

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

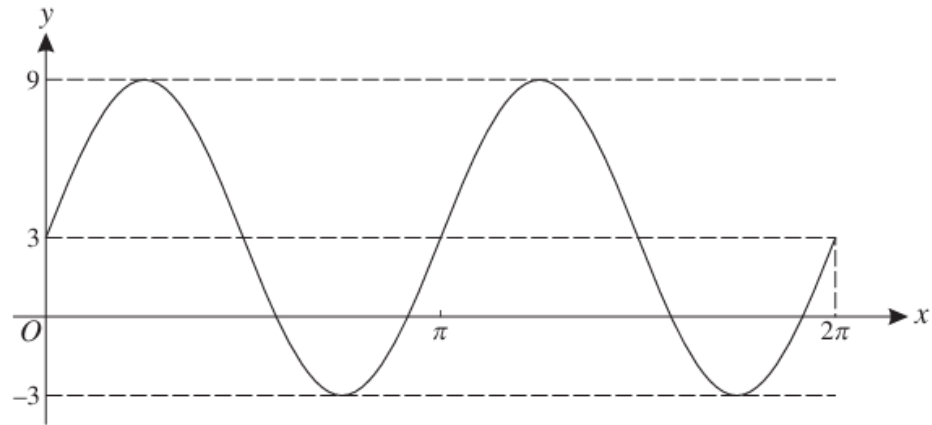
Topic 5-Trigonometry

Question No (12)

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Question No (12)

The diagram shows the graph of $y = a \sin(bx) + c$ for $0 \leq x \leq 2\pi$.

- (i) Find the values of a , b and c .
- (ii) Find the smallest value of x in the interval $0 \leq x \leq 2\pi$ for which $y = 0$.

Solution

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(i) $y = a \sin(bx) + c$ for $0 \leq x \leq 2\pi$

knowledge sharing

a:

indicates the amplitude of the curve which is the maximum or minimum range of the curve from the mean position.

b:

indicates the periodicity of the curve.
we see that in the given figure there are two cycles in a normal period of sine.

c:

indicates the vertical shift in the graph from the horizontal axis, which in this case is 3 units.

As in $y = a \sin(bx) + c$

a = amplitude of the curve

$\therefore$ from graph, $a = 9 - 3$

max-
mean position

As there are two cycles (one from $0 \rightarrow \pi$
and 2nd from $\pi \rightarrow 2\pi$)
in the normal period of sine

$$\therefore b = 2$$

c indicates the vertical shift or mean position in the graph from the horizontal axis.

$$\therefore c = 3$$

(ii)

Given equation

$$y = a \sin(bx) + c \quad \text{for } 0 \leq x \leq 2\pi$$

$$y = 6 \sin(2x) + 3$$

$$\text{for } y = 0$$

$$\text{for } 0 \leq x \leq 2\pi$$

$$\therefore a = 6, b = 2$$

$$c = 3$$

$$\Rightarrow 6 \sin(2x) + 3 = 0$$

$$6 \sin(2x) = -3$$

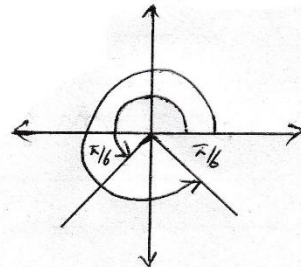
$$\sin(2x) = -3/6$$

$$\sin(2x) = -1/2$$

Sine is -ve, so it lies in III and IV quadrant

Basic angle

$$\sin \theta = 1/2$$



$$\alpha = \sin^{-1}(1/2)$$

$$\alpha = \pi/6$$

$\therefore$ Smallest value

$$2x = \pi + \pi/6$$

$$2x = \frac{7\pi}{6}$$

$$x = \frac{7\pi}{12} \quad \text{ans}$$