

CS 20600: Homework 1

Your name:

Due: Tuesday, September 6.

[>

- Instructions

Do all of your work in this Maple worksheet. If you are asked to explain something, type your explanation in this worksheet. Do not give the most terse answer that you can think of. Try to give a full explanation of whatever is being asked. Your explanations should be clear, well written, and make use of proper spelling, punctuation, grammar, etc. Make your explanations as presentable as possible. Make use of Maple's basic formatting and word processing abilities. (Do not use a # to put your explanations on a Maple command line after a prompt.)

If you need to do a calculation, you should use Maple to do the calculation here in this worksheet. Do not do a calculation on a handheld calculator and then copy the result into this worksheet.

If you need more Maple prompts for commands, use Ctrl-j to create a new prompt.

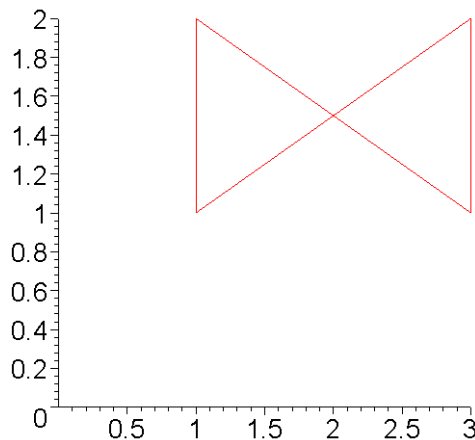
Be sure to save your worksheet (as a "classic worksheet") as you work on it.

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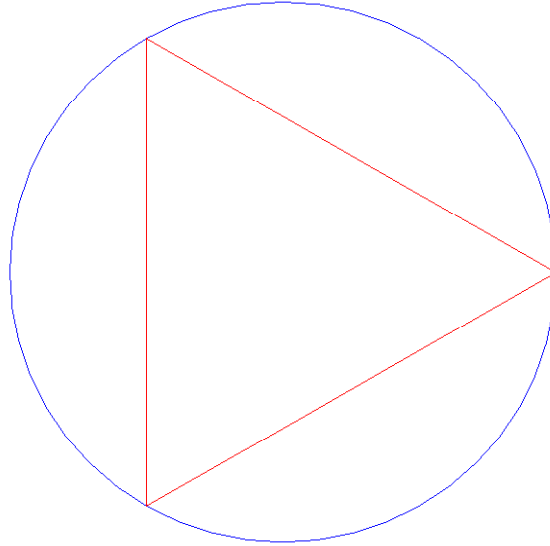
- Problem 1

In Section 1.3.3 from Worksheet 1 there are examples of using the `plot` command along with a list of points to draw polygons. Here is one of the examples.

```
[ > pointList := [ [1,1], [3,2], [3,1], [1,2], [1,1] ];  
                               pointList := [[1, 1], [3, 2], [3, 1], [1, 2], [1, 1]]  
[ > plot( pointList, 0..3, 0..2 );
```



Part (a): Find a list of points that when used with the `plot` command will draw an equilateral triangle with its vertices on the circle of radius one centered at the origin. Here is an example graph. Be sure to show any calculations that you make. (Remember that every point on the unit circle has coordinates of the form $(\cos(\theta), \sin(\theta))$ for some angle θ measured in radians.)

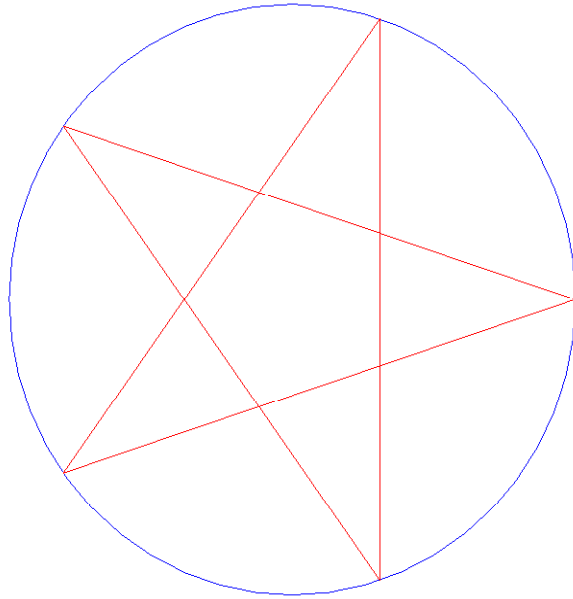


```
[ > pointList2 := ??? ;
[ > plot( ???, scaling=constrained );
```

The following three commands will add the blue circle to your graph and show whether or not your three points really are on the unit circle.

```
[ > graph1 := %:
[ > graph2 := plot( [cos(theta), sin(theta), theta=0..2*Pi],
[ color=blue ):
[ > plots[display]( graph1, graph2, scaling=constrained );
[ >
```

Part (b): Find a list of points that when used with the `plot` command will draw a pentagram with its vertices on the circle of radius one centered at the origin. Here is an example graph. Notice that the five points of the pentagram on the unit circle are equally spaced. What is the angle between two adjacent points? What is the angle between two connected points? Be sure to show any calculations that you make.



```
[ > pointList3 := ??? ;  
[ > plot( ???, scaling=constrained );
```

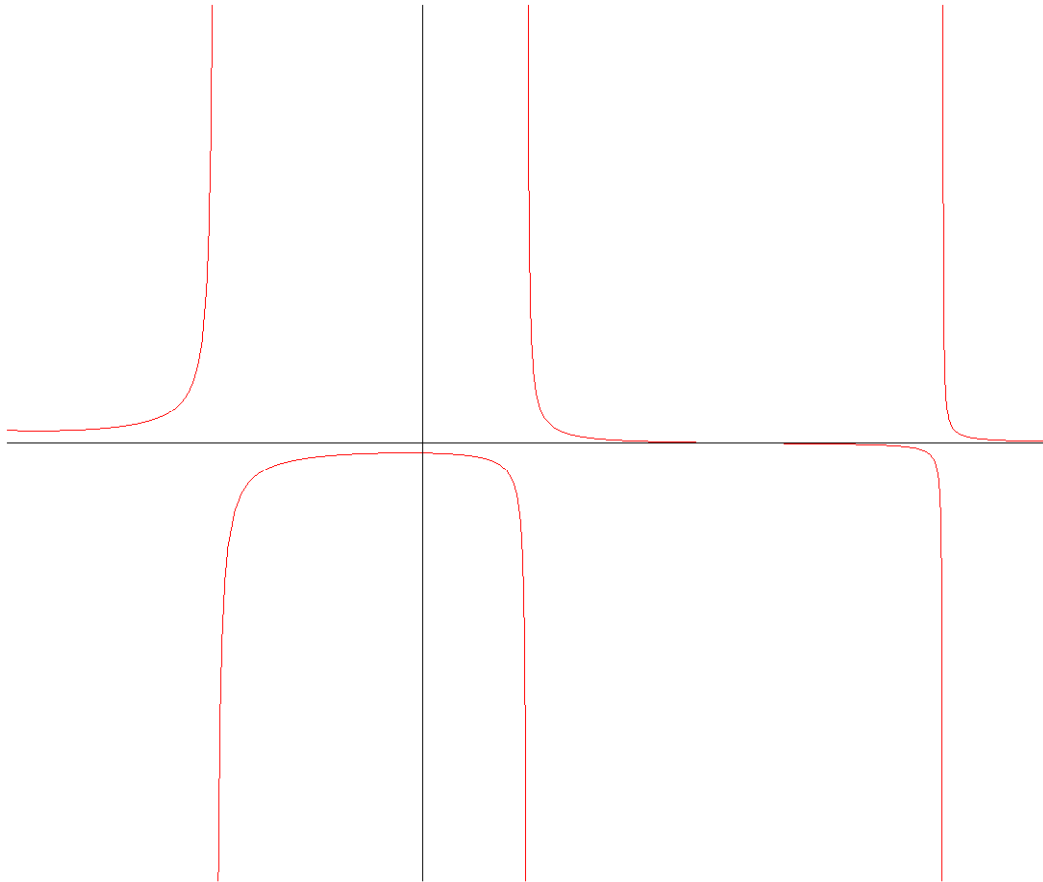
The following three commands will add the blue circle to your graph and show whether or not your five points really are on the circle.

```
[ > graph3 := %:  
[ > graph4 := plot( [cos(theta), sin(theta), theta=0..2*Pi],  
[ > plots[display]( graph3, graph4, scaling=constrained );  
[ >
```

```
[ >
```

- Problem 2

Use the `plot` command to draw a graph that looks like this,



for the function

$$\frac{(x-3)(x-9)}{(x+5)(x+2)(x-1)(x-5)(x-8)}$$

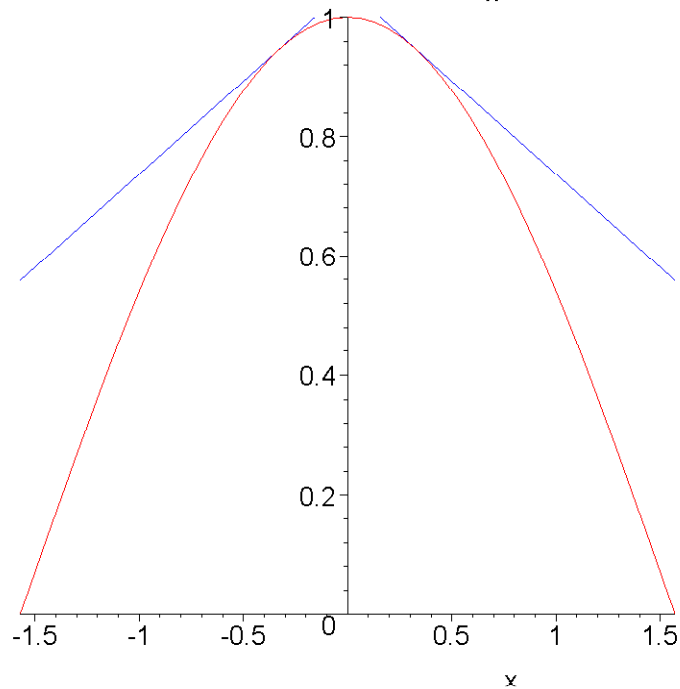
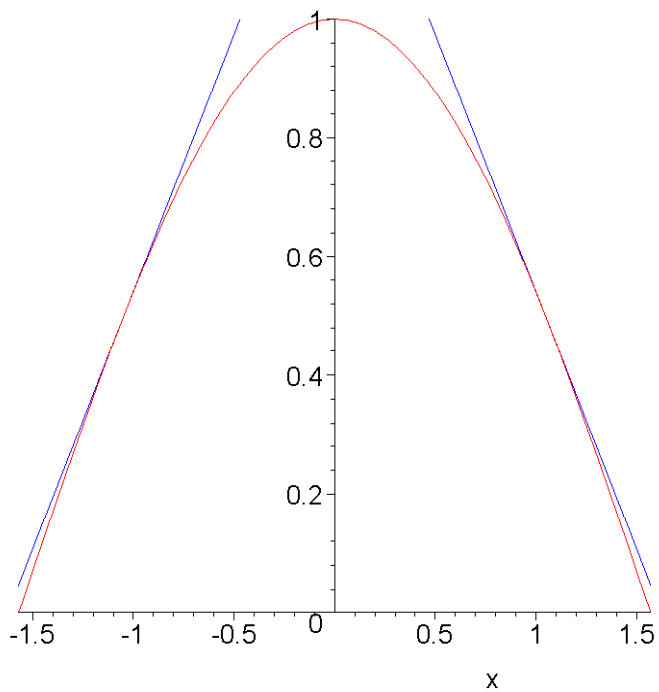
To get the above graph, you need to choose appropriate horizontal and vertical ranges for the **plot** command. You will also need to use the **discont** option for the **plot** command. (Your graph should have tickmarks on the axes. I left the tickmarks off the above graph so that you will have to figure out the appropriate ranges.)

```
[ > plot(      );
[ >
[ >
```

- Problem 3

Given a number y_0 between 0 and 1, draw a graph of $\cos(x)$, with x between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$, and the two tangent lines at the points where $\cos(x) = y_0$.

Here are two example graphs, with $y_0 = 0.5$ and $y_0 = 0.95$.



Solve this problem with a sequence of Maple commands that begins with giving the variable y_0 a value and ends with a `plot` command that draws the graph. To get the graph for different values of y_0 , you should only need to change the first Maple command in the sequence. None of the other Maple commands should need to be changed when the value of y_0 is changed.

```
[ >  $y_0 := .95;$ 
[ >
[ >
[ >
[ >
[ ]
```

```
[ >  
[ >  
[ > plot( ??? );  
[ >
```

Hint:: First you need to compute the two x values associated with y_0 . Then compute the slope at one of the x values (which really gives you both slopes). Then find the equations for the two tangent lines and then use the two tangent line equations, along with $\cos(x)$, in the `plot` command, so that the single plot command actually graphs three functions.

```
[ >
```