MATH 126 A & B
Exam I
April 19, 2012

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	12	
2	10	
3	10	
4	12	
5	6	
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 problems. 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 approximations. (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 calculators) are forbidden.
- 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. (12 points) For parts (a) and (b), show your work. For parts (c) and (d), no justification is needed—just give answers.

   (a) Find a vector $\vec{w}$ with magnitude 20 that is parallel to $\vec{v} = \langle 3, 4, 2\rangle$.

   (b) Give the angle between the vectors $\vec{a} = 3\vec{i} - \vec{j} + 5\vec{k}$ and $\vec{b} = \vec{i} + 2\vec{j}$. (Give an exact expression for your answer and then approximate to the nearest degree.)

   (c) Let P be the point with polar coordinates $\left(3, \frac{2\pi}{3}\right)$. Give a polar coordinate representation (r, θ) for P with $-\dfrac{\pi}{2} \leq \theta \leq \dfrac{\pi}{2}$.

   (d) Consider the quadric surface represented by the equation $x^2 - 81y^2 + z^2 = 0$.

      i. Identify the trace of the surface in the plane $y = 1$. (i.e., Is it an ellipse, a circle, a parabola, a hyperbola, etc?)

      ii. Identify the trace of the surface in the plane $x = 1$. (i.e., Is it an ellipse, a circle, a parabola, a hyperbola, etc?)

      iii. Identify the surface. (i.e., Is this an ellipsoid, paraboloid, cone, hyperboloid of one sheet, etc?)

2. (10 points) Consider a line ℓ and a plane $\mathscr{P}$ given by:

$$\ell : x = 1 - 3t, y = 4t, z = 2 + t \qquad\qquad \mathscr{P} : x + y + z = 15.$$

Let P be the point at which the line ℓ intersects the plane $\mathscr{P}$. Find the equation of the plane that contains P and the points $Q(-15, 23, 10)$ and $R(-16, 24, 7)$. (Write your answer in the form $ax + by + cz = d$.)

3. (10 points) Let $\vec{r}(t) = \langle te^t, t^2 e^{-t} \rangle$ for $-\infty < t < \infty$.

   (a) Find all values of t at which the tangent line to $\vec{r}(t)$ is horizontal.

   (b) Find all values of t at which the tangent line to $\vec{r}(t)$ is vertical.

   (c) Let P_0 be the point on this curve at $t = 1$ and P be the point (x, e) for some real number x. Find the value of x that makes $\overrightarrow{P_0P}$ orthogonal to $\vec{r}\,'(1)$.

4. (12 points)

Let C be the curve of intersection of the parabolic cylinder $z^2 = 4y$ and the surface $5x = yz$.

(a) If we represent C by a vector function of the form

$$\vec{r}(t) = \langle x(t), y(t), t \rangle,$$

find the formulas for $x(t)$ and $y(t)$.

(b) Give parametric equations for the line tangent to C at the point $(50, 25, 10)$.

(c) Find the curvature of C at the point $(50, 25, 10)$. (Give an exact answer and then give a decimal expression with at least four digits after the decimal.)

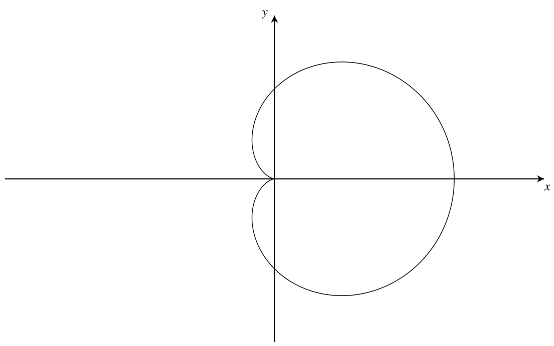
5. (6 points) Match each equation to the correct polar curve. (You do NOT need to show any work or justify your answers.)

   (a) $r = 3\cos\theta$

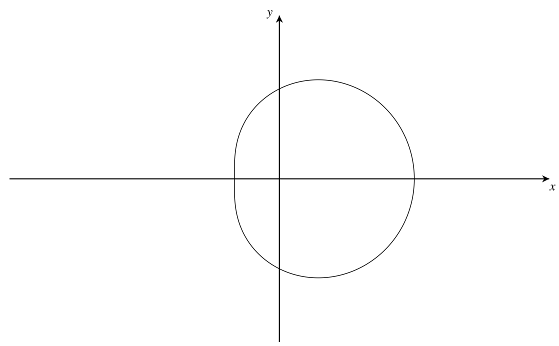
   (b) $r = 1 + \cos\theta$

   (c) $r = 1.5 + \cos 2\theta$

   (d) $r = 2 + \cos\theta$



ANSWER: ______



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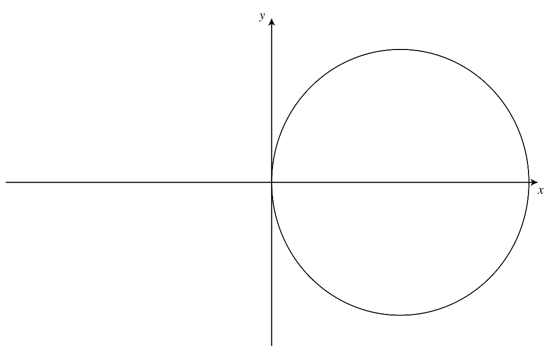

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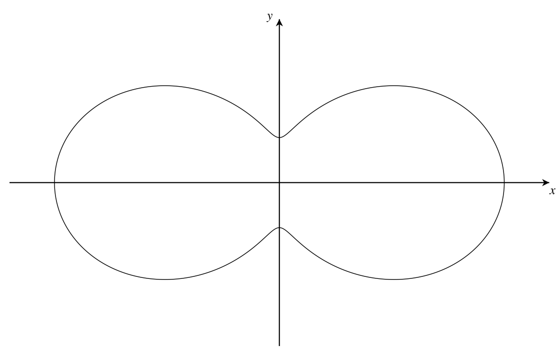

ANSWER: ______