Math 253 Homework 2 Written Part (2 pages) **Name:**________________________________

Due Monday of week 2. (30 points)

Write legibly. Show your work. Graph neatly. Pencil only. Use a ruler for all straight lines.

For 1) and 2) you are finding the equation of a tangent line two different ways:

1) Follow the steps to find the equation of the tangent line to $x = 1 + \ln(t) \quad y = t^2 + 2$ at the point $(x,y) = (1,3)$ by using the parametric equations.

a) If $(x,y) = (1,3)$, find t.

b) Using the original parametric equations $x = 1 + \ln(t) \quad y = t^2 + 2$, find a formula for $\frac{dy}{dx}$ in terms of t, then find the value for $\frac{dy}{dx}$ at $(x,y) = (1,3)$ using the value of t you found in step a).

c) Find an x-y equation for the tangent line.

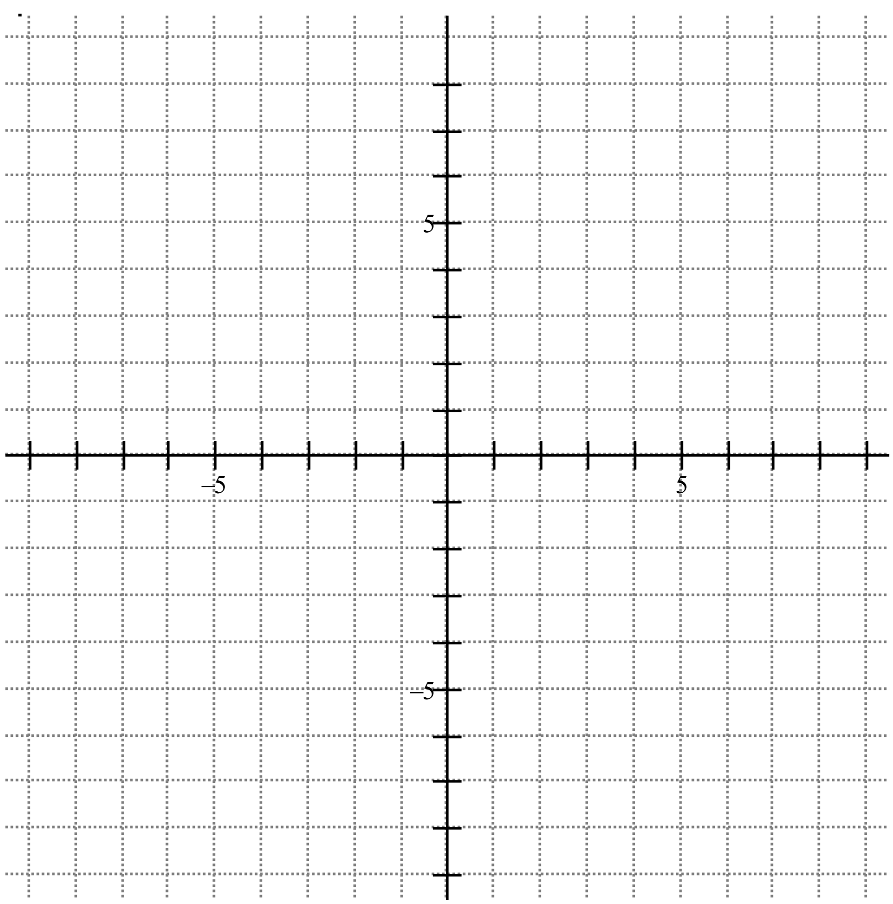
2) Now, find the equation of the tangent line by first eliminating the parameter using the steps:

a) Eliminate the parameter from $x = 1 + \ln(t) \quad y = t^2 + 2$, **solve your equation for y**, and simplify.

b) Find a Cartesian formula for $\frac{dy}{dx}$, i.e. y ', then find the value for $\frac{dy}{dx}$ at $(x,y)=(1,3)$.

c) Does this give the same answer for the tangent line as problem 1?

3) Graph and label the function given in 1) & 2) and its tangent line on the same graph.

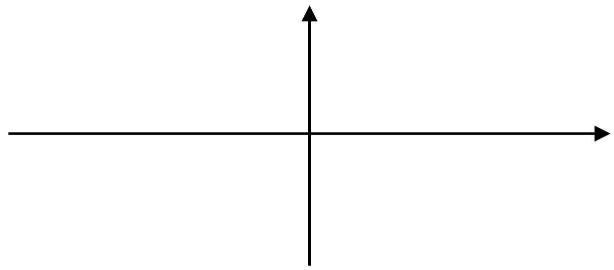


Math 253 Homework 3 Written Part (2 pages) **Name:**______________________________
Due Friday, Week 2 (20 points)
Write legibly. Show your work. Graph neatly. Use a ruler for all straight lines.

(1) Use the parametric equation of an ellipse to find its area in terms of a and b:

$$x = a\cos(t) \qquad y = b\sin(t) \qquad 0 \le t \le 2\pi \qquad a > 0 \qquad b > 0$$

Sketch the ellipse. Use arrows to show the direction of movement. Label $t = 0, \pi, 2\pi$. Draw a vertical representative rectangle on the top half of the ellipse. Label it in terms of x and y then label a and b on the axes.



The total area of the ellipse will be two times the area of the top half. Set up an integral in terms of x and y that finds twice the area of the top half of the ellipse.

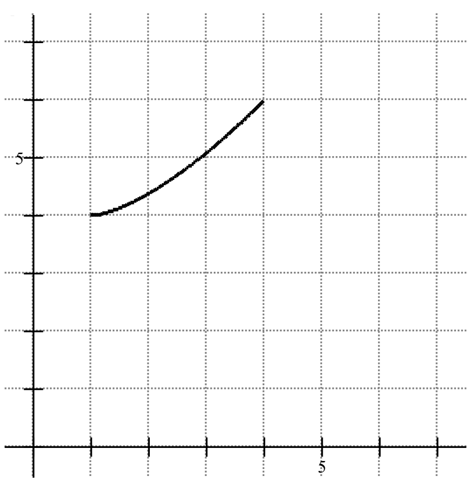
Convert all the variables to be in terms of t, then solve the integral.

(2) Find the exact length of the curve. Show your integration by substitution clearly.

$$x = 1 + 3t^2 \quad y = 4 + 2t^3 \quad 0 \le t \le 1$$

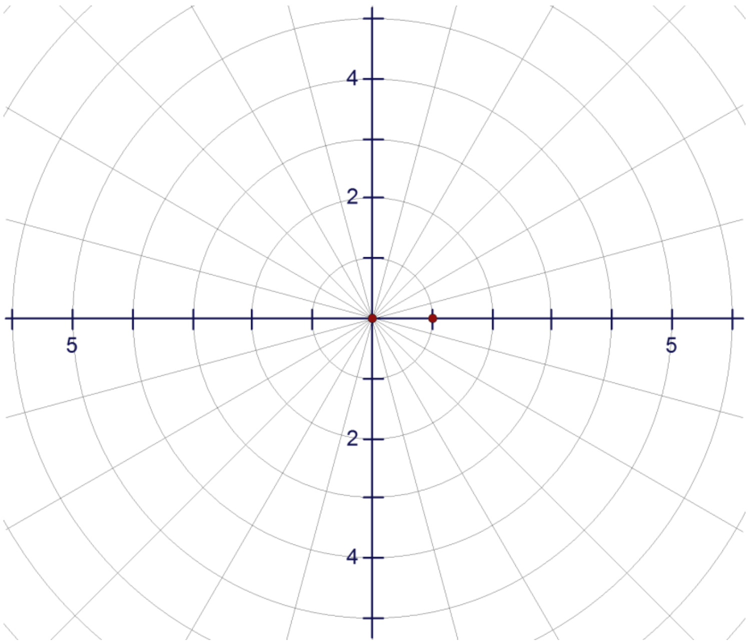
Now that you've found the exact answer, also express the length of the curve as a decimal, correct to 4 places.

Here is a graph of the same curve. Make a geometric argument that the length you just found makes sense.
Hint: think about a right triangle…

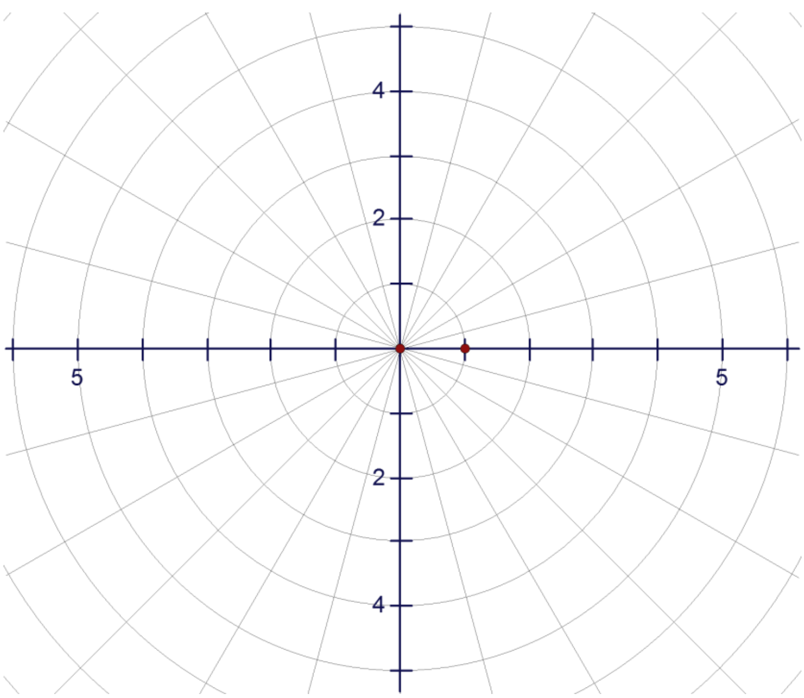


Math 253 Homework 4 Written Part (4 pages/2sheets) Name:_______________________________
(21 pts) DUE MONDAY OF WEEK 3
Write legibly. Show your work. Graph neatly. Use a ruler for all straight lines.

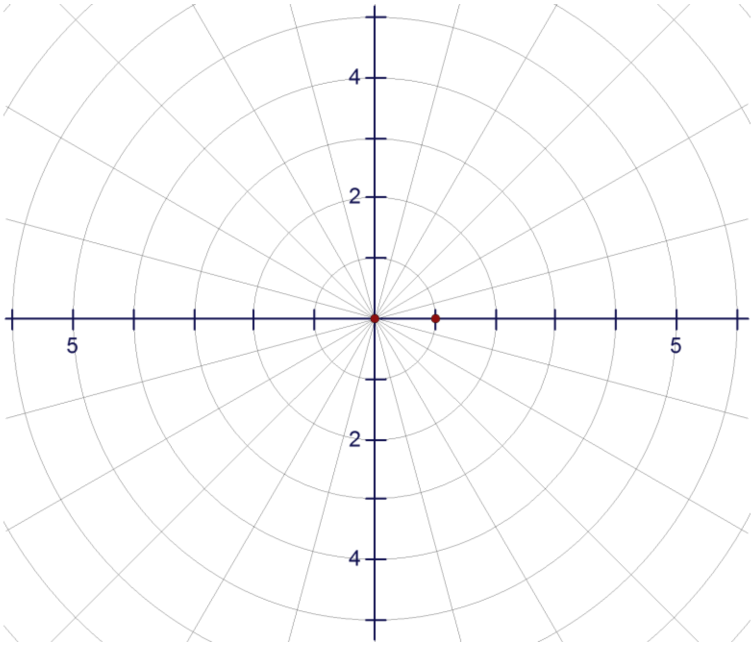
(1) Graph the region $0 \le r < 4$ *and* $\frac{-\pi}{2} \le \theta < \frac{\pi}{6}$. Graph solid versus dotted lines clearly.



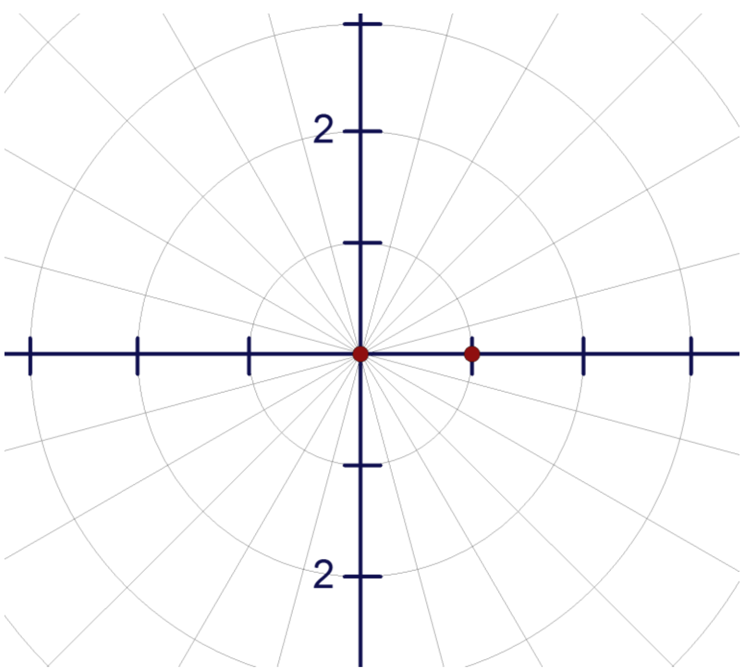
(2) Graph $\theta = -\dfrac{\pi}{6}$



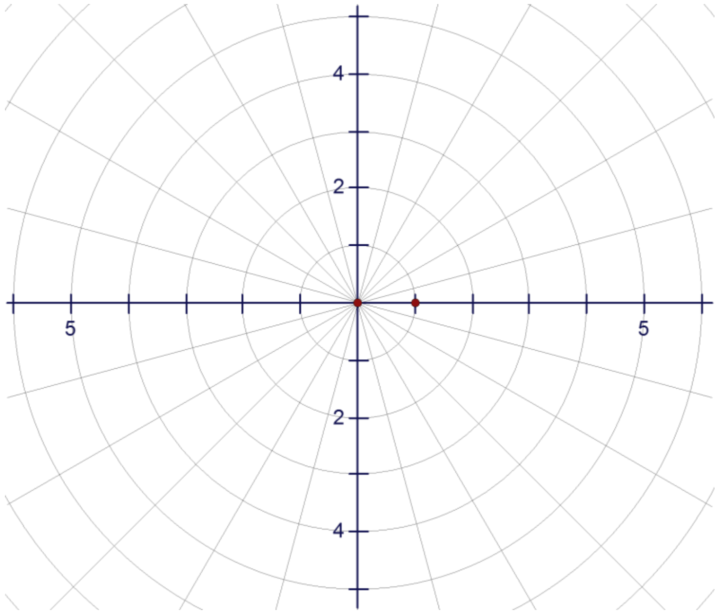
(3) Graph $r^2 - 8r + 15 = 0$. (Hint: start by factoring!)



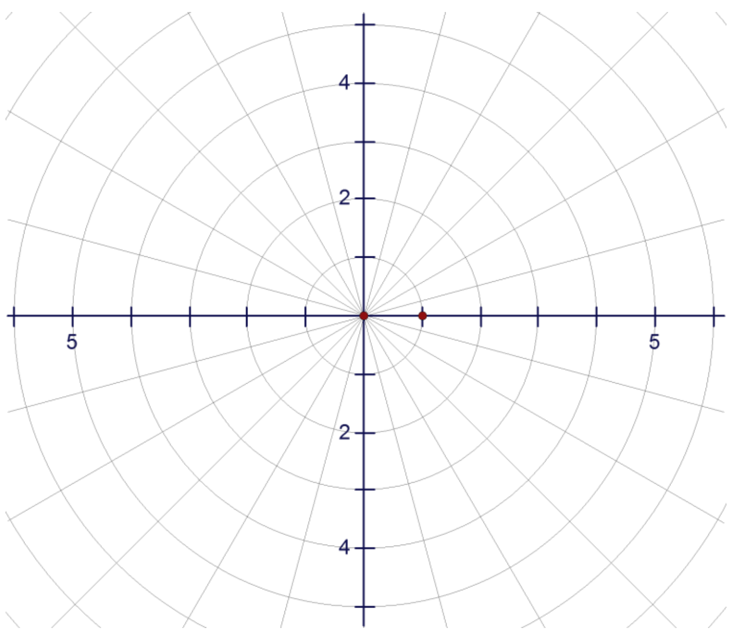
(4) Sketch $r = 3\sin(\theta)$.



(5) Sketch $r = \theta, \quad \theta \geq 0$. Label your scale clearly.



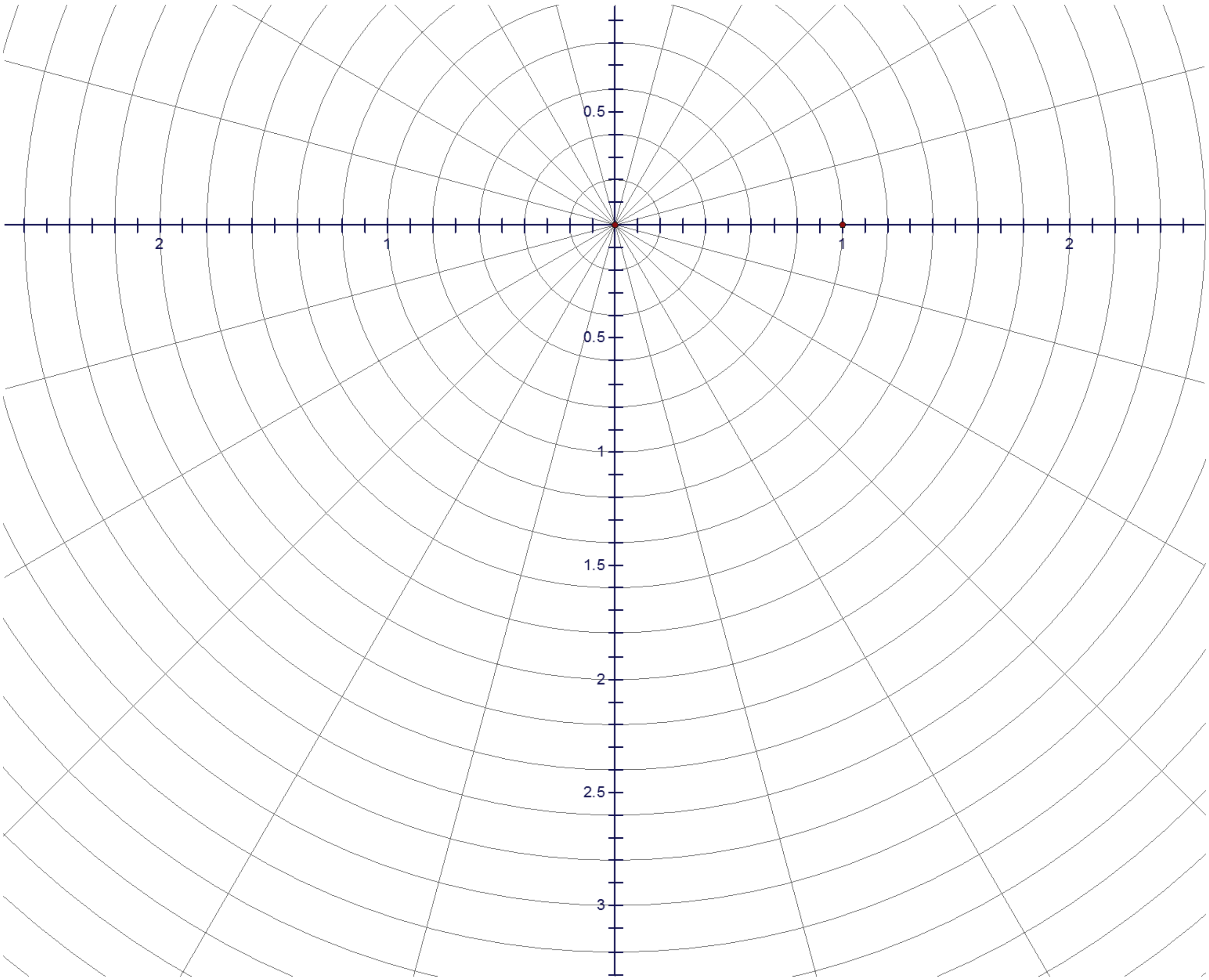
(6) Sketch $r = 4\sin(3\theta)$. Label your scale clearly.



(7) Make an "exact" graph of $r = 1 - 2\sin(\theta)$. Start by filling in the table. Round decimals to tenths.

θ	0°	15°	30°	45°	60°	75°	90°						
r													

θ	195°												
r													



Math 253 Homework 5 Written Part (2 pages) Name:______________________________

Due Friday of Week 3 (20 points)

Write legibly. Show your work. Graph neatly. Use a ruler for all straight lines.

(1) Find the slope of the tangent line to $r = 3\cos(2\theta)$ ....

a) First, find a formula for $\frac{dy}{dx}$ in terms of θ.

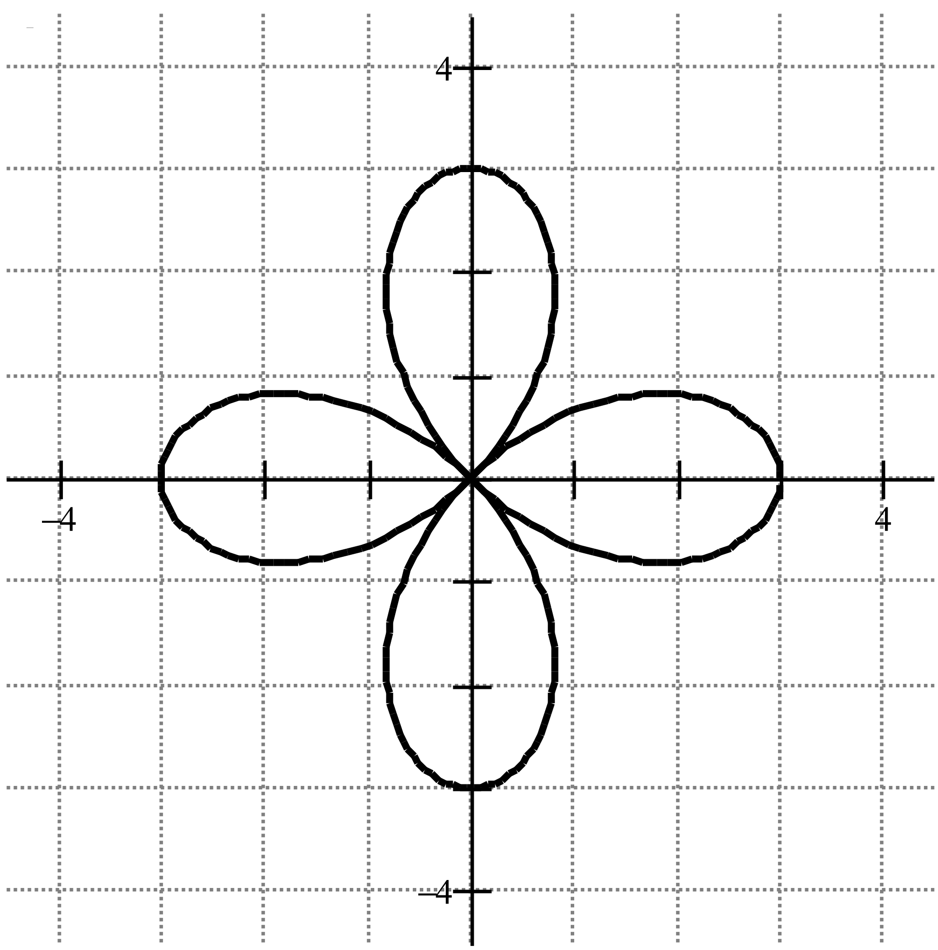
b) Now, find the slope of the tangent at $\theta = \frac{\pi}{4}$. Express your answer in simplified radical form.

c) Now, find the slope of the tangent at $\theta = \frac{\pi}{3}$. Express your answer in simplified radical form, and then convert it to a decimal rounded to the nearest hundredth.

d) Now, find the slope of the tangent at $\theta = \frac{\pi}{2}$. Express your answer in simplified radical form, and then convert it to a decimal rounded to the nearest hundredth.

e) Now, find the slope of the tangent at $\theta = \pi$. Express your answer in simplified radical form, and then convert it to a decimal rounded to the nearest hundredth.

f) Finally, draw tangent lines corresponding to the above theta values on this graph. (You should start by finding the correct location on the graph for each theta!) Label the tangent lines clearly! Do the slopes make sense?

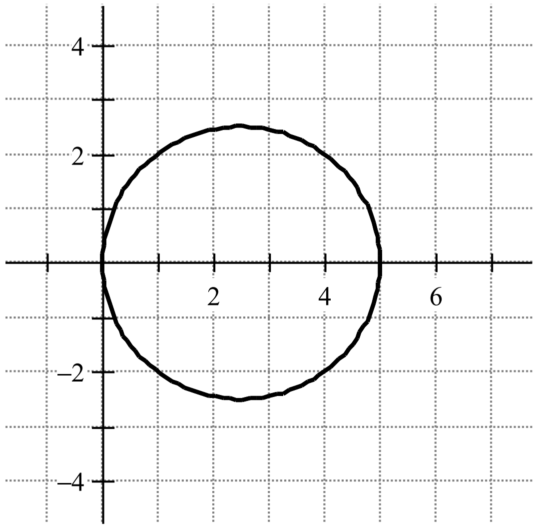


Math 253 Homework 6 Written Part **(2 pages)** **Name:**______________________________

Due Monday of week 4, 10 points. First test is Friday of week 4.

Write legibly. Show your work.

Here is a graph of $r = 5\cos(\theta)$ for $0 \le \theta \le \pi$. Label where $\theta = 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi$, and use arrows to show the direction of movement as θ increases.



(1) Find the exact length of the curve using calculus:

(2) Find the exact length of the curve using a formula from geometry:

(3) Find the area enclosed by the curve using calculus:

(4) Find the area enclosed by the curve using a formula from geometry: