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COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

MATRIC NO: 19/MHS01/163

COURSE CODE: MAT 104

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

$x_1 = 1 \quad y_1 = 2$

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

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

$m = 4$

a The equation of the tangent:

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

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

$y - 2 = 4x - 4$

$y = 4x - 4 + 2$

$y = 4x - 2$ OR

$y - 4x + 2 = 0$

b The equation of the normal:

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

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

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

$4y - 8 = -x + 1$

$4y = -x + 1 + 8$

$4y = -x + 9$ OR

$4y + x - 9 = 0$

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

$x_1 = 2 \quad y_1 = 8$

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

$m = \frac{dy}{dx} \Big| x = 2$

$= 6(2) - 2$

$= 12 - 2$

$m = 10$

The equation of the tangent

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

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

$y - 8 = 10x - 20$

$y = 10x - 20 + 8$

$y = 10x - 12$ OR

$y - 10x + 12 = 0$

The equation of the normal:

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

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

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

$10y - 80 = -x + 2$

$10y = -x + 2 + 80$

$10y = -x + 82$ OR

$10y + x - 82 = 0$

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

$x_1 = -1 \quad y_1 = -\frac{1}{2}$

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

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

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

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

3a The equation of the tangent:

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

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

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

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

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

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

$$2y = 3x + 2$$

OR

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

3b The equation of the normal:

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

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

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

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

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

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

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

OR

$$3y + 2x + \frac{7}{2} = 0$$

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

$x_1 = -2$ $y_1 = -5$

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

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

$$= 1 - 2(-2)$$

$$= 1 + 4$$

$$m = 5$$

4a The equation of the tangent:

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

4b The equation of the normal:

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

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

$x_1 = 3 \quad y_1 = \frac{1}{3}$

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

$$m = \frac{dy}{dx}\Big|_{x=3}$$

$$= -\frac{1}{3^2}$$

$$m = -\frac{1}{9}$$

5a The equation of the tangent:

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

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

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

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

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

$$9y = -x + 6$$

OR

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

5b The equation of the normal:

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

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

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

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

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

$$y = 9x - \frac{80}{3}$$

OR

$$y - 9x + \frac{80}{3} = 0$$