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

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

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

$2y + 1 = 3x + 3$

$2y - 3x + 1 - 3 = 0$

$2y - 3x - 2 = 0$ //

Eqn of normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

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

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

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

take lcm and multiply through by lcm i.e 6

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

$6y + 4x + 3 + 4 = 0$

$6y + 4x + 7 = 0$ //

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

$dy/dx = 1 - 2x$ $\quad x_1 = -2, y_1 = -5, y = 1 + x - x^2$

$\frac{dy}{dx}\Big|_{x=-2}$ $\quad 1 - 2(-2)$

$1 + 4 = 5$

$m = 5$

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

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

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

$y + 5 = 5x + 10$

$y - 5x + 5 - 10 = 0$

$y - 5x - 5 = 0$ //

Eqn of normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

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

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

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

-take lcm and multiply by 2cm i.e 5

$5y + 25 = -x - 2$

$= 4y + x - 8 - 1 = 0$

$= 4y + x - 9 = 0$

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

$x_1 = 2 \quad y_1 = 8 \quad y = 3x^2 - 2x$

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

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

$12 - 2 = 10$

$m = 10$

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

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

$y - 8 = 10x - 20$

$y - 10x - 8 + 20 = 0$

$y - 10x + 12 = 0$

Eqn of normal $= y - y_1 = \frac{1}{m}(x - x_1)$

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

$y - 8 = \frac{x}{10} + \frac{2}{10}$

$10y - 80 = x + 2$

$10y - x - 80 - 2 = 0$

$10y - x - 82 = 0$

③ $y = x^3/2$ at the point $(-1, -1/2)$

$x_1 = -1, \; y_1 = -1/2 \quad y = x^3/2$

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

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

$m = \frac{3}{2}$

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

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QUESTION

For the Curves in Problem 1 to 5 at the point given find (a) the equation of the tangent, and (b) the equation of the normal

(1) $y = 2x^2$ at the point (1, 2)
(2) $y = 3x^2 - 2x$ at the point (2, 8)
(3) $y = x^3/2$ at the point $(-1, -1/2)$
(4) $y = 1 + x - x^2$ at the point $(-2, -5)$
(5) $y = 1/x$ at the point $(3, 1/3)$.

Solution

(1) $y = 2x^2$ at the point (x, y) $(1, 2)$

$x = 1, y = 2, y = 2x^2$

$dy/dx = 4x$

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

$m = 4$

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

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

$y - 2 = 4x - 4$

$y - 4x = -4 + 2 = 0$

$y - 4x + 4 - 2 = 0$

$y - 4x + 2 = 0$ //

Equation of the normal $= y - y_1 = \frac{-1}{m}(x - x_1)$

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

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

$4y - 8 = -x + 1$

$5y + x + 25 + 2 = 0$

$5y + x + 27 = 0$ //

(5) $y = 1/x$ at the point $(3, 1/3)$

$x = 3, y = 1/3, y = 1/x$

$\frac{dy}{dx}$ $y = x^{-1}$

$\frac{dy}{dx} = -1(x)^{-1-1}$

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

$dy/dx = -1/x^2$

$dy/dx|_{x=3} = \frac{1}{(3)^2} = 1/9$

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

$y - 1/3 = 1/9(x - 3)$

$9y - 3 = -x + 3$

$9y + x - 3 - 3 = 0$

$9y + x - 6 = 0$ //

Eqn of normal $= y - y_1 = \frac{-1}{m}(x - x_1)$

$y - 1/3 = -1/1/9(x - 3)$

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

$y - 1/3 = 9(x - 3)$

$y - 1/3 = 9x - 27$

$3y - 1 = 27x - 81$

$3y - 27x - 1 + 81 = 0$

$3y - 27x + 80 = 0$ //