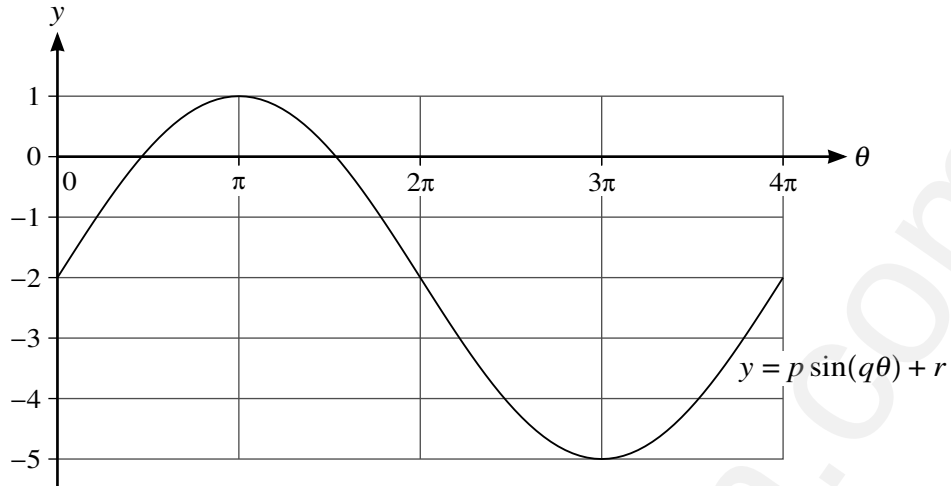




The diagram shows part of the curve with equation $y = p \sin(q\theta) + r$, where p , q and r are constants.

- (a) State the value of p . [1]

.....

.....

.....

.....

- (b) State the value of q . [1]

.....

.....

.....

.....

.....

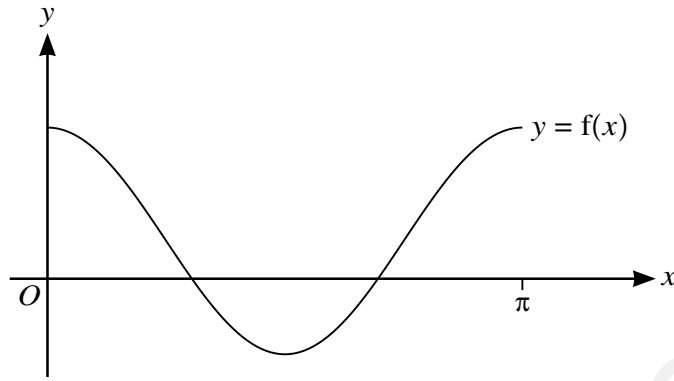
- (c) State the value of r . [1]

.....

.....

.....

.....



The diagram shows the graph of $y = f(x)$, where $f(x) = \frac{3}{2} \cos 2x + \frac{1}{2}$ for $0 \leq x \leq \pi$.

- (a) State the range of f .

[2]

.....

.....

.....

A function g is such that $g(x) = f(x) + k$, where k is a positive constant. The x -axis is a tangent to the curve $y = g(x)$.

- (b) State the value of k and hence describe fully the transformation that maps the curve $y = f(x)$ on to $y = g(x)$.

[2]

.....

.....

.....

.....

.....

.....

- (c) State the equation of the curve which is the reflection of $y = f(x)$ in the x -axis. Give your answer in the form $y = a \cos 2x + b$, where a and b are constants.

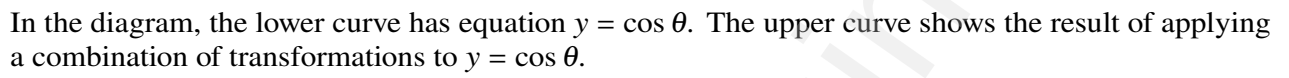
[1]

.....

.....

.....

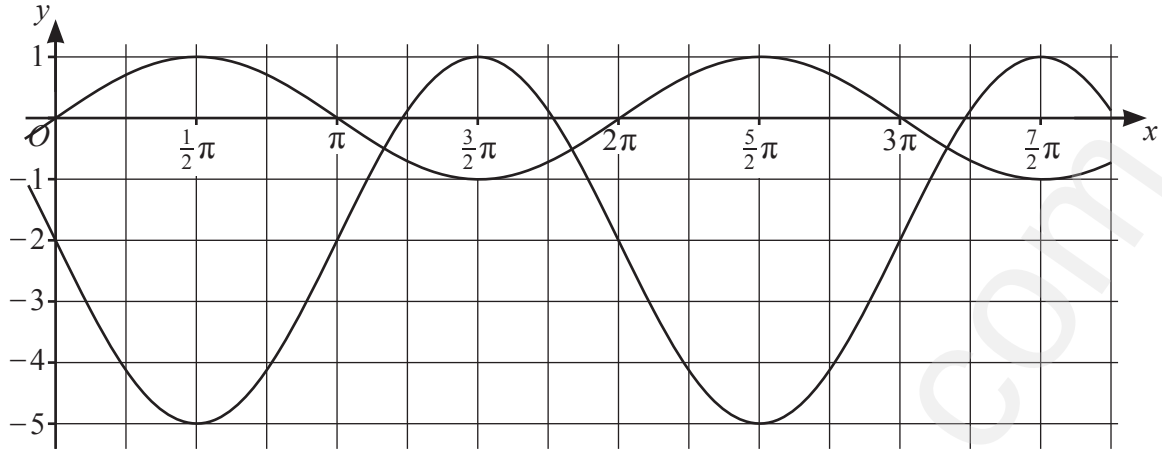
.....



[3]

[illegible]

2



The diagram shows two curves. One curve has equation $y = \sin x$ and the other curve has equation $y = f(x)$.

- (a) In order to transform the curve $y = \sin x$ to the curve $y = f(x)$, the curve $y = \sin x$ is first reflected in the x -axis.

Describe fully a sequence of two further transformations which are required.

[4]

.....

.....

.....

.....

.....

.....

.....

- (b) Find $f(x)$ in terms of $\sin x$.

[2]

.....

.....

.....

.....

.....

.....

.....

7 A curve has equation $y = 2 + 3 \sin \frac{1}{2}x$ for $0 \leq x \leq 4\pi$.

(a) State greatest and least values of y .

[2]

.....

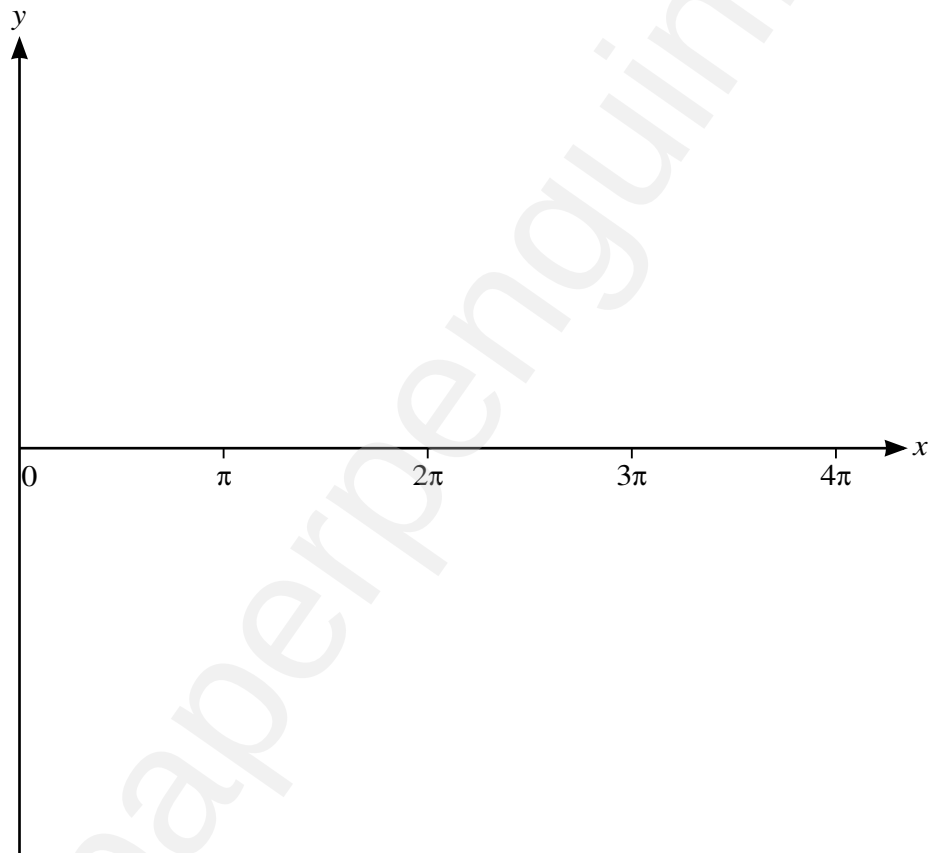
.....

.....

.....

(b) Sketch the curve.

[2]



(c) State the number of solutions of the equation

$$2 + 3 \sin \frac{1}{2}x = 5 - 2x$$

for $0 \leq x \leq 4\pi$.

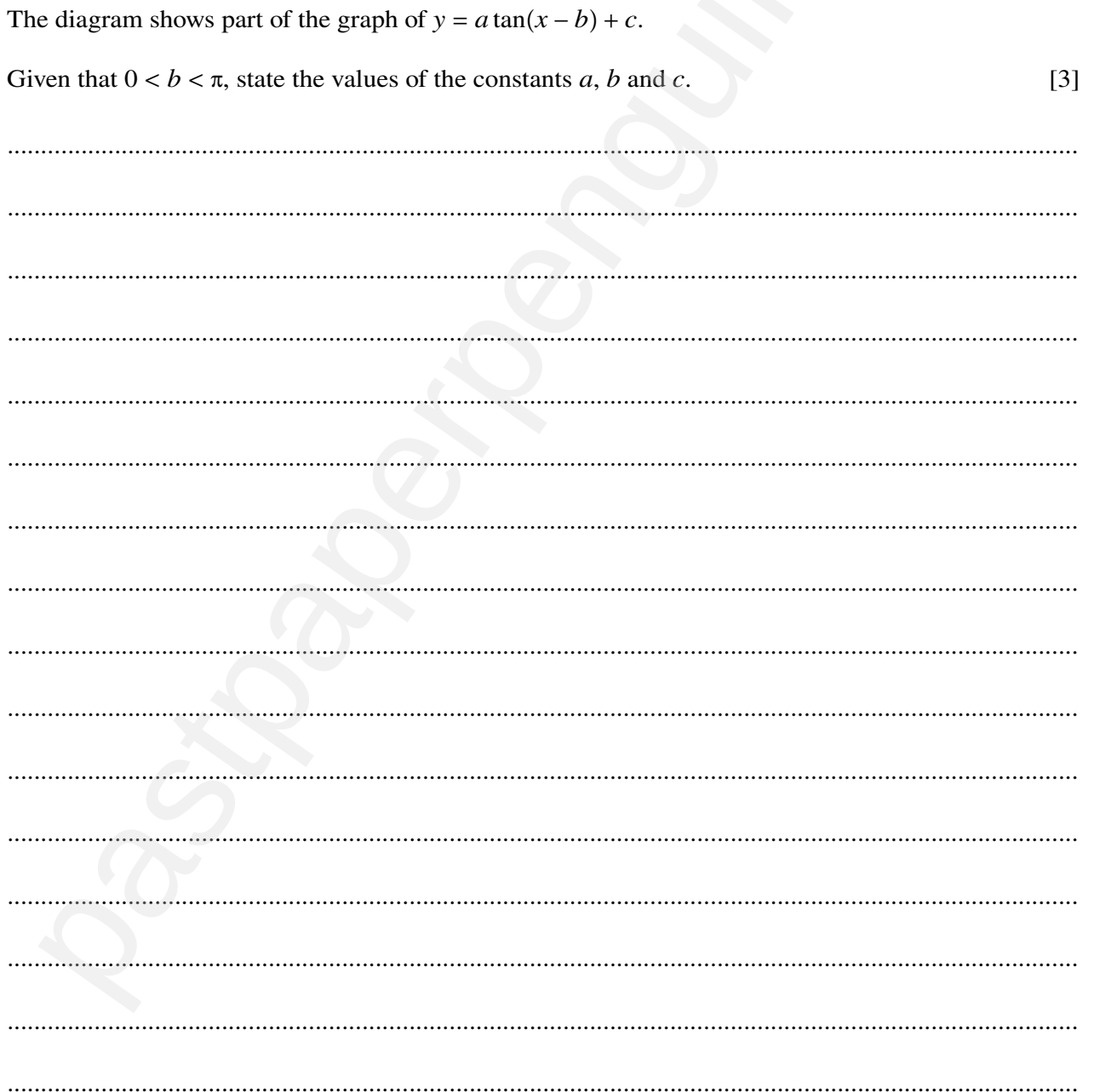
[1]

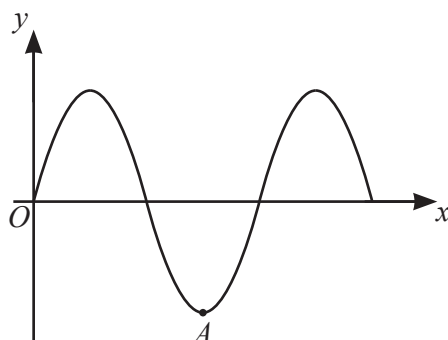
.....

.....

.....

.....





(a) State the coordinates of A . [1]

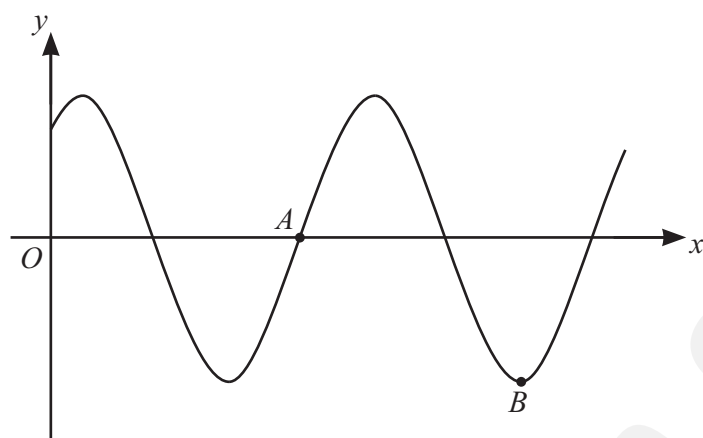
[illegible]

Reflection in the x -axis

Find the equation of the new curve and determine the coordinates of the point on the new curve corresponding to A . [3]

This image shows a blank sheet of white paper designed for handwriting practice. It features ten sets of horizontal dashed lines, each set consisting of three parallel lines. A large, light gray watermark with the word "Pastpaper" is oriented diagonally from the bottom-left towards the top-right across the center of the page. The paper is otherwise empty of any other markings or text.

2 (a)



The diagram shows the curve $y = k \cos(x - \frac{1}{6}\pi)$ where k is a positive constant and x is measured in radians. The curve crosses the x -axis at point A and B is a minimum point.

Find the coordinates of A and B .

[3]

.....

.....

.....

.....

.....

.....

.....

.....

(b) Find the exact value of t that satisfies the equation

$$3 \sin^{-1}(3t) + 2 \cos^{-1}\left(\frac{1}{2}\sqrt{2}\right) = \pi.$$

[2]

.....

.....

.....

.....

.....

.....

.....

- Describe fully a sequence of transformations that have been combined, making clear the order in which the transformations are applied. [5]

[illegible]

- 9 Functions f and g are such that

$$f(x) = 2 - 3 \sin 2x \quad \text{for } 0 \leq x \leq \pi,$$

$$g(x) = -2f(x) \quad \text{for } 0 \leq x \leq \pi.$$

- (a) State the ranges of f and g .

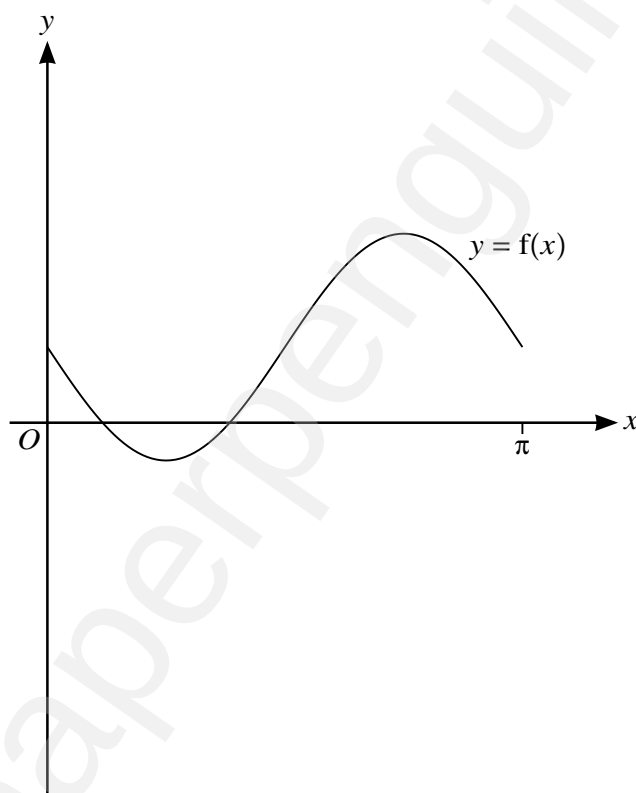
[3]

.....

.....

.....

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



- (b) Sketch, on this diagram, the graph of $y = g(x)$.

[2]

The function h is such that

$$h(x) = g(x + \pi) \quad \text{for } -\pi \leq x \leq 0.$$

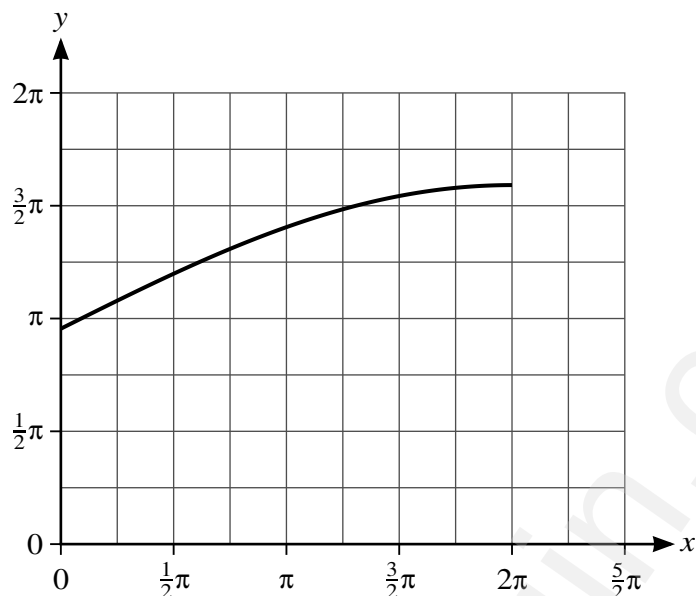
- (c) Describe fully a sequence of transformations that maps the curve $y = f(x)$ on to $y = h(x)$.

[3]

.....

.....

.....



The diagram shows the graph of $y = f(x)$ where the function f is defined by

$$f(x) = 3 + 2 \sin \frac{1}{4}x \text{ for } 0 \leq x \leq 2\pi.$$

(a) On the diagram above, sketch the graph of $y = f^{-1}(x)$. [2]

(b) Find an expression for $f^{-1}(x)$. [2]

.....

.....

.....

.....

.....

.....

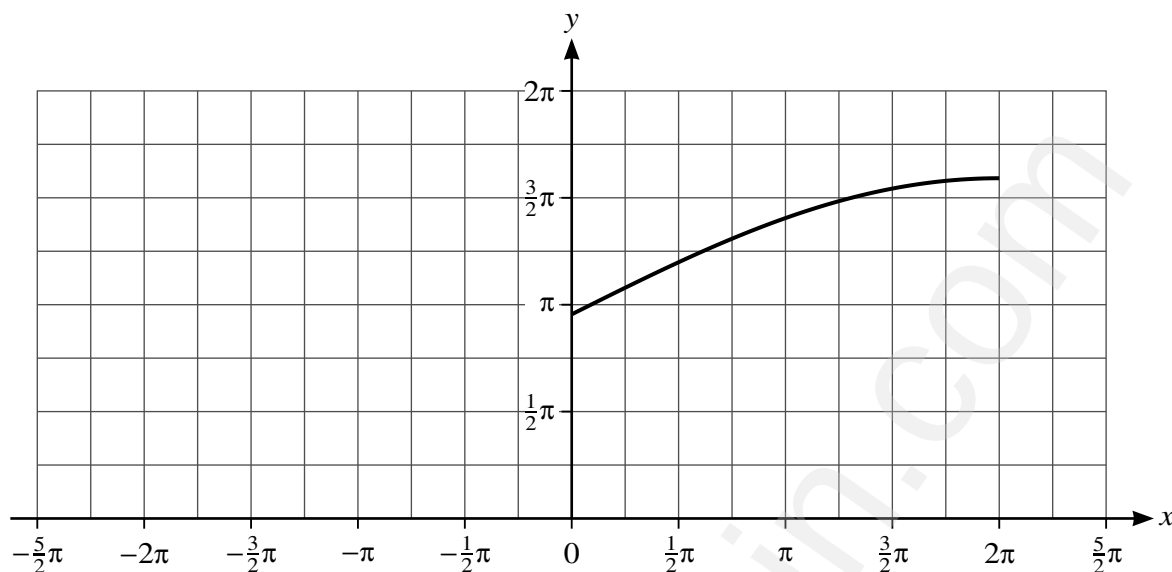
.....

.....

.....

.....

(c)



The diagram above shows part of the graph of the function $g(x) = 3 + 2 \sin \frac{1}{4}x$ for $-2\pi \leq x \leq 2\pi$.

Complete the sketch of the graph of $g(x)$ on the diagram above and hence explain whether the function g has an inverse. [2]

.....

.....

.....

(d) Describe fully a sequence of three transformations which can be combined to transform the graph of $y = \sin x$ for $0 \leq x \leq \frac{1}{2}\pi$ to the graph of $y = f(x)$, making clear the order in which the transformations are applied. [6]

.....

.....

.....

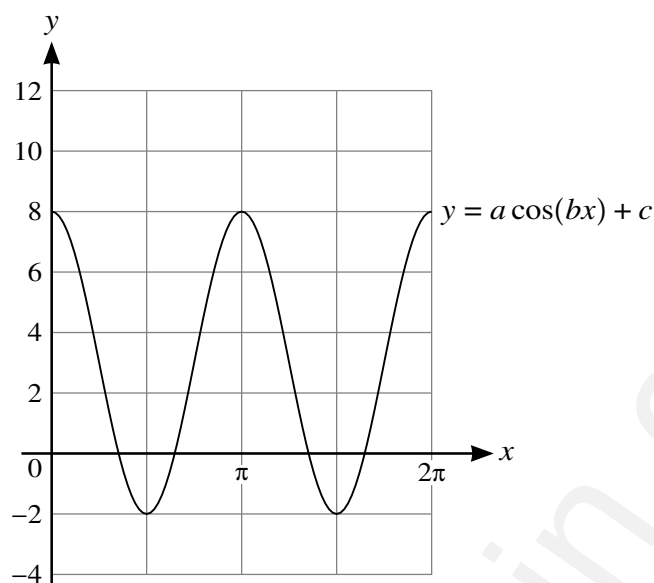
.....

.....

.....

.....

.....



The diagram shows part of the graph of $y = a \cos(bx) + c$.

- (a) Find the values of the positive integers a , b and c . [3]

.....

.....

.....

.....

.....

.....

- (b) For these values of a , b and c , use the given diagram to determine the number of solutions in the interval $0 \leq x \leq 2\pi$ for each of the following equations.

(i) $a \cos(bx) + c = \frac{6}{\pi}x$ [1]

.....

.....

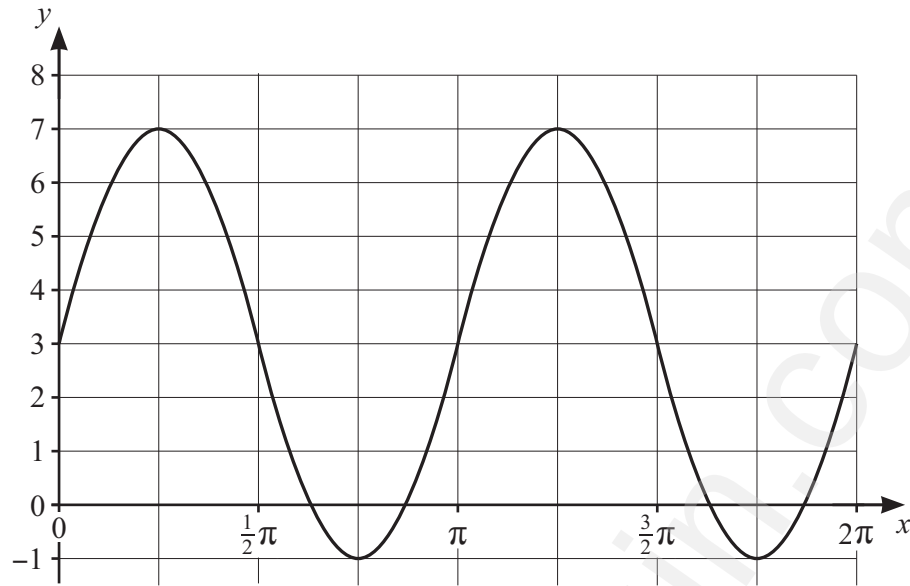
(ii) $a \cos(bx) + c = 6 - \frac{6}{\pi}x$ [1]

.....

.....



1



The diagram shows the curve with equation $y = a \sin(bx) + c$ for $0 \leq x \leq 2\pi$, where a , b and c are positive constants.

- (a) State the values of a , b and c . [3]

.....

.....

.....

.....

.....

.....

.....

.....

- (b) For these values of a , b and c , determine the number of solutions in the interval $0 \leq x \leq 2\pi$ for each of the following equations:

(i) $a \sin(bx) + c = 7 - x$ [1]

.....

.....

(ii) $a \sin(bx) + c = 2\pi(x - 1)$. [1]

.....

.....



11 A curve has equation $y = 3 \cos 2x + 2$ for $0 \leq x \leq \pi$.

- (a)** State the greatest and least values of y . [2]

.....

.....

.....

.....

- (b)** Sketch the graph of $y = 3 \cos 2x + 2$ for $0 \leq x \leq \pi$. [2]

- (c)** By considering the straight line $y = kx$, where k is a constant, state the number of solutions of the equation $3 \cos 2x + 2 = kx$ for $0 \leq x \leq \pi$ in each of the following cases.

- (i)** $k = -3$ [1]

.....

.....

- (ii)** $k = 1$ [1]

.....

.....

- (iii)** $k = 3$ [1]

.....

.....

Functions f , g and h are defined for $x \in \mathbb{R}$ by

$$f(x) = 3 \cos 2x + 2,$$

$$g(x) = f(2x) + 4,$$

$$h(x) = 2f\left(x + \frac{1}{2}\pi\right).$$

- (d) Describe fully a sequence of transformations that maps the graph of $y = f(x)$ on to $y = g(x)$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (e) Describe fully a sequence of transformations that maps the graph of $y = f(x)$ on to $y = h(x)$. [2]

.....

.....

.....

.....

.....

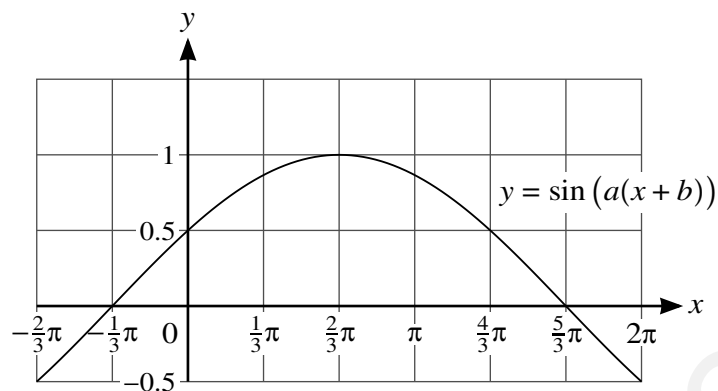
.....

.....

.....

.....

.....



The diagram shows part of the graph of $y = \sin(a(x+b))$, where a and b are positive constants.

- (a) State the value of a and one possible value of b . [2]

.....

.....

.....

.....

Another curve, with equation $y = f(x)$, has a single stationary point at the point (p, q) , where p and q are constants. This curve is transformed to a curve with equation

$$y = -3f\left(\frac{1}{4}(x+8)\right).$$

- (b) For the transformed curve, find the coordinates of the stationary point, giving your answer in terms of p and q . [3]

.....

.....

.....

.....

.....

.....

.....

.....