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

Solution

For normal..

$$y = 1/x$$

$$y = x^{-1}$$

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

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

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

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

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

For equation of tangent:

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

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

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

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

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

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

For equation of normal:

$$y - y_1 = -1/m(x - x_1)$$

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

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

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

Multiply through by 3

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

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

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

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

b) For equation of ~~tangent~~ normal:

$(y-y_1) = -1/m(x-x_1)$

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

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

Multiply through by 6

$6(y+\frac{1}{2}) = -4(x+1)$

$6y+3 = -4(x+1)$

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

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

$6y+4x+7=0$

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

for normal:

$y = 1+x-x^2$

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

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

$= 1+4$

$m = \frac{dy}{dx} = 5$

a)

for equation of tangent:

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

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

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

$y+5 = 5x+10$

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

b) $y-5x-5=0$

for equation of normal:

$y-y_1 = -1/m(x-x_1)$

$y-(-5) = -1/5(x-(-2))$

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

$5(y+5) = -1(x+5)$

$5y+25 = -x-2$

$5y+x+27=0$

a)

∴ For equation of tangent:

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

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

$y - 8 = 10x - 20$

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

∴ b) $y - 10x + 12 = 0$

for equation of normal:

$y - y_1 = -1/m(x - x_1)$

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

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

$10y - 80 = -x + 2$

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

$10y + x - 82 = 0$

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

Solution

for normal:

$y = x^3/2$

$\frac{dy}{dx} \text{ of } \frac{1}{2}x^3 = \frac{3}{2}x^2$

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

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

a) for equation of tangent:

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

$y - (-1/2) = m(x - (-1))$

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

$y + \frac{1}{2} = \frac{3}{2}(x + 1)$; Then multiply through by 2

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

$2y + 1 = 3x + 3$

$2y - 3x - 2 = 0$

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MAT 104

MATHS ASSIGNMENT ANSWER:

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

solution

For normal:

$$y = 2x^2$$

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

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

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

a) Equation of tangent:

$$y - y_1 = m(x - x_1)$$
$$y - 2 = 4(x - 1)$$
$$y - 2 = 4x - 4$$
$$y - 4x - 2 + 4 = 0$$
$$y - 4x + 2 = 0$$

b) Equation of the normal:

$$y - y_1 = -1/m(x - x_1)$$
$$y - 2 = -1/4(x - 1)$$
$$4(y - 2) = -1(x - 1)$$
$$4y - 8 = -x + 1$$
$$4y + x - 8 - 1 = 0$$
$$4y + x - 9 = 0$$

~~2. $y = 3x^2 - 2x$ at~~

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

solution

For normal:

$$y = 3x^2 - 2x$$
$$\frac{dy}{dx} = 6x - 2$$
$$\left.\frac{dy}{dx}\right|_{x=2} = 6(2) - 2 = 10$$
$$m = \frac{dy}{dx} = 10$$