1. Differentiate
   a. y = $2x^3$
   b. y = $4x$
   c. y = 6
   d. y = $5x^3 - 7x^2 + 3$

2. Differentiate
   a. y = $\sqrt{x}$
   b. y = $\frac{1}{x}$
   c. $y = \frac{5}{x^3} + \sqrt[3]{x}$
   d. $y = \frac{x^2 - x^{\frac{1}{2}}}{x}$
   e. $y = \left(x + \frac{1}{x}\right)^2$

3. Find the range of values for which y = $4x^3 - 3x^2 + 11$ is a decreasing function.

4. Find the range of values for which y = $4x^4 - 8x^2 - 10$ is an increasing function.

5. Is f(x) = $x^3 - 6x^2 + 2$ an increasing or decreasing function?

6. Given the equation y = $2x^3 - 6x$.
   a. Show that the curve crosses the x-axis at the origin and the points ($\sqrt{3}$, 0) and ($-\sqrt{3}$, 0)
   b. Hence find the stationary points on the curve.
   c. Determine the nature of the stationary points.
   d. Sketch the curve.

7. Find the stationary points of the graph $y = \frac{1}{x} + \frac{1}{x^2} - \frac{1}{x^3}$ and determine the nature of each.

8. Find the stationary points and their nature for each equation.
   a. y = $2x^3 + 3x^2 - 36x + 4$
   b. y = $2x^3 - 3px^2 - 3qx2 + 6pqx + p$
   c. $y = 4x + \frac{9}{x}$
   d. $y = 4x^2 - \frac{1}{x} + 1$
   e. y = $x^4 - 14x^2 + 24x - 7$
   f. y = $6x^4 - 16x^3 - 3x^2 + 12x - 5$

9. A cuboid has a square base of length x cm and height y cm.
   a. Express the volume V of the cuboid in terms of x and y
   b. Show that the surface area of the cuboid is $2x^2 + 4xy$.
   c. The surface area of the cuboid is 24cm^2. Show V = $6x - 0.5x^3$
   d. Show that the maximum volume of the box occurs when x = 2, and find the maximum volume.

10. The population size of foxes (y) in an area increases and decreases over the years (x) since 1990 as

    y = $2x^3 - 19x^2 + 40x + 100$.
    a. What was the population in 1990?
    b. What year was the population at its lowest?
    c. What was the smallest size of the population?

11. What would the sides be for a cuboid made from an A4 sheet of paper that would give the largest volume?

12. A piece of rope of 100cm is put in the shape of a minor segment. What radius for this minor segment maximises the area covered by the rope?