



Increasing and Decreasing Functions Ex 17.2 Q14

We have,

$$f(x) = \tan x$$

$$\therefore f'(x) = \sec^2 x$$

Now,

$$x \in \left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$$

$$\Rightarrow \sec^2 x > 0$$

$$\Rightarrow f'(x) > 0$$

Hence, $f(x)$ is increasing function on $\left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$.

Increasing and Decreasing Functions Ex 17.2 Q15

We have,

$$f(x) = \tan^{-1}(\sin x + \cos x)$$

$$\begin{aligned} \therefore f'(x) &= \frac{1}{1 + (\sin x + \cos x)^2} \times (\cos x - \sin x) \\ &= \frac{\cos x - \sin x}{1 + \sin^2 x + \cos^2 x + 2 \sin x \cos x} \\ &= \frac{\cos x - \sin x}{2(1 + \sin x \cos x)} \end{aligned}$$

Now,

$$x \in \left(\frac{\pi}{4}, \frac{\pi}{2} \right)$$

$$\Rightarrow \cos x - \sin x < 0$$

$$\Rightarrow \frac{\cos x - \sin x}{2(1 + \sin x \cos x)} < 0 \quad \left[\because 2(1 + \sin x \cos x) > 0 \right]$$

$$\Rightarrow f'(x) < 0$$

Hence, $f(x)$ is decreasing function on $\left(\frac{\pi}{4}, \frac{\pi}{2} \right)$.

Increasing and Decreasing Functions Ex 17.2 Q16

We have,

$$f(x) = \sin\left(2x + \frac{\pi}{4}\right)$$

$$\therefore f'(x) = \cos\left(2x + \frac{\pi}{4}\right) \times 2$$

$$\therefore f'(x) = 2 \cos\left(2x + \frac{\pi}{4}\right)$$

Now,

$$x \in \left(\frac{3\pi}{8}, \frac{5\pi}{8}\right)$$

$$\Rightarrow \frac{3\pi}{8} < x < \frac{5\pi}{8}$$

$$\Rightarrow \frac{3\pi}{4} < 2x < \frac{5\pi}{4}$$

$$\Rightarrow \pi < 2x < \frac{\pi}{4} < \frac{3\pi}{2}$$

$$\Rightarrow 2x + \frac{\pi}{4} \text{ lies in IIrd quadrant}$$

$$\Rightarrow \cos\left(2x + \frac{\pi}{4}\right) < 0$$

$$\Rightarrow 2 \cos\left(2x + \frac{\pi}{4}\right) < 0$$

$$\Rightarrow f'(x) < 0$$

Hence, $f(x)$ is decreasing on $\left(\frac{3\pi}{8}, \frac{5\pi}{8}\right)$.

We have,

$$f(x) = \tan x - 4x$$

$$\begin{aligned}\therefore f'(x) &= \sec^2 x - 4 \\ &= \frac{1 - 4\cos^2 x}{\cos^2 x} \\ &= \frac{(1 + 2\cos x)(1 - 2\cos x)}{\cos^2 x} \\ &= 4\sec^2 x \left(\frac{1}{2} + \cos x \right) \left(\frac{1}{2} - \cos x \right)\end{aligned}$$

Now,

$$x \in \left(-\frac{\pi}{3}, \frac{\pi}{3} \right)$$

$$\Rightarrow -\frac{\pi}{3} < x < \frac{\pi}{3}$$

$$\Rightarrow \cos x > \frac{1}{2}$$

$$\Rightarrow \left(\frac{1}{2} - \cos x \right) < 0$$

$$\Rightarrow 4\sec^2 x \left(\frac{1}{2} + \cos x \right) \left(\frac{1}{2} - \cos x \right) < 0$$

$$\Rightarrow f'(x) < 0$$

Hence, $f(x)$ is decreasing function on $\left(-\frac{\pi}{3}, \frac{\pi}{3} \right)$.

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