Sample Exam Problems Related to Chapter 2
(Source: Fall 2008 Midterm Exam, ECO 5315)

1. Total profit is maximized when

   A. marginal profit equals average profit.
   B. <u>marginal profit equals zero.</u>
   C. average profit equals zero.
   D. average profit is maximized.
   E. marginal profit is greater than average profit.

<u>Note:</u> Response B (marginal profit equals zero) is correct here because this is another way of saying that the first-order condition for profit maximization has been satisfied!

2. If marginal revenue is less than marginal cost at every level of output, a profit maximizing firm should

   A. produce when the difference between marginal revenue and marginal cost is greatest.
   B. produce when total revenue is maximized.
   C. produce when the difference between total revenue and marginal cost is maximized.
   D. produce when the difference between average revenue and average cost is equal to 1.
   E. <u>not produce any output.</u>

<u>Note:</u> Suppose $\pi = TR - TC = PQ - CQ,$ where π = profit, TR = total revenue, TC = total cost, P = product price per unit, C = cost per unit, and Q = number of units sold. Then marginal revenue is P, marginal cost is C, and if $P < C$ for all P and C, then no output should ever be produced because one always loses money!

3. Shag Express, a retailer of lamps, has determined that its total cost of retailing lamps is $TC = 200 + 10Q + 5Q^2$. At 10 units of output, the firm's marginal cost is

   A. <u>$110.</u>
   B. $100.
   C. $800.
   D. $230.
   E. $10.

<u>Note:</u> Since $TC = 200 + 10Q + 5Q^2$, $MC = dTC/dQ = 10 + 10Q$ $\Rightarrow MC = 10+10(10) = \$110.$

4. Fox's Fine Furs (FFF) estimates that its total cost of production is $TC = 125 + 100Q + 25Q^2$. Furs sell for $1,100 each. To maximize profits, FFF should sell

   A. 8 furs.
   B. no furs.
   C. <u>20 furs.</u>
   D. 38 furs.
   E. 22 furs.

Note: $\pi = TR - TC = \$1{,}100Q - 125 - 100Q - 25Q^2;$
$\therefore d\pi / dQ = 1{,}100 - 100 - 50Q = 0 \Rightarrow Q = 20$ furs.

5. The demand for answering machines is Q = 1,000 - 150P + 25I. Assume that per capita disposable income I is \$200. When the price of answering machines is P = \$10, the income elasticity of demand is

   A. 2.5.
   B. 0.11.
   C. 1.0.
   D. 25.
   E. <u>1.11.</u>

   <u>Note:</u> $dQ/dI = 25$; at P = \$10, Q = 1,000 – 150(10) + 25(200) = 4,500. Therefore, I/Q = 200/4,500 = .0444, and $\eta_I = \frac{\partial Q}{\partial I}\frac{I}{Q} = 25(.0444) = 1.11.$

6. In Russia, as per capita income rises from \$1,980 to \$2,020, everything else remaining constant, annual per capita consumption of vodka falls from 525 to 475 liters; this implies an income elasticity of demand for vodka of

   A. -0.50.
   B. <u>-5.0.</u>
   C. 2.0.
   D. 5.0.
   E. 0.50.

   <u>Note:</u> $\frac{\%\Delta Q}{\%\Delta I} = \frac{(475-525)/525}{(2{,}020-1{,}980)/1{,}980}$ = -4.71; rounded, this equals -5.0.

7. A manufacturer of infant clothes has found that the demand for its product is given by $Q = 100P^{-1.25}A^{0.5}$, where P is price and A is advertising expenditures. The price elasticity of demand for these infant clothes is

   A. -0.8.
   B. <u>-1.25.</u>
   C. -1.0.
   D. -2.5.
   E. -0.5.

   <u>Note:</u> $\eta = \frac{dQ}{dP}\frac{P}{Q}; \frac{dQ}{dP} = -125P^{-2.25}A^{0.5}$ and $\frac{P}{Q} = \frac{P}{100P^{-1.25}A^{0.5}};$
   $\therefore \eta = \frac{-125P^{-2.25}A^{0.5}}{100P^{-1.25}A^{0.5}}P = -1.25\frac{P}{P} = -1.25.$

8. The demand for cough medicine is Q = 10 - 2P. At a price of \$2.50, the price elasticity of demand is

   A. -2.0.
   B. <u>-1.0.</u>
   C. -2.5.
   D. -0.4.
   E. -1.5.

   <u>Note:</u> $\eta = \frac{dQ}{dP}\frac{P}{Q}; \frac{dQ}{dP} = -2, Q = 10 - 2(2.5) = 5; \therefore \frac{P}{Q} = \frac{2.5}{5} = .5;$
   and $\eta = -2(.5) = -1.0.$

9. The price elasticity of demand for Portland Cement at a local retail outlet is -3 at the current price of \$3. If the marginal cost is \$2, then the store manager should

   A. increase the price to \$4.
   B. lower the price to \$2.75.
   C. quit selling cement.
   D. <u>leave the price unchanged.</u>
   E. lower the price to \$2.50.

   <u>Note:</u> Since the current price of \$3 *is* the profit-maximizing price $(P = \frac{MC}{(1+1/\eta)} = 2/(1-1/3) = \$3)$, leave the price unchanged!

Sample Exam Problems Related to Chapter 4
(Source: Fall 2008 Midterm Exam, ECO 5315)

10. A production function is a table, a graph, or an equation showing the

A. least-cost method of producing output.
B. optimal combination of inputs.
C. <u>maximum output that can be achieved from specified levels of inputs.</u>
D. combinations of inputs that can be produced with equal costs.
E. optimal production technology that a firm should employ.

11. When average product is at a maximum, marginal product is

A. zero.
B. increasing.
C. <u>equal to average product.</u>
D. greater than average product.
E. less than average product.

<u>Note:</u> See Figure 4.2, p. 100, which illustrates that when average product is at a maximum, marginal product is equal to average product. The math proof for this is given on page 101 in the quant option box.

12. The law of diminishing marginal returns states that

A. the marginal product of labor declines as all inputs are increased.
B. production functions exhibit decreasing returns to scale.
C. the marginal product of labor returns as more capital is used.
D. <u>the marginal product of a factor eventually diminishes as more of the input is used, holding other inputs fixed.</u>
E. the marginal product of a factor always diminishes as more of the input is used, holding other inputs fixed.

13. If output is produced according to $Q = (KL)^{3/4}$, then this production process exhibits

A. <u>increasing returns to scale.</u>
B. decreasing returns to scale.
C. first increasing and then decreasing returns to scale.
D. constant returns to scale.

<u>Note:</u> Since the exponents for K and L sum to 1.5, this means that there are increasing returns to scale; doubling the K and L inputs will cause Q to more than double!

14. An isoquant represents combinations of inputs that

A. <u>produce the same level of output.</u>
B. produce increasing amounts of output.
C. minimize costs.
D. maximize output.
E. create wealth.

15. The marginal rate of technical substitution between two inputs

A. shows the rate at which one input can be traded for another, holding output constant.
B. shows the efficient combination of inputs.
C. increases as we move down an isoquant.
D. shows the rate at which output can be increased by using more of both inputs.
E. shows the rate at which output decreases when using less of one of the inputs.

16. Lines that represent bundles of inputs that cost the same total amount are called

A. total cost curves.
B. isocost curves.
C. cost curves.
D. isoquants.
E. isoprofit curves.

17. If output is produced according to $Q = 3K + 4L$, then this production process exhibits

A. increasing returns to scale.
B. decreasing returns to scale.
C. first increasing and then decreasing returns to scale.
D. constant returns to scale.
E. first decreasing and then increasing returns to scale.

Solution: If $K = L = 1$, then $Q = 7$. If we double the number of labor and capital inputs; i.e., if $K = L = 2$, then $Q = 14$. Therefore this production process exhibits constant returns to scale.

18. If output is produced according to $Q = 4LK$ (L is the quantity of labor input and K is the quantity of capital input), the price of K is \$10, and the price of L is \$5, then the cost minimizing combination of K and L capable of producing 32 units of output is

A. $L = 8$ and $K = 1$.
B. $L = 4$ and $K = 2$.
C. $L = 2$ and $K = 2$.
D. $L = 2$ and $K = 4$.
E. $L = 1$ and $K = 8$.

Solution: The cost minimizing combination of K and L capable of producing 32 units of output is found by equating the marginal products per dollar spent of labor and capital; i.e., $MP_L / P_L = 4K / 5 = 4L / 10 = MP_K / P_K \Rightarrow 2K = L \Rightarrow Q = 4(2K \times K) = 32 \Rightarrow K = 2$;
$\therefore Q = 4(L \times 2) = 32 \Rightarrow L = 4.$

19. The addition to total cost resulting from the addition of the last unit of output is known as

    a. marginal product.
    b. average product.
    c. average variable cost.
    d. average total cost.
    e. <u>marginal cost.</u>

20. The long-run average cost curve slopes downward if there are

    a. some factors without diminishing marginal returns.
    b. economies of scope in the management of multiplant operations.
    c. <u>economies of scale.</u>
    d. diseconomies of scope in the management of multiplant operations.
    e. no factors without diminishing marginal returns.

21. The long-run average cost curve slopes upward if there are

    a. some factors without diminishing marginal returns.
    b. diseconomies of scope in the management of multiplant operations.
    c. economies of scale.
    d. <u>diseconomies of scale.</u>
    e. no factors without diminishing marginal returns.

22. Average variable cost is equal to the

    a. change in total variable cost divided by the change in output levels.
    b. <u>total variable cost divided by the level of output.</u>
    c. marginal cost divided by the average product of the variable input.
    d. marginal cost divided by the marginal product of the variable input.
    e. total variable cost divided by the change in output levels.

23. Minimum efficient scale is the output at which

    a. <u>long-run average cost is first minimized.</u>
    b. long-run average cost first equals long-run marginal cost.
    c. short-run average cost equals long-run average cost for the first time.
    d. short-run marginal cost equals long-run marginal cost for the first time.
    e. diseconomies are first overcome and then economies of scale set in.

24. If total cost is given by $TC = 10Q - 5Q^2 + 0.1Q^3$, then average cost is minimized at _____ units of output.

a. 0.5
b. 0.01
c. 50
d. <u>25</u>
e. 0.1

<u>Note:</u> Since $TC = 10Q - 5Q^2 + 0.1Q^3$, average cost is $AC = 10 - 5Q + 0.1Q^2$. $dAC/dQ = -5 + 0.2Q = 0 \Rightarrow 5 + 0.2Q \Rightarrow Q = 25.$

25. In the model of perfect competition, there are

A. high barriers to entry and no nonprice competition.
B. low barriers to entry and some advertising and product differentiation.
C. very high barriers to entry and some advertising and product differentiation.
D. high barriers to entry and some advertising and product differentiation.
E. <u>low barriers to entry and no nonprice competition.</u>

26. A representative firm with short-run total cost given by $TC = 50 + 2q + 2q^2$ operates in a competitive industry where the short-run market demand and supply curves are given by $Q_D = 1{,}410 - 40P$ and $Q_S = -390 + 20P$. Its short-run profit maximizing level of output is

A. 0 units.
B. 1 unit.
C. 2 units.
D. 5 units.
E. <u>7 units.</u>

<u>Note:</u> Setting $Q_D = Q_S = 1{,}410 - 40P = -390 + 20P \Rightarrow P = 30$. In a short-run equilibrium $P = MC$; $MC = 2 + 4q$; $\therefore\ 2 + 4q = 30$ $\Rightarrow$ short-run profit maximizing level of output = 7 units.

27. If a representative firm with long-run total cost given by $TC = 50 + 2q + 2q^2$ operates in a competitive industry where the short-run market demand and supply curves are given by $Q_D = 1{,}410 - 40P$ and $Q_S = -390 + 20P$, its long-run profit maximizing level of output is

A. 0 units.
B. 1 unit.
C. 2 units.
D. <u>5 units.</u>
E. 7 units.

<u>Note:</u> This can be solved in two ways: 1) In the long run, the competitive firm minimizes average total cost (ATC), where $ATC = TC/Q =$ $ATC = 50q^{-1} + 2 + 2q$; therefore, $dATC/dq = -50q^{-2} + 2 = 0 \Rightarrow 50 = 2q^2 \Rightarrow$ $q = 5$ units, or 2) Set $MC = ATC$; $MC = 2 + 4q = 50q^{-1} + 2 + 2q$ ⊚⊚ $q = 5$ units.

28. If a representative firm with long-run total cost given by $TC = 50 + 2q + 2q^2$ operates in a competitive industry where the market demand is given by $Q_D = 1{,}410 - 40P$, the long-run equilibrium output of the industry will be

A. 490 units.
B. 530 units.
C. 570 units.
D. 610 units.
E. 650 units.

Note: Since $q = 5$ at the firm level in the long run, this implies that the long-run equilibrium price for the industry will be $P = MC = 2 + 4q = 2 + 4(5) = \$22$. Thus, in a competitive long-run equilibrium, $P = MC = 2 + 4q = 2 + 4(5) = \$22$. Since $P = \$22$, $Q_D = 1{,}410 - 40(22) = 530$

Sample Exam Problems Related to Chapters 7 and 10

29. Maximum profit occurs wherever

A. the slope of the total revenue function equals marginal revenue.
B. the slope of the total revenue function equals marginal cost.
C. the slope of the total revenue function is maximized.
D. the total revenue is maximized.
E. none of the above.

Note: $\pi(Q) = TR(Q) - TC(Q); \frac{\pi(Q)}{dQ} = MR(Q^*) - MC(Q^*) = 0; \therefore MR(Q^*) = MC(Q^*).$

30. If a monopolist faces a constant elasticity of demand curve given by $Q = 400P^{-2}$ and has total costs given by $TC = 0.625Q^2$, its profit maximizing level of output is

A. 0.
B. 2.
C. 4.
D. 6.
E. 8.

Note: $\eta = (dQ/dP)(P/Q) = -2(400)P^{-3}P^1 400^{-1}P^2 = -2$. For the monopolist, $P = MC/[1+(1/\eta)]$. Here, $MC = 1.25Q$. Therefore, $P = 1.25Q/[1+(1/(-2)] = 2.5Q$. Therefore, $Q = 400P^{-2} = 400(2.5Q)^{-2} \Rightarrow Q^3 = 400/2.5^2$

31. If elasticity of demand is -2, marginal cost is \$4, and average cost is \$6, the price at which profit is maximized is

A. \$4.
B. \$6.
C. \$8.
D. \$10.
E. \$12.

Note: See equation (7.3), p. 207 in the textbook. This equation implies that the profit maximizing price is $P = MC/[1+(1/\eta)]$, where η is the price elasticity of demand. Therefore, $P = 4/[1+(1/(-2))] = \$8$.

32. If Gulfstream and Bombardier, both producers of upscale jet airplanes, were to collude rather than compete, consumers could expect

A. higher prices and lower quantities offered for sale.
B. lower prices and lower quantities offered for sale.
C. higher prices and higher quantities offered for sale.
D. each firm to cheat on the cartel agreement.
E. one firm to emerge as the price leader in the oligopoly.

Use the following information to answer questions 33-35.

Suppose duopolists in the market for spring water share a market demand curve given by $P = 50 - 0.02Q$, where P is the price per gallon and Q is thousands of gallons of water per day. The marginal cost of producing water is zero for both firms.

33. If firm *A* produces zero, firm *B*'s best response is producing

A. 0 gallons of water per day.
B. 48 gallons of water per day.
C. 833 gallons of water per day.
D. 1,250 gallons of water per day.
E. 2,500 gallons of water per day.

Note: Here, since firm *A* effectively cedes the market to firm *B*, firm *B* will act a s a monopolist. Since market demand is $P = 50 - 0.02Q$ and marginal cost is zero, then firm *B* maximizes profit by selecting Q = 1,250; note that $\pi_B = (50 - 0.02Q)Q = 50Q - .02Q^2 \Rightarrow d\pi_B / dQ = 50 - .04Q = 0 \Rightarrow Q = 1,250.$

34. Optimal output for Cournot duopolists moving simultaneously is

A. 0 gallons of water per day per firm.
B. 625 gallons of water per day per firm.
C. 833 gallons of water per day per firm.
D. 1,250 gallons of water per day per firm.
E. 2,500 gallons of water per day per firm.

Note: In order to solve this problem, we need to setup profit for each firm and derive its reaction function. In the case of firm *A*, $\pi_A = (50 - 0.02(Q_A + Q_B))Q_A = 50Q_A - .02Q_A^2 - .02Q_AQ_B$. Therefore, $d\pi_A / dQ_A = 50 - .02Q_A - .02Q_B = 0 \Rightarrow Q_A = 1,250 - .5Q_B$.

For firm *B*, $\pi_B = (50 - 0.02(Q_A + Q_B))Q_B = 50Q_B - .02Q_B^2 - .02Q_AQ_B$. Therefore, $d\pi_B / dQ_B = 50 - .02Q_B - .02Q_A = 0 \Rightarrow Q_B = 1,250 - .5Q_A$.

Substituting *B*'s reaction function into *A*'s, we find that $Q_A = 1,250 - .5(1,250 - .5Q_A) \Rightarrow Q_A = 833$ gallons of water per day per firm (by symmetry, the same result obtains for firm *B*).

35. If one firm acts as a first mover, the second firm will produce

A. 0 gallons of water per day per firm.
B. 625 gallons of water per day.
C. 833 gallons of water per day.
D. 1,250 gallons of water per day.
E. 2,500 gallons of water per day.

Note: Let's allow firm A to act as the leader. $\pi_A = 50Q_A - .02Q_A^2 - .02Q_AQ_B$. Substituting firm B's reaction function into firm A's profit function, we obtain $\pi_A = 50Q_A - .02Q_A^2 - .02Q_A(1,250 - .5Q_A)$. Simplifying further, we obtain
$\pi_A = 50Q_A - .02Q_A^2 - 25Q_A + .01Q_A^2 \Rightarrow d\pi_A / dQ_A = 25 - .02Q_A = 0 \Rightarrow Q_A = 1,250$. The second firm ($B$) will therefore produce $Q_B = 1,250 - .5Q_A = 1,250 - .5(1,250) = 625$.