mathematics assignment
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MATRIC NO: 19/MHS01/245
COURSE CODE: MATHS 104

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

solution

$y = mc + x$

$y = 2x^2$

$m = \left.\frac{dy}{dx}\right|_1$ $\quad m = 4x$

$m = 4(1)$

$m = 4$

a) equation of tangent

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

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

$y - 2 = 4x - 4$

$y = 4x - 4 + 2$

$y = 4x - 2$ which gives the equation of the tangent

b) equation of the normal

$y - y_1 = \frac{-1}{m_1}(x - x_1)$

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

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

~~$4(y-2) =$~~

~~$\frac{4(y-2)}{4} = -1x + 1$~~ multiply both sides by 4 $\quad 4(y-2) = -1x + 1$

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

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

$4y = -1x + 9$

$y = \frac{-1}{4}x + \frac{9}{4}$

which gives the the equation of the normal.

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

solutions

$y = 3x^2 - 2x$

$m = \frac{dy}{dx}\Big|_2 = 6x - 2$

$= 6(2) - 2$

$= 12 - 2$

$= 10$

a) equation of the tangent

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

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

$y - 8 = 10x - 20$

$y = 10x - 20 + 8$

$y = 10x - 12$ which gives the equation of the tangent

b) equation of the normal

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

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

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

multiply both sides by 10

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

$10y - 80 = -1x + 2$

$10y = -1x + 2 + 80$

$10y = -x + 82$

$y = \frac{-x}{10} + \frac{82}{10}$ which gives the equation of the norm

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

solution

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

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

$y = \frac{u}{v}$

using quotient rule

$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

$u = x^3$ $\frac{du}{dx} = 3x^2$

$v = 2$ $\frac{dv}{dx} = 0$

$\frac{dy}{dx} = \frac{2(3x^2) - x^3(0)}{2^2}$

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

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

a) equation of the tangent

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

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

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

~~y+½~~ multiply both sides by 2

$2y + 1 = 3x + 3$

$2y = 3x + 3 - 1$

$y = \frac{3x}{2} + 1$ which gives the equation of the tangent

b) equation of the normal

$y - y_1 = \frac{-1}{m_1}(x - x_1)$

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

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

multiply both sides by 6

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

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

$6y = -4x - 7$

$y = \frac{-4}{6}x - \frac{7}{6}$

$y = -\frac{2}{3}x - \frac{7}{6}$ which gives the equation of the normal

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

solution

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

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

$$= 5$$

a) equation of the tangent

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

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

$$y + 5 = 5x + 10$$

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

$y = 5x + 5$ which gives the equation of the tangent

b) equation of the normal

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

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

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

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

$$5y + 5 = 5 - x$$

$$5y = 5 - x - 5$$

$$5y = -x$$

$y = \frac{x}{5}$ which gives the equation of the normal

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

solution

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

$$\left.\frac{dy}{dx}\right|_3 = -(3)^{-2}$$

$$= -1/9$$

a) equation of the normal

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

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

$y - \cancel{1}$ multiply both side by 9

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

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

$$9y = -x + 6$$

$$y = \frac{-x}{9} + \frac{6}{9}$$ which gives the equation of the tangent

b) equation of the tangent

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

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

multiply both sides by 3

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

$$3y = 3x - 9 + 1$$

$$3y = 3x - 8$$

$$y = x - \frac{8}{3}$$ which gives the equation of the normal