

Q. 1.

$$\lim_{x \rightarrow -\frac{2}{3}} \frac{15x^2 + 7x - 2}{42x^2 + 52x + 16}$$

Numerator $15x^2 + 7x - 2$ $P = -30$

$$15x^2 + 10x -$$

$$S = 7$$

$$15x^2 - 3x + 10x - 2$$

$$3x(5x-1) + 2(5x-1) = (3x+2)(5x-1)$$

Denominator

$$42x^2 + 52x + 16 \rightarrow 14x$$

$$2(21x^2 + 26x + 8) \rightarrow 2(7x+4)(3x+2)$$

$$\lim_{x \rightarrow -\frac{2}{3}} \frac{(3x+2)(5x-1)}{2(7x+4)(3x+2)} = \frac{5x-1}{2(7x+4)}$$

$$\Rightarrow \frac{5(-\frac{2}{3}) - 1}{2(7(-\frac{2}{3}) + 4)} = \frac{-\frac{10}{3} - 1}{2(-\frac{14}{3} + 4)}$$

$$= \frac{13}{4} = 3.25$$

Q.2

Date / /

$$y = \sqrt[3]{6x^2 - x}$$

$$= y = (6x^2 - x)^{1/3} \quad \text{let } (6x^2 - x) = u$$

$$y = u^{1/3} \quad \frac{dy}{du} = \frac{1}{3} u^{-2/3}$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$\frac{du}{dx} = \underline{\underline{12x - 1}}$$

$$\hookrightarrow = \frac{1}{3} (6x^2 - x)^{-2/3} \cdot (12x - 1)$$

$$\Rightarrow \frac{dy}{dx} = \frac{12x - 1}{3(6x^2 - x)^{2/3}}$$

Q.3

Date / /

$$C(x) = \frac{5x^3 - 8x^2 + 11x + 1000}{x}$$

$$\text{T. Revenue} - 200 \text{ c.} \rightarrow \$250,000$$

$$\text{M.R} \rightarrow \$995$$

$$C'(x) = 10x - 8$$

$$\text{T. Profit} \Rightarrow x = 210 = R(x) - (cx)$$

$$C(210) = 219831.52$$

$$R(x) = 428,831 \quad P = 428831 - 219831.52$$

$$R(x) = x(C(x)) \rightarrow = \$208,999.48$$

$$\text{T. Profit at } x=195 \quad C_x = 189,576$$

$$R(x) = 383,576$$

$$\text{Profit} = \underline{194,000}$$

Increasing sales to 210 is more profitable

Q. 4

$$f(x) = \frac{1}{3}x^3 + 2x^2 - 5x + \frac{8}{3}$$

$$f'(x) = x^2 + 4x - 5 = 0$$

$x = -5, 1$ - critical points:

Sign	$-\infty < x < -5$	$x = -5$	$-5 < x < 1$	$x = 1$
Sign	+ve	0	-	0
	Increasing	Max.	decreasing	Minimum

substituting $x = -5$ to $f(x)$

$$= \frac{1}{3}(-5^3) + 2(-5^2) - 5(-5) + \frac{8}{3}$$

$$= 36 \quad \text{Max } (-5, 36) \dots$$

$$x = 1 \quad y = 1 \quad \text{Min } (1, 0) \dots$$

Inflection point

$$y' = x^2 + 4x - 5 \quad y'' = 2x + 4 = 0$$

$$y = \frac{1}{3}(-2^3) + 2(-2^2) - 5(-2) \quad x = -2$$

$$+ \frac{8}{3} = 18 \quad \text{Point (Inflection)}$$

$$= (-2, 18)$$