EXAMINATION #3 VERSION A
"Producers and Competition"
October 29, 2015

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—10 pts total]
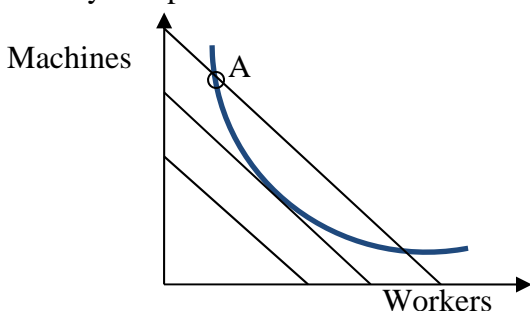
(1) Which production function has L-shaped isoquants?
a. $q = x_1^{0.4} x_2^{0.6}$.
b. $q = (0.4) x_1 + (0.6) x_2$.
c. $q = \min\{ (0.4) x_1, (0.6) x_2) \}$.
d. $q = x_1^{0.4} + x_2^{0.6}$.
e.   All of the above.
f.   None of the above.

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.

(2) 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.

(3) 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.

(4) "Economies of scale" mean that the firm's average cost curve
a.   slopes up.
b.   slopes down.
c.   is horizontal.
d.   is vertical.

(5) In the short run, a firm should shut down immediately if its
a.   revenue is less than fixed cost.
b.   profit is negative.
c.   revenue is less than producer surplus.
d.   revenue is less than variable cost.

(6) If price is greater than minimum average cost in a competitive industry,
a. firms will try to lower the price.
b. firms will try to raise the price.
c. new firms will enter the industry.
d. existing firms will leave the industry.

(7) In *long-run* competitive equilibrium,
a. price equals marginal cost.
b. price equals average cost.
c. average cost equals marginal cost.
d. all of the above.

(8) Suppose the demand for pomegranate juice suddenly and permanently shifts to the *right* because of a permanent change in eating preferences. The price of pomegranate juice will
a. rise in the short run but fall back in the long run.
b. fall in the short run but rebound in the long run.
c. rise in the short run and rise further in the long run.
d. fall in the short run and fall further in the long run.
e. remain constant in the short and long run.

(9) Suppose the price of wheat rises. The increase in long-run producer surplus goes to farmers and
a. all wheat buyers.
b. farmland owners.
c. food processing companies that use wheat to make other products.
d. ultimate consumers of wheat-based products.

(10) A *Pareto improvement* is defined as a change in the economy where
a. everyone gains.
b. at least one person gains.
c. at least one person gains and no one loses.
d. the gains to the winners exceed the losses to the losers.

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 0.6% and capital input increases by 2.7%.

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

%

b. Suppose output in fact increases by 2.1%. What is the increase in multifactor or total factor productivity (also called the Solow residual)?

%

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

Quantity of output (thousands)

— SMC   — □ — SAVC   — △ — SATC
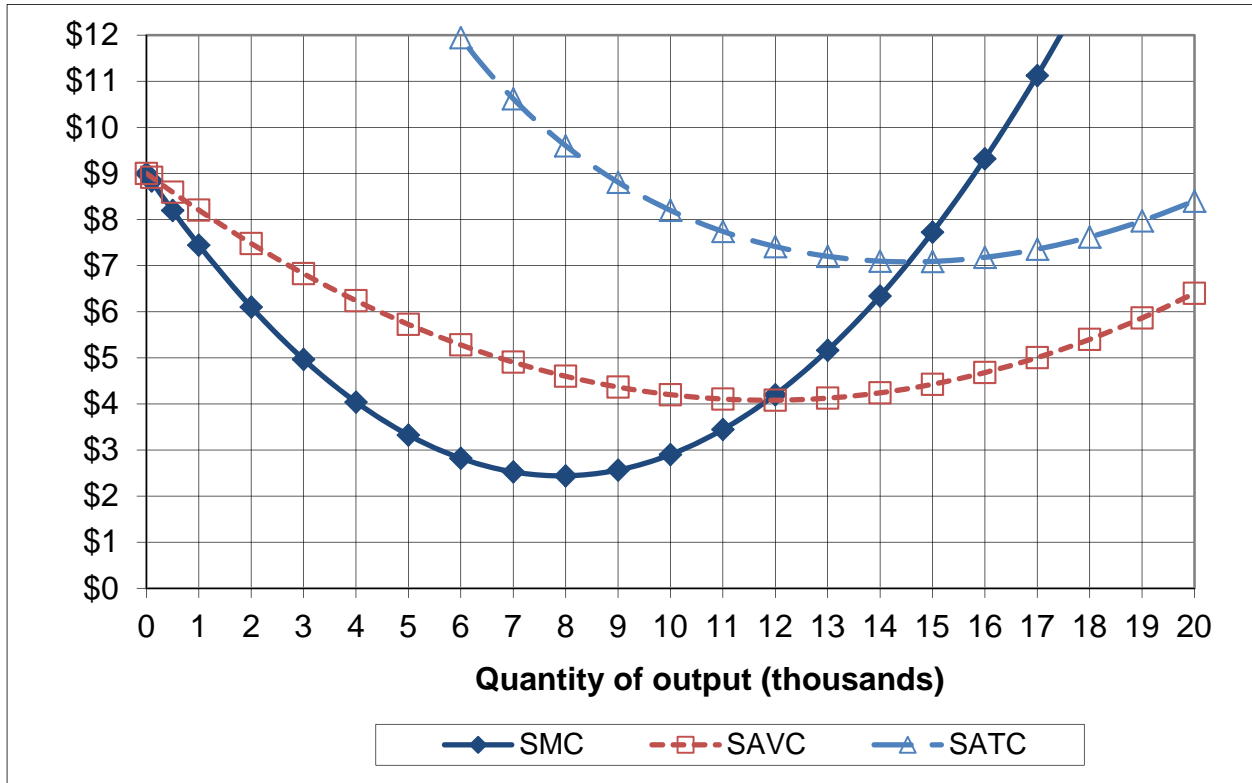
a. If the market price is $5, about how much output will XYZ try to produce?	thousand
b. If the market price is $11, about how much output will XYZ try to produce?	thousand
c. If the market price is $3, about how much output will XYZ try to produce?	thousand
d. What is XYZ's *breakeven price*—that is, the lowest price at which XYZ can produce output without making losses in the short run?	$
e. What is XYZ's *shutdown price*—that is, the lowest price at which XYZ will continue to operate in the short run?	$

(3) [Welfare effects of price controls: 16 pts] The following graph shows the market for blue cheese.
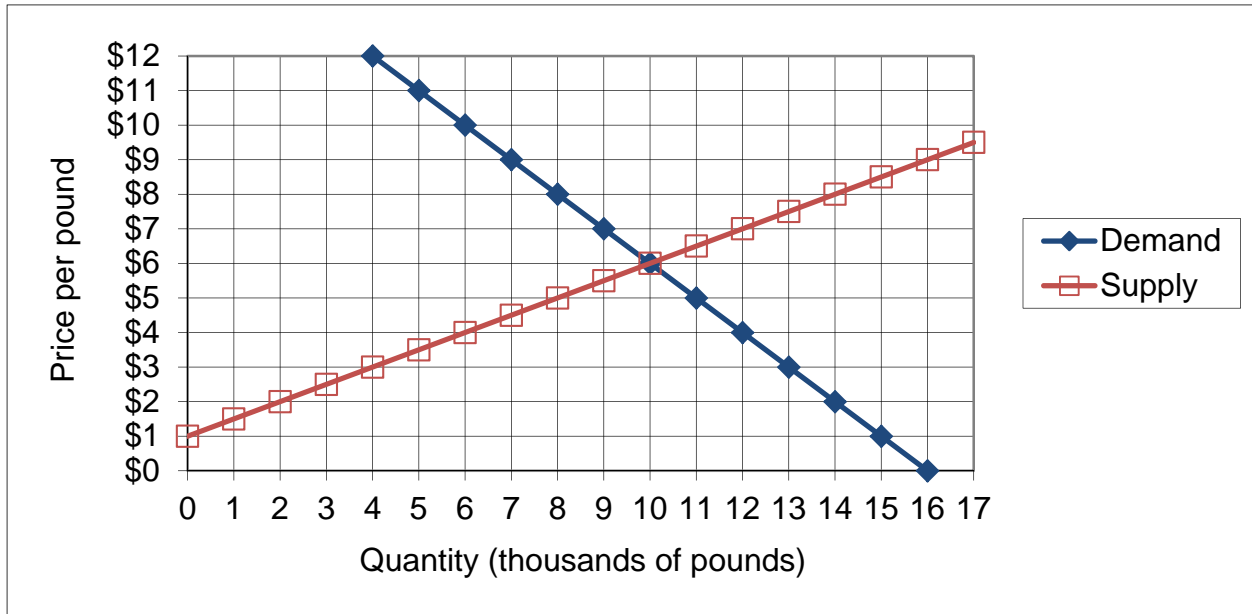
Suppose the government imposes a *quota on sellers*. No more than 6 thousand pounds of blue cheese may be sold. Quota rights or permits to sell 6 thousand pounds of blue cheese are distributed to sellers for free, but no one may sell blue cheese without a permit.

a. Would this quota on sellers cause the price of blue cheese to *increase, decrease,* or *remain constant* ?

b. Compute the new equilibrium price of blue cheese with the quota system on sellers.

$ _____ per pound

c. Does producer surplus *increase, decrease,* or *remain constant* because of the quota system, as compared to the market without government intervention? (Assume optimistically that quota rights to sell blue cheese are given to those blue cheese producers with the lowest cost.)

d. By how much?

$ _____ thousand

e. Does consumer surplus *increase, decrease,* or *remain constant* because of the quota system, as compared to the market without government intervention?

f. By how much?

$ _____ thousand

g. If the government sold the quota rights or permits at auction, what would be the equilibrium **price of a permit** to sell one pound of blue cheese?

$ _____ per permit

h. Compute the deadweight social loss caused by the quota system.

$ _____ thousand

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 $q = 12\, x_1^{1/4}\, x_2^{3/4}$.

    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 200 toys 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 toys 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=400, and the isoquant for q=600.
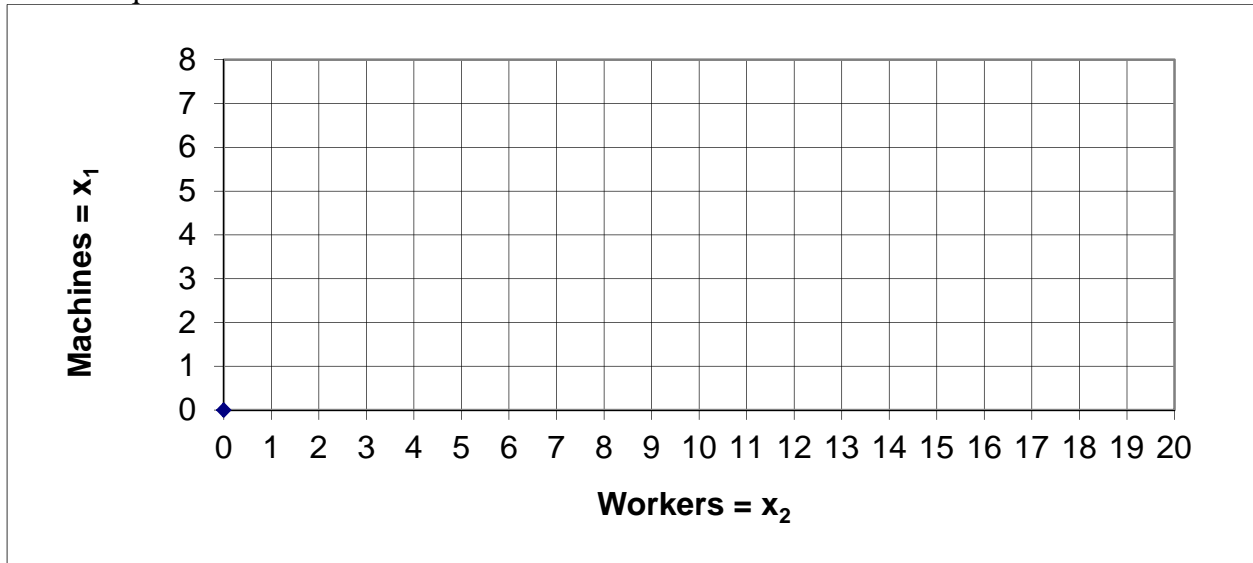
(3) [Cost minimization: 10 pts] Suppose a firm wishes to produce 6 units of output per hour at minimum cost. Machines cost $20 per hour to rent and workers must be paid $5 per hour. The firm's hourly production function is given by $q = \sqrt{x_1 x_2}$, where x_1 denotes the number of machines and x_2 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 6 units of output, TC(6).

(4) [Long-run profit maximization and supply: 8 pts] Suppose a typical firm faces a (long-run) total cost function given by $TC(q) = 0.25\,q^3 - 6\,q^2 + 41\,q$.

   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.
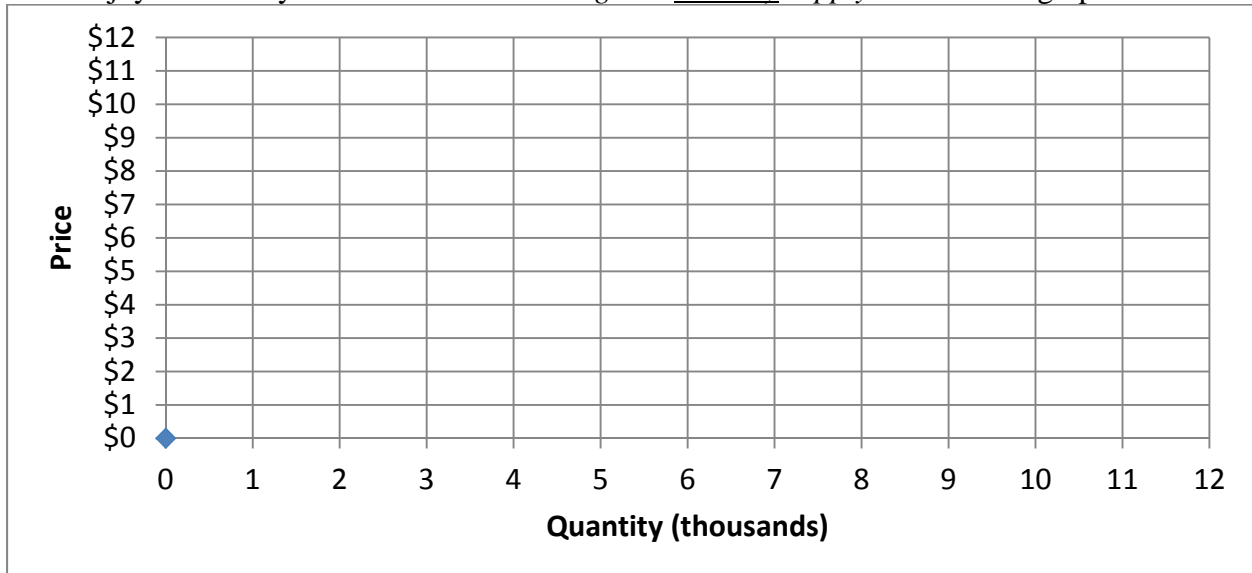
(5) [Welfare effects of international trade: 15 pts] Suppose domestic demand and supply for a good are given by the following equations. (Use the graph at right for scratch work.)

Domestic demand:
$$Q_D = 2000 - 100\,P$$

Domestic supply:
$$Q_S = 200\,P - 100$$

Price

Quantity

First consider the market without international trade.
a. Compute the equilibrium price and quantity.

Now suppose the market is opened to international trade, and the world price of the good turns out to be **$9.**
b. Will the country now *import* or *export* the good? How much?

c. Does consumer surplus *increase* or *decrease* as a result of international trade? By how much?

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

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

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

(1) Consider the following claim: "Free competition destroys industries. When firms compete and there is free entry, profits are driven to zero and all firms in the industry fail." Do you agree or disagree? Justify your answer. (Ignore the graph.)

(2) Suppose supply of a good is *perfectly elastic*. If the good is taxed, who bears the burden of the tax—buyers, sellers, or both? Justify your answer with a supply-and-demand graph.

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]