MATH 126 E & F
Exam II
Spring 2017

Student ID #_____

Name _____ 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	10	
2	12	
3	6	
4	10	
5	12	
Total	50	

- Your exam should consist of this cover sheet, followed by 5 problems on 4 pages. 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 about 12 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. (10 points) Find all points (x, y) at which the graph of the following function has a saddle point:
$$f(x, y) = x^3 - 15x + y^3 + 3y^2 - 9y.$$

2. (12 points) A **constant** force $\mathbf{F} = \langle 0, -6, 10 \rangle$ acts on a particle of mass $m = 2$.
   Newton's Law dictates that $\mathbf{F} = m\mathbf{a}$, where $\mathbf{a}$ is the particle's acceleration.
   At time $t = 0$, the particle is at the origin and has velocity $\mathbf{v}(0) = \langle -2, 1, 3 \rangle$.

   (a) Find the particle's acceleration $\mathbf{a}(t)$, velocity $\mathbf{v}(t)$, and position $\mathbf{r}(t)$ at time t.

   (b) Compute the binormal vector to $\mathbf{r}(t)$ at time t.

   (c) Find the equation of the osculating plane to $\mathbf{r}(t)$ at time $t = 1$.

3. (6 points) Use linear approximation to estimate the value of $f(1.05, 1.03)$ if

$$f(x, y) = \sin(xy - 1).$$

4. (10 points) Let V be the volume of the solid bounded by the plane $2x + 5y + z = 10$ and the three coordinate planes.

   Fill in the boxes below to give the iterated integrals one would need to evaluate in order to find the volume V. Show your work.

$$V = \int_{\square}^{\square} \int_{\square}^{\square} \square \; dy\, dx$$

$$= \int_{\square}^{\square} \int_{\square}^{\square} \square \; dx\, dy$$

YOU DO NOT NEED TO COMPUTE THE VOLUME. JUST FILL IN THE BOXES.

5. (12 points) Suppose $f(x, y)$ is a continuous function of x and y and that

$$\iint_D f(x,y)\,dA = \int_{-3}^{0}\int_{-x}^{\sqrt{18-x^2}} f(x,y)\,dy\,dx + \int_{0}^{3}\int_{x}^{\sqrt{18-x^2}} f(x,y)\,dy\,dx.$$

(a) Sketch, shade, and label the region D.

(b) Compute $\iint_D y(x+1)\,dA$ by converting to polar coordinates.