



Increasing and Decreasing Functions Ex 17.2 Q22

A function  $f(x)$  is said to be increasing on  $[a, b]$  if  $f'(x) > 0$

Now, we have,

$$f(x) = x^2 - 6x + 3$$

$$\begin{aligned}\therefore f'(x) &= 2x - 6 \\ &= 2(x - 3)\end{aligned}$$

Again,

$$x \in [4, 6]$$

$$\Rightarrow 4 \leq x \leq 6$$

$$\Rightarrow 1 \leq x - 3 \leq 3$$

$$\Rightarrow (x - 3) > 0$$

$$\Rightarrow 2(x - 3) > 0$$

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

Hence,  $f(x)$  is an increasing function for  $x \in [4, 6]$ .

Increasing and Decreasing Functions Ex 17.2 Q23

We have,

$$f(x) = \sin x - \cos x$$

$$\therefore f'(x) = \cos x + \sin x$$

$$= \sqrt{2} \left( \frac{1}{\sqrt{2}} \cos x + \frac{1}{\sqrt{2}} \sin x \right)$$

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

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

Now,

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

$$\Rightarrow -\frac{\pi}{4} < x < \frac{\pi}{4}$$

$$\Rightarrow 0 < \frac{\pi}{4} + x < \frac{\pi}{2}$$

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

$$\Rightarrow 0 < \sin \left( \frac{\pi}{4} + x \right) < 1$$

$$\Rightarrow \sqrt{2} \sin \left( \frac{\pi}{4} + x \right) > 0$$

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

Hence,  $f(x)$  is an increasing function on  $\left( -\frac{\pi}{4}, \frac{\pi}{4} \right)$ .

We have,

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

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

Now,

$$x \in \mathbb{R}$$

$$\Rightarrow x^2 > 0 \text{ and } 1+x^2 > 0$$

$$\Rightarrow \frac{x^2}{1+x^2} > 0$$

$$\Rightarrow \frac{-x^2}{1+x^2} < 0$$

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

Hence,  $f(x)$  is a decreasing function for  $x \in \mathbb{R}$ .

Increasing and Decreasing Functions Ex 17.2 Q25

We have,

$$f(x) = -\frac{x}{2} + \sin x$$

$$\therefore f'(x) = -\frac{1}{2} + \cos x$$

Now,

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

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

$$\Rightarrow \cos\left(-\frac{\pi}{3}\right) < \cos x < \cos\frac{\pi}{3}$$

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

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

$$\Rightarrow -\frac{1}{2} + \cos x > 0$$

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

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

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