Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 2-Functions

Question No (32)

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Functions f and g are defined by

$$f: x \to 2 - 3\cos x \ \ for\ 0 \ \leq x \leq 2\pi$$

$$g: x \to \ \frac{x}{2}\ 0 \ \leq x \leq 2\pi$$

(i) Solve the equation $fg(x) = 1$.

(ii) Sketch the graph of $y = f(x)$.

Solution

$f: x \to 2-3\cos x$ for $0 \le x \le 2\pi$

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

and $g: x \to \frac{x}{2}$ for $0 \le x \le 2\pi$

$\Rightarrow g(x) = \frac{x}{2}$

(i) Given equation

$fg(x) = 1$

$f\left(\frac{x}{2}\right) = 1$ $\quad \because g(x) = \frac{x}{2}$

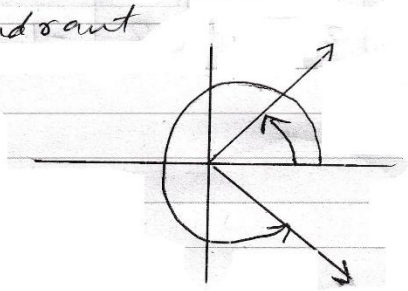
$2 - 3\cos\left(\frac{x}{2}\right) = 1$ $\quad \because f(x) = 2-3\cos x$

$-3\cos(x/2) = 1-2$

$-3\cos(x/2) = -1$

$\cos(x/2) = 1/3$

cos is +ve in first and forth quadrant



Basic angle

$\cos\alpha = \frac{1}{3}$

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

$\alpha = 1.23$ radians

As angle lie in I and IV quadrant

$\alpha,\ 2\pi - \alpha$

$\frac{x}{2} = \alpha,\ 2\pi - \alpha$

$= 1.23,\ 2\pi - 1.23$

$\frac{x}{2} = 1.23,\ 5.05$

$x = 2(1.23),\ 2(5.05)$

$x = 2.46,\ 10.1$

$\therefore x = 2.46$ radians (10.1 is out of range)

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

x	0	$\pi/2$	π	$\frac{3\pi}{2}$	2π
$f(x)$	-1	2	5	2	-1