Advanced Higher Homework 7

1. Differentiate with respect to x:

    (a) $y = 2^{x + 4}$

    (b) $y = x^{\cot x}$

    (c) $y = (\tan x)^x$

2. Use logarithmic differentiation to find the gradient of the tangent to the curve

    $$y = \frac{(3x + 1)^4(1 - x)^{1/2}}{(2x - 1)^3} \quad \text{when } x = 0.$$

3. (a)   Find the gradient of the tangent to the curve whose parametric equations are
         $x = \operatorname{cosec} \theta$ and $y = \cot \theta$.

    (b)   Find an expression for $\dfrac{d^2y}{dx^2}$ in terms of a single trigonometric function.

4. A curve is defined by the parametric equations

    $$x = 2t + 1, \qquad y = 2t(t - 1).$$

    (i)   Find $\dfrac{dy}{dx}$ in terms of t.

    (ii)   Find $\dfrac{d^2y}{dx^2}$.

    (iii) Eliminate t to find y in terms of x.
           Hence or otherwise, evaluate the finite area between the curve and the x-axis.