

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 5-Trigonometry

Question No (5)

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Question No (5)

The function f is defined by $f(x) = a + b \cos 2x$, for $0 \leq x \leq \pi$. It is given that $f(0) = -1$ and $f(\frac{1}{2}\pi) = 7$.

- (i) Find the values of a and b .
- (ii) Find the x -coordinates of the points where the curve $y = f(x)$ intersects the x -axis.
- (iii) Sketch the graph of $y = f(x)$.

Solution

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$$\textcircled{2} \quad f(x) = a + b \cos 2x \rightarrow \textcircled{1}$$

Given condition

$$f(0) = -1$$

so $\textcircled{1}$ becomes

$$\begin{aligned} f(0) &= a + b \cos 2(0) \\ &= a + b \cos 0 \end{aligned}$$

$$f(0) = a + b$$

$$\because \cos 0 = 1$$

$$a + b = -1 \rightarrow \textcircled{2}$$

$$\therefore f(0) = -1$$

$$\text{Also } f(\pi/2) = 7$$

so $\textcircled{1}$ becomes

$$\begin{aligned} f(\pi/2) &= a + b \cos 2(\pi/2) \\ &= a + b \cos \pi \end{aligned}$$

$$f(\pi/2) = a - b$$

$$\because \cos \pi = -1$$

$$7 = a - b \rightarrow \textcircled{3}$$

$$\therefore f(\pi/2) = 7$$

solving $\textcircled{2}$ & $\textcircled{3}$

$$a + b = -1$$

$$a - b = 7$$

$$2a = 6$$

$$\Rightarrow a = 6/2 = 3$$

put $a=3$ in (3)

$$7 = 3 - b$$

$$b = 3 - 7$$

$$b = -4$$

$$\therefore a = 3, b = -4$$

(ii)

$$f(x) = a + b \cos 2x$$

$$f(x) = 3 - 4 \cos 2x$$

$$\therefore a = 3, b = -4$$

$$f(x) = y = 3 - 4 \cos 2x$$

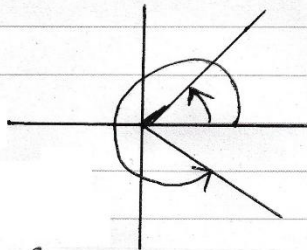
for x -intercept

$$f(x) = 0$$

$$\Rightarrow 3 - 4 \cos 2x$$

$$\cos 2x = 3/4$$

$\cos$ is +ve in I and II quadrant



Basic angle

$$\alpha = \cos^{-1}(3/4)$$

$$2x = \alpha, \quad 2\pi - \alpha$$

$$= 0.723, \quad 2\pi - 0.723$$

$$2x = 0.723, \quad 5.56$$

$$x = \frac{0.723}{2}, \quad \frac{5.56}{2}$$

$$x = 0.36, \quad 2.78 \text{ radians.}$$

(iii)

$$y = 3 - 4 \cos 2x \quad 0 \leq x \leq \pi$$

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π
y	-1	3	7	3	-1

