

Math 126 C - Winter 2022
Midterm Exam Number One
February 3, 2022

Name: _____

Student ID no. : _____

Signature: _____

1	15	
2	8	
3	11	
4	8	
5	6	
6	12	
Total	60	

*This grid is purely decorative.
The exam is graded online.*

- This exam consists of **SIX** problems on **FOUR** double-sided pages. The fourth page is left blank for scratch work.
- Show all work for full credit.
- You may use a TI-30X IIS (or equivalent) 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 one of the scratch work pages **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 50 minutes to complete the exam.

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see first page” below a problem.

1. [5 points per part] For this problem, consider the points

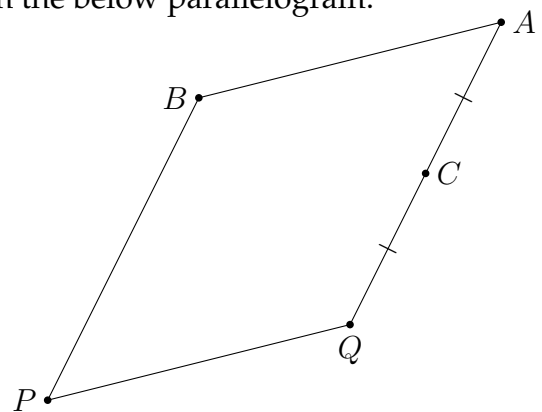
$$A = (2, 3, 3) \quad B = (1, 1, 1) \quad C = (1, 4, -3).$$

(a) Compute the angle $\angle ABC$.

(b) Find the equation of the plane containing A , B , and C .

(c) Find the coordinates of the point P marked in the below parallelogram.

(C is the midpoint of AQ .)



2. [2 points per part] For each of the following objects, figure out how they intersect.

Circle one option. You do not need to show work on this problem.

(a) The line $x = t, y = 3t, z = 1 - 4t$ and the plane $x + 3y - 4z = 7$.

a point a line a plane no intersection

(b) The line $x = t, y = 2t, z = 3t$ and the plane $x + y - z = 1$.

a point a line a plane no intersection

(c) The planes $2x + 4y + 6z = 2$ and $3x + 6y + 9z = 3$.

a point a line a plane no intersection

(d) The planes $x + 4y - 2z = 1$ and $x + 4y + 2z = 7$.

a point a line a plane no intersection

3. You do not need to show work on parts (a) and (b). Please show work on part (c).

(a) [3 points] Give an example of a vector \mathbf{a} such that $\mathbf{a} \cdot \mathbf{a} = 7$.

(b) [3 points] Give an example of a vector \mathbf{a} such that $\text{comp}_{\mathbf{a}} \langle 1, 2, 3 \rangle = -2$.

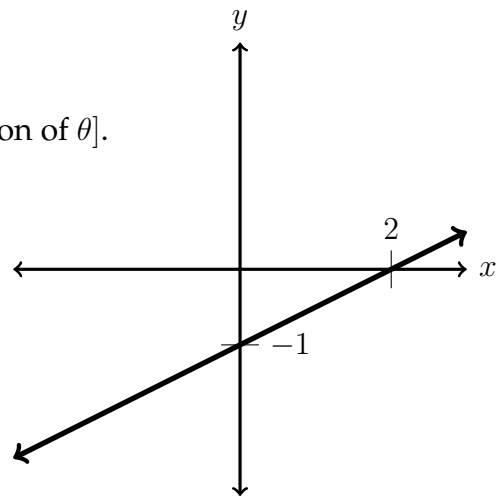
(c) [5 points] Give an example of two nonzero vectors \mathbf{a} and \mathbf{b} such that $|\mathbf{a} \times \mathbf{b}| = -\mathbf{a} \cdot \mathbf{b}$.

4. [8 points] Find the equation of the ellipsoid which is centered at the origin and contains the points $(3, 8, 0)$, $(5, 0, 0)$, and $(2, 1, 1)$.

5. [6 points] Consider the line in the following graph.

Convert the equation for this line to polar form.

Write your final answer in the form $r = [\text{some function of } \theta]$.



6. [6 points per part] The force exerted on an 8-kg cat at time t is given by the vector function

$$\mathbf{F}(t) = \langle 16t, 24, 8\sqrt{t+7} \rangle \text{ Newtons.}$$

At time $t = 0$, the cat is at the point $(1, 2, 3)$. At time $t = 2$, the cat is at rest.

(a) Find parametric equations for the line tangent to the cat's path at time $t = 0$.

(b) Find the tangential component of acceleration of the cat at time $t = 0$.

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see back page” below a problem.

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