Assignment 9: Implicit Differentiation (2.8) **Name___________________**
Please provide a handwritten response.

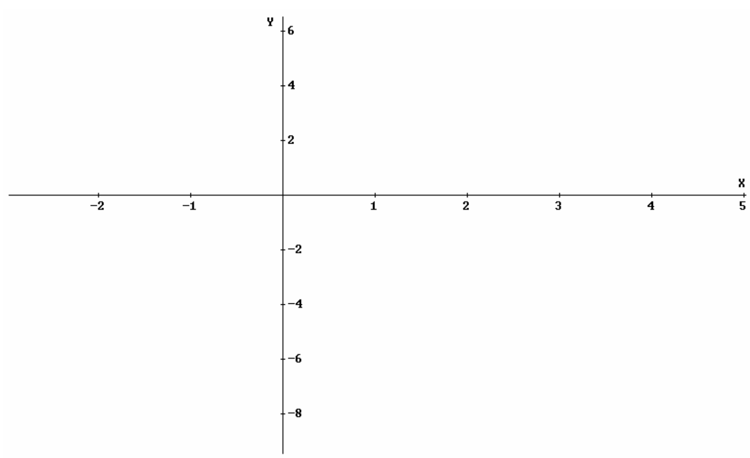
1a. The implicit function $x^2 y^2 - 2x = 4 - 4y$ can be entered into *Derive* by **Author**ing x^2 y^2 - 2x = 4 - 4y. Suppose we wanted to find y'. Begin by taking the derivative with respect to *x* of both sides of the equation. To do this, highlight the equation, click ∂, specify *x* as the variable, 1 as the order, and click **OK**. Simplify the result using = and record the results below. Did *Derive* calculate the derivative with respect to *x* correctly? What happened? Did *Derive* treat *y* as a constant?

1b. There is not an "easy" way to have *Derive* calculate y' from an implicit function such as the one entered above. We must get creative and use a method that depends upon knowing partial differentiation, which we will study much later. For now, we will simply learn how to make *Derive* give us the correct answer for y'.

Author yprime(z):=solve(dif(z,x)+dif(z,y)d,d) (Be very careful!!)

Now, to find y', **Author** yprime(x^2 y^2 - 2x = 4 - 4y). (Note: To reproduce an equation already entered, highlight the equation, then click the right mouse button wherever we need the equation entered again. We can insert the equation with or without parentheses. This is faster than re-typing!) Highlight the result and simplify by clicking =. Record the result below. What is d used in place of? You should verify that d is actually y'!

2. Obtaining the graph of an implicit equation in *Derive* is simple; by hand it is very time consuming and difficult! In *Derive*, plot the equation as we have plotted all our other equations. Highlight the equation, click the plot button to switch to a 2D-Plot window, then click the plot button again to see the plot. Zoom to an appropriate view and sketch the results on the axes at right.



3a. Using *Derive*, we can draw any tangent line we wish. For example, suppose we want the tangent line at $x = 2.235$. First, we need to find the y value. Highlight the original implicit equation from **1a** and use to substitute 2.235 for x. Click **OK** then click to numerically solve for the approximate value of y. Record the approximation of y below. How many points on this curve satisfy $x = 2.235$? Mark them with dots on the curve we drew in Question 2, and label their coordinates clearly.

3b. One of the y-values we found in **3a** is -1.762705878; based on your graph in Question 2, would you expect y' to be positive or negative at the point (2.235,-1.762705878)? About how large would you expect y' to be? Why?

3c. Now we need the slope of the tangent line at this point. Highlight y' that we found in **1b**. (Recall that y' is actually labeled d.) Use to calculate y' at the point (2.235,-1.762705878). To do this, we must first substitute in $x = 2.235$. Next, using this "new" equation, we must substitute in $y = -1.762705878$. Record the value of y' below (recall that d = y').

3d. Since we found that $y' = 0.8735256139$ in **3c**, an equation of the tangent line to our curve at the point (2.235,-1.762705878) is $y = 0.8735256139(x - 2.235) - 1.762705878$. **Author** this equation as $t(x)$ and plot its graph on the axes with the original implicit equation. Sketch the result on the axes below.