

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 3.3

Math 1000 Worksheet

FALL 2023

For practice only. Not to be submitted.

1. Find $\frac{dy}{dx}$ given the implicit function

$$y^2 = x^4 - x^6.$$

(The graph of this equation is known as the *dumbbell curve*, and is found in Figure 1a.)

2. Find $\frac{dy}{dx}$ given the implicit function

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

(The graph of this equation is known as the *knot curve*, and is found in Figure 1b.)

3. Find $\frac{dy}{dx}$ given the implicit function

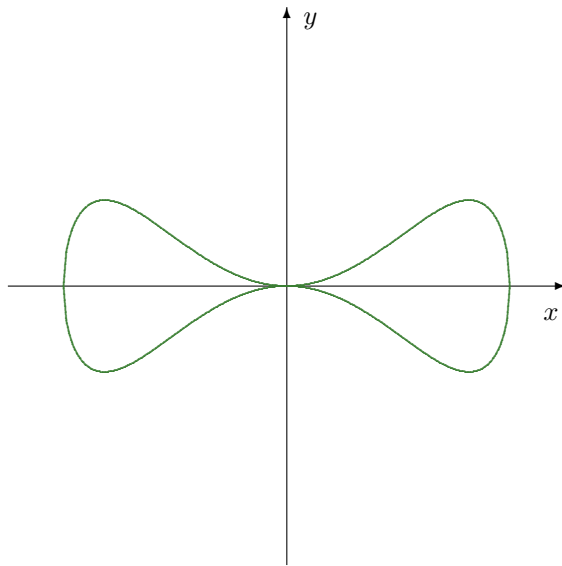
$$9y^2 = (y - 1)^2(x^2 + y^2).$$

(The graph of this equation is known as the *conchoid of Nicomedes*, and can be found in Figure 2a.)

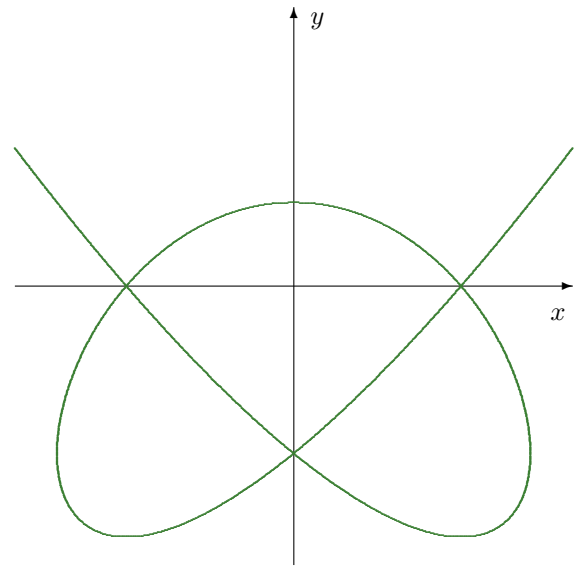
4. Find the equation of the tangent and normal lines to the curve

$$\frac{xy}{\pi} = \cos(x + y)$$

at the point $(0, \frac{\pi}{2})$. (The graph of this equation can be found in Figure 2b.)

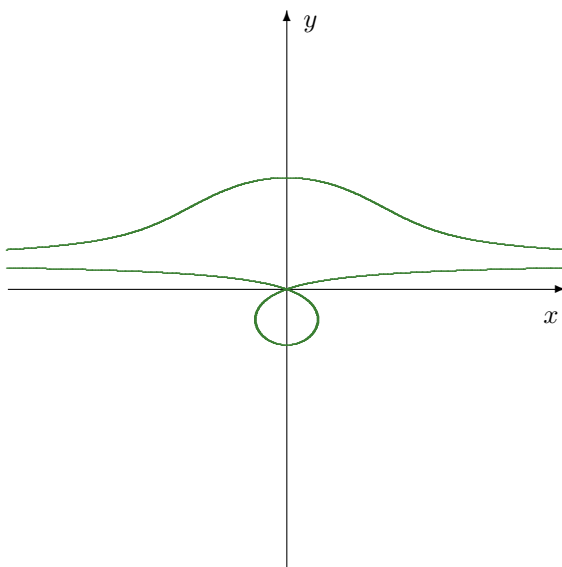


(a) The dumbbell curve

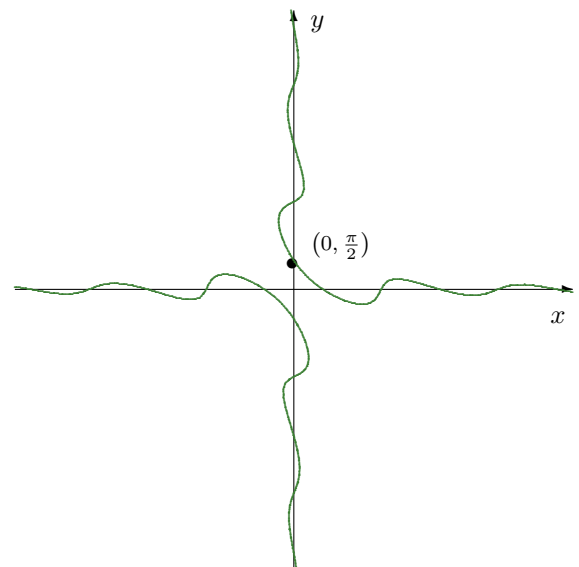


(b) The knot curve

Figure 1: The graphs of the implicit functions in Questions 1 and 2.



(a) The conchoid of Nicomedes



(b) A tangent and normal line problem

Figure 2: The graphs of the implicit functions in Questions 3 and 4.