MATHS 104

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QUESTION

for the curves problems one to five at the point given find.

i) the equation of the tangent

ii) the equation of the normal

Solution

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

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

i) $\left.\frac{dy}{dx}\right|_{x=1} = 4(1) = 4$

where $m = 4, x = 1$ & $y = 2$

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

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

$$y - 2 = 4x - 4$$

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

$$y - 4x + 2 = 0$$ [equation of the tangent]

$$m_1 m_2 = 1$$

$$m_2 = \frac{-1}{m_1} = \frac{-1}{4} = -0.25$$

$$y - y_1 = m_2(x - x_1)$$

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

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

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

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

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

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

$$\left.\frac{dy}{dx}\right|_{x=2} = 6(2) - 2 = 12 - 2 = 10$$

where $m = 10, x = 2$ & $y = 8$

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

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

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

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

$y - 10x + 12 = 0$ [Equation of the tangent]

b) $m_1 m_2 = -1$

$m_2 = \frac{-1}{m_1} = \frac{-1}{10}$

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

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

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

$10y + x - 82 = 0$ [Equation of the normal]

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

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

$\left.\frac{dy}{dx}\right|_{x=-1} = \frac{3}{2}(-1)^2 = 3/2$ where $m = 3/2$ $x_1 = -1$ and $y_1 = -1/2$

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

$y - (-1/2) = 3/2\,(x - (-1))$

$y + 1/2 = 3/2\,(x + 1)$

$2y + 1 = 3x + 3$

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

$2y - 3x - 2 = 0$ [Equation of the tangent]

$m_1 m_2 = -1$

$m_2 = -1/m_1 = -1/3/2 = -2/3$

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

$y - (-1/2) = -2/3\,(x - (-1))$

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

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

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

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

4) $y = 1 + x - x^2$ at points $(-2, -3)$

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

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

where $m = 5$ $x = -2$ & $y = -5$.

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

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

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0$ [Equation of the tangent]

ii) $m_1 m_2 = -1$

$m_2 = \frac{1}{m_1} = \frac{-1}{5}$

$y - y_1 = m_2(x - x_1)$

$y + 5 = -1/5\,(x + 2)$

$5y + 25 = -x - 2$

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

$5y + x + 27 = 0$ [Equation of the normal]

5) $y = 1/x$ at points $(3, 1/8)$

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

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

where $m = 1/9$ $x = 3$ & $y = 1/3$

z) $y - y_1 = m(x - x_2)$

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

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

$9y - 3 = x - 3$

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

$9y - x = 0$ [Equation of the tangent]

b) $m_2 = \frac{-1}{m_1} = \frac{-1}{1/9} = -9$

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

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

$y + 9x - \frac{82}{3} = 0$

$3y + 27x - 82 = 0$ [Equation of the normal.