Math 120 A - Spring 2022
Midterm Exam Number One
April 21st, 2022

Name: _____   Student ID no. : _____

Signature: _____   Section: _____

1	15	
2	15	
3	15	
4	15	
Total	60	

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

- This exam consists of **FOUR** 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. **[15 points]** Jim is standing at the center of a circular ring of radius 10 meters.

   At time $t = 0$, Naomi is 16 meters west and 2 meters south of Jim.

   Naomi runs in a straight line towards the northernmost point of the ring.

   Naomi runs at a constant speed of 5 meters per second while she's outside the ring, but slows down to 3 meters per second once she enters the ring.

   (a) When does Naomi enter the ring?

   (b) When is Naomi closest to Jim?

2. **[5 points per part]** Gregg and Bea are walking around the coordinate plane.

   (a) Gregg starts at the point $(5, -2)$, and walks towards the point $(-13, 7)$ in a straight line at a constant speed, reaching it after 12 seconds.

   Write parametric equations for Gregg's location after t seconds.

   (b) Bea starts at the point $(-3, 4)$, and walks towards the point $(3, -4)$ at a constant speed of 4 units per second.
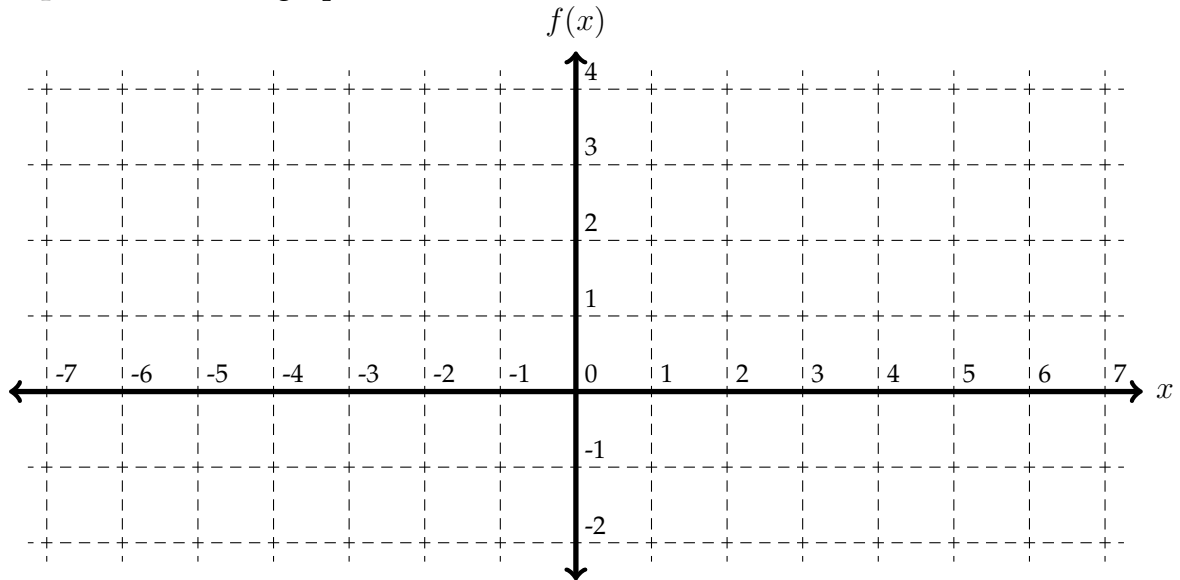
   Write parametric equations for Bea's location after t seconds.

   (c) When is Gregg due north of Bea?

3. For this problem, consider the following multipart function:

$$f(x) = \begin{cases} x + 6 & \text{if } -6 \leq x < -3 \\ -1 + \sqrt{25 - (x-2)^2} & \text{if } -3 \leq x < 2 \\ -1 & \text{if } 2 \leq x < 5 \end{cases}$$

(a) **[6 points]** Sketch a graph of f here:

(b) **[3 points]** What is the range of f?

(c) **[6 points]** Find all values of x such that $f(x) = 2$.

4. Merlin is selling orbs. His profit is a quadratic function of how much he charges.

   If Merlin gives away the orbs for free, he'll **lose** $200.

   If Merlin charges $10 per orb, he'll **earn** a profit of $280.

   If Merlin charges $20 per orb, he'll **earn** a profit of $700.

   (a) **[12 points]** Write a function $f(x)$ for Merlin's profit if he charges x per orb.

   (b) **[3 points]** How much should Merlin charge to maximize his profit?

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