Increasing and Decreasing Functions Ex 17.2 Q10

We have,

$$f(x) = x^3 - 15x^2 + 75x - 50$$

$$\therefore \quad f'(x) = 3x^2 - 30x + 75$$

$$\Rightarrow \quad f'(x) = 3\left(x^2 - 10x + 25\right)$$

$$= 3(x-5)^2$$

Now,

$$x \in R$$

$$\Rightarrow \quad (x-5)^2 > 0$$

$$\Rightarrow \quad 3(x-5)^2 > 0$$

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

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

Increasing and Decreasing Functions Ex 17.2 Q11

We have,

$$f(x) = \cos^2 x$$

$$\therefore \quad f'(x) = 2\cos x(-\sin x)$$

$$\Rightarrow \quad f'(x) = -2\sin x \cos x$$

$$\Rightarrow \quad f'(x) = -\sin 2x$$

Now,

$$x \in \left(0, \frac{\pi}{2}\right)$$

$$\Rightarrow \quad 2x \in (0, \pi)$$

$$\Rightarrow \quad \sin 2x > 0 \text{ when } 2x \in (0, \pi)$$

$$\Rightarrow \quad -\sin 2x < 0$$

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

Hence, $f(x)$ is a decreasing function on $\left(0, \frac{\pi}{2}\right)$.

Increasing and Decreasing Functions Ex 17.2 Q12

We have

$f(x)=\sin x$

$f'(x)=\cos x$

Now,

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

$\Rightarrow \cos x>0$

$\Rightarrow f'(x)>0$

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

Increasing and Decreasing Functions Ex 17.2 Q13

We have,

$f(x) = \cos x$

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

Now,

If $x \in (0, \pi)$

$\Rightarrow \quad \sin x > 0$

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

Hence, $f(x)$ is decreasing function on $(0, \pi)$

If $x \in (-\pi, 0)$

$\Rightarrow \quad \sin x < 0 \qquad [\because \sin(-\theta) = -\sin\theta]$

$\Rightarrow \quad -\sin x > 0$

Hence, $f(x)$ is increasing function on $(-\pi, 0)$

If $x \in (-\pi, \pi)$

Thus, $\sin x > 0$ for $x \in (0, \pi)$

and $\sin x < 0$ for $x \in (-\pi, 0)$

$\Rightarrow \quad -\sin x < 0$ for $x \in (0, \pi)$

and $-\sin x > 0$ for $x \in (-\pi, 0)$

Hence, $f(x)$ is neither increasing nor decreasing on $(-\pi, \pi)$.

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