Week 4: Di□erentiation

Solutions

1. $y = 2x^3$

   $x + \frac{1}{2x} + 10$

   (a) Find $\frac{dy}{dx}$

   Solution: $\frac{dy}{dx}$ $\frac{}{2}x^{-2}$.

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

   Solution: $\frac{d^2y}{dx^2} = -x^{-\frac{3}{2}} + x^{-3}$.

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

   (a) Find $\frac{dy}{dx}$

   Solution: $3x^2 - 8x - 3$

   (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 $g(x) = 5x^2 + 4\sin(3x)$ Find $g(x)$

   Solution: $g(x) = 10x + 12\cos(3x)$.

5. Given that $f(x) = \frac{x}{(x+2)}$ find $f(x)$

   (a) using the product rule,

   Solution: $f(x) = x(-1)(x+2)^{-2} + (x+2)^{-1} = \frac{2}{(x+2)^2}$.

   (b) using the quotient rule.

   Solution: $\frac{dy}{dx} = \frac{x+2-x}{(x+2)^2} = \frac{2}{(x+2)^2}$.

6. $y = \frac{x^2}{x+4}$ Find $y(x)$

   Solution: $\frac{x^2+8x}{(x+4)^2}$

7. Di□erentiate with respect to x

   (a) $(x^2 - 4)^3$

   Solution: $6x(x^2 - 4)^2$

   (b) $2(3x^2 + 1)^6$

   Solution: $72x(3x^2 + 1)^5$

   (c) e^{x^2+3x}

   Solution: $(2x + 3)e^{x^2+3x}$