Increasing and Decreasing Functions Ex 17.2 Q30

We have,

$$f(x) = 3x^5 + 40x^3 + 240x$$

$$\therefore \quad f'(x) = 15x^4 + 120x^2 + 240$$

$$= 15\left(x^4 + 8x^2 + 16\right)$$

$$= 15\left(x^2 + 4\right)^2$$

Now,

$$x \in R$$

$$\Rightarrow \quad \left(x^2 + 4\right)^2 > 0$$

$$\Rightarrow \quad 15\left(x^2 + 4\right)^2 > 0$$

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

Hence, $f(x)$ is an increasing function for all x.

Increasing and Decreasing Functions Ex 17.2 Q31

We have,

$$f(x) = \log \cos x$$

$$\therefore f'(x) = \frac{1}{\cos x}(-\sin x) = -\tan x$$

In interval $\left(0, \frac{\pi}{2}\right)$, $\tan x > 0 \Rightarrow -\tan x < 0.$

$$\therefore f'(x) < 0 \text{ on } \left(0, \frac{\pi}{2}\right)$$

$\therefore f$ is strictly decreasing on $\left(0, \frac{\pi}{2}\right)$.

In interval $\left(\frac{\pi}{2}, \pi\right)$, $\tan x < 0 \Rightarrow -\tan x > 0.$

$$\therefore f'(x) > 0 \text{ on } \left(\frac{\pi}{2}, \pi\right)$$

Increasing and Decreasing Functions Ex 17.2 Q32

Given $f(x) = x^3 - 3x^2 + 4x$

$$\therefore \quad f'(x) = 3x^2 - 6x + 4$$

$$= 3\left(x^2 - 2x + 1\right) + 1$$

$$= 3(x-1)^2 + 1 > 0, \text{ for all } x \in \mathbf{R}$$

Hence, f is strictly increasing on **R**.

Increasing and Decreasing Functions Ex 17.2 Q33

Given $f(x) = \cos x$

$\therefore \quad f'(x) = -\sin x$

(i) Since for each $x \in (0, \pi)$, $\sin x > 0$

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

So f is strictly decreasing in $(0, \pi)$

(ii) Since for each $x \in (\pi, 2\pi)$, $\sin x < 0$

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

So f is strictly increasing in $(\pi, 2\pi)$

(iii) Clearly from (i) & (ii) above, f is neither increasing nor decreasing in $(0, 2\pi)$

********** END **********