MARK BOX		
PROBLEM	POINTS	
1	5	
2	5	
TOTAL	10	

NAME (legibly printed): Sol'n Key

class PIN: 17

INSTRUCTIONS:

(1) To receive credit you must:
  - (a) **work in a logical fashion, show all your work, indicate your reasoning; no credit will be given for an answer that *just appears*;** such explanations help with partial credit
  - (b) if a line/box is provided, then:
    — show you work BELOW the line/box
    — put your answer on/in the line/box
  - (c) if no such line/box is provided, then box your answer

(2) The MARK BOX indicates the problems along with their points. Check that your copy of the exam has all of the problems.

(3) This exam covers (from *Calculus* by Stewart 6^{th} ed.,ET): § 10.3, 10.4 .

Problem Inspiration: just like the homework.

This take home part of the final is due at the beginning of our in class final on April 29 at 9am.

You may use your notes, book, and calculator. However, you may not discuss this examine with anyone other than yourself!

Honor Code Statement

I understand that it is the responsibility of every member of the Carolina community to uphold and maintain the University of South Carolina's Honor Code.
As a Carolinian, I certify that I have neither given nor received unauthorized aid on this exam.
Furthermore, I have not only read but will also follow the above Instructions.
I hereby verify that I did NOT receive help from other people on this take-home exam problem.

Signature : Prof. Maria Girardi

1. Consider the curve in polar coordinate

$$r = 5\cos(3\theta) \ .$$

1a. The period of $r = 5\cos(3\theta)$ is $\frac{2\pi}{3}$ ________.

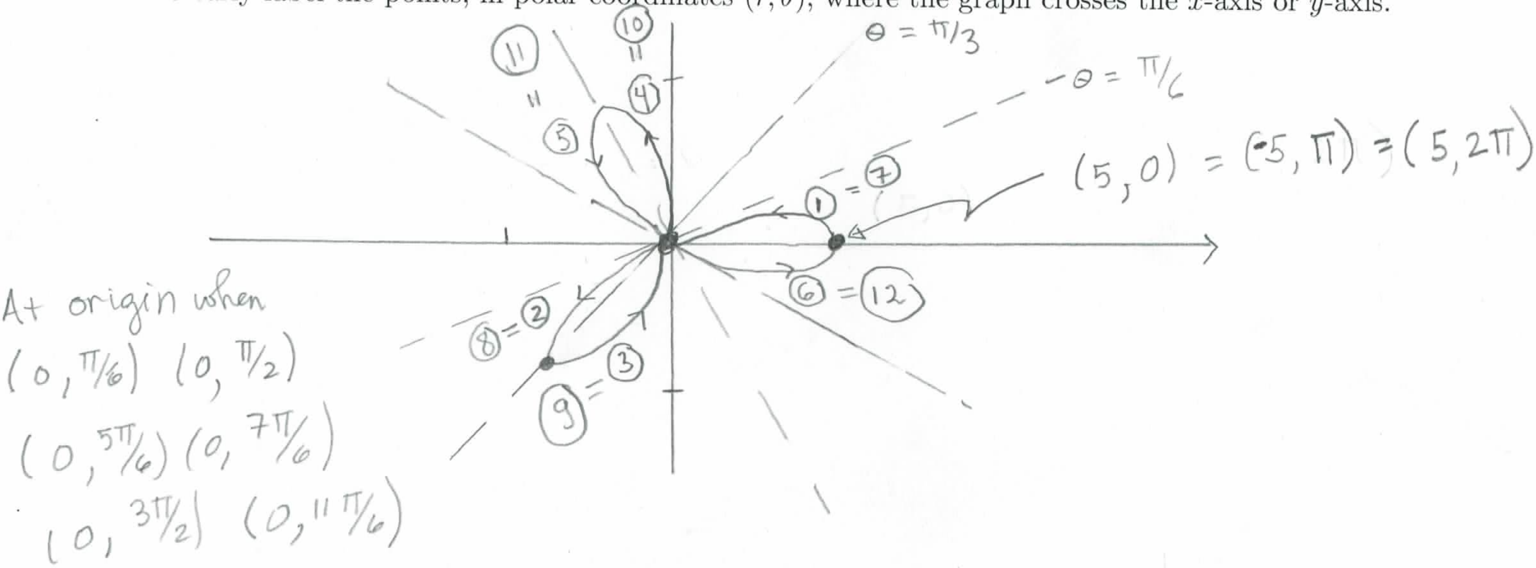
1a. $\frac{\text{the period of } r = 5\cos(3\theta)}{4} = \frac{2\pi}{3 \cdot 4} = \frac{\pi}{6}$

1c. Make a chart, as we did in class, to help you graph $r = 5\cos(3\theta)$.

	θ	3θ	$\cos(3\theta)$	$r = 5\cos(3\theta)$
1	$0 \to \pi/6$	$0 \to \pi/2$	$1 \to 0$	$5 \to 0$
2	$\pi/6 \to \pi/3$	$\pi/2 \to \pi$	$0 \to -1$	$0 \to -5$
3	$\pi/3 \to \pi/2$	$\pi \to 3\pi/2$	$-1 \to 0$	$-5 \to 0$
4	$\pi/2 \to 2\pi/3$	$3\pi/2 \to 2\pi$	$0 \to 1$	$0 \to 5$
5	$2\pi/3 \to 5\pi/6$	around	$1 \to 0$	$5 \to 0$
6	$5\pi/6 \to \pi$	unit	$0 \to -1$	$0 \to -5$
7	$\pi \to 7\pi/6$	circle	$-1 \to 0$	$-5 \to 0$
8	$7\pi/6 \to 4\pi/3$	2^{nd} time	$0 \to 1$	$0 \to 5$
9	$4\pi/3 \to 3\pi/2$	around	$1 \to 0$	$5 \to 0$
10	$3\pi/2 \to 5\pi/3$	unit	$0 \to -1$	$0 \to -5$
11	$5\pi/3 \to 11\pi/6$	circle	$-1 \to 0$	$-5 \to 0$
12	$11\pi/6 \to 2\pi$	3^{rd} time	$0 \to 1$	$0 \to 5$

1d. Graph $r = 5\cos(3\theta)$.

Clearly label the points, in polar coordinates (r, θ), where the graph crosses the x-axis or y-axis.



2. Express the area enclosed by $r = 5\cos(3\theta)$ as an integral with respect to θ (ok ... with respect to θ means a $d\theta$ in there).
(You do not have to evaluate this integral.)

area =

$$\text{Area} = \frac{1}{2}\int_{\theta=\alpha}^{\theta=\beta} [f(\theta)]^2 \, d\theta$$

$$= \frac{1}{2}\int_{\theta=\alpha}^{\theta=\beta} [5\cos(3\theta)]^2 \, d\theta$$

... many answers here ... be careful .... get the area "enclosed" by using, eg, ①-⑥ .... b/c ⑦-⑫ "retraces".

$$\frac{1}{2}\int_{\theta=0}^{\theta=\pi} [5\cos(3\theta)]^2 \, d\theta \quad \leftarrow \text{uses ①-⑥}$$

symmetry gives

$$6 \cdot \frac{1}{2}\int_{\theta=0}^{\theta=\pi/6} [5\cos(3\theta)]^2 \, d\theta \quad \leftarrow 6 \cdot \text{part ①}$$

$$3 \cdot \frac{1}{2}\int_{\theta=\frac{\pi}{2}}^{\theta=5\pi/6} [5\cos(3\theta)]^2 \, d\theta \quad \leftarrow 3 \cdot \text{part ④ \& ⑤}$$

... possibilities are endless!