5 $y = 1/x$ at the point $(3, 1/3)$ $\therefore x_1 = 3, y_1 = 1/3$

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

$y = x^{-1}$

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

when $x = 3$

$m = -(3)^{-2}$

$m = -1/9$

a) For the equation of the tangent,

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

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

$y - 1/3 = -1/9\,x + 1/3$

$1/9\,x + y - 1/3 - 1/3 = 0$

$1/9\,x + y - 2/3 = 0$

Multiply through by 9

$x + 9y - 6 = 0$

$\therefore 9y + x - 6 = 0$ (eqn of the tangent)

b) For the equation of the normal,

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

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

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

$9x - y - 27 + 1/3 = 0$

$9x - y - 80/3 = 0$

Multiply through by 3

$27x - 3y - 80 = 0$

$\therefore -3y + 27x - 80 = 0$ (eqn of the normal)

a) For the equation of the tangent,

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

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

$y-8 = 10x-20$

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

$10x-y-12=0$

$\therefore -y+10x-12=0$ (eqn of the tangent)

b) For the equation of the normal,

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

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

$y-8) = -1/10x + 1/5$

$1/10x + y - 8 - 1/5 = 0$

$1/10x + y - 4 1/5 = 0$

Multiply through by 10

$x + 10y - 82 = 0$

$\therefore 10y + x - 82 = 0$ (eqn of the normal)

3) $y = x^3/2$ at the point $(-1, -1/2)$ $\therefore y = 1/2\,x^3$; $x_1 = -1, y_1 = -1/2$

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

when $x = -1$

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

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

a) For the equation of the tangent,

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

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

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

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

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

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

Multiply through by 2

$3x - 2y + 2 = 0$

$\therefore -2y + 3x + 2 = 0$ (eqn of the tangent)

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MAT 104 ASSIGNMENT

For the curves in Problem 1 to 5, at the points given, find
a) the equation of the tangent
b) the equation of the normal

Soln

1) $y = 2x^2$ at the point $(1, 2) \therefore x_1 = 1, y_1 = 2$

$y = 2x^2$

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

when $x = 1$

$m = 4(1) = 4$

$m = 4$

a) For the equation of the tangent,

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

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

$y - 2 = 4x - 4$

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

$4x - y - 2 = 0$

$\therefore -y + 4x - 2 = 0$ (eqn of the tangent)

b) For the equation of the normal,

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

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

$y - 2 = -1/4x + 1/4$

$1/4x + y - 2 - 1/4 = 0$

$1/4x + y - 9/4 = 0$

Multiply through by 4

$x + 4y - 9 = 0$

$\therefore 4y + x - 9 = 0$ (eqn of the normal)

2) $y = 3x^2 - 2x$ at the point $(2, 8) \therefore x_1 = 2, y_1 = 8$

$y = 3x^2 - 2x$

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

when $x = 2$

$m = 6(2) - 2$

$m = 12 - 2$

$m = 10$

b For the equation of the normal,

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

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

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

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

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

$2/3x + y + 7/6 = 0$

Multiply through by 6

$4x + 6y + 7 = 0$

$\therefore 6y + 4x + 7 = 0$ (eqn of the normal)

4 $y = 1 + x - x^2$ at the point $(-2, -5)$ $\therefore x_1 = -2, y_1 = -5$

$y = 1 + x - x^2$

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

when $x = -2$

$m = 1 - 2(-2)$

$m = 1 + 4$

$m = 5$

$y_1 = -1/2$

a For the equation of the tangent,

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

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

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

$y+5 = 5x + 10$

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

$5x - y + 5 = 0$

$\therefore -y + 5x + 5 = 0$ (eqn of the tangent).

b For the equation of the normal,

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

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

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

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

$1/5\,x + y + 5 + 2/5 = 0$

$1/5\,x + y + 27/5 = 0$

Multiply through by 5

$x + 5y + 27 = 0$

$5y + x + 27 = 0$ (eqn of the normal)