Edexcel A level Mathematics Differentiation

Topic assessment

1. Using the chain rule, differentiate $(x^2 - 1)^6$. [3]

2. Show that the gradient of $y = (x^2 - 1)(x - 2)^3$ is given by

$$\frac{dy}{dx} = (x - 2)^2 (5x^2 - 4x - 3).$$ [4]

3. Find the gradient of the curve $y = \dfrac{x - 1}{x^2 - 3}$ at the point where $x = 2$. [5]

4. A curve has equation $y = x^3 - 6x^2 + 1$.
   Find the coordinates of the point of inflection. [4]

5. A potter is making an open topped vessel shaped as a right circular cylinder of radius r and height $2r$.
   (i) Find the rate at which the volume is increasing when the radius is 2 cm and increasing at a rate of 0.25 cm/s. [5]
   (ii) Given that the volume is increasing at a rate of 5π cm^3/s when the radius is 5 cm, find the rate at which the surface area is increasing at this point. [6]

6. A curve has equation $y = 3x^4 - 8x^3 + 6x^2 + 1$.
   (i) Find the coordinates of the stationary points and determine their nature. [6]
   (ii) Sketch the curve. [2]
   (iii) Find the values for x for which the curve is convex. [3]

7. Three pieces of wire are cut and used to make two equal circles and a square. The total length of wire used is 100 cm. If the radius of each circle is x cm and the side of the square y cm:
   (i) Write down an equation that connects x and y and simplify as far as possible. [3]
   (ii) Write down an expression for the total area enclosed (A) in terms of x and y. [2]
   (iii) Eliminate y from your expression in (ii) using a substitution from your equation in (i) and hence express A in terms of x only. [2]
   (iv) Find a value for x that will make A a minimum. [5]

Total 50 marks