MATH 126 D, E, & F
Exam I
Autumn 2017

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	15	
2	10	
3	15	
4	10	
Total	50	

- Your exam should consist of this cover sheet, followed by 4 problems. Check that you have a complete exam.

- Pace yourself. You have 50 minutes to complete the exam and there are 4 pages. Try not to spend more than 12.5 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 **TI 30XII S** calculator and one 8.5×11-inch sheet of handwritten notes. **All other calculators, electronic devices, and sources 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.

- You are not allowed to use your phone for any reason during this exam. **Turn your phone off and put it away for the duration of the exam**.

GOOD LUCK!

1. (15 points) The points $A(0, -1, 4)$, $B(1, 1, -2)$ and $C(3, 3, 2)$ form a triangle.

   (a) Compute $\angle BAC$, the interior angle of the triangle at the vertex A. (Give an exact answer.)

   (b) Find the area of the triangle with vertices A, B, and C.

   (c) Compute the distance from the point $D(5, 1, 3)$ to the plane that contains A, B, and C.

2. (10 points)

    (a) Which of the following is the graph of the polar curve $r = 2\theta + 1$ for $0 \le \theta \le 2\pi$ in $\mathbb{R}^2$? (Place an X in the blank at the lower left corner of the correct graph. You do not need to show any work.)
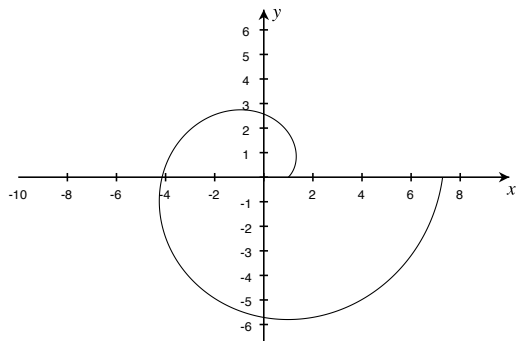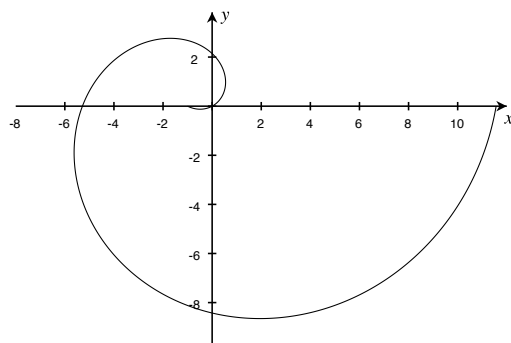

A. _____
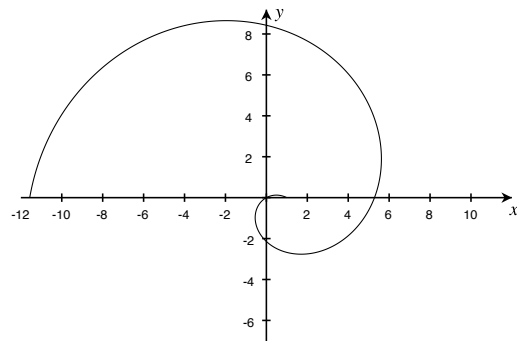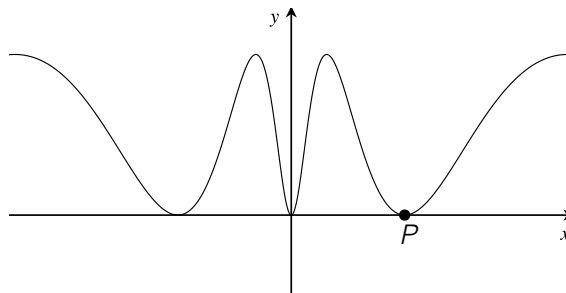

B. _____
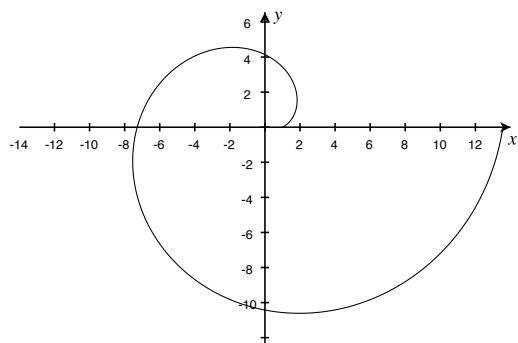
C. _____

D. _____

    (b) Find the slope of the line tangent to the curve $r = 2\theta + 1$ at $\theta = \dfrac{\pi}{2}$.

3. (15 points) An object moves in the xy-plane according to the vector function

$$\vec{r}(t) = \langle t + t^3, \sin^2(\pi t)\rangle, \quad -\infty < t < \infty.$$

The path of the object is shown at right.

(a) Determine whether the object moves from left to right or from right to left along this curve. (You must justify your answer with some calculations and/or a short sentence in order to receive credit.)

(b) Find the first time after $t = 0$ at which the curve has a horizontal tangent line.

(c) The curve is tangent to the x-axis at the point labeled P. Compute the curvature at that point.

4. (10 points)

   (a) Find a vector $\mathbf{v}$ that has magnitude 101 and is orthogonal to $\mathbf{a} = 10\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$.

   (b) Give parametric equations for the intersection of the surfaces

   $$2y^2 + z^2 = 1 \text{ and } x = y^2 + z^2.$$