

Problems for Section 4.4

23. At a price of \$8 per ticket, a musical theater group can fill every seat in the theater, which has a capacity of 1500. For every additional dollar charged, the number of people buying tickets decreases by 75. What ticket price maximizes revenue?
25. (a) Production of an item has fixed costs of \$10,000 and variable costs of \$2 per item. Express the cost, C , of producing q items.
 (b) The relationship between price, p , and quantity, q , demanded is linear. Market research shows that 10,100 items are sold when the price is \$5 and 12,872 items are sold when the price is \$4.50. Express q as a function of price p .
 (c) Express the profit earned as a function of q .
 (d) How many items should the company produce to maximize profit? (Give your answer to the nearest integer.) What is the profit at that production level?

Homework
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Problems for Section 4.6

1. The elasticity of a good is $E = 0.5$. What is the effect on the quantity demanded of:
 - (a) A 3% price increase? (b) A 3% price decrease?
3. What are the units of elasticity if:
 - (a) Price p is in dollars and quantity q is in tons?
 - (b) Price p is in yen and quantity q is in liters?
 - (c) What can you conclude in general?
7. There are many brands of laundry detergent. Would you expect the elasticity of demand for any particular brand to be high or low? Explain.
9. There is only one company offering local telephone service in a town. Would you expect the elasticity of demand for telephone service to be high or low? Explain.
11. School organizations raise money by selling candy door to door. The table shows p , the price of the candy, and q , the quantity sold at that price.

p	\$1.00	\$1.25	\$1.50	\$1.75	\$2.00	\$2.25	\$2.50
q	2765	2440	1980	1660	1175	800	430

- (a) Estimate the elasticity of demand at a price of \$1.00. At this price, is the demand elastic or inelastic?
- (b) Estimate the elasticity at each of the prices shown. What do you notice? Give an explanation for why this might be so.
- (c) At approximately what price is elasticity equal to 1?
- (d) Find the total revenue at each of the prices shown. Confirm that the total revenue appears to be maximized at approximately the price where $E = 1$.
13. The demand for yams is given by $q = 5000 - 10p^2$, where q is in pounds of yams and p is the price of a pound of yams.

Problems for Section 4.5

1. For each cost function in Figure 4.61, is there a value of q at which average cost is minimized? If so, approximately where? Explain your answer.

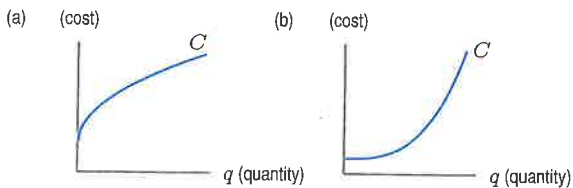


Figure 4.61

5. The cost function is $C(q) = 1000 + 20q$. Find the marginal cost to produce the 200th unit and the average cost of producing 200 units.
9. The average cost per item to produce q items is given by

$$a(q) = 0.01q^2 - 0.6q + 13, \quad \text{for } q > 0.$$

- (a) What is the total cost, $C(q)$, of producing q goods?
- (b) What is the minimum marginal cost? What is the practical interpretation of this result?
- (c) At what production level is the average cost a minimum? What is the lowest average cost?
- (d) Compute the marginal cost at $q = 30$. How does this relate to your answer to part (c)? Explain this relationship both analytically and in words.
13. Figure 4.65 shows the average cost, $a(q) = b + mq$.
 - (a) Show that $C'(q) = b + 2mq$.
 - (b) Graph the marginal cost $C'(q)$.

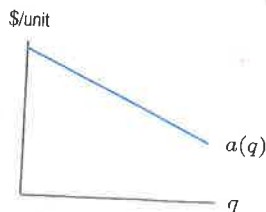


Figure 4.65

Solutions

Section 4.4

- 1 $5.5 < q < 12.5$ positive;
 $0 < q < 5.5$ and $q > 12.5$ negative;
 Maximum at $q \approx 9.5$

- 3 (a) $q = 2500$
 (b) \$3 per unit
 (c) \$3000

- 5 (a) \$9
 (b) -\$3
 (c) $C'(78) = R'(78)$

- 7 (a) Increase production
 (b) $q = 8000$

- 9 \$0.20/item

- 11 $q = 0$ or $q = 3000$

- 13 One; between 40 and 50

- 15 (a) MR ; increase production
 (b) MC ; decrease production

- 17 Global maximum of \$6875 at $q = 75$

- 19 (a) Approximately \$1
 (b) No
 (c) About 400 items

- 21 (a) \$10; \$30,000; \$50,000
 (b) $R(q) = 70q - 0.02q^2$
 (c) 1750
 (d) \$35
 (e) \$61,250

- 23 \$14.

- 25 (a) $10,000 + 2q$
 (b) $q = 37,820 - 5544p$
 (c) $\pi = -0.00018q^2 + 4.822q - 10,000$
 (d) 13,394 items, \$22,294

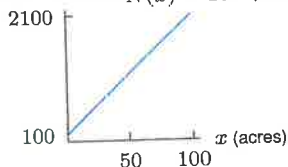
- 27 Maximum revenue = \$27,225
 Minimum = \$0

- 29 (a) q/r months
 (b) $(ra/q) + rb$ dollars
 (c) $C = (ra/q) + rb + kq/2$ dollars
 (d) $q = \sqrt{2ra/k}$

- 31 $L = [\beta pcK^\alpha/w]^{1/(1-\beta)}$

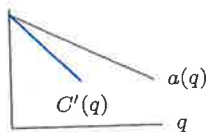
- 9 (a) $C(q) = 0.01q^3 - 0.6q^2 + 13q$
 (b) \$1
 (c) $q = 30, a(30) = 4$
 (d) Marginal cost is 4

- 11 (a) number of bees $N(x) = 100 + 20x$



- (b) (i) $N'(x) = 20$
 (ii) $N(x)/x = (100/x) + 20$

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Section 4.6

- 1 (a) 1.5% decrease
 (b) 1.5% increase

- 5 Elastic

- 7 High

- 9 Low

- 11 (a) $E \approx 0.470$, inelastic
 (c) $P = 1.25$ and 1.50

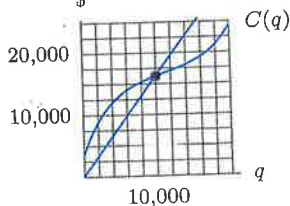
- 13 (a) $q = 4960$
 (b) $E = 0.016$, so demand is inelastic

3(a, b)
 units are dimensionless
 regardless of units of
 P and q .
 C) Always dimensionless

Section 4.5

- 1 (a) No
 (b) Yes

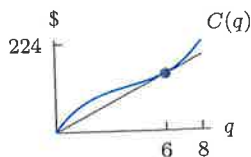
- 3 (a) $a(1000) \approx \$1.60$ per unit
 (b) \$



- (c) 18,000 units

- 5 $MC = \$20; a(q) = \25

- 7 (a) $q = 6$



- (b) $q = 6$