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MAT 104

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MBBS

Find (i) eq of Tangent and (ii) eq of Normal

(a) $y = 2x^2$ at $(1, 2)$

$\frac{dy}{dx} = 4x = 4(1) = 4 = m$ at $x = 1$

$m = \frac{dy}{dx}\Big|_{x=1} = 4$

(i) Tangent: $y - y_1 = m(x - x_1)$

$y - 2 = 4(x - 1)$

$y - 2 = 4x - 4$

$y = 4x - 2$

(ii) Normal: $(y - y_1) = -\frac{1}{m}(x - x_1)$

$y - 2 = -\frac{1}{4}(x - 1)$

$4(y - 2) = -x + 1$

$4y - 8 = -x + 1$

$4y = 9 - x$

(b) $y = 3x^2 - 2x$ at $(2, 8)$

$\frac{dy}{dx} = 6x - 2$

$m = \left.\frac{dy}{dx}\right|_{x=2} = 6(2) - 2 = 12 - 2$

$m = 10$

(a) tangent : $y - y_1 = m(x - x_1)$

$y - 8 = 10(x - 2)$

$y - 8 = 10x - 20$

$y = 10x - 12$

Tangent → $y = 10x - 12$

(b) Normal : $y - y_1 = -\frac{1}{m}(x - x_1)$

$y - 8 = -\frac{1}{10}(x - 2)$

$10(y - 8) = -1(x - 2)$

$10y - 80 = -x + 2$

Normal → $10y = 82 - x$

(3) $y = \frac{x^3 - 4}{2 - 4}$ at point $(-1, -\frac{1}{2})$

$\frac{dy}{dx} = \frac{V\frac{du}{dx} - U\frac{dv}{dx}}{v^2} = \frac{(3x^2 \times 2) - (x^3 \times 0)}{4}$

$\frac{dy}{dx} = \frac{6x^2}{4} = \frac{3x^2}{2}$

$m = \left.\frac{dy}{dx}\right|_{x=-1} = \frac{3(-1)^2}{2} = \frac{3}{2}$

(c) Tangent : $y - y_1 = m(x - x_1)$

$\left(y - \left(-\frac{1}{2}\right)\right) = \frac{3}{2}(x - (-1))$

$y + \frac{1}{2} = \frac{3}{2}(x+1)$

$2x\left(\frac{2y+1}{2}\right) = 3x + 3$

$2y + 1 = 3x + 3$

$2y = 3x + 2$

(d) Normal : $y - y_1 = \frac{-1}{m}(x - x_1)$

$\left(y - \left(-\frac{1}{2}\right)\right) = -\frac{2}{3}(x - (-1))$

$\left(y + \frac{1}{2}\right) = -\frac{2}{3}(x+1)$

$3 \cancel{6} \times \frac{2y+1}{\cancel{2}} = \frac{-2x-2}{\cancel{3}} \times \cancel{6}\,2$

$6y + 3 = -4x - 4$

$6y = -4x - 7$

(4) $y = 1 + x - x^2$ at point $(-2, -5)$

$\frac{dy}{dx} = 1 - 2x$

$m = \left.\frac{dy}{dx}\right|_{x=-2} = 1 - 2(-2) = 1 + 4 = 5$

(i) tangent : $y - y_1 = m(x - x_1)$

$y - (-5) = 5(x - (-2))$

$y + 5 = 5(x + 2)$

$y + 5 = 5x + 10$

$y = 5x + 5$

(ii) Normal : $y - y_1 = \frac{-1}{m}(x - x_1)$

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

$5y + 25 = -x - 2$

$5y = -x - 27$

(5) $y = \frac{1}{x - 4}$ at $(3, \frac{1}{3})$

$\frac{dy}{dx} = \frac{V\frac{du}{dx} - U\frac{dv}{dx}}{V^2} = \frac{0 - 1}{x^2} = \frac{-1}{x^2}$

$m = \left.\frac{dy}{dx}\right|_{x=3} = \frac{-1}{x^2} = \frac{-1}{9}$

(i) Tangent : $y - y_1 = m(x - x_1)$

$\left(y - \frac{1}{3}\right) = -\frac{1}{9}(x - 3)$

$9 \times \frac{3y - 1}{3} = \frac{-x + 3}{9} \times 9$

$3(3y - 1) = -x + 3$

$9y - 3 = -x + 3$

$9y = -x + 6$

(ii) Normal :- $y - y_1 = \frac{-1}{m}(x - x_1)$

$\left(y - \frac{1}{3}\right) = 9(x - 3)$

$\frac{3y - 1}{3} = 9(x - 3)$

$3y - 1 = 27(x - 3)$

$3y - 1 = 27x - 81$

$3y = 27x - 80$