

Section 3: Further applications of differentiation

Exercise level 1

1. Find the range of values of x for which $f(x) = 2x^2 - 3x + 1$ is an increasing function.
2. Find the range of values of x for which $f(x) = 4 + 7x - 3x^2$ is a decreasing function.

3. Find $\frac{d^2y}{dx^2}$ for each of the following.

(i) $y = x^3 - 3x^2 + 4x - 1$

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

(iii) $y = 2\sqrt{x}$

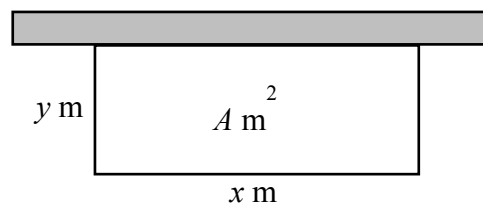
4. A curve has equation $y = x^3 - 3x^2 + 6$.

(i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

- (ii) Find the coordinates of any turning points and use $\frac{d^2y}{dx^2}$ to determine the nature of the turning points.

(iii) Sketch the curve.

5. A farmer has 100 m of fence available, with which he intends to build a pen for his sheep. He intends to create a rectangular pen against a permanent stone wall, as in the diagram.



(i) Show that $A = \frac{1}{2}x(100 - x)$.

(ii) Find $\frac{dA}{dx}$ and $\frac{d^2A}{dx^2}$.

- (iii) Find the value of x that makes the area as large as possible, and explain how you know that this is a maximum.