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Quantitative Methods:

Exercises Set 1

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1. Linear demand is given by equation *Q* = *A*-*BP*, with *A*>0 and *B*>0.

a) The price at which demand becomes zero is called "choke price." Find the choke price.

b) Plot that relationship (with *P* on horizontal axis and *Q* on vertical axis) for *A*=48, *B*=2.

c) Find inverse demand (i.e., such function f that P=f(Q)) and plot it (with Q on horizontal axis and P on vertical axis) for A=48, B=2.

2. The cost of a patient's stay in a hospital may be a function of the length of the stay (in days) and the amount of medical attention (in hours). Two patients had the following bills.

Patient	Days in Hospital (*H*)	Hours of Attention (*A*)	Total Bill (*C*)
1	4	10	$ 500
2	7	30	$ 1,125

If the cost is a linear function of length of stay, *H*, and hours of attention, *A*, such that *C*(*H*,*A*) = *aH* + *bA*, find the values of the constants *a* and *b*.

3. The prices of wheat and bread are P_w and P_b respectively. The demand (denoted by *D*) and supply (denoted by *S*) for each commodity are dependent on the two prices:

$$S_w = 50 + 20P_w - 5P_b \qquad D_w = 50 - 10P_w + 5P_b$$
$$S_b = -10P_w + 10P_b \qquad D_b = 400 + 10P_w - 10P_b$$

Find the values of P_w and P_b such that both markets are in equilibrium. That is, solve for P_w and P_b such that $D_w = S_w$ and $D_b = S_b$.

4. The inverse supply and demand functions for a particular market are given by the following equations.

$$P_d = -(Q+4)^2 + 100$$
$$P_s = (Q+2)^2$$

Find the equilibrium price and quantity.

5. **A company manufactures and sells a watch designed for sailboat racing. The financial analyst found that the company could sell 300 watches at a wholesale price of $ 140 each, and 1,100 watches at $ 92 each.**

   Assuming a linear relationship between price and demand, find a linear function that models the price-demand relationship.

   What would be the price at a demand of 700 watches? 1200 watches?

6. **A marketing manager wants to spend his entire budget, *B*, on advertising in two media, magazines and television**. A unit of magazine costs $*a* and a unit of television costs $*c*. The manager wishes to buy twice as many television units as magazine units. In terms of *a*, *c* and *B*, how many magazine units should he buy?

7. **Linear relationship**
   The Dundee Corporation has estimated that total production cost is 100,000 at a level of activity of 5,000 units and 240,000 at a level of 40,000 units.
   Write a linear rule for this function and use it to estimate the level of fixed cost (cost incurred even though output is 0) of the Dundee company.

8. **Equilibrium price**
   Given the following system of simultaneous equations for two substitute goods, beef *b* and pork *p*, find the equilibrium price and quantity for each market.

   $S_b = 15P_b - 5$

   $D_b = -3P_b + P_p + 82$

   $S_p = 32P_p - 6$

   $D_p = 2P_b - 4P_p + 92$

9. **Market equilibrium**
   A used-car dealer in Fontainebleau found that when the price of a car is 1000€, there are 10 buyers who are interested in buying a car. When the price increases to 2000€, only 6 individuals are still interested.
   The Supply function of used-cars is $P = 500 + 125\ Q$
   Assume that for Demand, price is a linear function of quantity.
   What is the market equilibrium?

10. Price-Demand*:*

A company manufactures and sells a specialty watch. The financial research department, using statistical and analytical methods, determined that at a price of $88 each, the demand would be 2000 watches, and at $38 each**,** 12000 watches. Assuming a linear relationship between price and demand, find a linear function that models the price-demand relationship.

Consider:

1. Price as a function of Demand
2. Demand as a function of Price

What would be the price at a demand of 8000 watches, 15000 watches?

11. Simplify the following expressions:

a) $\left(\frac{x}{y}\right)^{3} * \left(\frac{x}{z}\right)^{-2}$

b) $\frac{x^3 y^2}{x^5 y^{-2}}$

c) $\frac{24x^5 y^3 z^7}{6x^3 y^2 z^4}$

d) $\frac{120xy^3 z^7}{6x^3 y^2 z^4}$

12. Evaluate each of the following expressions.

a) $(9)^{3/2}$

b) $(8)^{4/3}$

c) $\left(\frac{1}{4}\right)^{5/2}$

d) $27^{-2/3}$

e) $(-4)^{5}$

f) $(-2)^{6}$

13. Find the future values (A) of the following amounts.

a) P = $ 2000, at r = 5% interest compounded annually for t = 10 years.

$$A = P\,(1 + r)^t$$

b) P = $1,500,000, at r = 7% interest compounded semi-annually (n = 2) for t = 6 years.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

14. If you borrowed $ 800 for 4 years at simple yearly interest rate 4%, how much would the creditor receive at the termination of the contract? How much would the interest amount be?

15. If a man invests for 10 years at 5% compounded quarterly, and receives $ 16,436.20 at the end of the 10 years, what was his original investment?

16. Suppose I put a sum of money in the bank at a rate of 3% compounded yearly. The total interest received after 2 years is $ 300. How much was the original sum?

