

Math 126 G - Autumn 2017  
Midterm Exam Number One  
October 24, 2017

Name: \_\_\_\_\_

Student ID no. : \_\_\_\_\_

Signature: \_\_\_\_\_

Section: \_\_\_\_\_

|       |    |  |
|-------|----|--|
| 1     | 12 |  |
| 2     | 10 |  |
| 3     | 10 |  |
| 4     | 13 |  |
| 5     | 15 |  |
| Total | 60 |  |

- This exam consists of FIVE problems on FIVE pages, including this cover sheet.
- Show all work for full credit. Show no work for zero credit.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- Write all of your work on the exam itself. If you use the back of the page, please indicate that you have done so!
- You may use a TI-30X IIS on this exam. No other electronic devices are allowed.
- Draw a box around your final answer to each problem.
- You may use one hand-written double-sided 8.5" by 11" page of notes.
- You have 50 minutes to complete the exam.

1. [4 points per part]  $ABCD$  is a parallelogram, with diagonals  $AC$  and  $BD$ .

Here are some coordinates:

$$A = (2, 0, 5) \quad B = (1, 4, 8) \quad C = (2, 7, 10)$$

(a) What are the coordinates of  $D$ ?

(b) Find the area of the parallelogram  $ABCD$ .

(c) Find the equation of the plane containing this parallelogram.

2. [10 points] Write an equation for the ellipsoid centered at  $(2, 4, -1)$  and containing the points  $(-6, 1, -1)$ ,  $(2, -1, -1)$ , and  $(4, 3, 2)$ .

3. [10 points] I have some secret vectors  $\mathbf{u}$  and  $\mathbf{v}$ .

- $\text{proj}_{\mathbf{v}} \mathbf{u} = \langle 3, -1, 2 \rangle$
- $\text{proj}_{\mathbf{u}} \mathbf{v} = \langle 5, 1, -1 \rangle$

So, what's  $\mathbf{u}$ ?

4. Consider the polar curve  $r = 1 - 6 \cos(\theta)$ .

(a) **[4 points]** Find all intersections of the curve with the  $x$ -axis.

(b) **[9 points]** Find the  $x$ -coordinates of all points on the curve at which the tangent line is horizontal.

5. [5 points per part]

(a) Write a vector function  $\mathbf{r}(t)$  whose space curve is the intersection of the surfaces

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

(b) Let  $P_1$  and  $P_2$  be the intersections of this space curve with the plane  $y = -11$ . Find parametric equations for the lines tangent to the curve at  $P_1$  and  $P_2$ .

(c) Are the lines you found in part (b) parallel, intersecting, or skew?