PROBLEM SUMMARY

1. Total cost, revenue, profit, and break-even
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4. Break-even volume
5. Graphical analysis (1–2)
6. Graphical analysis (1–4)
7. Break-even sales volume
8. Break-even volume as a percentage of capacity (1–2)
9. Break-even volume as a percentage of capacity (1–3)
10. Break-even volume as a percentage of capacity (1–4)
11. Effect of price change (1–2)
12. Effect of price change (1–4)
13. Effect of variable cost change (1–12)
14. Effect of fixed cost change (1–13)
15. Break-even analysis
16. Effect of fixed cost change (1–7)
17. Effect of variable cost change (1–7)
18. Break-even analysis
19. Break-even analysis
20. Break-even analysis
21. Linear programming
22. Linear programming
23. Linear programming
24. Forecasting/statistics

PROBLEM SOLUTIONS

1a. \( v = 300, \ c_t = 8,000, \ c_v = 65 \) per table, \( p = 180; \)
\( TC = c_t + vc_v = 8,000 + (300)(65) = 27,500; \)
\( TR = vp = (300)(180) = 54,000; \)
\( Z = 54,000 - 27,500 = 26,500 \) per month

b. \( v = \frac{c_t}{p - c_v} = \frac{8,000}{180 - 65} = 69.56 \) tables per month

2a. \( v = 12,000, \ c_t = 60,000, \ c_v = 9, \ p = 25; \)
\( TC = c_t + vc_v = 60,000 + (12,000)(9) = 168,000; \)
\( TR = vp = (12,000)(25) = 300,000; \)
\( Z = 300,000 - 168,000 = 132,000 \) per year

b. \( v = \frac{c_t}{p - c_v} = \frac{60,000}{25 - 9} = 3,750 \) tires per year

3a. \( v = 18,000, \ c_t = 21,000, \ c_v = .45, \ p = 1.30; \)
\( TC = c_t + vc_v = 21,000 + (18,000)(.45) = 29,100; \)
\( TR = vp = (18,000)(1.30) = 23,400; \)
\( Z = 23,400 - 29,100 = -5,700 \) (loss)

b. \( v = \frac{c_t}{p - c_v} = \frac{21,000}{1.30 - .45} = 24,705.88 \) yd per month

4. \( c_t = 25,000, \ p = .40, \ c_v = .15, \ v = \frac{c_t}{p - c_v} = \)
\( \frac{25,000}{.40 - .15} = 100,000 \) lb per month

5. [Graph of break-even analysis]

6. [Graph of break-even analysis]
16. \[ v = \frac{cf}{p - cv} = \frac{25,000}{30 - 10} = 1,250 \text{ dolls} \]

8. Break-even volume as percentage of capacity = \[ \frac{v}{k} = \frac{3,750}{8,000} = .469 = 46.9\% \]

9. Break-even volume as percentage of capacity = \[ \frac{v}{k} = \frac{24,705.88}{25,000} = .988 = 98.8\% \]

10. Break-even volume as percentage of capacity = \[ \frac{v}{k} = \frac{100,000}{120,000} = .833 = 83.3\% \]

11. \[ v = \frac{cf}{p - cv} = \frac{60,000}{31 - 9} = 2,727.3 \text{ tires per year}; \] it reduces the break-even volume from 3,750 tires to 2,727.3 tires per year.

12. \[ v = \frac{cf}{p - cv} = \frac{25,000}{.60 - .15} = 55,555.55 \text{ lb per month}; \] it reduces the break-even volume from 100,000 lb per month to 55,555.55 lb.

13. \[ v = \frac{cf}{p - cv} = \frac{25,000}{.60 - .22} = 65,789.47 \text{ lb per month}; \] it increases the break-even volume from 55,555.55 lb per month to 65,789.47 lb per month.

14. \[ v = \frac{cf}{p - cv} = \frac{39,000}{.60 - .22} = 102,631.57 \text{ lb per month}; \] it increases the break-even volume from 65,789.47 lb per month to 102,631.57 lb per month.

15. Initial profit: \[ Z = vp - c_v = (9,000)(.75) - 4,000 = 6,750 - 4,000 = 1,890 = \$860 \text{ per month}; \] increase in price: \[ Z = vp - c_v = (5,700)(.95) - 4,000 = (5,700)(.21) = 5,415 - 4,000 - 1,197 = $218 \text{ per month}; \] the dairy should not raise its price.

18. a) \[ v = \frac{cf}{p - cv} = \frac{27,000}{8.95 - 3.75} = 5,192.3 \text{ pizzas} \]

b) \[ \frac{5,192.3}{20} = 259.6 \text{ days} \]

\[ c) \text{ Revenue for the first 30 days} = 30(pv - vcv) = 30[(8.95)(20) - (20)(3.75)] = $3,120 \]

\[ $27,000 - 3,120 = $23,880, \text{ portion of fixed cost not recouped after 30 days}. \]

\[ \text{New } v = \frac{cf}{p - cv} = \frac{23,880}{7.95 - 3.75} = 5,685.7 \text{ pizzas} \]

Total break-even volume = 600 + 5,685.7 = 6,285.7 pizzas

Total time to break-even = 30 + \[ \frac{5,685.7}{20} = 314.3 \text{ days} \]

19. a) Cost of Regular plan = $55 + (.33)(50) \text{ minutes) = } $71.50

Cost of Executive plan = $75 + (.25)(20 \text{ minutes) = } $80

Select regular plan.

b) \[ .55 + (x - 70)(.33) = 75 + (x - 100)(.25) \]

31.9 + .33x = 50 + .25x

x = 226.25 minutes per month

20. a) \[ 14,000 = \frac{7,500}{p - .35} \]

p = $0.89 to break even

b) If the team did not perform as well as expected the crowds could be smaller; bad weather could reduce crowds and/or affect what fans eat at the game; the price she charges could affect demand.

c) This will be an objective answer, but $1.25 seems to be a reasonable price.

\[ Z = (14,000)(1.25) - 7,500 = (14,000)(.35) \]

= 17,500 - 12,400 = 5,100

21. There are two possible answers, or solution points:

\[ x = 25, y = 0 \text{ or } x = 0, y = 50 \]

Substituting these values in the objective function:

\[ Z = 15(25) + 10(0) = 375 \]

Z = 15(0) + 10(50) = 500