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19/MHS01/317
Maths 104 Assignment

For the Curves in question 1 to 5, at the point given, find
a) The equation of the tangent
b) The equation of the normal

1. $y = 2x^2$ at the point $(1, 2)$
2. $y = 3x^2 - 2x$ at the point $(2, 8)$
3. $y = \frac{x^3}{2}$ at the points $(-1, -1/2)$
4. $y = 1 + x - x^2$ at the point $(-2, -5)$
5. $y = 1/x$ at the point $(3, 1/3)$

Solutions

1 $y = 2x^2$ $(1, 2)$

$$m = \frac{dy}{dx} = \frac{d(y)}{dx} = \frac{d}{dx}(2x^2) = 4x$$

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

$$m = 4$$

(1)

a equation of the tangent

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

$y_1 = 2,\ x_1 = 1\ m = 4$

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$ —— equation of the tangent

B Equation of normal

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

$y - y_2 = -\frac{1}{4}(x - 1)$

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$ —— equation of normal

(2) $y = 3x^2 - 2x\ (2, 8)$

$m = \frac{dy}{dx} = \frac{d}{dx}(y) = 6x - 2$

$= 6(2) - 2 = 12 - 2 = 10$

$m = \frac{dy}{dx}\Big|_{x=2}$

$m = 10$

(4)

a Equation of tangent

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

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

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0$ —— equation of tangent

b equation of normal

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

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

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

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

$5y + 25 = -x - 2$

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

$5y + x + 27 = 0$ —— equation of normal

3 b) equation of normal

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

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

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

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

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

multiply through by 2

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

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

$6y + 4x + 7 = 0$ equation of normal

(4) $y = +x - x^2 \ (-2, -5)$

$m = \frac{dy}{dx} = \frac{d(y)}{dx} = 1 - 2x$

$= 1 - 2(-2) = 5$

$m = \frac{dy}{dx}\Big|_{x=-2}$

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

$$m = \frac{dy}{dx} = \frac{d(y)}{dx} = \frac{3x^2}{2}$$

$$m = \left.\frac{dy}{dx}\right|_{x=-1} = 3/2\,(-1)^2 = 3/2$$

a Equation of tangent

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

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

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

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

multiplying out through by 2

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

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

$2y - 3x - 2$ — equation of tangent

(2)

a) equation of tangent

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

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

$y - 8 = 10x - 20$

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

$y - 10x + 12 = 0$ —— equation of tangent

b equation of normal

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

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

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

$10y - 80 = x + 2$

$10y + x - 80 - 2 = 0$, $10y + x - 82 = 0$ {Equation of normal}

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

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

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

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

a equation of tangent

$y - y_1 = m(x_1)$

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

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

$9y - 3 = -x + 3$

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

$9y + x - 6 = 0$ — equation of tangent

b) 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

$3y - 1 = 27x - 81$

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

$3y - 27x - 80 = 0$ equation of normal