

1. (150 points; 8 minutes) Decide whether each of the following statements is **True**, **False**, or **Uncertain**, and give a **brief but clear explanation** of your answer. (Most of the credit will be given for the explanation.)

- (a) If average cost is falling, marginal cost must be falling as well.
- (b) Paint prices have risen in the past year, largely due to oil price increases. When defining the market for paint, oil companies should be included.

2. (225 points; 12 minutes) With Hurricane Rob approaching, the market conditions for plywood to protect homes are given by:

$$\begin{array}{ll} \text{Demand:} & P = 30 - Q_d \\ \text{Supply:} & P = 4 + Q_s \end{array}$$

where Q is measured in tons and P is in thousands of dollars per ton.

- (a) Graph the supply and demand for plywood. Find the equilibrium quantity and price. Calculate the consumer surplus.
- (b) Newspapers often report that retailers are taking advantage of consumers by charging high prices during these times of crisis. Consider if the local government passed a consumer protection law that set  $P=5$ .

How much would be supplied? How would consumer surplus compare to part (a)?

3. (225 points; 12 minutes) A local franchise has a monopoly on Krispy Kreme doughnuts with daily demand and cost given by:

$$\begin{array}{ll} \text{Demand:} & P = 150 - 2Q \\ \text{Cost:} & C = 250 + 30Q \end{array}$$

where Q is hundreds of donuts, P=price per 100 donuts, and C is in dollars.

- (a) To maximize profits, how many doughnuts will be sold daily? At what price? What will daily profits be?
- (b) Concerned about rising health care costs of municipal employees, the local government raises Krispy Kreme's real estate taxes, causing its daily fixed costs to increase from 250 to 350. How much will its daily sales change?

4. (300 points; 16 minutes) Old McAdams had a farm. ... And on this farm, he grows some corn. ... To grow corn, he needs a tractor. A new tractor costs \$100,000. There is a very active resale market for tractors; a tractor that is one year old sells for \$70,000 and a tractor that is two years old sells for \$45,000. For simplicity, assume that all tractors three or more years old cannot be used to grow corn and sell for \$0. These prices are expected to stay the same in the future. The variable cost of producing corn is the same regardless of whether you are using a tractor that is new, one year old or two years old.

- (a) Old McAdams faces an interest rate of 10%. What is the user cost of capital associated with using a new tractor for one year? What is the user cost of capital associated with using a one year old tractor for one year? What is the user cost of capital associated with using a two year old tractor for one year?
- (b) Old McAdams is formulating a plan for growing corn for the next three years. What is the optimal arrangement for the necessary tractor input over the three years? (For instance, should he buy a new tractor and use it for three years, or something else?)

5. (450 points; 24 minutes) Your company produces a specialized pump, that sells at a price around \$60. Your factory (A) can produce these pumps with the following cost structure: the first 5000 units are produced at a constant (marginal) cost of \$15 a unit, and the next 5000 units are produced at a constant (marginal) cost of \$45 a unit. Factory A has a fixed cost of  $C$  (specified below), and a sunk cost of \$257,000 from initial factory set-up.

Demand is soaring; you expect to sell 8000 units. Because of this, you develop a new outsourcing division (B) that arranges for production of the pumps in Korea, at a constant cost of \$20 per unit (including transportation and other fees), with no fixed costs.

- (a) Graph the marginal cost for Factory A. Graph the marginal cost for Division B.
- (b) If there were no fixed cost ( $C = 0$ ) in factory A, how much should you produce in factory A, and how much should you outsource to B?
- (c) Does your answer change if A's fixed cost were  $C = \$20,000$ ? How would your answer change if A's fixed cost were  $C = \$45,000$ ?
- (d) Consider the case above where  $C = \$45,000$ .

You are worried about the international situation. In particular, depending on the outcome of the November elections, you feel there is a .5 probability that your outsource costs stay at \$ 20 per unit, and that there is a .5 probability that your outsource costs double to \$40 per unit, for all units. (You are risk neutral.)

Suppose you must decide whether to pay the \$45,000 now to keep Factory A open. Should you make the investment? (Show any calculations used to arrive at your answer.)

**6. (150 points; 8 minutes) Short Answer.** For many years, a large number of charter boats have operated out of Boston Harbor that take people out to fish. In this competitive market, the price of a full day's fishing is \$150 per person. Boats hold up to 12 people and will operate on any given day as long as at least 6 people sign up. On average, over the entire season, 8 people a day go out on each boat. The cost of a trip is the same regardless of the number of people on board.

In light of the information provided above, what can be said (numerically) about the variable cost of operating a fishing boat trip in Boston Harbor?