In-class Activity 7

Implicit Differentiation

Question 1 Complete the following differentiation formulas:

- $\dfrac{\mathrm{d}}{\mathrm{d}x}c =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\sin(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\cos(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}e^x =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\ln(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\tan(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\sec(x)$
- $(f(x)+g(x))' =$
- $(f(x)-g(x))' =$
- $(cf(x))' =$
- $(f(x)g(x))' =$
- $\left(\dfrac{f(x)}{g(x)}\right)' =$
- $\Big(f(g(x))\Big)'$

Question 2
Given the following implicit relations between y and x, find $y'(x)$:

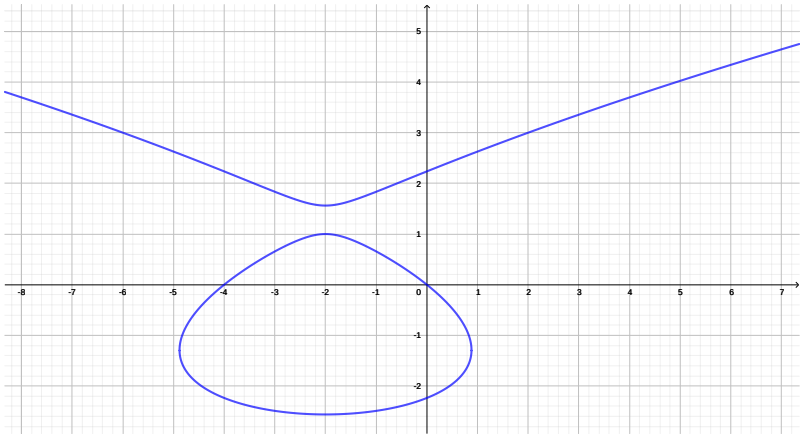
- $y^3 + 3x^5 = 10$

- $x^3y^2 - y = 3e^x$

- $e^{x+y} + \sin x = \cos(y)$

- $x\sqrt{y} = \ln(y) + 4$

Question 3



Above is the graph of the curve described by the equation $y^3 = x^2 + 5y + 4x$.
This is an example of an **elliptic curve**, which are used in cryptography.

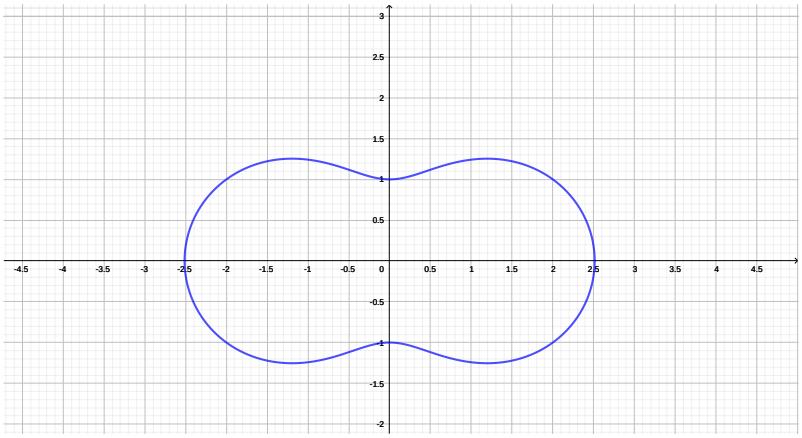
a) Draw the tangent line to the graph at the point $(-2, 1)$.

- Find $y'(-2)$.

- Use your answer above to find an equation of the tangent line to the graph of the curve at the point $(-2, 1)$.

b) Find the equation of the tangent line to the graph of the curve at the point $(0, 0)$.

Question 4



Above is the graph of the curve described by the equation

$$(x^2 + y^2)^2 = 6x^2 - y^2 + 2.$$

This curve is called **hippopede** (which means *horse fetter* in ancient greek).

a) Find the equation of the tangent line at the point $(2, 1)$.

b) What do you notice if you try to compute $y'\left(\frac{5}{2}\right)$? Can you find the equation of the tangent line at the point $\left(\frac{5}{2}, 0\right)$?