

Q8 : At what points in the interval $[0, 2\pi]$, does the function $\sin 2x$ attain its maximum value?

Answer :

Let $f(x) = \sin 2x$.

$$\therefore f'(x) = 2 \cos 2x$$

Now,

$$f'(x) = 0 \Rightarrow \cos 2x = 0$$

$$\Rightarrow 2x = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}$$

$$\Rightarrow x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$$

Then, we evaluate the values of f at critical points $x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$ and at the end points of the interval $[0, 2\pi]$.

$$f\left(\frac{\pi}{4}\right) = \sin \frac{\pi}{2} = 1, f\left(\frac{3\pi}{4}\right) = \sin \frac{3\pi}{2} = -1$$

$$f\left(\frac{5\pi}{4}\right) = \sin \frac{5\pi}{2} = 1, f\left(\frac{7\pi}{4}\right) = \sin \frac{7\pi}{2} = -1$$

$$f(0) = \sin 0 = 0, f(2\pi) = \sin 2\pi = 0$$

Hence, we can conclude that the absolute maximum value of f on $[0, 2\pi]$ is occurring at $x = \frac{\pi}{4}$ and

$$x = \frac{5\pi}{4}.$$