

**MATH1003
ASSIGNMENT 6**

Suggested practice questions (the answers are in the back of the textbook):

- §3.4; 51, 53, 59, 61, 71.
- §3.5; 5, 7, 9, 11, 27, 31.

1. Let $g(x) + x \sin g(x) = x^2$, and $g(1) = 0$. Find $g'(1)$ and $g''(1)$.
2. Differentiate the following functions to find an expression for dy/dx in terms of x and y :
 - (i) $y \sin x^2 = x \sin y^2$,
 - (ii) $xy = \cot(xy)$,
 - (iii) $1 + x = \sin(xy^2)$.

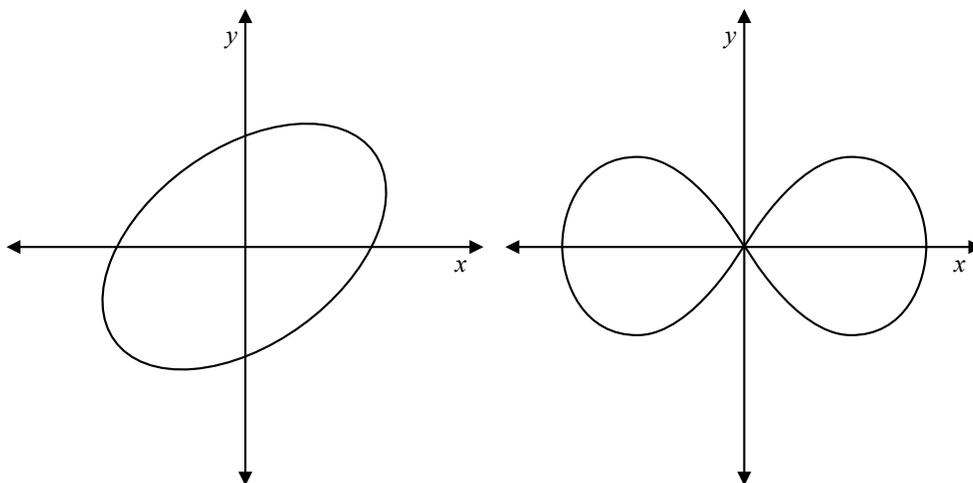


FIGURE 1. The graphs of $x^2 - xy + y^2 = 3$ and $(x^2 + y^2)^2 = 2(x^2 - y^2)$.

3. Find the derivative of the following functions, simplifying where possible:
 - (i) $y = \tan^{-1} x$,
 - (ii) $y = \tan^{-1} \sqrt{x}$,

(iii) $y = \tan^{-1} x + \cos^{-1} x$.

4. The graph of $x^2 - xy + y^2 = 3$ is called a “tilted ellipse” (see the left-hand graph of Figure 1). Find the minimum and maximum values of y that this graph takes, and the minimum and maximum values of x .
5. The graph of $(x^2 + y^2)^2 = 2(x^2 - y^2)$ is called a “lemniscate” and is depicted in the right-hand graph of Figure 1. At what points is the tangent to the graph parallel to the x -axis? Have you any comments to make about this result?