SALAWU-ERICA ELIZABETH
19/MHS01/393
Medicine and surgery
31 MARCH 2020
MAT 104 Assignment

(1) Find the equation of tangent and normal of :-
$y = 2x^2$ at a point (1, 2)

SOL →

$$y = 2x^2$$

$$\frac{dy}{dx} = 4x$$

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

The equation of the tangent giving:-

$\therefore y - y_1 = m(x - x_1)$

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$

$\therefore$ the equation of tangent = ↓

$$y = 4x - 2$$

The equation for the normal:-

$$m = \frac{-1}{4}$$

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$

$\therefore$ the equation for the normal = ↓

$$4y + x - 9 = 0$$

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(2) Find the equation of tangent and normal of $y = 3x^2 - 2x$ at the point (2, 8)

SOL →

$$y = 3x^2 - 2x$$

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

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

$$m = 12 - 2 = 10$$

The equation of the tangent giving :-

$$y - y_1 = m(x - x_1)$$

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

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

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

$$y - 10x + 12 = 0$$

∴ equation of tangent = $y = 10x - 12$

The equation for the normal :-

$$m = \frac{-1}{10}$$

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

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

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

$$10y + x - 82 = 0$$

∴ the equation of normal = $10y + x - 82 = 0$

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③ Find the equation of the tangent and normal to curve $y = \frac{x^3}{2}$ at the point $(-1, -1/2)$

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

$M = \frac{dy}{dx}\Big|_{x=-1} = \frac{3(-1)^2}{2}$

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

The equation of the tangent giving:

$y - y_1 = m(x - x_1)$

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

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

$2y + 1 = 3x + 3$

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

$2y - 3x - 2 = 0$

∴ equation of the tangent = $2y - 3x - 2 = 0$

The equation for the normal:

$m = \frac{-1}{(3/2)} = \frac{-2}{3}$

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

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

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

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

∴ the equation for the normal = ↓

$y = -\frac{2}{3}x - \frac{7}{6}$

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(4) Find the equation of the tangent and normal to curve :- $y = 1 + x - x^2$ at the point $(-2, -5)$

SOL →

$$y = 1 + x - x^2$$

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

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

$$\therefore m = 1 + 4 = 5$$

The equation of the tangent giving :-

$$y - y_1 = m(x - x_1)$$
$$y - (-5) = 5(x - -2)$$
$$y + 5 = 5(x + 2)$$
$$y + 5 = 5x + 10$$
$$y - 5x + 5 - 10 = 0$$
$$y - 5x - 5 = 0$$

∴ the equation of the tangent = $y = 5x + 5$

The equation for the normal :-

$$m = \frac{-1}{5}$$

$$y - y_1 = m(x - x_1)$$
$$y - (-5) = \frac{-1}{5}(x - -2)$$
$$y + 5 = \frac{-1}{5}(x + 2)$$
$$5y + 25 = -x - 2$$
$$5y + x + 25 + 2 = 0$$
$$5y + x + 27 = 0$$

∴ the equation for the normal = $5y + x + 27 = 0$

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(5) Find the equation of the tangent and normal to curve :- $y = \frac{1}{x}$ at the point $(3, 1/3)$

SOL → $y = 1/x$

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

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

The equation of the tangent giving :-

$$y - y_1 = m(x - x_1)$$

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

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

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

$$y = \frac{-1}{9}x + \frac{2}{3}$$

∴ the equation of the tangent $= y = -1/9\,x + 2/3$

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(Continuation)

The equation for the normal:-

$$m = \frac{-1}{(-1/9)} = 9$$

$$y - y_1 = m(x - x_1)$$

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

$$y - \frac{1}{3} = 9x - 27$$

$$y - 1 = 27x - 81$$

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

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

∴ the equation for the normal = ↓

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