Increasing and Decreasing Functions Ex 17.2 Q1(xxvi)

Consider the given function

$f(x) = 3x^4 - 4x^3 - 12x^2 + 5$

$\Rightarrow f'(x) = 12x^3 - 12x^2 - 24x$

$\Rightarrow f'(x) = 12x(x^2 - x - 2)$

$\Rightarrow f'(x) = 12x(x + 1)(x - 2)$

For $f(x)$ to be increasing, we must have,

$f'(x) > 0$

$\Rightarrow 12x(x + 1)(x - 2) > 0$

$\Rightarrow x(x + 1)(x - 2) > 0$

$\Rightarrow -1 < x < 0$ or $2 < x < \infty$

$\Rightarrow x \in (-1, 0) \cup (2, \infty)$

So, $f(x)$ *i*s increasing in $(-1, 0) \cup (2, \infty)$

For $f(x)$ to be decreasing, we must have,

$f'(x) < 0$

$\Rightarrow 12x(x + 1)(x - 2) < 0$

$\Rightarrow x(x + 1)(x - 2) < 0$

$\Rightarrow -\infty < x < -1$ or $0 < x < 2$

$\Rightarrow x \in (-\infty, -1) \cup (0, 2)$

So, $f(x)$ *i*s *decrea*sing in $(-\infty, -1) \cup (0, 2)$

Increasing and Decreasing Functions Ex 17.2 Q1(xxvii)

Consider the given function

$$f(x) = \frac{3}{2}x^4 - 4x^3 - 45x^2 + 51$$

$$\Rightarrow f'(x) = 4 \times \frac{3}{2}x^3 - 12x^2 - 90x$$

$$\Rightarrow f'(x) = 6x^3 - 12x^2 - 90x$$

$$\Rightarrow f'(x) = 6x\left(x^2 - 2x - 15\right)$$

$$\Rightarrow f'(x) = 6x(x+3)(x-5)$$

For f(x) to be increasing, we must have,

$$f'(x) > 0$$

$$\Rightarrow 6x(x+3)(x-5) > 0$$

$$\Rightarrow x(x+3)(x-5) > 0$$

$$\Rightarrow -3 < x < 0 \text{ or } 5 < x < \infty$$

$$\Rightarrow x \in (-3, 0) \cup (5, \infty)$$

So, f(x) *i*s *increasing* in $(-3, 0) \cup (5, \infty)$

For f(x) to be decreasing, we must have,

$$f'(x) < 0$$

$$\Rightarrow 6x(x+3)(x-5) < 0$$

$$\Rightarrow x(x+3)(x-5) < 0$$

$$\Rightarrow -\infty < x < -3 \text{ or } 0 < x < 5$$

$$\Rightarrow x \in (-\infty, -3) \cup (0, 5)$$

So, f(x) *i*s *decrea*sing in $(-\infty, -3) \cup (0, 5)$

Increasing and Decreasing Functions Ex 17.2 Q1(xxviii)

Consider the given function

$$f(x) = \log(2+x) - \frac{2x}{2+x}, x \in R$$

$$\Rightarrow f'(x) = \frac{1}{2+x} - \frac{(2+x)2 - 2x \times 1}{(2+x)^2}$$

$$\Rightarrow f'(x) = \frac{1}{2+x} - \frac{4+2x-2x}{(2+x)^2}$$

$$\Rightarrow f'(x) = \frac{1}{2+x} - \frac{4}{(2+x)^2}$$

$$\Rightarrow f'(x) = \frac{2+x-4}{(2+x)^2}$$

$$\Rightarrow f'(x) = \frac{x-2}{(2+x)^2}$$

For $\mathrm{f}(\mathrm{x})$ to be increasing, we must have,

$f'(x) > 0$

$\Rightarrow x - 2 > 0$

$\Rightarrow 2<x<\infty$

$\Rightarrow x \in (2, \infty)$

So, $\mathrm{f}(\mathrm{x})$ *i* sin*crea*sing in $(2, \infty)$

For $\mathrm{f}(\mathrm{x})$ to be decreasing, we must have,

$f'(x) < 0$

$\Rightarrow x - 2 < 0$

$\Rightarrow -\infty<x<2$

$\Rightarrow x \in (-\infty, 2)$

So, $\mathrm{f}(\mathrm{x})$ is decreasing in $(-\infty, 2)$

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