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MAT104 Assignment
19/MHS01/426

ASSIGNMENT 6

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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.

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

$x_1 = 1$ $\quad y_1 = 2$

Gradient, $m = dy/dx = 4x$

$m_1 = \left.\frac{dy/dx}{x \to 1}\right. = 4(1) = 4 \qquad m_1 = 4$

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

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

$y - 2 = 4x - 4$

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

$4x - y - 2 = 0$ (which gives the equation of the tangent).

$m_1 m_2 = -1$

$m_2 = -1/m_1 = -1/4$

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

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

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

$4y - 8 = -x + 1$

$-x - 4y + 1 + 8 = 0$

$-x - 4y + 9 = 0$ (which gives the equation of the normal).

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

$x_1 = 2$ $\quad y_1 = 8$

Gradient, $m = dy/dx = 6x - 2$

$m = \left.\frac{dy/dx}{x \to 2}\right. = 6(2) - 2 = 12 - 2 = 10 \qquad m = 10$

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$y - y_1 = m_1(x - x_1)$
$y - 8 = 10(x - 2)$
$y - 8 = 10x - 20$
$10x - y - 20 + 8 = 0$
$10x - y - 12 = 0$ (which gives the equation of the tangent).

$m_1 m_2 = -1$
$m_2 = -1/m_1 = -1/10$
$(y - y_1) = m(x - x_1)$
$y - 8 = \frac{-1}{10}(x - 2)$
$10(y - 8) = -1(x - 2)$
$10y - 80 = -x + 2$
$-x - 10y + 2 + 80 = 0$
$-x - 10y + 82 = 0$ (which gives the equation of the normal)

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

$x_1 = -1$, $y_1 = -1/2$ $\quad y = x^3/2 = 1/2 x^3$
Gradient, $m = dy/dx = 3/2 x^2$
$dy/dx = 3/2(-1)^2$
$m_1 = dy/dx = 3/2$ $\quad m_1 = 3/2$

$y - y_1 = m(x - x_1)$
$y - (-1/2) = \frac{3}{2}(x - (-1))$
$y + \frac{1}{2} = \frac{3}{2}(x + 1)$
$2(y + 1/2) = 3(x + 1)$
$2y + 1 = 3x + 3$
$3x - 2y + 3 - 1 = 0$
$3x - 2y + 2 = 0$ (which gives the equation of the tangent).

$m_1 m_2 = -1$
$3/2 m_2 = -1$

$\therefore m_2 = -1 \div 3/2$

$m_2 = -1 \times 2/3$

$m_2 = -2/3.$

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

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

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

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

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

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

$-2x - 3y - 7/2 = 0$ (which gives the equation of the normal)

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

$x_1 = -2$, $y_1 = -5$.

Gradient, $m = dy/dx = 1 - 2x$

dy/dx at $x = -2 = 1 - 2(-2)$

$m = dy/dx = 1 + 4 = 5.$

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

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

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

$y + 5 = 5x + 10$

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

$5x - y + 5 = 0$ (which gives the equation of the tangent)

$m_1 m_2 = -1$

$m_2 = -1/m_1$

$m_2 = -1/5.$

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

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

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

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

$5y+25 = -x-2$

$-x-5y-2-25=0$

$-x-5y-27=0$ (which gives the equation of the normal)

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

$x_1 = 3 \quad , y_1 = 1/3$

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

$m_1 = \left.\frac{dy/dx}{x=3}\right. = \frac{-1}{3^2} = \frac{-1}{9}$

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

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

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

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

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

$-x-9y+6=0$ (which gives the equation of the tangent)

$m_1 m_2 = -1$

$m_2 = -1/m_1$

$m_2 = -1/-1/9 = -1 \div \frac{-1}{9} = -1 \times \frac{9}{-1} = 9$

$\therefore m_2 = 9$

$y-y_1 = m_2(x-x_1)$

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

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

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

$9x-y-\frac{27}{1}+1/3=0$

$9x-y-\frac{81+1}{3}=0$

$9x-y-80/3=0$ (which gives the equation of the normal)