CS 206   Homework 6

Your name:

Due: Tuesday, November 22.

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Instructions

These problems use material from Sections 5.4.4, 5.4.5, 5.5.1 and 5.5.2 from Worksheet 5.

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. 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 solutions and explanations as presentable as possible. Make use of Maple's basic formatting and word processing abilities. (Do not 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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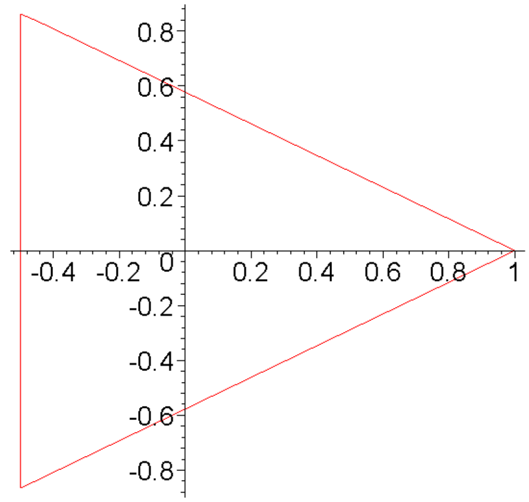
Problem 1

Part (a): Define two piecewise defined Maple functions `f` and `g` so that `f(t)` and `g(t)`, with `t` between 0 and 1, parameterize the following equilateral triangle with its vertices equally spaced around the unit circle. Your parameterization should begin at the point (1,0) when $t = 0$ and it should parameterize the triangle in the counter clockwise direction.

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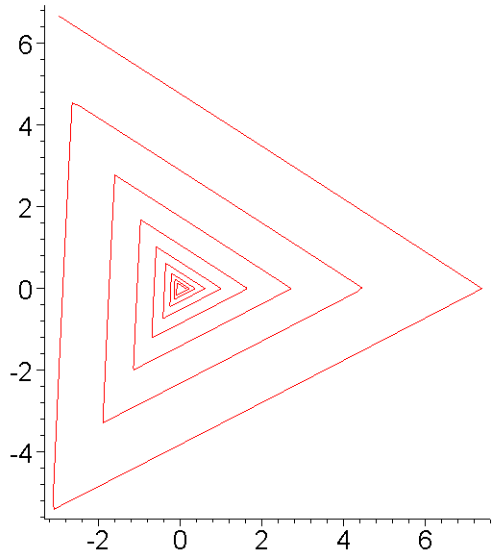
```

Part (b): Modify your Maple functions `f` and `g` from part (a) so that `f(t)` and `g(t)` can be used to parameterize the following triangular logarithmic spiral. (Hint: Make use of Maple's `floor` function.)

```
> plot( [exp(t/2)*f(t), exp(t/2)*g(t), t=-4..4.3], axes=framed );
```

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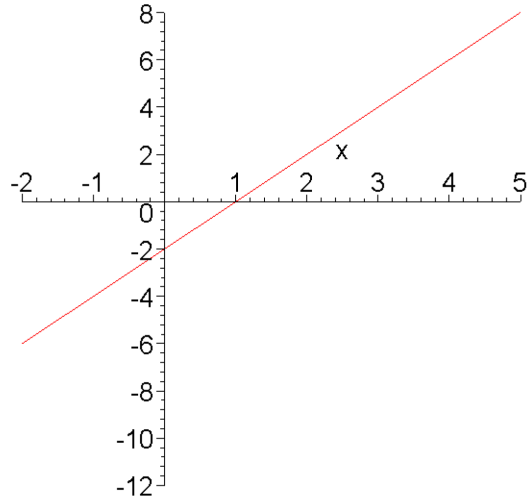
Problem 2

Part (a): Given a function $y = f(x)$ and its graph in Cartesian coordinates, the graph of $f(x - c)$ is the graph of $f(x)$ translated right or left (depending on whether c is a positive or negative number). A student wants to demonstrate this fact and creates the following animation. Explain why this is *not* a good demonstration of this idea. Also, create your own, better animation of this idea.

```
> f := x -> 2*x - 2;
> p := c -> plot( f(x-c), x=-2..5 );
> seq( p(n/30), n=0..90 ):
> plots[display]( %, insequence=true );
```

$$f := x \to 2\,x - 2$$

$$p := c \to \mathrm{plot}(\,\mathrm{f}(x - c),\, x = \text{-}2\,..\,5\,)$$

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```

Part (b): Suppose we have a function $r = \mathrm{f}(\theta)$ and its graph in polar coordinates. Describe how the graph of $\mathrm{f}(\theta - c)$ is related to the graph of $\mathrm{f}(\theta)$. Use Maple to demonstrate several examples of a (polar) function $\mathrm{f}(\theta)$ and its related graphs $\mathrm{f}(\theta - c)$. Your description and examples should be clear and well organized.

```
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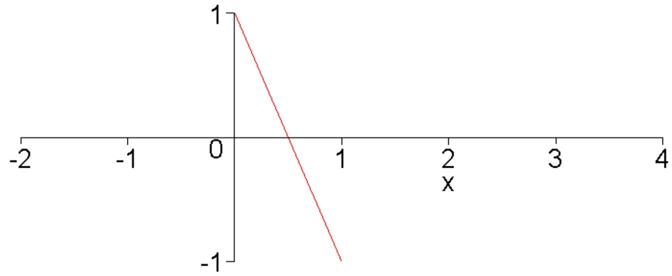
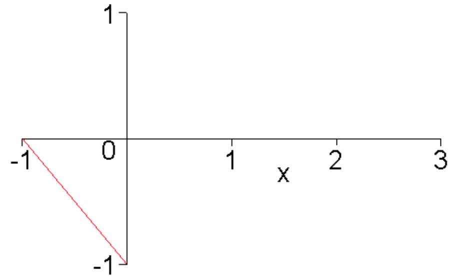
Problem 3

Part (a): Suppose that (x_1, y_1) and (x_2, y_2) are points in the Cartesian plane with $x_1 < x_2$. Write a plot-valued function that graphs the segment of the linear function that connects the point (x_1, y_1) to the point (x_2, y_2).

```
> p := (x1, y1, x2, y2) -> plot( ??? );
>
>
```

Use your plot-valued function to reproduce each of the following two animations.



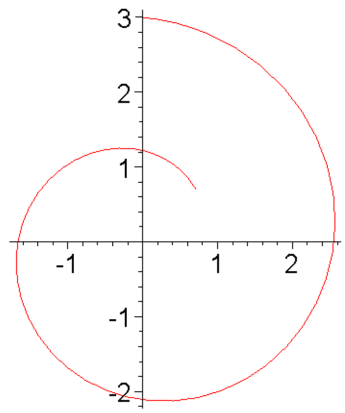


Part (b): Suppose that (r_1, θ_1) and (r_2, θ_2) are points in the polar plane and that $\theta_1 < \theta_2$. Write a plot-valued function that draws the segment of the spiral curve that connects the point (r_1, θ_1) to the point (r_2, θ_2).

```
> p := (r1, theta1, r2, theta2) -> plot( ??? );
```

Here is an example of what this function should draw.

```
> p(1, Pi/4, 3, 5*Pi/2);
```



Hint: Notice that spirals, $r = \alpha\,\theta + \beta$, are the polar equivalent of lines in the Cartesian plane. So your answer to part (b) can be based on your answer to part (a). (When you switch from Cartesian to polar coordinates, be careful about the order of the independent and the dependent variables.)

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Part (c): Use your plot-valued function from part (b) to reproduce each of the following two animations.

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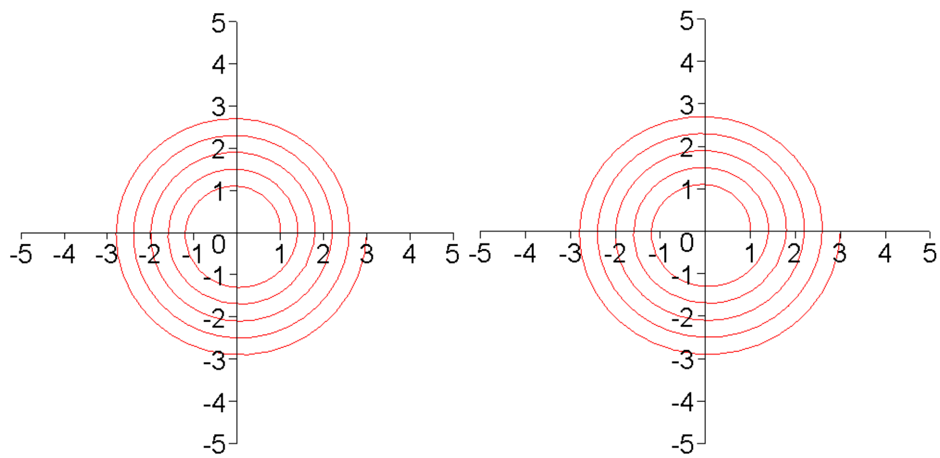

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