Math 120 **First Midterm** **Winter 2019**

Your Name (please PRINT clearly)

Student ID #

PLEASE READ DIRECTIONS BELOW:

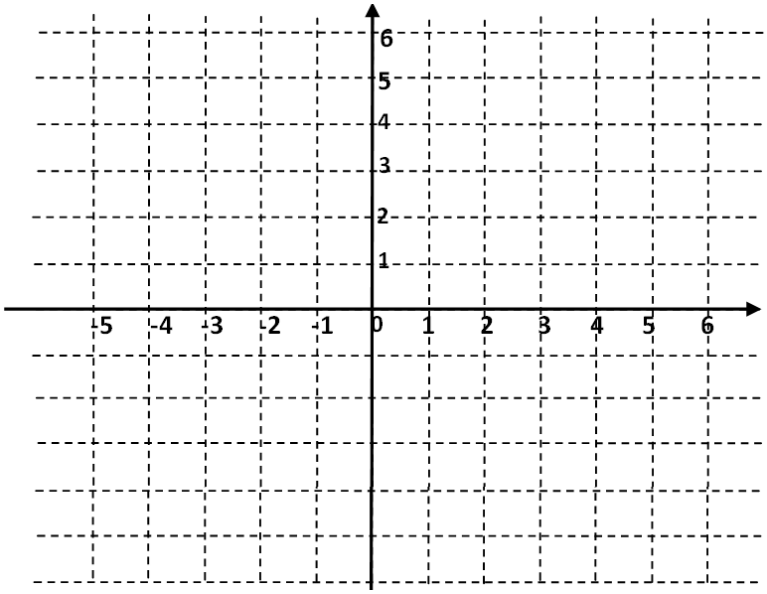
- Do not open the test until instructed to do so. Once the exam starts, check that you have a complete exam: there should be 4 questions on 4 pages.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ page of handwritten notes. Do not share notes.
- Only a Ti-30x IIS calculator is allowed.
  Turn off your cell phone and put it away until the exam is over.
- In order to receive credit, you **MUST SHOW YOUR WORK**. If we cannot tell how you are getting your answers, you may receive little or no credit, even if the answer happens to be correct.
- If you need more room, use the backs of pages and indicate to the grader that you have done so.
- You may round off your final answer to 2 or more decimal digits. Keep at least 4 digits of precision throughout your computations.
- Place a box around $\boxed{\text{YOUR FINAL ANSWER}}$ to each question.
- Raise your hand if you have a question. (But please don't try fishing for answers. Your TA can clarify a question, but cannot offer hints or confirm your work.)
- Read each question carefully, before and after answering it. Do your best, and show your work. Good luck!

Problem	Points	Score
1	12	
2	12	
3	12	
4	14	
Total	50	

1. Consider the function:

$$f(x) = \begin{cases} 2, & \text{if } -5 \le x \le -2 \\ -x^2 + 4, & \text{if } -2 < x < 2 \\ 2x - 2, & \text{if } 2 \le x < \infty \end{cases} \tag{1}$$

(a) (6 points) Sketch the graph of this function.



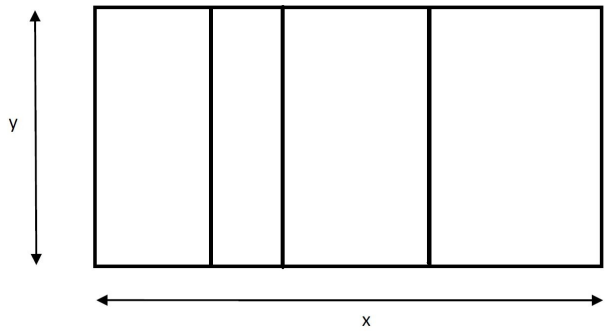
(b) (6 points) Find all solutions for the equation:

$$f(x) = x$$

ANSWER: $x =$ _____

2. (12 points) Sammy has a total length of 400 meters of fence and wants to use this fence to build a rectangular enclosure with 4 compartments, as shown in the picture below.

   What dimensions x and y should Sammy use for the enclosure in order to maximize the total area inside the enclosure, and what is the largest area that can be enclosed? Include units.

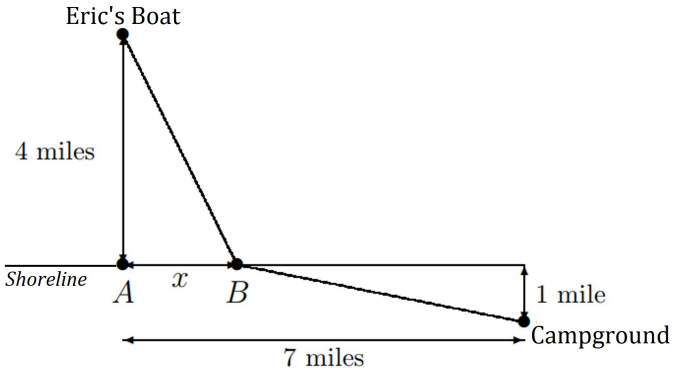


ANSWER: maximal area =_____ (**include units**)

achieved when x =_____ and y =_____

3. (12 points) Eric is in a rowboat located 4 miles north of point A on the shore of a lake. He wants to go to a campground located 7 miles east and 1 mile south of the point A. To get there, Eric first paddles at 2 miles per hour in a straight line to a point B, located on the shore x miles east of point A, and then walks in a straight line from B to the campground, at 4.5 miles per hour. His path is pictured below.

   (a) (6 points) Find a function $T(x)$ that gives the total time it takes Eric to get to the campground as an expression of x.



ANSWER: $T(x) =$ _____

   (b) (6 points) Take point A as the origin of a coordinate system and assume Eric reaches the shore at point B that's $x = 1$ mile away from A. Write parametric equations for Eric's coordinates as functions of time t for the portion of his trip when he's paddling towards point B.

ANSWER: $x(t) =$ _____

$y(t) =$ _____

4. (14 points) Lassie is a dog and she is looking for her owner, a boy named Timmy. Timmy has fallen in a well and he is blowing a whistle that can be heard from up to 1 km away. Initially, Lassie is at a point 0.8 km south and 0.8 km west of the well.

   (a) (4 points) Can Lassie hear Timmy's whistle from her initial point? Justify your answer.

   (b) (10 points) Lassie starts running due north, at a constant speed of 20 km/hr. After a while, she hears the whistle and, as soon as she hears it, she turns and continues running at the same speed in a straight line towards the well. How long does it take Lassie to reach Timmy, in minutes?

ANSWER: $t =$_____ minutes