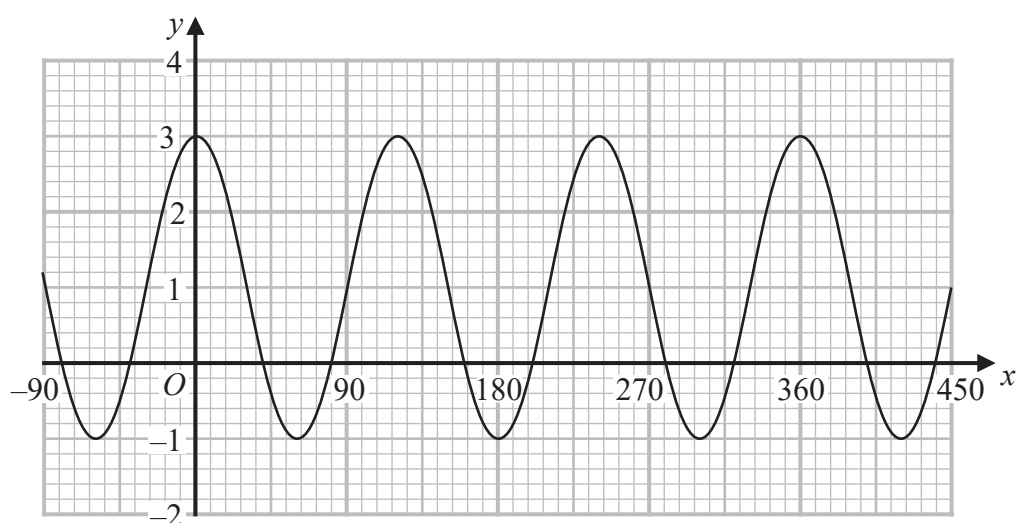The diagram shows the graph of $y = f(x)$

(b) On the grid, draw the graph of $y = 2f(x - 1)$

(2)

(Total for Question 25 is 3 marks)

26 Here is a sketch of the curve with equation $y = a \cos bx° + c$ where $-90 \leqslant x \leqslant 450$

Find the value of a, the value of b and the value of c

$a =$ ....

$b =$ ....

$c =$ ....

(Total for Question 26 is 3 marks)

25 The diagram shows a sketch of the graph of $y = 2\sin(x + 60)°$
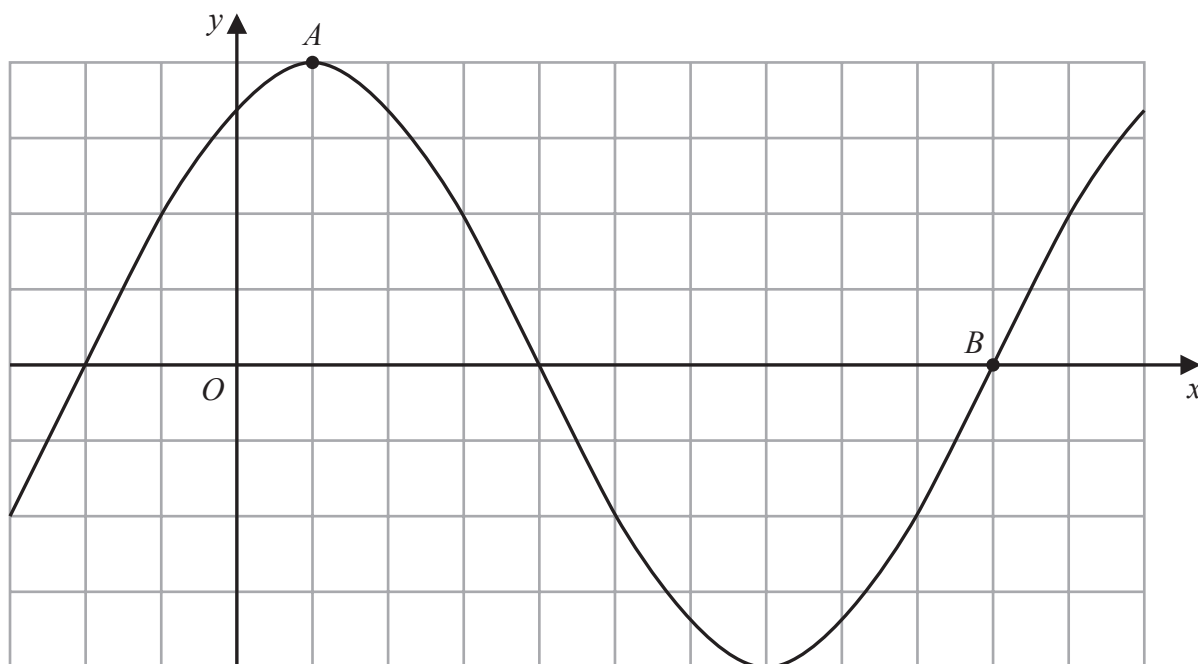
(i) Find the coordinates of the point A

(.........................., ...)

(1)

(ii) Find the coordinates of the point B

(.........................., ...)

(1)

(Total for Question 25 is 2 marks)