Course: Maths 104

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For the curves in problem 1 to 5, at the points given, find (a) the equation of the tangent, and (b) the equation of the normal.

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

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$y = 2x^2$

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

$m = \frac{dy}{dx}/_{x=x_1} = 4x$, when $x = 1$

$m = 4(1)$

$m = 4$

1a) Equation of a tangent

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

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

$y - 2 = 4x - 4$

$y - 4x = -4 + 2$

$y - 4x = -2$

$-4x + y + 2$

$4x - y - 2 = 0$

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1b.) Equation of the normal

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

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

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

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

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

$4y - 8 = -x + 1$

$4y + x - 9 = 0$

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

$y = \cancel{6x - 2}\ 3x^2 - 2$

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

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

when $x = 2$,

$m = 6(2) - 2$

$= 12 - 2$

$\therefore m = 10$

2a. Equation of the tangent

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

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

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$y - 8 = 10x - 20$
$y - 10x = -20 + 8$
$y - 10x = -12$
$10x - y - 12 = 0$

2b.) Equation of normal
$y - y_1 = -1/m\ (x - x_1)$
$y - 8 = -1/10\ (x - 2)$
$10(y - 8) = +x + 2$
$10y - 80 = -x + 2$
$10y + x - 82 = 0$.

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

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

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

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

When $x = -1$
$m = 3(-1)^2$
$\therefore m = 3$

3a.) Equation of the tanget
$y - y_1 = m(x - x_1)$

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

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

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

$2y + 1 = 2 \times 3(x+1)$

$2y + 1 = 6(x+1)$

$2y + 1 = 6x + 6$

$2y - 6x - 5 = 0$

3b.) Equation of the normal

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

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

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

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

$6y + 3 = -2x - 2$

$6y + 2x + 5 = 0.$

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

~~$y = 1 - 2x$~~ $y = 1 + x - x^2$

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

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

when $x = -2$

$m = 1 - 2(-2)$

$m = 1 + 4$

$\therefore m = 5$

4a.) Equation of the tangent

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

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

$y + 5 = 5x + 10$

$y - 5x - 5 = 0$

4b.) Equation of the normal

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

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

$5y + 25 = -x - 2$

$5y + x + 27 = 0$

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

$y = 1/x$

$dy/dx = -1/x^2$

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

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When $x = 3$

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

$$\therefore m = -1/9$$

5a) Equation of the tangent

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

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

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

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

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

5b) Equation of the normal

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

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

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

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

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

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