Math 126 - Winter 2016
Exam 1
February 2, 2016

Name: _____

Section: _____

Student ID Number: _____

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- There are 4 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**). And you are allowed one **hand-written** 8.5 by 11 inch page of notes (front and back).
- You must show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.** Give exact answers wherever possible.
- Leave your answer in exact form. Simplify standard trig, inverse trig, natural logarithm, and root values. For example, don't leave your answer in the form $\sqrt{4}$ or $\cos(\pi/4)$ instead write $\sqrt{4} = 2$ and $\cos(\pi/4) = \sqrt{2}/2$. But otherwise, you do not have to simplify.
- There may be multiple versions of the test. **Cheating will not be tolerated**. We report all suspicions of cheating to the misconduct board. If you are found guilty of cheating by the misconduct board, then you will get a zero on the exam (and likely face other academic penalties). Avoid suspicion of cheating by showing your work and keeping your eyes on your exam!
- You have 50 minutes to complete the exam. Use your time effectively, spend less than 10 minutes on each page and make sure to leave plenty of time to look at every page. Leave nothing blank, show me what you know!

GOOD LUCK!

1. (12 points)

(a) Find the equation of the plane that goes through the three points $(1, 2, 5)$, $(2, 2, 2)$, $(3, 3, 3)$.

(b) Find parametric equations for the line of intersection of $x - z = 10$ and $x + y + 2z = 0$.

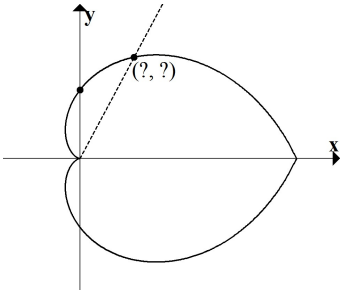
2. (5 pts) Consider the surface $z^2 - 6x^2 - 6y^2 = -9$.

   (a) (2 pts) Give the precise name of this surface as given in the book and in class.

   (b) (3 pts) The surfaces $z^2 - 6x^2 - 6y^2 = -9$ and $z = x^2 + y^2$ intersect to form a circle that is parallel to the xy-plane. Find the center and radius of this circle.
   (For the center, give the (x, y, z) coordinates).

3. (8 pts) Consider the polar curve $r = 1 - \sin\left(\frac{1}{2}\theta\right)$. (shown below)

   (a) (3 pts) In the first quadrant, the line $y = \sqrt{3}x$ intersects the curve at the origin and at one other point (as shown). Find this other point.
   (Note: The line makes a 60 degree angle with the positive x-axis).

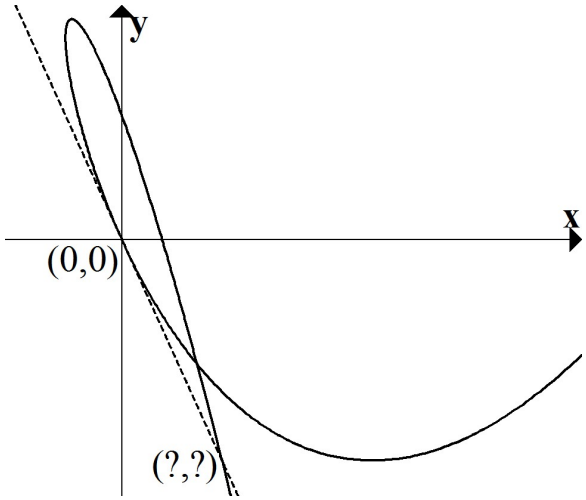


   (b) (5 pts) The polar curve has one positive y-intercept. Find the slope of the tangent line at this point.

4. (10 pts) Consider the parametric equations $x = t^2 - 3t$, $y = 12t - t^3$ (curve shown below).

(a) Find the (x, y) coordinates of all locations on the curve at which the tangent line is horizontal.

(b) The tangent line at $t = 0$ also intersects the curve at one other point (as shown). Find the (x, y) coordinates of the other intersection point.



5. (15 pts) At time $t = 0$, an egg is thrown up into the air toward Dr. Loveless by a disgruntled student. The egg's path is described parametrically by $x = t$, $y = 8\sqrt{t+1}$, $z = 15t - t^2$.

   (a) (3 pts) At the time $t = 0$, find a vector that is tangent to the curve and has length 5.

   (b) Find parametric equations for the tangent line at the positive time when the egg hits the xy-plane.

   (c) A rock is also flying through the air following the path $x = 3$, $y = 14 + u$, $z = 28 + u^3$. The path of the rock and the path of the egg intersect (unfortunately for Dr. Loveless, the rock and egg don't collide). Find the (acute) angle of intersection of the two paths.
   Give your final answer in degrees rounded to two digits after the decimal.