

EXAMINATION #3 VERSION A
“Producers and Competition”
October 22, 2014

INSTRUCTIONS: This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices are NOT permitted. Point values for each question are noted in brackets.

I. MULTIPLE CHOICE: Circle the one best answer to each question. Use margins for scratch work [1 pt each—13 pts total]

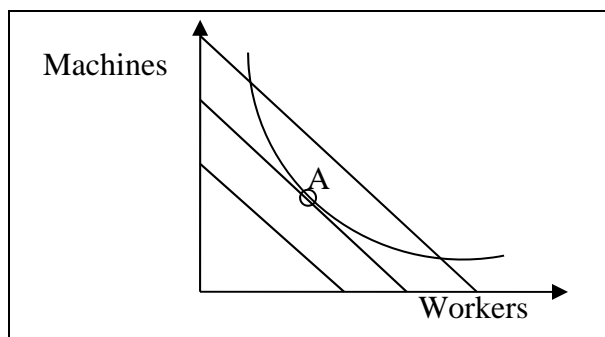
(1) Suppose a production function is given by $q = 20 x_1^{1/4} x_2^{3/4}$. The number (1/4) equals the

- a. marginal product of input #1.
- b. marginal rate of substitution in production.
- c. returns to scale.
- d. elasticity of output with respect to input #1.

(2) Which production function has L-shaped isoquants?

- a. $q = (1/3) x_1 + (2/3) x_2$.
- b. $q = \min\{ (1/3) x_1, (2/3) x_2 \}$.
- c. $q = x_1^{1/3} + x_2^{2/3}$.
- d. $q = x_1^{1/3} x_2^{2/3}$.
- e. All of the above.
- f. None of the above.

The next two questions refer to the following diagram of a firm's isocost lines and an isoquant. Suppose the firm is currently at input combination A.



- (3) This firm could lower its total cost, without reducing output, by
- a. using fewer machines and more workers.
 - b. using more machines and fewer workers.
 - c. either (a) or (b).
 - d. neither (a) nor (b).
 - e. cannot be determined.

(4) Let MP_1 denote the marginal product of machines and MP_2 the marginal product of workers for this firm. Let w_1 denote the price of machines and w_2 denote the price of workers. At input combination A,

- a. $MP_2/MP_1 < w_2/w_1$.
- b. $MP_2/MP_1 > w_2/w_1$.
- c. $MP_2/MP_1 = w_2/w_1$.
- d. $MP_2 = MP_1$ and $w_2 = w_1$.
- e. cannot be determined from information given.

(5) Suppose a competitive firm is now producing 200 units of output per day. Its marginal cost is \$3, its average cost is \$6, and it can sell its output at a price of \$5.

This firm can increase its profit by

- increasing its output by one unit.
- decreasing its output by one unit.
- It cannot increase its profit by small changes in output.
- cannot be determined from information given.

(6) In the short run, a firm should continue to operate only if its revenue is greater than its

- fixed cost.
- variable cost.
- total cost.
- producer surplus.

(7) Existing firms will try to exit an industry in the long run if the market price

- is less than average cost.
- equals average cost.
- is greater than average cost.
- none of the above.

(8) Price equals average cost in

- short-run competitive equilibrium.
- long-run competitive equilibrium.
- both short-run and long-run competitive equilibrium.
- none of the above.

(9) Suppose that in a certain industry, cost curves for each firm remain fixed as other firms enter or leave the industry. In this case, the long-run supply curve

- is vertical (infinite slope).
- is horizontal (zero slope).
- slopes up (positive slope).
- slopes down (negative slope).
- cannot be determined from information given.

(10) Suppose the price of oil rises. The increase in long-run producer surplus goes to oil producers and

- companies that refine oil into products such as gasoline.
- owners of land where oil is drilled.
- purchasers of products made from oil, such as gasoline.
- all of the above.

(11) A *Pareto improvement* is defined as a change in the economy where

- everyone gains.
- at least one person gains.
- at least one person gains and no one loses.
- the gains to the winners exceed the losses to the losers.

(12) A quota on sellers of soccer balls would have basically the same effect on the market for soccer balls as

- a price ceiling on soccer balls.
- a price floor on soccer balls.
- a tax on soccer balls.
- a subsidy for soccer balls.
- a free market for soccer balls.

(13) The number of pedometers actually sold would increase if the government enacted a

- a tax on pedometers.
- a quota on sellers of pedometers.
- a subsidy for pedometers.
- a price floor (or legal minimum price) for pedometers.
- all of the above.
- none of the above.

II. SHORT ANSWER: Please write your answers in the boxes on this question sheet. Use margins for scratch work.

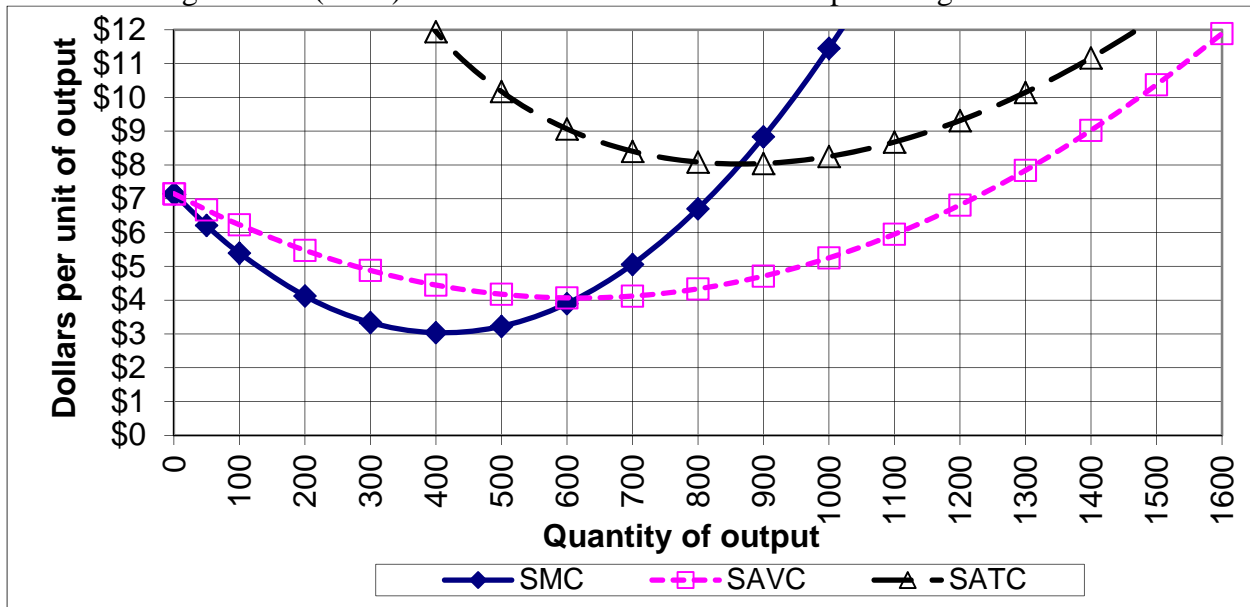
(1) [Technical change: 4 pts] The elasticity of output with respect to labor input for the US economy as a whole is about $2/3$. The elasticity of output with respect to capital input is about $1/3$. Suppose labor input increases by 0.9% and capital input increases by 3.0%.

- a. By how much would output increase, without any technical change?

	%
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- b. Suppose output in fact increases by 2.5%. What is the increase in multifactor or total factor productivity (also called the Solow residual)?

	%
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(2) [Short-run cost curves and supply: 10 pts] The following graph shows Acme Manufacturing Company's short-run average total cost (SATC), short-run average variable cost (SAVC), and short-run marginal cost (SMC). Assume Acme takes its market price as given.



- a. If the market price is \$9, about how much output will Acme try to produce? Give an answer to the nearest 100.

	units
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- b. If the market price is \$5, about how much output will Acme try to produce? Give an answer to the nearest 100.

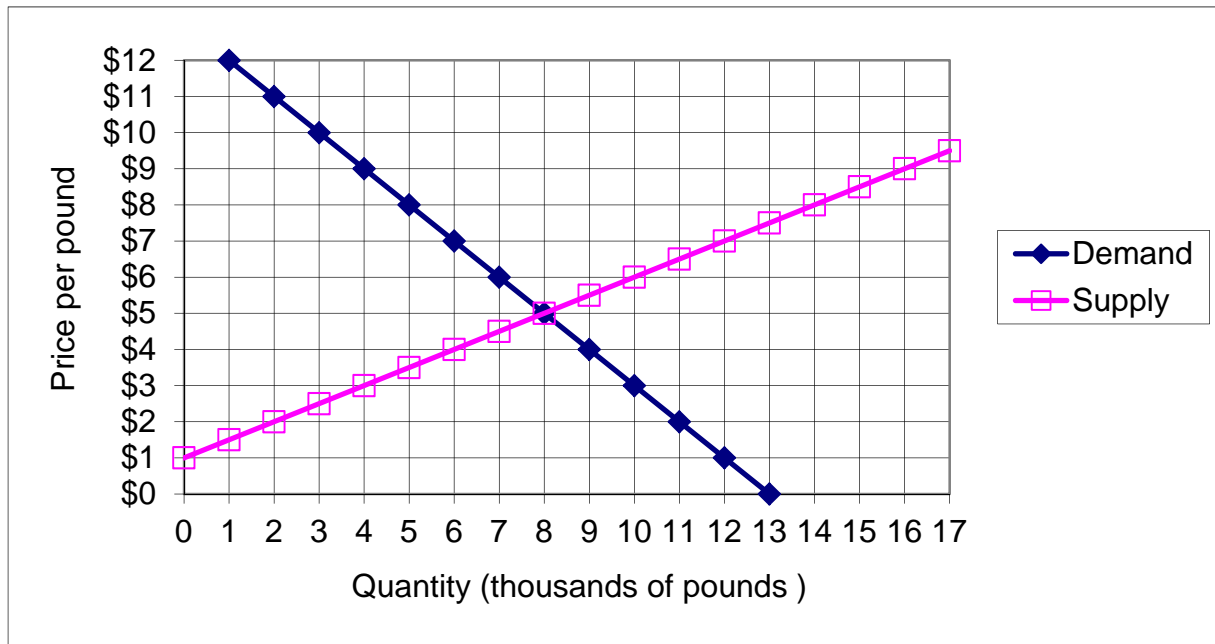
	units
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- c. If the market price is \$3, about how much output will Acme try to produce? Give an answer to the nearest 100.

	units
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- d. What is Acme's *breakeven price*—that is, the lowest price at which Acme will avoid losses in the short run? Give an answer to the nearest dollar.

	\$
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- e. What is Acme's *shutdown price*—that is, the lowest price at which Acme will continue to operate in the short run? Give an answer to the nearest dollar.

	\$
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(3) [Welfare effects of price controls: 16 pts] The following graph shows the market for artichokes.



a. Find the equilibrium price without government intervention.

\$

Suppose the government imposes a price ceiling, or legal maximum price, of \$4. No artichokes may be sold for more than this price.

b. Compute the quantity traded with the price ceiling.

thousand pounds

c. Does the price ceiling create *excess demand*, *excess supply*, or *neither*?

d. How much?

thousand pounds

e. Does producer surplus *increase or decrease* because of the price ceiling, as compared to the market without government intervention?

f. By how much?

\$	thousand
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g. Does consumer surplus *increase or decrease* because of the price ceiling, as compared to the market without government intervention? (Assume optimistically that artichokes are actually purchased by those buyers who value them the most.)

h. By how much?

\$	thousand
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i. Compute the deadweight social loss caused by the price ceiling.

\$	thousand
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III. PROBLEMS: Please write your answers in the boxes on this question sheet. Show your work and circle your final answers.

(1) [Production functions: 12 pts] Suppose a production function is given by $q = 8x_1^{3/4}x_2^{1/2}$.

- a. Find an expression for the marginal product of input 1. Are there diminishing returns to input 1? Justify your answer.

- b. Find an expression in terms of x_1 and x_2 for the marginal rate of substitution in production of input 2 for input 1—that is, the absolute value of the slope of an isoquant, with x_1 on the vertical axis and x_2 on the horizontal axis. Does production show a diminishing marginal rate of substitution? Justify your answer.

- c. Does this production function have *constant* returns to scale, *increasing* returns to scale, or *decreasing* returns to scale? Justify your answer.

(2) [Fixed-proportions technology: 11 pts] Suppose a particular machine can make 50 parts per hour if it is operated by four workers. The machine cannot be operated by fewer than four workers, and extra workers on the same machine add nothing to output. A firm can use as many machines as desired, with no loss in output per machine, provided each machine is operated by at least four workers. Let x_1 denote the number of machines and x_2 denote the number of workers used by the firm. Let q denote the number of parts produced.

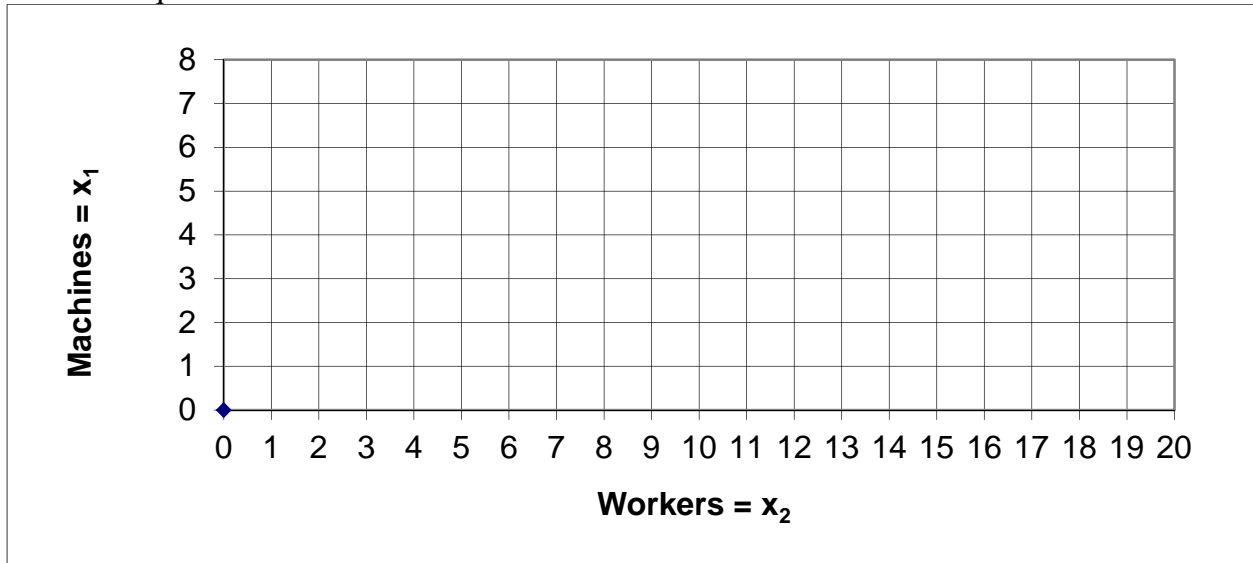
- a. Give an equation for the firm's so-called "expansion path"—that is, the efficient relationship between x_1 and x_2 .

- b. If there are plenty of workers, what is the relationship between output q and the number of machines x_1 ? Give an equation with q on the left side.

- c. If there are plenty of machines, what is the relationship between output q and the number of workers x_2 ? Give an equation with q on the left side.

- d. Give an equation for the firm's production function using the minimum function " $\min\{ , \}$ ".

- e. [3 pts] Draw and label the firm's expansion path, the isoquant for $q=100$, and the isoquant for $q=150$.



(3) [Cost minimization: 10 pts] Suppose a firm wishes to produce 120 units of output per hour at minimum cost. Machines cost \$75 per hour to rent and workers must be paid \$20 per hour. The firm's hourly production function is given by $q = 2 x_1 x_2$, where x_1 denotes the number of machines and x_2 denotes the number of workers.

- a. Give an equation for the firm's target isoquant. The variables x_1 and x_2 should be the only unknowns.

- b. Find a formula for the firm's marginal rate of substitution in production of workers for machines—that is, the slope of the firm's isoquant with machines on the vertical axis and workers on the horizontal axis. The variables x_1 and x_2 should be the only unknowns. Circle your final answer.

- c. [4 pts] Solve for the number of machines (x_1^*) and workers (x_2^*) required to produce the firm's target output at minimum cost. Circle your final answers.

- d. Compute the total cost to produce 120 units of output, $TC(120)$.

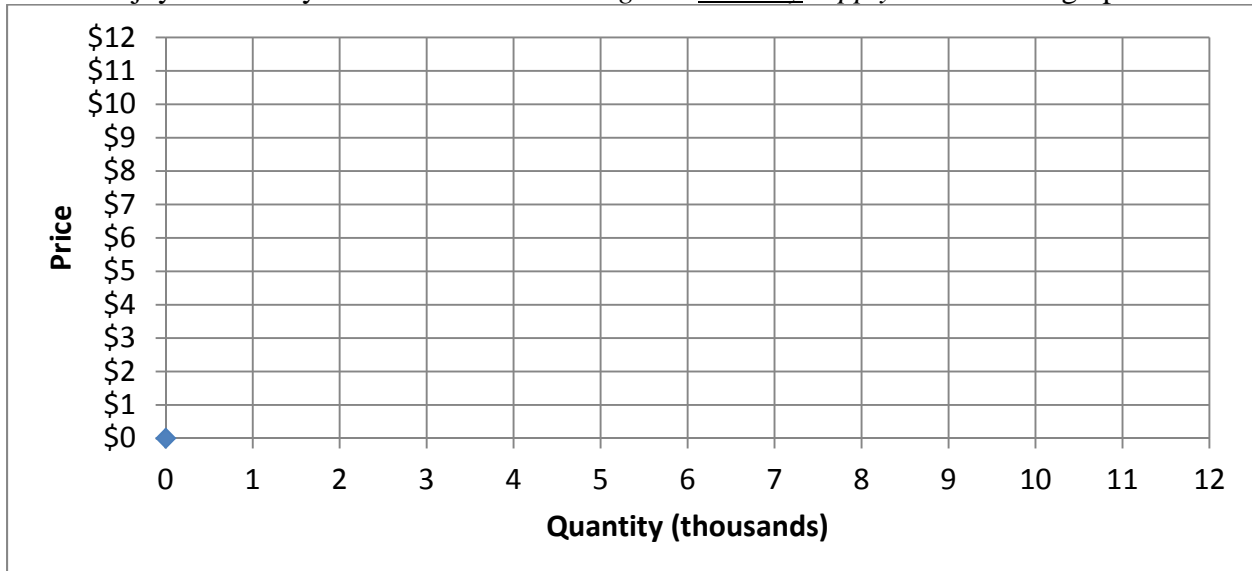
(4) [Long-run profit maximization and supply: 8 pts] Suppose a typical firm faces a (long-run) total cost function given by $TC(q) = 0.01q^3 - 0.4q^2 + 15q$.

- a. Compute the typical firm's efficient scale q_{ES} . Show your work and circle your final answer.

- b. Compute the firm's breakeven price—the minimum price at which it will avoid losses. Show your work and circle your final answer.

- c. Find an equation for the *firm's supply curve*. Show your work and circle your final answer.

- d. Suppose all firms in this industry have the same costs, and these costs are not affected by other firms in the same industry or by total industry output. Further assume the industry enjoys free entry and exit. Draw the *long-run industry supply curve* in the graph below.



(5) [Welfare effects of tax or subsidy: 10 pts] Suppose demand and supply for a good are given by the following equations. (Use the graph at right for scratch work.)

Demand: $P_D = 20 - (Q/100)$

Supply: $P_S = 2 + (Q/200)$



First consider the market without any tax or subsidy.

- a. Compute the equilibrium price and quantity.

Now suppose the government offers a **subsidy of \$ 3** per unit.

- b. Compute the new equilibrium quantity.

- c. Does consumer surplus *increase* or *decrease* as a result of the subsidy? By how much?

d. Does producer surplus *increase* or *decrease* as a result of the subsidy? By how much?

e. Does society as a whole *gain* or *lose* as a result of the subsidy? By how much?

IV. CRITICAL THINKING: Answer just *one* of the questions below (your choice). [4 pts]

(1) Suppose a country opens its tee-shirt industry to international trade. As a consequence, the price of tee-shirts falls from \$10 to \$6, and 15 million tee-shirts are imported. Does the country's overall welfare *increase* or *decrease* as a result of this change? By how much? Sketch a graph, show your work and circle your final answer.

(2) Consider the following claim: "Profit per unit of output equals price minus average cost. So to maximize total profit, a firm should operate at the output level where its average cost is lowest." Do you agree or disagree? Justify your answer with a graph of cost curves.

Circle the question you are answering and write your answer below. Full credit requires good grammar, legible writing, accurate spelling, and correct reasoning.



[end of exam]