MATH 126 B & C
Exam II
Autumn 2015

Name ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Student ID #⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯   Section ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

1	10	
2	10	
3	10	
4	10	
5	10	
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 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 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.

- 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) A particle travels with position at time t given by

$$\mathbf{r}(t) = \left\langle t^2 - 3t, \frac{1}{\pi}\cos(\pi t), \frac{1}{\pi}\sin(\pi t) \right\rangle.$$

Find the equation of the normal plane at the first time the particle passes through the plane $x = -2$.

2. (10 points) Use implicit differentiation to find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ if

$$x^2 y + \sin z = e^{xy} \cos y.$$

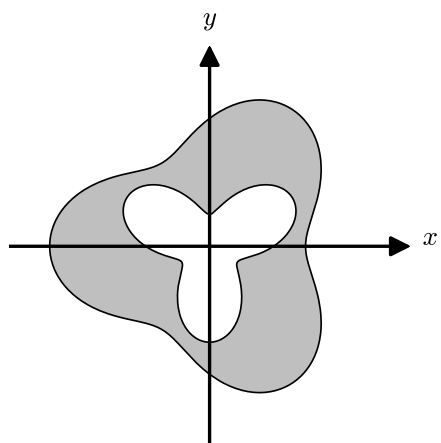3. (10 points) Find the smallest value of

$$E = \frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2}$$

if $xyz = 8$ and $x > 0$ and $y > 0$.

(For full credit, you must argue that your answer is indeed the smallest.)

4. (10 points) The graph below shows the polar curves

$$r = 2 + \sin(3\theta) \text{ and } r = 4 - \cos(3\theta).$$

Find the area of the region D that lies between the two curves.

You may find one or both of the Double Angle Identities useful:

$$\cos^2 x - \sin^2 x = \cos(2x) \quad \text{and} \quad 2\sin x \cos x = \sin(2x).$$

5. (10 points) A lamina has the shape of a triangle with vertices at $(0,0)$, $(0,2)$ and $(1,2)$. Its density at the point (x,y) is given by $\rho(x,y) = y^2 \sin(xy)$. Find its mass.