Math 126 G - Autumn 2018
Midterm Exam Number One
October 25, 2018

Name: ______________________________ Student ID no. : ________________

Signature: ____

1	12	
2	12	
3	13	
4	15	
5	8	
Total	60	

- This exam consists of **FIVE** problems on **FOUR** double-sided pages.
- Show all work for full credit.
- You may use a TI-30X IIS calculator during this exam. Other calculators and electronic devices are not permitted.
- 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.
- Draw a box around your final answer to each problem.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- If you run out of room, write on the back of the first or last page and indicate that you have done so. If you still need more room, raise your hand and ask for an extra page.
- You may use one hand-written double-sided 8.5″ by 11″ page of notes.
- You have 80 minutes to complete the exam.

1. **[6 points per part]** Consider the following two planes:

$$\mathcal{P}_1 : 4x - 8y + z = 3 \qquad \mathcal{P}_2 : x = 3y + 4$$

(a) Find the (acute) angle of intersection between $\mathcal{P}_1$ and $\mathcal{P}_2$.

(b) Find the line of intersection of $\mathcal{P}_1$ and $\mathcal{P}_2$.

Write your answer in symmetric form.

2. **[2 points each]** Here are six polar equations:

(A) $r = 1 + \cos(\theta)$

(B) $r = \cos(\theta) + 2\sin(\theta)$

(C) $r = \cos(\theta) + 2\sin^2(\theta)$

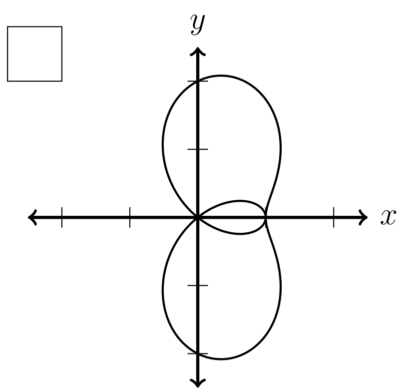
(D) $r = \dfrac{\theta}{10}$

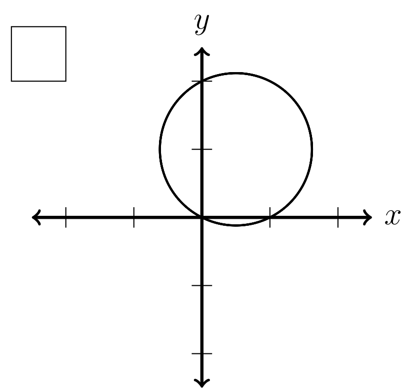
(E) $r = 2\sin\left(\dfrac{\theta}{2}\right)$

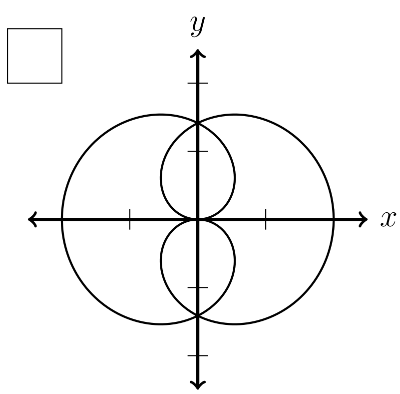
(F) $r = \dfrac{1}{2}\sqrt{\theta}$

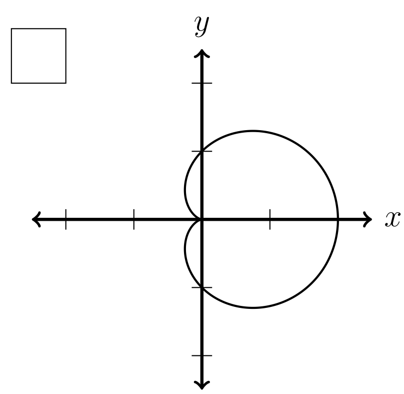
Write the letter of each equation in the box next to its graph below.

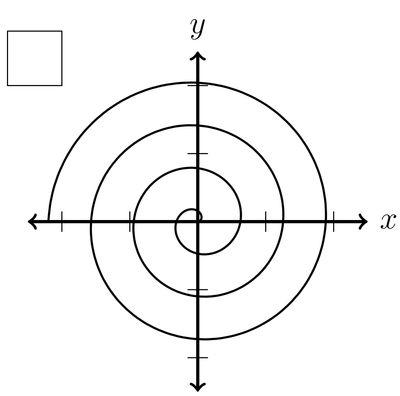
You do not need to show any work for this problem.

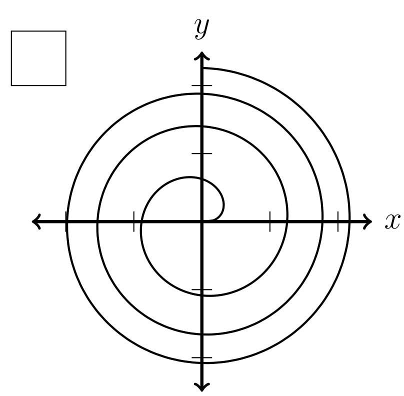












The next two questions on this exam are sponsored by the vector function

$$\mathbf{r}(t) = \langle t+1, t^2+6t+8, 2t+5 \rangle.$$

3. (a) **[5 points]** Write parametric equations for the line tangent to $\mathbf{r}(t)$ at the point $(2, 15, 7)$.

(b) **[5 points]** Find the maximum curvature of $\mathbf{r}(t)$.

(c) **[3 points]** Find the point where your maximum curvature from part (b) occurs.

4. **[5 points per part]** This question is again brought to you by $\mathbf{r}(t) = \langle t+1, t^2+6t+8, 2t+5 \rangle$.

(a) List all intersections of $\mathbf{r}(t)$ with the plane $y = 0$.

(b) $\mathbf{r}(t)$ lies within a plane. Give the equation for that plane.

(c) Find *another* surface (not a plane!) containing $\mathbf{r}(t)$.

Write an equation for that surface, and give its name.

5. **[8 points]** I have two secret vectors $\mathbf{u}$ and $\mathbf{v}$. Here are some facts:

   - $\mathbf{u} + \mathbf{v} = \langle 1, 2, 3 \rangle$
   - $\text{proj}_{\mathbf{u}} \mathbf{v} = \langle 4, 3, 0 \rangle$

   What are $\mathbf{u}$ and $\mathbf{v}$?