Math 126, Section C - Winter 2015
Midterm I
February 3, 2015

Name: _____

Student ID Number: _____

Section: CA 11:30-12:20 by Sam ☐ CB 12:30-1:20 by Sam ☐

CC 11:30-12:20 by Ru-Yu ☐ CD 12:30-1:20 by Ru-Yu ☐

exercise	**possible**	**score**
1	7	
2	11	
3	8	
4	12	
5	12	
total	50	

- Check that this booklet has all the exercises indicated above.
- TURN OFF YOUR CELL PHONE.
- Write your name and your student ID.
- This is a 50 minute test.
- You may use a scientific calculator and one 8.5×11 inch sheet of (two-sided) handwritten notes. All other electronic devices (including graphing calculators) are forbidden.
- Unless otherwise indicated, your answers should be exact instead of decimal approximations. For example $\frac{\pi}{4}$ is an exact answer and is preferable to its decimal approximation 0.78.
- Unless otherwise indicated, show your work and justify all your answers. Box your $\boxed{\text{final answer}}$.

Exercise 1 (7 points).

Consider the points $A = (3, 4, 1)$, $B = (4, -1, 0)$ and $C = (1, 2, 2)$. What is the area of the triangle ABC?

Exercise 2 (11 points).

Consider the two lines in $\mathbb{R}^3$ given by symmetric equations

$$\ell_1 : \; x-1 = y+2 = z-3 \qquad\qquad \ell_2 : \; \frac{x-4}{2} = y = z-5$$

(a) Both lines intersect in exactly one point. Compute the angle of the intersection (rounded to the nearest degree).

(b) Find the equation of the plane that contains both lines ℓ_1 and ℓ_2.

Exercise 3 (2+2+2+2=8 points).

We want to study the surface in $\mathbb{R}^3$ that is described by the equation

$$\frac{x^2}{9} - \frac{y^2}{4} + \frac{z^2}{16} + 5 = 0$$

a) Fill out the following table (no justification needed).

	a parabola	a hyperbola	an ellipse	empty	other
The trace with the xy-plane is	☐	☐	☐	☐	☐
The trace with the plane $y = 2$ is	☐	☐	☐	☐	☐
The trace with the plane $y = 6$ is	☐	☐	☐	☐	☐

b) Hence, the surface is an

- ☐ elliptic cylinder
- ☐ parabolic cylinder
- ☐ hyperbolic cylinder
- ☐ ellipsoid
- ☐ cone
- ☐ elliptic paraboloid
- ☐ hyperboloid of one sheet
- ☐ hyperboloid of two sheets

Exercise 4 (4+8=12 points).

The equation $r = 2\theta + 1$ for $\theta \geq 0$ describes a curve in $\mathbb{R}^2$ in polar coordinates.

a) List 3 points (in Cartesian coordinates) where the curve intersects the positive y-axis.

b) Consider the line that is tangent to the curve at $\theta = \pi$. What is its slope?

Exercise 5 (12 points).

Compute the curvature $\kappa(t)$ for the curve $\vec{r}(t) = (t + \sin(t), \frac{t^3}{\pi}, \cos(3t))$ at $t = \frac{\pi}{2}$ (I prefer an exact answer).