NAME: _____ Student ID #: _____

QUIZ SECTION:_____

**Math 120A**
**Midterm I**
January 30th, 2014

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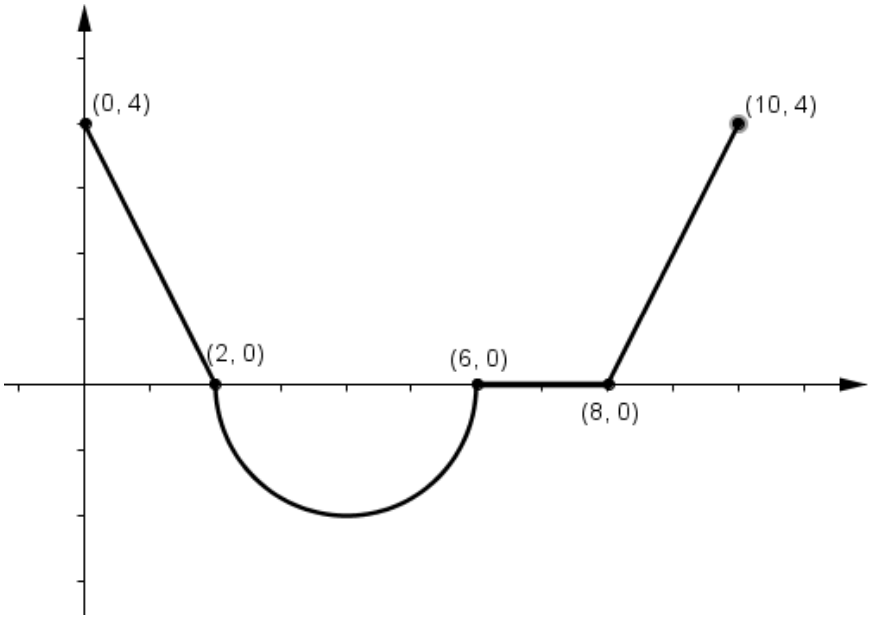
|---|---|---|
| Problem 1 | 13 | |
| Problem 2 | 13 | |
| Problem 3 | 14 | |
| Problem 4 | 10 | |
| Total: | 50 | |

- Please do not open your exam until instructed to do so.
- You are allowed to use a non-graphing calculator and one double-sided handwritten sheet of notes Do not share notes.
- When the exam starts, **check that you have a complete exam**. In addition to this cover page, there should be **4 problems on 4 pages**.
- Unless otherwise stated, you **MUST SHOW YOUR WORK**. Correct (or incorrect) answers with no supporting work may result in little or no credit.
- Make sure to read each question carefully, and not to spend too much time on any one page. Aim for about 12 min/page.
- Please box your **final answer** to each question. Include units, if appropriate.
- You may round off your final answers to 2 decimal digits. Keep at least 3-4 digits of precision throughout your computations.
- If you need more room, use the backs of pages and indicate to the grader that you have done so.
- 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.)

GOOD LUCK!

1. (13 pts) The graph below shows a multi-part function, $y = f(x)$, consisting of 3 line segments and half of a circle. All questions below refer to this function. You do not have to show work in parts (a) and (b).




a) (8 pts) Write the multi-part rule for this function in terms of $x$. Include corresponding domains.

$$f(x) = \begin{cases} \\ \\ \\ \end{cases}$$

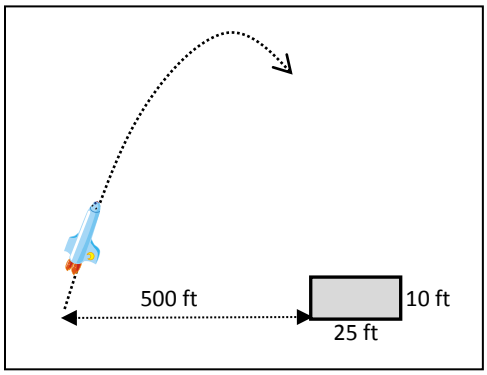
b) (2 pts) What is the range of this function?

c) (3 pts) Find all solutions to the equation $f(x) = 2$. You may use the graph, or solve algebraically, but justify how you get your answers.

2. (13 pts) A rocket is launched as shown. The trajectory of the rocket is a parabola described by the equation

$$y = -0.01x^2 + 6x,$$

where $y$ **is the height of the rocket above the ground**, and $x$ **is the rocket's horizontal distance from its launching point** (origin), in feet. The rocket is meant to hit a flat-roofed storage building, 25 feet long and 10 feet tall, which is located 500 feet away from the rocket launcher, as shown in the diagram.



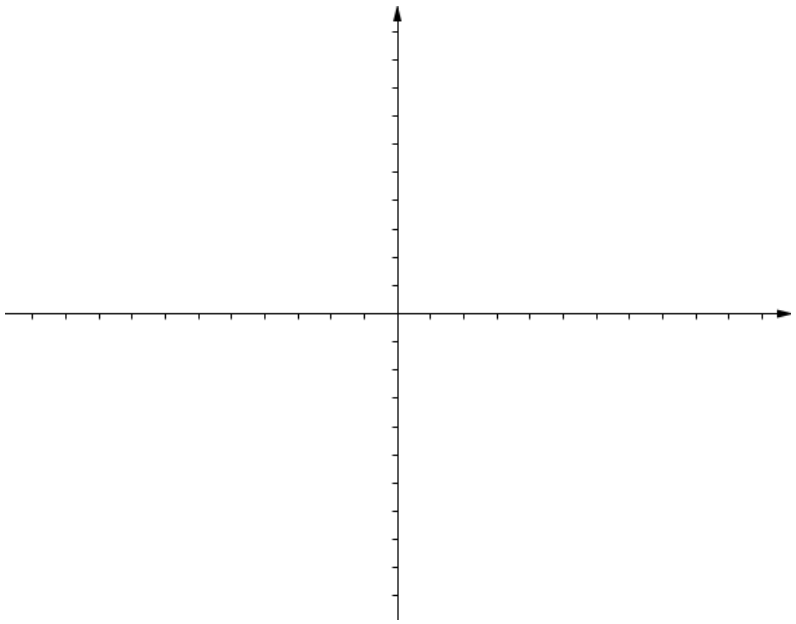

a) (5 pts) What is the maximum height of the rocket above the ground?

b) (3 pts) Write down the rule $y = f(x)$ and the domain for the function describing just the **roof of the storage building.** No need to show work.

c) (5 pts) Will the rocket hit the roof of the storage building?
If yes, find the coordinates $(x, y)$ for the point of impact. If no, explain why not.

3. (14 pts) The traffic control tower at an airport has a circular radar range with a radius of 70 km around the tower. An airplane starts off at a point 80 km due North of the tower and flies in a straight line towards a point which is 100 km due East of the tower.

a) Draw a picture and impose a coordinate system with the origin at the tower. What is the $x$-coordinate of the airplane's position when it enters the range of the traffic control tower?



b) How close does the airplane get to the traffic control tower?

4. (10 pts) Consider the same plane as in the previous problem: the airplane starts off at a point 80 km due North of the tower and flies in a straight line towards a point which is 100 km due East of the tower. Suppose the plane flies at a speed of 500 miles per hour ($1\ mile \approx 1.6\ km$).

   Compute the parametric equations for the plane, and determine the position of the airplane six minutes after it starts flying.