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For the curves of the following questions, at the points given, find (a) the equation of the tangent (b) equation of the normal

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

$dy/dx = 4x$

m at $x = 1$ is: $4(1) = 4$

(a) Equation of tangent: $m = \frac{y_0 - y_1}{x_0 - x_1}$

$(x_1, y_1) = (1, 2)$ $\quad 4 = \frac{y-2}{x-1}$ ∴ $4(x-1) = y-2$

$4x - 4 = y - 2$

$y - 4x + 2 = 0$

(b) Equation of normal: $-\frac{1}{m} = \frac{y - y_1}{x - x_1}$

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

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

$-x + 1 = 4y - 8$

$4y + x - 9 = 0$

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

$dy/dx = 6x - 2$

Gradient (m) at $x = 2 = 6(2) - 2$

$m = 10$

(a) Equation of tangent: $m = \frac{y - y_1}{x - x_1}$

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

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

$y - 8 = 10x - 20$

$y - 10x + 12 = 0$

(b) Equation of normal: $-\frac{1}{m} = \frac{y - y_1}{x - x_1}$

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

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

$-x + 2 = 10y - 80$

$10y + x - 82 = 0$

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

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

Gradient (m) at $x = -1 = \frac{3(-1)^2}{2} = 3/2$

$m = 3/2$

(a) Equation of tangent: $m = \frac{y - y_1}{x - x_1}$

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

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

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

$3x + 3 = 2y + 1$

$2y - 3x - 2 = 0$

(b) Equation of normal:

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

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

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

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

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

Multiply through by 2

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

$6y + 4x + 7 = 0$

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

$dy/dx = 1 - 2x$

Gradient (m) at $x = -2 = 1 - 2(-2)$

$m = 1 + 4 = 5$

(a) Equation of tangent: $m = \frac{y - y_1}{x - x_1}$

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

No 4 cont.

$$5 = \frac{y+5}{x+2}$$

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

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

$$y - 5x - 5 = 0$$

(b) Equation of normal: $-\frac{1}{m} = \frac{y-y_1}{x-x_1}$

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

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

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

$$-x-2 = 5y+25$$

$$5y+x+27 = 0$$

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

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

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

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

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

(a) Equation of tangent: $m = \frac{y-y_1}{x-x_1}$

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

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

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

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

(b) Equation of normal:

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

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

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

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

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

Multiply through by 3

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

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