Increasing and Decreasing Functions Ex 17.2 Q1(i)

We have,

$f(x) = 10 - 6x - 2x^2$

$\therefore f'(x) = -6 - 4x$

Now,

$f'(x) = 0 \Rightarrow x = -\frac{3}{2}$

The point $x = -\frac{3}{2}$ divides the real line into two disjoint intervals i.e., $\left(-\infty, -\frac{3}{2}\right)$ and $\left(-\frac{3}{2}, \infty\right)$.

In interval $\left(-\infty, -\frac{3}{2}\right)$ i.e., when $x < -\frac{3}{2}$, $f'(x) = -6 - 4x < 0$.

$\therefore f$ is strictly increasing for $x < -\frac{3}{2}$.

In interval $\left(-\frac{3}{2}, \infty\right)$ i.e., when $x > -\frac{3}{2}$, $f'(x) = -6 - 4x < 0$.

$\therefore f$ is strictly decreasing for $x > -\frac{3}{2}$.

Increasing and Decreasing Functions Ex 17.2 Q1(ii)

We have,

$f(x) = x^2 + 2x - 5$

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

Now,

$f'(x) = 0 \Rightarrow x = -1$

Point $x = -1$ divides the real line into two disjoint intervals i.e., $(-\infty, -1)$ and $(-1, \infty)$.

In interval $(-\infty, -1)$, $f'(x) = 2x + 2 < 0$.

$\therefore f$ is strictly decreasing in interval $(-\infty, -1)$.

Thus, f is strictly decreasing for $x < -1$.

In interval $(-1, \infty)$, $f'(x) = 2x + 2 > 0$.

$\therefore f$ is strictly increasing in interval $(-1, \infty)$.

Thus, f is strictly increasing for $x > -1$.

Increasing and Decreasing Functions Ex 17.2 Q1(iii)

We have,

$f(x) = 6 - 9x - x^2$

$\therefore f'(x) = -9 - 2x$

Now,

$f'(x) = 0$ gives $x = -\frac{9}{2}$

The point $x = -\frac{9}{2}$ divides the real line into two disjoint intervals i.e., $\left(-\infty, -\frac{9}{2}\right)$ and $\left(-\frac{9}{2}, \infty\right)$.

In interval $\left(-\infty, -\frac{9}{2}\right)$ i.e., for $x < -\frac{9}{2}$, $f'(x) = -9 - 2x > 0$.

$\therefore f$ is strictly increasing for $x < -\frac{9}{2}$.

In interval $\left(-\frac{9}{2}, \infty\right)$ i.e., for $x > -\frac{9}{2}$, $f'(x) = -9 - 2x < 0$.

$\therefore f$ is strictly decreasing for $x > -\frac{9}{2}$.

Increasing and Decreasing Functions Ex 17.2 Q1(iv)

$f(x) = 2x^3 - 12x^2 + 18x + 15$

$$\begin{aligned} \therefore \quad f'(x) &= 6x^2 - 24x + 18 \\ &= 6\left(x^2 - 4x + 3\right) \\ &= 6(x-3)(x-1) \end{aligned}$$

Critical point

$$f'(x) = 0$$

$$\Rightarrow \quad 6(x-3)(x-1) = 0$$

$$\Rightarrow \quad x = 3,\ 1$$

Clearly, $f(x) > 0$ if $x < 1$ and $x > 3$

and $f(x) < 0$ if $1 < x < 3$

Thus, $f(x)$ increases on $(-\infty, 1) \cup (3, \infty)$, decreases on $(1, 3)$.

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