

7. $s = t^2 + \frac{1}{2}t^3$ at $t = 1$

$$\frac{ds}{dt} = 2t + \frac{3}{2}t^2$$

at $x=1$, $m = 2(1) + \frac{3}{2}(1)^2$
 $m = \frac{7}{2}$

8. $y = (2x^2 - 3)(4 - x^2)$ at $x = 5$

$$y = 8x^2 - 2x^4 - 12 + 3x^2$$

$$y = -2x^4 + 11x^2 - 12$$

$$\frac{dy}{dx} = -8x^3 + 22x$$

at $x=5$, $m = -8(5)^3 + 22(5)$
 $m = -890$

9. $y = \frac{5t^3 + 3t^2}{2t} + 3$ at $t = 0$

$$y = \frac{5t^3}{2t} + \frac{3t^2}{2t} + 3$$

$$y = \frac{5}{2}t^2 + \frac{3}{2}t + 3$$

$$\frac{dy}{dt} = 5t + \frac{3}{2}$$

at $x=0$, $m = \frac{3}{2}$

10. $y = (5x^3 - 3x^2 + 1)^2$ at $x = 1$

$$y = (5x^3 - 3x^2 + 1)(5x^3 - 3x^2 + 1)$$

$$y = 25x^6 - 30x^5 + 9x^4 + 10x^3 - 6x^2 + 1$$

at $x=1$, $m = 150 - 150 + 36 + 30 - 12$
 $m = 54$

$$\frac{dy}{dx} = 150x^5 - 150x^4 + 36x^3 + 30x^2 - 12x$$

11. $y = [1 - (2x - 3)]^2$ at $(0, 1)$

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

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

$$y = 16 - 16x + 4x^2$$

$$\frac{dy}{dx} = -16 + 8x$$

at $x=0$, $m = -16 + 0$
 $m = -16$

12. $y = (x^3 + 4x^2 - 12x + 8)(3x^2 - 9x + 7)$ at $x = 1$

$$y = 3x^5 - 9x^4 + 7x^3 + 12x^4 - 36x^3 + 28x^2$$

$$- 36x^3 + 108x^2 - 84x + 24x^2 - 72x + 56$$

$$y = 3x^5 + 3x^4 - 65x^3 + 160x^2 - 156x + 56$$

$$\frac{dy}{dx} = 15x^4 + 12x^3 - 195x^2 + 320x - 156$$

at $x=1$, $m = 15 + 12 - 195 + 320 - 156$
 $m = -4$

WORKSHEET #5: DIFFERENTIATION PART ONE : THE GRADIENT FUNCTION

NAME: Answer Key

DATE: _____

CLASS: _____

SCORE: _____

Find the derivative of each of the following functions and write down the gradient of the curve at the specified point.

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

$$y = 3x^2 - x^3$$

$$\frac{dy}{dx} = 6x - 3x^2$$

$$\text{at } x = -2, \quad m = 6(-2) - 3(-2)^2$$

$$m = -24$$

2. $y = x^2 - 4x$ at $x = 1$

$$\frac{dy}{dx} = 2x - 4$$

$$\text{at } x = 1, \quad m = 2(1) - 4$$

$$m = -2$$

3. $y = 3x^2 - 3x + 1$ at $x = 0$

$$\frac{dy}{dx} = 6x - 3$$

$$\text{at } x = 0, \quad m = 6(0) - 3$$

$$m = -3$$

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

$$\frac{dy}{dx} = 3x^2 - 6x$$

$$\text{at } x = 3, \quad m = 3(3)^2 - 6(3)$$

$$m = 9$$

5. $V = 5t^4$ at $V = 20$

$$20 = 5t^4$$

$$\frac{20}{5} = \frac{5t^4}{5}$$

$$\sqrt[4]{t^4} = \sqrt[4]{4}$$

$$t = \sqrt{2}$$

$$\frac{dV}{dt} = 20t^3$$

$$\text{at } t = \sqrt{2}, \quad m = 20(\sqrt{2})^3$$

$$m = 40\sqrt{2}$$

6. $A = 2\pi x^2 - 3x + 4$ at $x = 5$

$$\frac{dA}{dx} = 4\pi x - 3$$

$$\text{at } x = 5, \quad m = 4\pi(5) - 3$$

$$m = 20\pi - 3 \text{ or } 59.8 \text{ (3sf)}$$