# Math 111
## Exam 2
### November 24, 2015

Name: _____

Quiz Section: _____

Student ID Number: _____

| | | |
|---|---|---|
| 1 | 16 | |
| 2 | 13 | |
| 3 | 10 | |
| 4 | 11 | |
| Total | 50 | |

- Check that your exam contains four pages of problems in addition to this cover page.

- You are allowed to use a Ti-30x IIS Calculator, a ruler, and one **hand-written** 8.5 by 11 inch page of notes. Put your name on your sheet of notes and turn it in with the exam.

- You must **show your work** on all problems. On problems in which you use a graph, draw lines and *clearly* label them in the graph. Your work and explanations on each problem should be very brief, so you should be able to fit them in the space provided. However, if you want more space, you can write on the backs of the previous page and indicate to the grader that you have done so.

- Put your final answer on the lines provided with the problems.

- Raise your hand if you have a question. Your TA can only clarify the wording of a question, he/she cannot comment on your work.

- There are multiple versions of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated. Any student found engaging in academic misconduct will receive a score of 0 on this exam. All suspicious behavior will be reported to the student misconduct board. In such an instance, you will meet in front of a board of professors to explain your actions.
  DO NOT CHEAT OR DO ANYTHING THAT LOOKS SUSPICIOUS!
  WE WILL REPORT YOU AND YOU MAY BE EXPELLED!
  Keep your eyes down and on your paper. If your TA sees your eyes wandering they will warn you only once before taking your exam from you.

- You have 50 minutes to complete the exam. Use your time wisely: Spend no more than 10 minutes on each page before moving on to the next page.

GOOD LUCK!

1. (16 points) A company has fixed costs of $43,000 (430 hundred dollars) and average variable costs given by $AVC(x) = x^2 - 5x + 10$ dollars per item, where $x$ is in hundreds of items. The selling price, $p$, for an order of $x$ hundred items is given by $p = 190 - \frac{4}{3}x$ dollars per item.

   Round your **final answers** to the nearest item or nearest cent.

   (a) (4 pts) Find and simplify the formulas for variable cost, total cost, average cost, and total revenue.

   $$VC(x) = \underline{\hspace{10cm}} \text{ hundred dollars}$$

   $$TC(x) = \underline{\hspace{10cm}} \text{ hundred dollars}$$

   $$AC(x) = \underline{\hspace{10cm}} \text{ dollars per item}$$

   $$TR(x) = \underline{\hspace{10cm}} \text{ hundred dollars}$$

   (b) (4 pts) Find the shutdown price.

   $$SDP = \underline{\hspace{5cm}} \text{ dollars/item}$$

   (c) (4 pts) Find the **selling price** that gives the maximum total revenue.

   $$p = \underline{\hspace{5cm}} \text{ dollars/item}$$

   (d) (4 pts) Find the range of quantities over which $AVC(x)$ is less than or equal to $6 per item.

   $$\text{from } x = \underline{\hspace{5cm}} \text{ to } x = \underline{\hspace{5cm}} \text{ hundred items}$$

2. (13 points) Consider the two functions

$$f(x) = \frac{3}{4}x^2 - 3x + 2 \quad \text{and} \quad g(x) = x^2 - 8x + 15.$$

(a) (5 pts) Find and completely simplify $\dfrac{g(x+h) - g(x)}{h}$.

$$\frac{g(x+h)-g(x)}{h} = \underline{\hspace{4cm}}$$

(b) (4 pts) Find all solutions to $g(x) - f(x) = 4$.

(List solutions) $x = \underline{\hspace{3cm}}$

(c) (4 pts) Find the longest interval over which $f(x)$ and $f(x) - g(x)$ are both increasing.

from $x = \underline{\hspace{4cm}}$ to $x = \underline{\hspace{3cm}}$

3. (10 points) On this page you will solve the following linear programming problem:
Maximize $f(x, y) = 4x + 5y$ subject to the constraints

$$x + y \leq 7.5 \quad , \quad 2.25x + y \leq 12 \quad , \quad y \leq 6 \quad , \quad x \geq 0 \quad , \quad y \geq 0.$$

(a) (8 pts) Accurately sketch the feasible region. Clearly, shade the feasible region and label ALL relevent corners for full credit. (Show your work and your solving! Do NOT estimate from the picture, you must show the necessary algebra to solve for the appropriate intersections to get full credit).
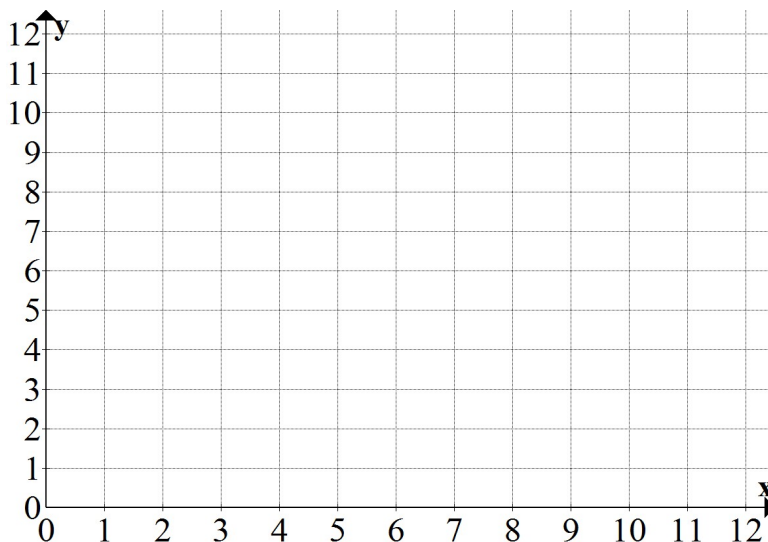


(b) (2 pts) What is the maximum value of $f(x, y) = 4x + 5y$ subject to the given constraints?

Max $f(x, y)$ value = _____

4. (11 pts)

   (a) The supply curve is $p - q = 10$ and the demand curve is $q(2p - 10) = 5500$, where $q$ is in items.

      i. (4 pts) Give the quantity and price that corresponds to market equilibrium.

$$(q, p) = \underline{\hspace{3cm}}$$

      ii. (3 pts) If the market price is \$30 per item is there a shortage or surplus?
          And how many items is the shortage or surplus?

Circle one: SHORTAGE or SURPLUS

By this many $\underline{\hspace{3cm}}$ items

   (b) (4 pts) Solve $21 - 3(1.05)^{0.1t} = 9$.
       Give your final answer as a decimal, accurate to three digits after the decimal.

$$t = \underline{\hspace{3cm}}$$