MATH 126 E
Exam I
Spring 2014

Name _____

Student ID #_____   Section _____

HONOR STATEMENT

"I affirm that my work upholds the highest standards of honesty and academic integrity at the
University of Washington, and that I have neither given nor received any unauthorized assistance
on this exam."

SIGNATURE:_____

1	11	
2	9	
3	14	
4	8	
5	8	
Total	50	

- Your exam should consist of this cover sheet, followed by 5 problems. Check that you have
  a complete exam.

- Pace yourself. You have 50 minutes to complete the exam and there are 5 pages. Try not
  to spend more than 10 minutes on each page.

- Unless otherwise indicated, show all your work and justify your answers.

- Unless otherwise indicated, your answers should be exact values rather than decimal approx-
  imations. (For example, $\frac{\pi}{4}$ is an exact answer and is preferable to its decimal approximation
  0.7854.)

- You may use a scientific calculator and one 8.5×11-inch sheet of handwritten notes. All
  other electronic devices (including graphing and programmable calculators and calculators
  with calculus functions) are forbidden.

- You are not allowed to use scratch paper. If you need more room, use the back of the page
  and indicate to the reader that you have done so.

- The use of headphones or earbuds during the exam is not permitted.

- There are multiple versions of the exam, you have signed an honor statement, and cheating
  is a hassle for everyone involved. DO NOT CHEAT.

- Turn your cell phone OFF and put it AWAY for the duration of the exam.

GOOD LUCK!

1. (11 points)

   (a) Find the equation of the sphere centered at the point $(4, 7, 6)$ that intersects the xy-plane at exactly one point.

   (b) The Cartesian coordinates of a point in $\mathbb{R}^2$ are $\left(-3, \sqrt{3}\right)$. Find polar coordinates (r, θ) of the point, where $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$.

   (c) Find the angle between the planes $x - y + 3z = 7$ and $-2x + y - 4z = 3$.

2. (9 points)

    (a) Use traces or reduce the equation to one of the standard forms to identify the surface given by the equation $x^2 - 4x + 2y^2 - 4y - 4z = 2$.

    (b) Find a vector $\mathbf{v}$ of length 2 that is parallel to the tangent vector to

$$\mathbf{r}(t) = \langle 4t^2 - 3t, 7\sin \pi t, e^{t^2 - 4} \rangle$$

    at the point $(10, 0, 1)$.

3. (14 points) Consider the points $P(3, 1, 1)$, $Q(-1, 2, 2)$, and $R(4, 0, 5)$.

   (a) Show that P, Q, and R do not lie on a single line.

   (b) Find the area of the triangle with vertices P, Q, and R.

   (c) Find the point at which the line

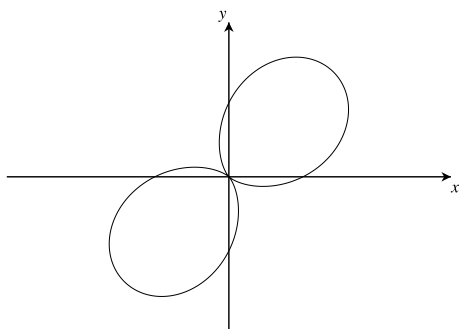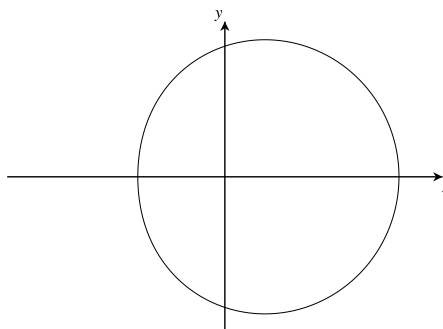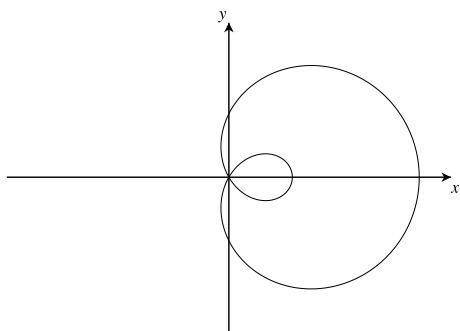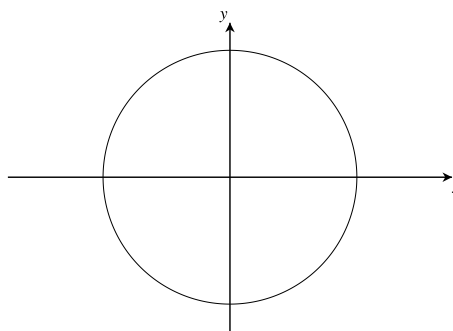$$x = 4 + t, y = 2t, z = 1 - t$$

   intersects the plane that contains P, Q, and R.

4. (8 points)

    (a) Find a vector function $\mathbf{r}(t)$ that represents the intersection of the parabolic cylinder $y^2 = 4z$ and the surface $5x = yz$.

    (b) Compute the curvature of the function $\mathbf{r}(t)$ from part (a) at $t = 20$.

5. (8 points)

   (a) Find the slope of the line tangent to the polar curve $r = 3 + \cos\theta$ at $\theta = \frac{\pi}{4}$.

   (b) Which of the following is the graph of $r = 3 + \cos\theta$? (Put an X in the box corresponding to the correct graph.)

   i. ☐   ii. ☐

   iii. ☐   iv. ☐