

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

Name _____

1a. The implicit function $x^2y^2 - 2x = 4 - 4y$ can be entered into *Maple* by executing

```
eqn:=x^2*y^2-2*x=4-4*y;
```

Record the result below. (Be careful! The single equal sign = is used within the equation itself, whereas the colon equal sign := is used to assign the label **eqn** to the entire equation.)

1b. We can take the derivative of the equation with respect to x and solve for $y'(x)$, by executing the command `y1:=implicitdiff(eqn,y,x);`. Record the result below.

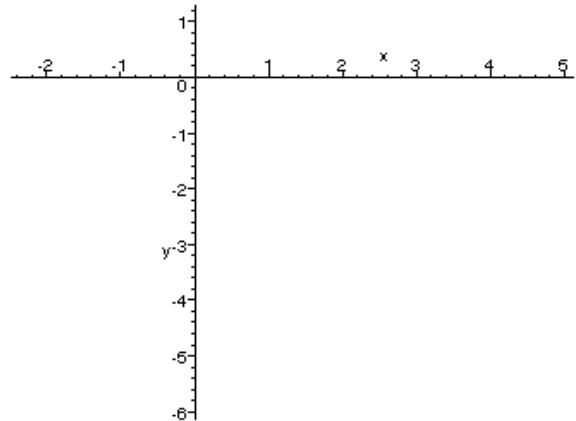
2. *Maple* can draw the graph of our equation, but first we must provide some extra capability by loading in a “package”. Execute the command

```
with(plots);
```

to load in the **plots** package. Now execute

```
implicitplot(eqn,x=-5..5,  
            y=-6..2);
```

and sketch the result on the axes.



3a. Using *Maple*, however, we are free to use any value of x we wish to draw a tangent line, for example $x = 2.235$. Execute the command

```
subs(x=2.235,eqn);
```

and record the result below. How was **eqn** changed by the substitution?

Now execute the command

```
solve(%,y);
```

and record the result below. How many points on this curve satisfy $x = 2.235$? Mark them with dots on the curve you drew in Question 2, and label their coordinates clearly.

3b. One of the y -values you found in part **a** is -1.76271 ; based on your graph in Question **2**, would you expect y' to be positive or negative at the point $(2.235, -1.76271)$? About how large would you expect y' to be? Why?

3c. Execute the command

```
subs(x=2.235,y=-1.76271,y1);
```

to replace x and y in $y1$ with the appropriate values, which will give the exact value of y' at the point $(2.235, -1.76271)$. Record the result below.

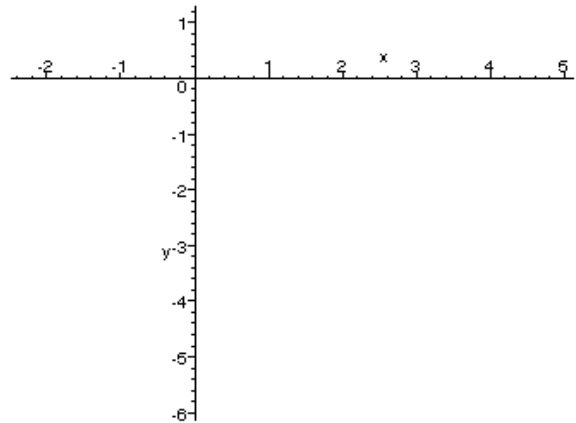
3d. Since we found that $y' = 0.873528$ in part **c**, an equation of the tangent line to our curve at the point $(2.235, -1.76271)$ is given by

$y = 0.873528(x - 2.235) - 1.76271$; execute

```
t:=0.873528*(x-2.235)-1.76271;
```

and then graph the tangent line by executing

```
plot(t,x=-2.5..5);
```



3e. Execute

```
curve:=implicitplot(eqn,x=-
```

```
5..5,y=-6..2):
```

```
tanline:=plot(t,x=-2.5..5):display(curve,tanline);
```

and sketch the result on the axes above. (We must first name each graph before we can display them.)