

MATH 111
Exam II
Winter 2015

Name _____

Student ID # _____

Section _____

HONOR STATEMENT

“I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam.”

SIGNATURE: _____

1	12	
2	14	
3	12	
4	12	
Total	50	

- Check that your exam contains this cover sheet followed by four problems.
- You are allowed to use a scientific (non-graphing) calculator, a ruler, and one sheet of hand-written notes. All other sources are forbidden.
- Do not use scratch paper. If you need more room, use the back of the page and indicate to the grader you have done so.
- Turn your cell phone OFF and put it away for the duration of the exam.
- You may not listen to headphones or earbuds during the exam.
- You must show your work. Clearly label lines and points that you are using and show all calculations. The correct answer with no supporting work may result in no credit.
- If you use a guess-and-check method when an algebraic method is available, you may not receive full credit.
- When rounding is necessary, you may round your final answer to two digits after the decimal.
- There are multiple versions of the exam, you have signed an honor statement, and cheating is a hassle for everyone involved. DO NOT CHEAT.
- Put your name on your sheet of notes and turn it in with the exam.

GOOD LUCK!

1. (12 points) You sell Hangups. The formulas for total revenue and total cost (in **hundreds** of dollars) at q **hundred** Hangups are:

$$TR(q) = 36.4q \text{ and } TC(q) = 2q^2 + 10q + 64.$$

- (a) What is the maximum possible profit?

ANSWER: _____ hundred dollars

- (b) Recall that, since q is being measured in hundreds of Hangups, marginal cost (in dollars per Hangup) is given by

$$MC(q) = \frac{TC(q + 0.01) - TC(q)}{0.01}.$$

Find and simplify the formula for $MC(q)$. (HINT: Your simplified formula should be **linear**.)

ANSWER: $MC(q) =$ _____

- (c) Find all quantities at which average cost ($AC(q)$) is \$170.80 per Hangup.

ANSWER: (list all) $q =$ _____ hundred Hangups

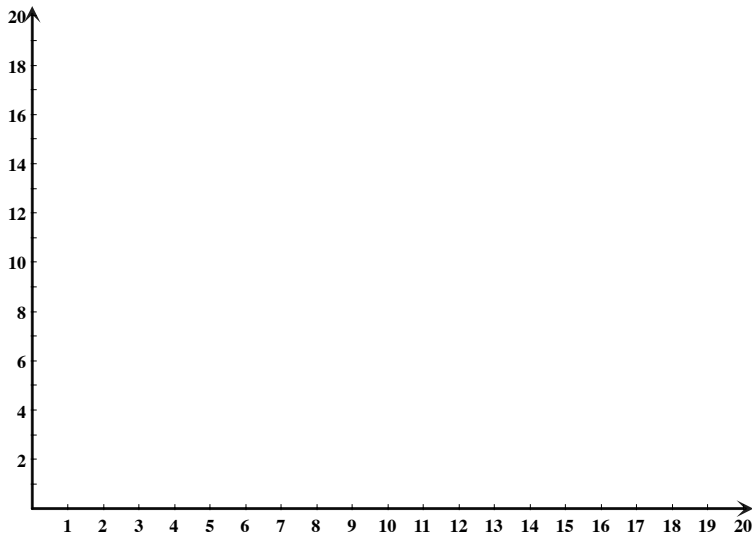
2. (14 points) A lawyer handles two kinds of cases: medical malpractice suits and corporate negligence claims. The malpractice suits each require 4 weeks of preparation and the hiring of 3 expert witnesses. Corporate negligence cases require 4 weeks of preparation and the hiring of 9 expert witnesses. Assume that the lawyer can work on only one case at a time. She can devote as much as 40 weeks a year preparing for cases and can afford to hire no more than 54 expert witnesses per year. On average, each medical malpractice suit brings in \$40,000 in profit and each corporate case brings in \$60,000 in profit.

Let x be the number of medical malpractice suits the lawyer handles in a year and let y be the number of corporate negligence cases she handles in a year. We'll apply the method of linear programming to find her maximum yearly profit.

(a) List the constraints.

(b) Give a formula for the objective function.

(c) Sketch and shade the feasible region and list all of its vertices. (You should find the exact coordinates of the vertices rather than approximating them from the graph. Show all work.)



Vertices: _____

(d) What is the maximum possible yearly profit?

\$ _____

3. (12 points) The demand curve for a product is given by

$$(p + 8)(q + 50) = 7600.$$

The supply function is **linear**. When price p is \$46.50, supply is 15 units. When price p is \$168, supply is 60 units.

- (a) Find the formula for the supply function. (Your answer should be in the form $p = mq + b$.)

ANSWER: $p =$ _____

- (b) Find the market equilibrium point.

ANSWER: $(q, p) =$ _____

4. (12 points) Two balloons, one red and one green, are released from the ground at the same time. Each balloon goes up for a while and then comes down.

The height (in feet) of the red balloon after t minutes is given by

$$R(t) = -4t^2 + 184t.$$

The height (in feet) of the green balloon after t -minutes is given by

$$G(t) = -45t^2 + 1032t.$$

- (a) Find the longest interval of time during which the red balloon is **rising** and the green balloon is **falling**.

ANSWER: from $t =$ _____ to $t =$ _____ minutes

- (b) When is the green balloon 1000 feet higher than the red balloon for the first time?

ANSWER: $t =$ _____ minutes