Homework #3 - Math 211

Problems for Section 1.4

1. Figure 1.52 shows cost and revenue for a company.
   - **(a)** Approximately what quantity does this company have to produce to make a profit?
   - **(b)** Estimate the profit generated by 600 units.

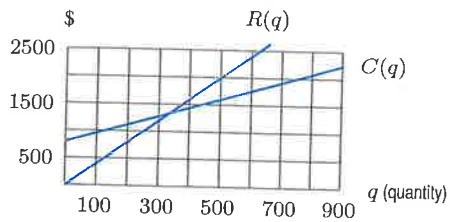


Figure 1.52

3. **(a)** Estimate the fixed costs and the marginal cost for the cost function in Figure 1.54.
   (b) Estimate $C(10)$ and interpret it in terms of cost.

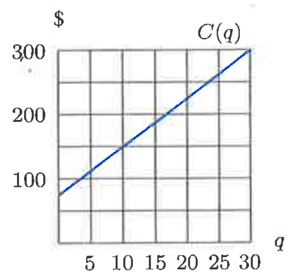


Figure 1.54

9. A company that makes Adirondack chairs has fixed costs of $5000 and variable costs of $30 per chair. The company sells the chairs for $50 each.
   - **(a)** Find formulas for the cost and revenue functions.
   - **(b)** Find the marginal cost and marginal revenue.
   - **(c)** Graph the cost and the revenue functions on the same axes.
   - **(d)** Find the break-even point.

11. A company has cost function $C(q) = 4000 + 2q$ dollars and revenue function $R(q) = 10q$ dollars.
   - **(a)** What are the fixed costs for the company?
   - **(b)** What is the marginal cost?
   - **(c)** What price is the company charging for its product?
   - **(d)** Graph $C(q)$ and $R(q)$ on the same axes and label the break-even point, q_0. Explain how you know the company makes a profit if the quantity produced is greater than q_0.
   - **(e)** Find the break-even point q_0.

13. A movie theater has fixed costs of $5000 per day and variable costs averaging $2 per customer. The theater charges $7 per ticket.
   - **(a)** How many customers per day does the theater need in order to make a profit?
   - **(b)** Find the cost and revenue functions and graph them on the same axes. Mark the break-even point.

15. Production costs for manufacturing running shoes consist of a fixed overhead of $650,000 plus variable costs of $20 per pair of shoes. Each pair of shoes sells for $70.
   - **(a)** Find the total cost, $C(q)$, the total revenue, $R(q)$, and the total profit, $\pi(q)$, as a function of the number of pairs of shoes produced, q.
   - **(b)** Find the marginal cost, marginal revenue, and marginal profit.
   - **(c)** How many pairs of shoes must be produced and sold for the company to make a profit?

19. A $15,000 robot depreciates linearly to zero in 10 years.
   - **(a)** Find a formula for its value as a function of time.
   - **(b)** How much is the robot worth three years after it is purchased?

Solutions

Section 1.4

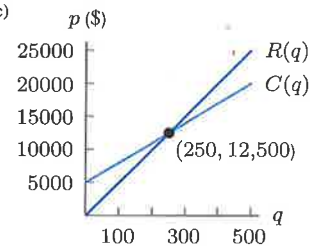
1 (a) When more than roughly 335 items are produced and sold
(b) About \$650

3 (a) \$75; \$7.50 per unit
(b) \$150

5 (a) Price \$12, sell 60
(b) Decreasing

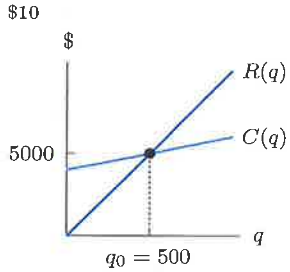
7 Vertical intercept: $p = 4$ dollars
Horizontal intercept: $q = 6$ units

9 (a) $C(q) = 5000 + 30q$
$R(q) = 50q$
(b) \$30/unit, \$50/unit
(c)



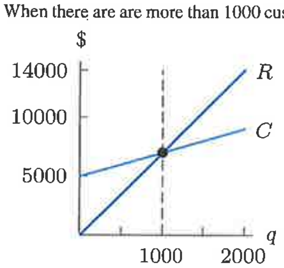
(d) 250 chairs and \$12,500

11 (a) \$4000
(b) \$2
(c) \$10
(d)



(e) 500

13 (a) When there are are more than 1000 customers
(b)

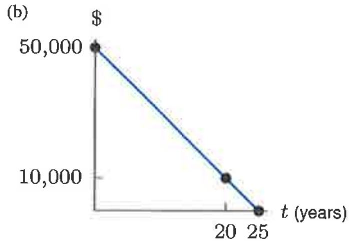


15 (a) $C(q) = 650,000 + 20q$
$R(q) = 70q$
$\pi(q) = 50q - 650,000$
(b) \$20/pair, \$70/pair, \$50/pair
(c) More than 13,000 pairs

17 (a) Between 20 and 60 units
(b) About 40 units

19 (a) $V(t) = -1500t + 15,000$
(b) $V(3) = \$10,500$

21 (a) $V(t) = -2000t + 50,000$
(b)



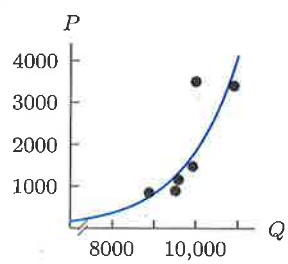
(c) (0 years, \$50,000) and (25 years, \$0)

23 (a) $p = \$10$; $q = 3000$
(b) Suppliers produce 3500 units; Consumers buy 2500
(c) Suppliers produce 2500 units; Consumers buy 3500

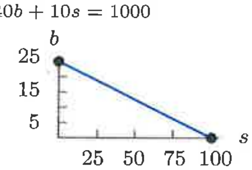
25 (a) $C = 5q + 7000$
$R = 12q$
(b) $q = 1520$, $\pi(12) = \$3640$
(c) $C = 17,000 - 200p$
$R = 2000p - 40p^2$
$\pi(p) = -40p^2 + 2200p - 17,000$
(d) At \$27.50 per shirt the profit is \$13,250

27 (a) $q = 820 - 20p$
(b) $p = 41 - 0.05q$

29

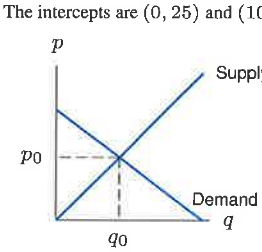


31 (a) $40b + 10s = 1000$
(b)



(c) The intercepts are (0, 25) and (100, 0)

33 (a)



(b) Equilibrium price will increase; equilibrium quantity will decrease
(c) Equilibrium price and quantity will decrease

35 $q = 4p - 28$

37 (a) $p = 100$, $q = 500$
(b) $p = 102$, $q = 460$
(c) Consumer pays \$2
Producer pays \$4
(d) \$2760

39 (a) Demand: $q = 100 - 2p$
Supply: $q = 2.85p - 50$
(b) New equilibrium price $p \approx \$30.93$
New equilibrium quantity $q \approx 38.14$ units
(c) Consumer pays \$0.93
Producer pays \$0.62
Total \$1.55
(d) \$59.12

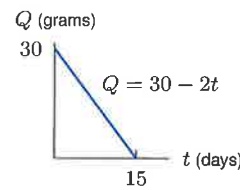
Section 1.5

1 (a) (i), 12%
(b) (ii), 1000
(c) Yes, (iv)

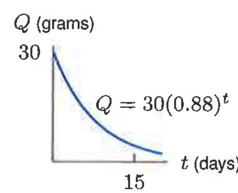
3 (a) II
(b) I
(c) III
(d) V

5 (a) $G = 310(1.03)^t$
(b) $G = 310 + 8t$

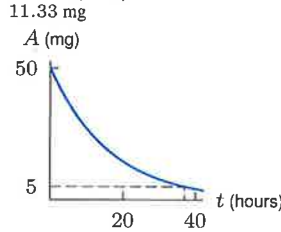
7 (a) $Q = 30 - 2t$



(b) $Q = 30(0.88)^t$



9 (a) $A = 50(0.94)^t$
(b) 11.33 mg
(c)



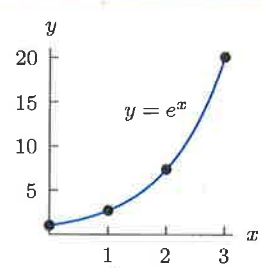
(d) About 37 hours

11 $\text{CPI} = 211(1.028)^t$

13 (a)

x	0	1	2	3
e^x	1	2.72	7.39	20.09

(b)



(c)

x	0	1	2	3
e^{-x}	1	0.37	0.14	0.05