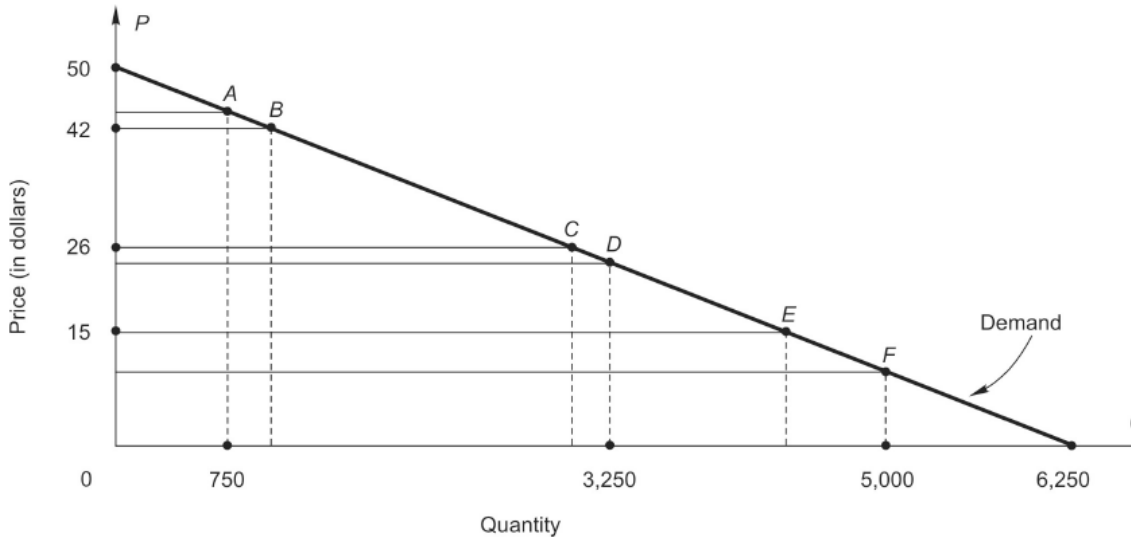
5. Use the graph below of a linear demand curve to answer questions 5 and 6:



a. The equation for the linear demand in the figure above is $Q_d =$ _____.

b. The equation for the *inverse* linear demand is $P =$ _____.

c. Using the equations in parts *a* and *b*, find the missing prices and quantities at points $A - F$:

A: $P =$ \$_____ C: $Q =$ _____ E: $Q =$ _____

B: $Q =$ _____ D: $P =$ \$_____ F: $P =$ \$_____

d. Compute the following interval (or arc) elasticities:

Interval A to B: $E_{AB} =$ _____

Interval C to D: $E_{CD} =$ _____

Interval E to F: $E_{EF} =$ _____

e. Compute the following point elasticities using the two formulas $E = (\Delta Q / \Delta P) \times (P / Q)$ and $E = P / (P - A)$:

Point	$E = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$	$E = \frac{P}{P - A}$
A	$E_A =$_____	$E_A =$_____
C	$E_C =$_____	$E_C =$_____
E	$E_F =$_____	$E_F =$_____

f. Demand is unitary elastic at a price of \$ _____ and quantity of _____.

g. As quantity increases along the demand curve, demand becomes _____ (more, less) elastic. As price falls along the demand curve, demand becomes _____ (more, less) elastic.

6. Use the figure in question 5 to answer the following:

   a. The equation for marginal revenue is $MR =$ _____.

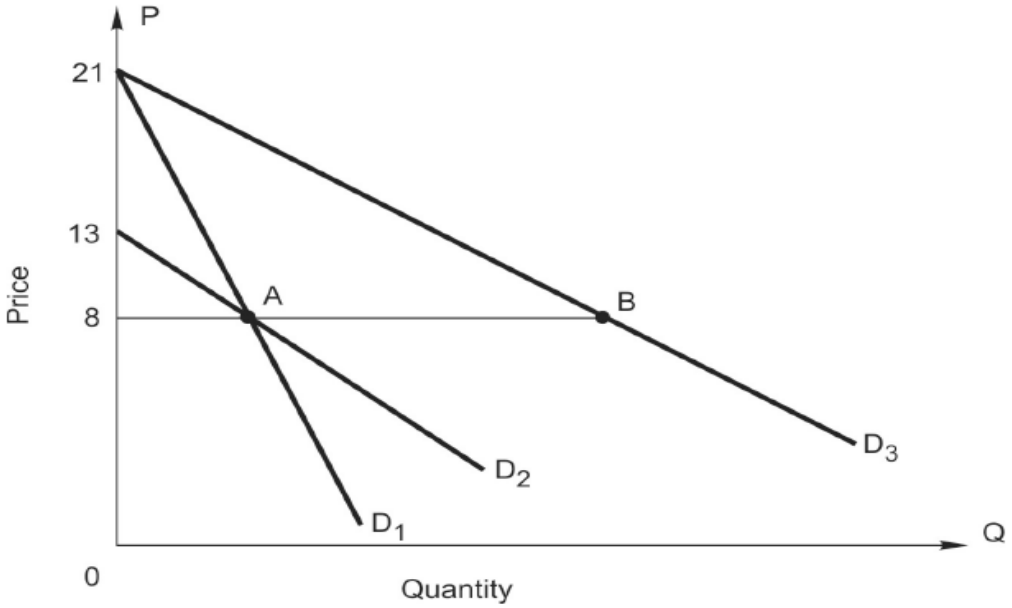
   b. MR crosses the price-axis at $P =$ $_____. MR is zero at $Q =$ _____.

   c. If MR is _____ (rising, falling, zero, positive, negative), then demand is elastic.

   d. If MR is _____ (rising, falling, zero, positive, negative), then demand is unitary elastic.

   e. If MR is _____ (rising, falling, zero, positive, negative), then demand is inelastic.

7. Use the figure below to answer the following questions:



   a. Compute the point elasticity of demand at a price of \$8 for D_1, D_2, and D_3.

   D_1: $E =$ _____

   D_2: $E =$ _____

   D_3: $E =$ _____

   b. At what price is demand unitary elastic for each of these three demand curves?

   D_1: $P =$ _____

   D_2: $P =$ _____

   D_3: $P =$ _____

   c. At a price of \$8, the point price elasticity of demand for D_1 and D_3 are _____. Explain this result.

11. The general linear demand for good X is estimated to be

$$Q = 125{,}000 - 400P - 0.76M + 360P_R$$

where P is the price of good X, M is average income of consumers who buy good X, and P_R is the price of related good R. The values of P, M, and P_R are expected to be \$200, \$45,000, and \$120, respectively. Use these values at this point on demand to make the following computations.

a. Compute the quantity of good X demanded for the given values of P, M, and P_R.

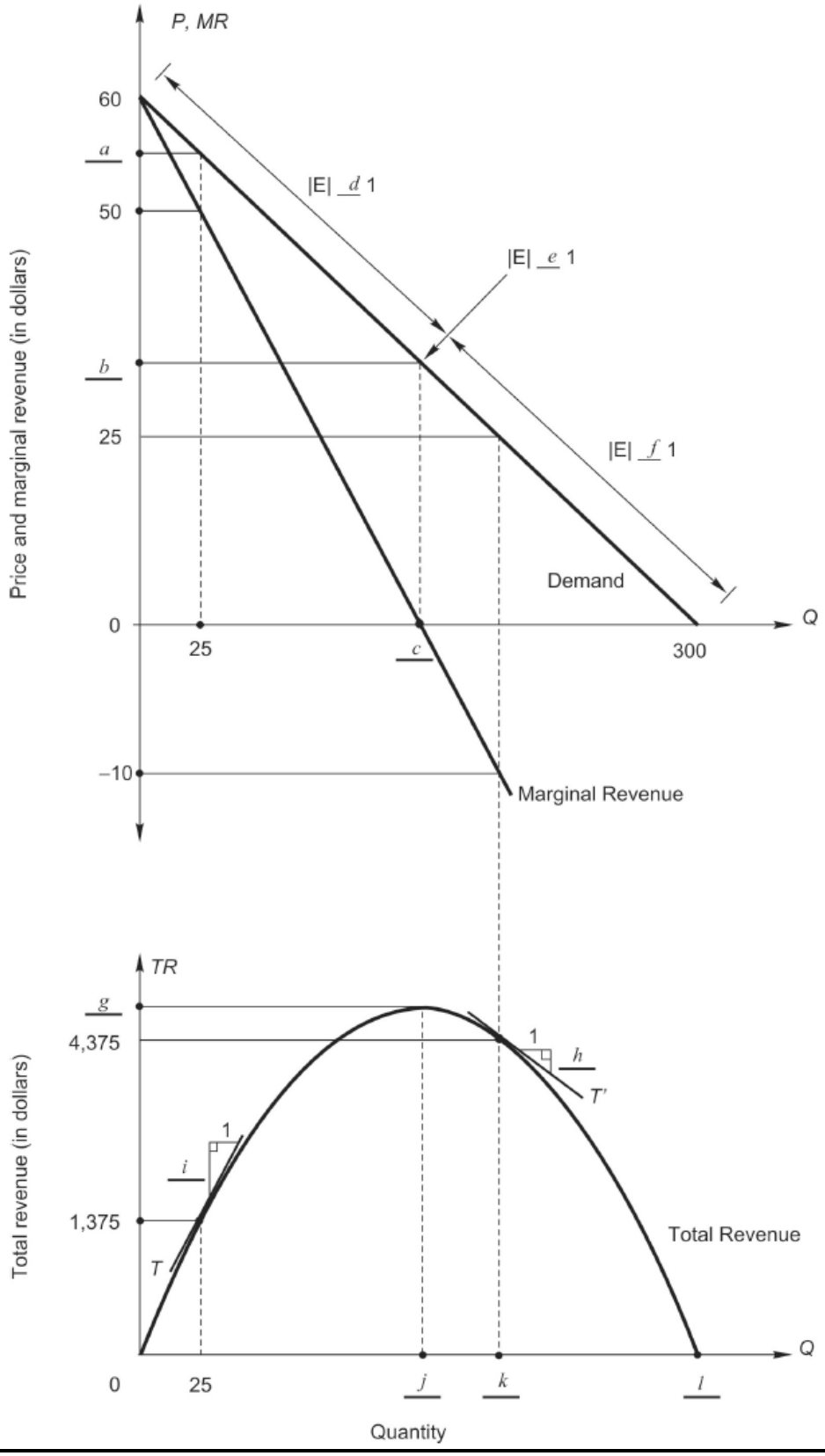
b. For the quantity in part a, calculate the point price elasticity of demand. At this point on the demand, is demand elastic, inelastic, or unitary elastic? How would decreasing the price of X affect total revenue? Explain.

c. Calculate the income elasticity of demand E_M. Is good X normal or inferior? Explain how a 3.5 percent decrease in income would affect demand for X, all other factors affecting the demand for X remaining the same.

d. Calculate the cross-price elasticity E_{XR}. Are the goods X and R substitutes or complements? Explain how a 6 percent increase in the price of related good R would affect demand for X, all other factors affecting the demand for X remaining the same?

e. Find the equations for demand, inverse demand and marginal revenue for the given values of P, M, and P_R. At the point on demand in parts a and b, is marginal revenue positive, negative or zero? Is this as you expected? Explain why or why not.

13. The following figure shows a linear demand curve. Fill in the blanks *a* through *l* as indicated in the following figure:



ANSWERS:

5. a. $Q_d = 6,250 - 125P$. Begin with the general linear form $Q_d = a + bP$. The intercept parameter, a, is the Q-intercept (= 6,250), and the slope parameter, b, measures $\Delta Q_d/\Delta P$ (= –6,250/50 = –125). If this is confusing, see *Linear Functions* on page 3 of this Workbook.

   b. $P = 50 - 0.008Q_d$. To find the inverse function, solve algebraically for P in the equation from part *a*. If this is confusing, see *Inverse Functions* on page 2 of this Workbook.

   c. A: $P = \$44$ C: $Q = 3,000$ E: $Q = 4,375$
   B: $Q = 1,000$ D: $P = \$24$ F: $P = \$10$

   d. $$E_{AB} = \frac{\Delta Q}{\Delta P} \cdot \frac{\text{Average } P}{\text{Average } Q} = \frac{+250}{-2} \cdot \frac{43}{875} = -6.14$$

$$E_{CD} = \frac{\Delta Q}{\Delta P} \cdot \frac{\text{Average } P}{\text{Average } Q} = \frac{+250}{-2} \cdot \frac{25}{3,125} = -1.0$$

$$E_{EF} = \frac{\Delta Q}{\Delta P} \cdot \frac{\text{Average } P}{\text{Average } Q} = \frac{+250}{-2} \cdot \frac{12.50}{4,687.5} = -0.33$$

e. $$E_A = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = -125 \cdot \frac{44}{750} = -7.33 = \frac{44}{44 - 50}$$

$$E_C = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = -125 \cdot \frac{26}{3,000} = -1.08 = \frac{26}{26 - 50}$$

$$E_E = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = -125 \cdot \frac{15}{4,375} = -0.43 = \frac{15}{15 - 50}$$

f. \$25; 3,125. For a linear demand, the unit elastic point occurs at the midpoint of the demand line.

g. less; less. Moving down linear demand, Q increases, P decreases, and $|E|$ decreases.

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6. a. $MR = 50 - 0.016Q$. Inverse demand and marginal revenue have the same intercept parameters and the slope parameter of MR is twice the slope parameter of inverse demand. Since inverse demand is $P = 50 - 0.008Q_d$, MR has an intercept of 50 and a slope of –0.016 (= 2 × –0.008).

   b. 50; 3,125. Inverse demand and marginal revenue have the same vertical intercepts. If MR is twice as steep as inverse demand, then MR must cross the Q axis midway between 0 and 6,250.

   c. positive. See Figure 6.5 and Table 6.4 in the textbook.

   d. zero. See Figure 6.5 and Table 6.4 in the textbook.

   e. negative. See Figure 6.5 and Table 6.4 in the textbook.

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7. a. $E_{D1} = 8/(8-21) = 8/-13 = -0.615$

$E_{D2} = 8/(8-13) = 8/-5 = -1.6$

$E_{D3} = 8/(8-21) = 8/-13 = -0.615$

b. $D_1: P = \$10.50$; $D_2: P = \$6.50$; $D_3: P = \$10.50$

c. equal; The two demand curves have equal point elasticities because they both have the same price-intercept (a = \$21). Measured at the same price (in this case, P= \$8), their point elasticities must be equal.

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11. a. 54,000 [= 125,000 + (–400 × 200) + (–0.76 × 45,000) + (360 × 120)

b. $E = b\dfrac{P}{Q} = -400\dfrac{200}{54,000} = -1.481$; elastic; increase *TR* because demand is elastic.

c. $E_M = c\dfrac{M}{Q} = -0.76\dfrac{45,000}{54,000} = -0.633$; inferior ($c$ <0); $\%\Delta Q = +2.21 (= -3.5 \times -0.633)$

d. $E_{XR} = d\dfrac{P_R}{Q} = 360\dfrac{120}{54,000} = 0.80$; substitutes ($d$ > 0); $\%\Delta Q = +4.8\% (= 6 \times 0.80)$

e. Demand:

$Q = (125,000 - 0.76 \times 45,000 + 360 \times 120) - 400P$

$= 134,000 - 400P$

Inverse Demand:

$P = -134,000 / -400 + (1 / -400)Q$

$= 335 - 0.0025Q$

Marginal Revenue:

$MR = 335 + 2 \times (-0.0025)Q$

$= 335 - 0.005Q$

At Q = 54,000, MR = 65. MR is expected to be positive because demand is elastic at this quantity (Recall that E = –1.481 in part *b*).

13.	a.	\$55	*TR* is \$1,375 at Q = 25, so P must be \$55 (= 1,375/25).
	b.	\$30	This is the unit elastic point on demand, so price is the midpoint between 0 and 60 on the vertical axis.
	c.	150	This is the unit elastic point on demand, so quantity is the midpoint between 0 and 300 on the horizontal axis.
d.	>		Since MR is positive over this range of demand, demand is elastic.
e.	=		Since MR is zero at this point on demand, demand is unitary elastic.
f.	<		Since MR is negative over this range of demand, demand is inelastic.
g.	\$4,500		$TR = P \times Q = \$30 \times 150$.

h.	–10	The slope of *TR* is *MR*, which is shown to be –10 on the *MR* curve.
i.	50	The slope of *TR* is *MR*, which is shown to be 50 on the *MR* curve.
j.	150	Total revenue reaches its peak at the quantity where demand is unit elastic, which is 150 (see blank *c*).
k.	175	*TR* is \$4,375 = \$25 × *Q*, so *Q* = 4,375/25 = 175.
l.	300	Total revenue equals zero at a positive output when *P* is zero, which occurs where the demand curve touches the horizontal axis.