

MAT 305: Review #2

May 29, 2014

1. Create a new worksheet. Set the title to, “Review #2”. Add other information to identify you, as necessary.

Part 1: Implicit plots

2. Select a problem according to the following schema.

If your ID ends with...	... use...	... with $[x_{\min}, x_{\max}] \times [y_{\min}, y_{\max}]$ as:
1,2,3	$x^3 + x = y^2$	$[-1, 3] \times [-1.5, 2.5]$
4,5,6	$(x^2 + y^2)^2 = \frac{25}{4}xy^2$	$[0, 4] \times [-2.5, 2.5]$
7,8,9	$x^4 - x^2y + y^4 = 1$	$[-2, -2] \times [-2, 2]$
other		weird: see me

3. First, create and display an implicit plot of the equation on the domain given. The curve should be black.
4. Choose an x -value in the interval $[x_{\min}, x_{\max}]$. Using your math skills (not Sage’s, nor anyone else’s — getting help from me is okay) find the equation of a line tangent to the curve at that point. Write the equation of this line in a text cell. Use basic \LaTeX commands to make sure it looks nice. *Note:* There may be more than one line tangent to the curve for that value of x , but you need plot only one.
5. Verify your claim by combining the plot of the curve with a plot of the tangent line. The line should be red. Put a red dot at the point where the line and curve intersect.

Part 2: Parametric plots

6. Plot a black Bézier curve. Recall that this involves four control points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) and the equations

$$\begin{cases} x(t) &= x_0(1-t)^3 + 3x_1t(1-t)^2 + 3x_2t^2(1-t) + x_3t^3 \\ y(t) &= y_0(1-t)^3 + 3y_1t(1-t)^2 + 3y_2t^2(1-t) + y_3t^3 \end{cases}$$

where $t \in [0, 1]$. You can choose the four control points at random, but don't use the ones I used in class. Feel free to make a loop, if you can. Add red dashed lines that connect the 1st and 2nd control points, and the 3rd and 4th control points.

7. Explain in a text box how the control points relate to the curve: where is the first control point? where is the last? how does the second control point relate to the first, and to the curve? how does the third control point relate to the fourth, and to the curve?

Part 3: Animate!

8. Animate some Bézier curves!

- Select values for (x_0, y_0) and (x_3, y_3) ; these will remain constant throughout this exercise.
- Select 12 different values for the (x_1, y_1) and (x_2, y_2) . Don't let the values change by very much, only a little, or the animation will jump around abruptly.
- For each value of (x_1, y_1) and (x_2, y_2) , plot the Bezier curve. Remember that (x_0, y_0) and (x_3, y_3) remain the same for each plot.
- Animate all the graphs using the `animate()` command, and `show()` it.

Part 4: Make it look good!

8. Add text cells throughout the document that clearly delineate the parts. It should be clear where each part begins and ends. In Part 1, a text cell should state specifically what value of x you chose; in Part 2, a text cell should state specifically what control points you used; in Part 3, a text cell should state clearly the sequence of adjustments made to the 2nd and 3rd control points. You should also add some explanatory text before each plot: "This is the first plot, with points...", "This is the second plot, with points...", ... and finally "This is the animation of all the frames." Use **L^AT_EX** for mathematical expressions and statements; don't forget the reference of useful L^AT_EX commands on the class website.