

## Week 4: Differentiation

### Solutions

1.  $y = 2x^3$

$$y' = 3 \cdot 2x^2 = 6x^2$$

(a) Find  $y'$

Solution:  $y' = 6x^2$

(b) Find  $\frac{d^2y}{dx^2}$

Solution:  $\frac{d^2y}{dx^2} = \frac{d}{dx}(6x^2) = 12x$

3.  $y = x^3 - 4x^2 - 3x + 9$

(a) Find  $y'$

Solution:  $y' = 3x^2 - 8x - 3$

(b) Find the range values of  $x$  for which  $y$  is increasing

Solution:  $y$  is increasing when the gradient is positive, i.e. when  $x < -\frac{1}{3}$  and  $x > 3$

4. Let  $y(x) = 5x^2 + 4\sin(3x)$  Find  $y'(x)$

Solution:  $y'(x) = 10x + 12\cos(3x)$