# CHAPTER 2
# COVERAGE OF LEARNING OBJECTIVES

| LEARNING OBJECTIVE | FUNDA-MENTAL ASSIGN-MENT MATERIAL | CRITICAL THINKING EXERCISES AND EXERCISES | PROBLEMS | CASES, NIKE 10K, EXCEL, COLLAB., & INTERNET EXERCISES |
|---|---|---|---|---|
| LO1: Explain how activity cost drivers affect cost behavior. | A1, B1 | 24, 25, 27, 29, 30 | 43,45, 47, 49, 52 | 64 |
| LO2: Show how changes in activity cost-driver levels affect variable and fixed costs. | A1, B1, A2, A3, B2, B3 | 24, 25, 28, 29,30,31,37 | 43,45, 48, 49, 50, 52, 55, 56, 59 | 64, 65, 69 |
| LO3: Calculate break-even sales volume in total dollars and total units. | A2, A3, B2, B3 | 36, 37,38, 39 | 43,46, 48, 50, 51, 53, 55, 57, | 64, 65, 69, 70 |
| LO4: Create a cost-volume-profit graph and understand the assumptions behind it. | | 32, 33, 34, 35 | 45 | |
| LO5: Calculate sales volume in total dollars and total units to reach a target profit. | A2 , B3 | 32, 33, 39, | 43,46, 48, 50, 51, 53, 55, | 65 |
| LO6: Differentiate between contribution margin and gross margin. | | | 57 | |
| LO7: Explain the effects of sales mix on profits (Appendix 2A). | | 40 | 60, 61 | 66 |
| LO8: Compute cost-volume-profit relationships on an after-tax basis (Appendix 2B). | | 41, 42 | 62, 63 | 67 |

## CHAPTER 2
### *Introduction to Cost Behavior and Cost-Volume Relationships*

2-A1 (20-25 Min.)

1. The cost driver for both resources is square feet cleaned. Labor cost is a fixed-cost resource, and cleaning supplies is a variable cost. Costs for cleaning between 4 and 8 times a month are:

| Number of times plant is cleaned | Square Feet Cleaned | Labor Cost | Cleaning Supplies Cost** | Total cost | Cost per Square Foot |
|---|---|---|---|---|---|
| 4 | 160,000* | $24,000 | $ 9,600*** | $33,600 | $0.210 |
| 5 | 200,000 | 24,000 | 12,000 | 36,000 | 0.180 |
| 6 | 240,000 | 24,000 | 14,400 | 38,400 | 0.160 |
| 7 | 280,000 | 24,000 | 16,800 | 40,800 | 0.146 |
| 8 | 320,000 | 24,000 | 19,200 | 43,200 | 0.135 |

* 4 × 40,000 square feet
** Cleaning supplies cost per square feet cleaned = $6,000 ÷ 100,000 = $0.06
*** $0.06 per square foot × 160,000

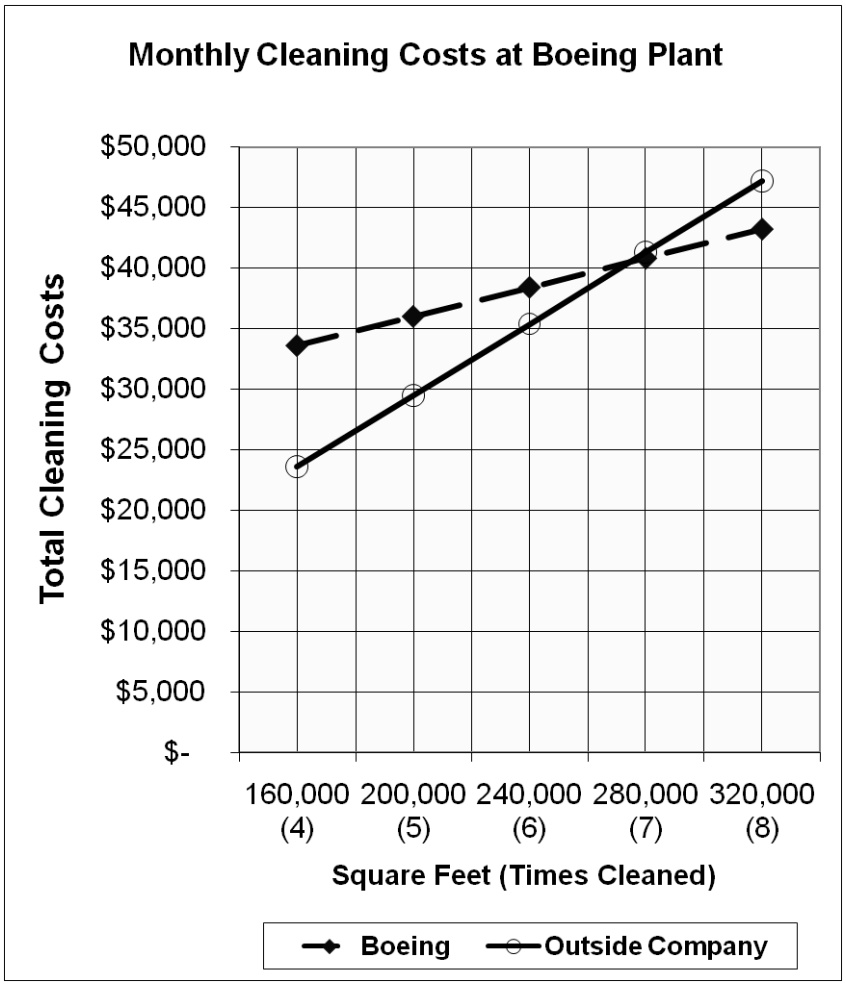
The predicted total cost to clean the plant during the next quarter is the sum of the total costs for monthly cleanings of 5, 6, and 8 times. This is

$$\$36,000 + \$38,400 + \$43,200 = \$117,600$$

2. If Boeing hires the outside cleaning company, all its cleaning costs will be variable at a rate of $5,900 per cleaning. The cost driver will be "number of times cleaned." The predicted cost to clean a total of 5 + 6 + 8 = 19 times is 19 × $5,900 = $112,100. Thus, Boeing will save by hiring the outside cleaning company. The table and chart on the next page show the total costs for the two alternatives. The cost driver for the outsource alternative is different than the cost driver if Boeing cleans the plant with its own employees. If Boeing expects average "times cleaned" to be 7 or more, it would save by cleaning with its own employees.

| Boeing Cleans Plant | | Outsource Cleaning Plant | |
|---|---|---|---|
| Square Feet Cleaned | Boeing | Times Cleaned | Outside |
| 160,000 | $ 33,600 | 4 | $23,600 |
| 200,000 | 36,000 | 5 | 29,500 |
| 240,000 | 38,400 | 6 | 35,400 |
| 280,000 | 40,800 | 7 | 41,300 |
| 320,000 | 43,200 | 8 | 47,200 |



2-A2 (20-25 min.)

1.

Let N = number of units
Sales = Fixed expenses + Variable expenses + Net income
$1.00 N = $6,000 + $.80 N + 0
$.20 N = $6,000
N = 30,000 units

Let S = sales in dollars
S = $6,000 + .80 S + 0
.20 S = $6,000
S = $30,000

Alternatively, the 30,000 units may be multiplied by the $1.00 to obtain $30,000.

In formula form:

In units

$$\frac{\text{Fixed costs + Net income}}{\text{Contribution margin per unit}} = \frac{(\$6{,}000 + 0)}{\$.20} = 30{,}000$$

In dollars

$$\frac{\text{Fixed costs + Net income}}{\text{Contribution margin percentge}} = \frac{(\$6{,}000 + 0)}{.20} = \$30{,}000$$

2. The quick way: (40,000 - 30,000) × $.20 = $2,000

Compare income statements:

| | Break-even Point | Increment | Total |
|---|---|---|---|
| Volume in units | 30,000 | 10,000 | 40,000 |
| Sales | $30,000 | $10,000 | $40,000 |
| Deduct expenses: | | | |
| Variable | 24,000 | 8,000 | 32,000 |
| Fixed | 6,000 | --- | 6,000 |
| Total expenses | 30,000 | 8,000 | 38,000 |
| Effect on net income | $ 0 | $ 2,000 | $ 2,000 |

3. Total fixed expenses would be $6,000 + $1,552 = $7,552

$\frac{\$7,552}{\$.20/\text{unit}} = 37,760$ units; $\frac{\$7,552}{.20} = \$37,760$ sales

or 37,760 × $1.00 = $37,760 sales

4. New contribution margin is $.18 per unit; $6,000 ÷ $.18 = 33,333 units

33,333 units × $1.00 = $33,333 in sales

5. The quick way: (40,000 - 30,000) × $.15 = $1,500. On a graph, the slope of the total cost line would have a kink upward, beginning at the break-even point.

2-A3 (20-30 min.)

The following format is only one of many ways to present a solution. This situation is really a demonstration of "sensitivity analysis," whereby a basic solution is tested to see how much it is affected by changes in critical factors. Much discussion can ensue, particularly about the final three changes.

The basic contribution margin per revenue mile is $1.50 - $1.30 = $.20

| | | (1) Revenue Miles Sold | (2) Contribution Margin Per Revenue Mile | (3) (1)×(2) Total Contribution Margin | (4) Fixed Expenses | (5) (3)-(4) Net Income |
|---|---|---|---|---|---|---|
| 1. | | 800,000 | $.20 | $160,000 | $120,000 | $ 40,000 |
| 2. | (a) | 800,000 | .35 | 280,000 | 120,000 | 160,000 |
| | (b) | 880,000 | .20 | 176,000 | 120,000 | 56,000 |
| | (c) | 800,000 | .07 | 56,000 | 120,000 | (64,000) |
| | (d) | 800,000 | .20 | 160,000 | 132,000 | 28,000 |
| | (e) | 840,000 | .17 | 142,800 | 120,000 | 22,800 |
| | (f) | 720,000 | .25 | 180,000 | 120,000 | 60,000 |
| | (g) | 840,000 | .20 | 168,000 | 132,000 | 36,000 |

2-B1 (20-25 Min.)

1. The cost driver for both resources is square feet cleaned. Labor cost is a fixed-cost resource, and cleaning supplies is a variable cost. Costs for cleaning between 35 and 50 times are:

| Times Cleaned | Square Feet Cleaned | Labor Cost | Cleaning Supplies Cost** | Total Cost | Cost per Square Foot |
|---|---|---|---|---|---|
| 35 | 175,000* | $30,000 | $ 10,500 | $40,500 | $0.2314 |
| 40 | 200,000 | 30,000 | 12,000 | 42,000 | 0.2100 |
| 45 | 225,000 | 30,000 | 13,500 | 43,500 | 0.1933 |
| 50 | 250,000 | 30,000 | 15,000 | 45,000 | 0.1800 |

* 35 × 5,000

** The cost of cleaning supplies per square feet cleaned = $10,500 ÷ 175,000 = $0.06 per square foot.

***Cleaning supplies cost = $0.06 × 175,000 = $10,500.

The predicted total cost to clean during the November and December is the sum of the total costs for monthly cleanings of 45 and 50 times. This is

$43,500 + $45,000 = $88,500

2. If Outback hires the outside cleaning company, all its cleaning costs will be variable at a rate of $0.20 per square foot cleaned. The predicted cost to clean a total of 45 + 50 = 95 times is 95 × 5,000 × $0.20 = $95,000. Thus Outback will not save by hiring the outside cleaning company.

To determine whether outsourcing is a good decision on a permanent basis, Outback needs to know the expected demand for the cost driver over an extended time frame. As the following table and graph show, outsourcing becomes less attractive when cost driver levels are high. If average demand for cleaning is expected to be more than the number of square feet at which the cost of outsourcing equals the internal cost, Outback should continue to do its own cleaning. This point is S square feet, where:

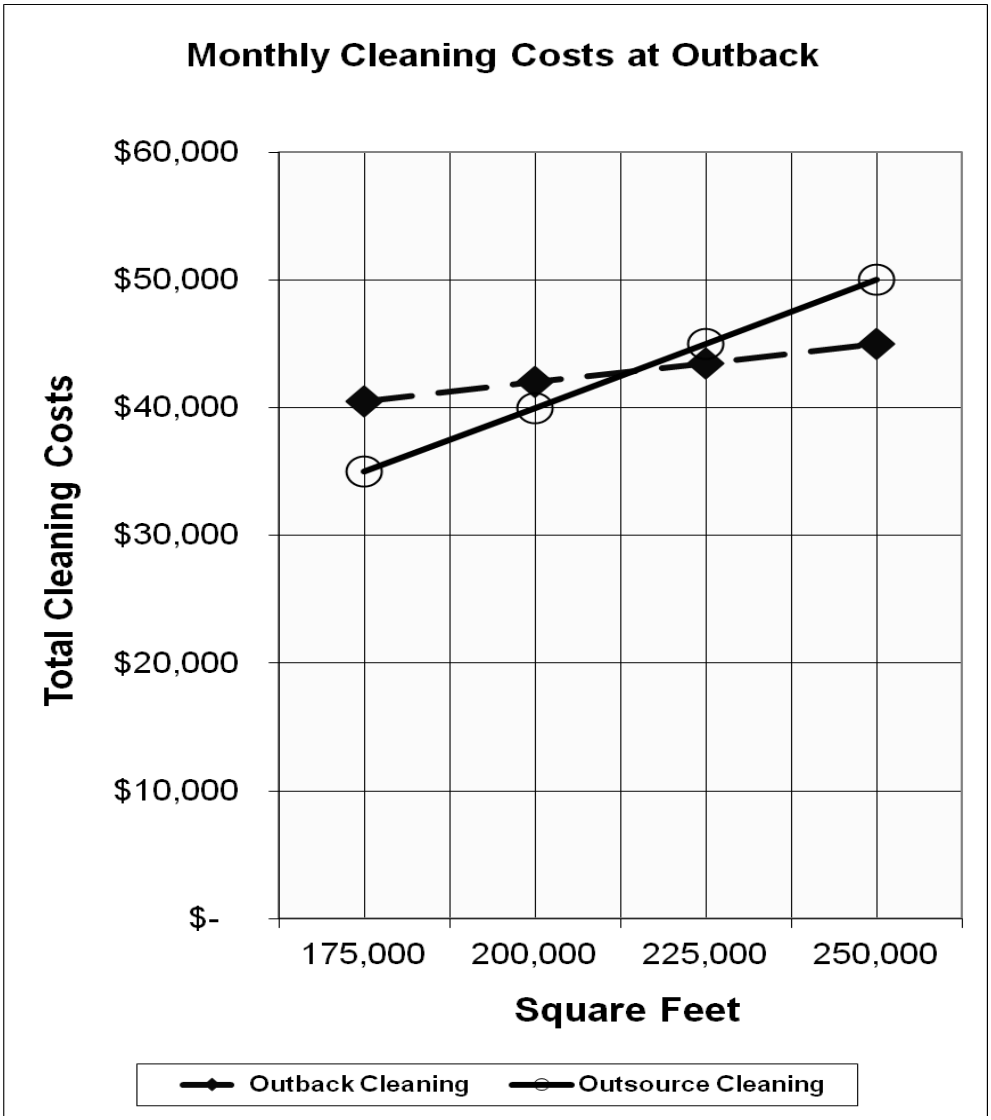
$.20 × S = $30,000 × $.06 × S
S = $30,000 ÷ $.14 = 214,286 square feet
Or 214,286 ÷ 5,000 = 42.9 cleanings

Outback should also consider such factors as quality and cost control when an outside cleaning company is used.

| (1) Times Cleaned | (2) Square Feet Cleaned | (3) Outback Total Cleaning Cost* | Outside Cleaning Cost $.20 × (2) |
|---|---|---|---|
| 35 | 175,000 | $40,500 | $35,000 |
| 40 | 200,000 | 42,000 | 40,000 |
| 45 | 225,000 | 43,500 | 45,000 |
| 50 | 250,000 | 45,000 | 50,000 |

* From requirement 1, total cost is the fixed cost of $30,000 + variable costs of $.06 x square feet cleaned



2-B2 (15-25 min.)

1. $2,300 ÷ ($30 - $10) = 115 child-days
   or 115 × $30 = $3,450 revenue dollars.

2. 176 × ($30 - $10) - $2,300 = $3,520 - $2,300 = $1,220

3. a. 198 × ($30 - $10) - $2,300 = $3,960 - $2,300 = $1,660
   or (22 × $20) + $1,220 = $440 + $1,220 = $1,660

   b. 176 × ($30 - $12) - $2,300 = $3,168 - $2,300 = $868
   or $1,220 - ($2 × 176) = $868

   c. $1,220 - $220 = $1,000

   d. [(9.5 × 22) × ($30 - $10)] - ($2,300 + $300) = $4,180 - $2,600 = $1,580

   e. [(7 × 22) × ($33 - $10)] - $2,300 = $3,542 - $2,300 = $1,242

2-B3 (15-20 min.)

1. $\frac{\$5,000}{(\$20–\$16)} = \frac{\$5,000}{\$4} =$ 1,250 units

2. Contribution margin ratio: $\frac{(\$40,000–\$30,000)}{(\$40,000)} =$ 25%

   $\$8,000 \div 25\% = \$32,000$

3. $\frac{(\$33,000+\$7,000)}{(\$30–\$14)} = \frac{\$40,000}{\$16} =$ 2,500 units

4. ($50,000 - $20,000)(110%) = $33,000 contribution margin;
   $33,000 - $20,000 = $13,000

5. New contribution margin: $40 - ($30 - 20% of $30)
   = $40 - ($30 - $6) = $16;

   New fixed expenses: $80,000 × 110% = $88,000;

   $\frac{(\$88,000+\$20,000)}{\$16} = \frac{\$108,000}{\$16} =$ 6,750 units

2-1 This is a good characterization of cost behavior. Identifying cost drivers will identify activities that affect costs, and the relationship between a cost driver and costs specifies how the cost driver influences costs.

2-2 Two rules of thumb to use are:

a. Total fixed costs remain unchanged regardless of changes in cost-driver activity level.

b. The per-unit variable cost remains unchanged regardless of changes in cost-driver activity level.

2-3 Examples of variable costs are the costs of merchandise, materials, parts, supplies, sales commissions, and many types of labor. Examples of fixed costs are real estate taxes, real estate insurance, many executive and supervisor salaries, and space rentals.

2-4 Fixed costs, by definition, do not vary in total as volume changes *within the relevant range* and during the time period specified (a month, year, etc.). However, when the cost-driver level is outside the relevant range (either less than or greater than the limits) management must decide whether to decrease or increase the capacity of the resource, expressed in cost-driver units. In the long run, all costs are subject to change. For example, the costs of occupancy such as a long-term non-cancellable lease cannot be changed for the term of the lease, but at the end of the lease management can change this cost. In a few cases, fixed costs may be changed by entities outside the company rather than by internal management – an example is the fixed, base charge for some utilities that is set by utility commissions.

2-5 Yes. Fixed costs per unit change as the volume of activity changes. Therefore, for fixed cost per unit to be meaningful, you must identify an appropriate volume level. In contrast, total fixed costs are independent of volume level.

2-6 No. Cost behavior is much more complex than a simple dichotomy into fixed or variable. For example, some costs are not linear, and some have more than one cost driver. Division of costs into fixed and variable categories is a useful simplification, but it is not a complete description of cost behavior in most situations.

2-7 No. The relevant range pertains to both variable and fixed costs. Outside a relevant range, some variable costs, such as fuel consumed, may behave differently per unit of activity volume.

2-8 The major simplifying assumption is that we can classify costs as either variable or fixed with respect to a single measure of the volume of output activity.

2-9 The same cost may be regarded as variable in one decision situation and fixed in a second decision situation. For example, fuel costs are fixed with respect to the addition of one more passenger on a bus because the added passenger has almost no effect on total fuel costs. In contrast, total fuel costs are variable in relation to the decision of whether to add one more mile to a city bus route.

2-10 No. Contribution margin is the excess of sales over all *variable* costs, not *fixed* costs. It may be expressed as a total, as a ratio, as a percentage, or per unit.

2-11 A "break-even analysis" does not describe the real value of a CVP analysis, which shows profit at any volume of activity within the relevant range. The break-even point is often only incidental in studies of cost-volume relationships. CVP analysis predicts how managers' decisions will affect sales, costs, and net income. It can be an important part of a company's planning process.

2-12 No. break-even points can vary greatly within an industry. For example, Rolls Royce has a much lower break-even volume than does Honda (or Ford, Toyota, and other high-volume auto producers).

2-13 No. The CVP technique you choose is a matter of personal preference or convenience. The equation technique is the most general, but it may not be the easiest to apply. All three techniques yield the same results.

2-14 Three ways of lowering a break-even point, holding other factors constant, are: decrease total fixed costs, increase selling prices, and decrease unit variable costs.

2-15 No. In addition to being quicker, incremental analysis is simpler. This is important because it keeps the analysis from being cluttered by irrelevant and potentially confusing data.

2-16 Operating leverage is a firm's ratio of fixed to variable costs. A highly leveraged company has relatively high fixed costs and low variable costs. Such a firm is risky because small changes in volume lead to large changes in net income. This is good when volume increases but can be disastrous when volumes fall.

2-17 An increase in demand for a company's products will drive almost all other cost-driver levels higher. This will cause cost drivers to exceed capacity or the upper end of the relevant range for its fixed-cost resources. Since fixed-cost resources must be purchased in "chunks" of capacity, the proportional increase in cost may exceed the proportional increase in the use of the related cost-driver. Thus cost per cost-driver unit may increase.

2-18 The margin of safety shows how far sales can fall before losses occur – that is before the company reaches the break-even sales level.

2-19 No. In retailing, the contribution margin is likely to be smaller than the gross margin. For instance, sales commissions are deducted in computing the contribution margin but not the gross margin. In manufacturing companies the opposite is likely to be true because there are many fixed manufacturing costs deducted in computing gross margin.

2-20 No. CVP relationships pertain to both profit-seeking and nonprofit organizations. In particular, managers of nonprofit organizations must deal with tradeoffs between variable and fixed costs. To many government department managers, lump-sum budget appropriations are regarded as the available revenues.

2-21 Contribution margin could be lower because the proportion of sales of the product bearing the higher unit contribution margin declines.

2-22

$$\text{Target income before income taxes} = \frac{\text{Target after-tax net income}}{1 - \text{tax rate}}$$

2-23

$$\text{Change in net income} = \text{Change in volume in units} \times \text{Contribution margin per unit} \times (1 - \text{tax rate})$$

2-24 The key to determining cost behavior is to ask, "If there is a change in the level of the cost driver, will the total cost of the resource change immediately?" If the answer is yes, the resource cost is variable. If the answer is no, the resource cost is fixed. Using this question as a guide, the cost of advertisements is normally variable as a function of the number of advertisements. Note that because the number of advertisements may not vary with the level of sales, advertising cost may be fixed with respect to the cost driver "level of sales." Salaries of marketing personnel are a fixed cost. Travel costs and entertainment costs can be either variable or fixed depending on the policy of management. The key question is whether it is necessary to incur additional travel and entertainment costs to generate added sales.

2-25 The key to determining cost behavior is to ask, "If there is a change in the level of the cost driver, will the total cost of the resource change immediately?" If the answer is yes, the resource cost is variable. If the answer is no, the resource cost is fixed. Using this question as a guide, the cost of labor can be fixed or variable as a function of the number of hours worked. Regular wages may be fixed if there is a commitment to the laborers that they will be paid for normal hours regardless of the workload. However, overtime and temporary labor wages are variable. The depreciation on plant and machinery is not a function of the number of machine hours used and so this cost is fixed.

2-26 Suggested value chain functions are listed below.

| New Products | New Technology | New Positioning Strategies | New Pricing |
|---|---|---|---|
| ❑ Marketing<br>❑ R & D<br>❑ Design | ❑ R & D<br>❑ Design | ❑ Marketing<br>❑ Support functions | ❑ Marketing |

2-27 (10 –15 min.)

| Situation | Best Cost Driver | Justification |
|---|---|---|
| 1. | Number of Setups | Because each setup takes the same amount of time, the best cost driver is number of setups. Data is both plausible, reliable, and easy to maintain. |
| 2. | Setup Time | Longer setup times result in more consumption of mechanics' time. Simply using number of setups as in situation 1 will not capture the diversity associated with this activity. |
| 3. | Cubic Feet | Assuming that all products are stored in the warehouse for about the same time (that is inventory turnover is about the same for all products), and that products are stacked, the volume occupied by products is the best cost driver. |
| 4. | Cubic Feet Weeks | If some types of product are stored for more time than others, the volume occupied must be multiplied by a time dimension. For example, if product A occupies 100 cubic feet for an average of 2 weeks and product B occupies only 40 cubic feet but for an average of 10 weeks, product B should receive twice as much allocation of warehouse occupancy costs. |
| 5. | Number of Orders | Because each order takes the same amount of time, the best cost driver is number of orders. Data is both plausible, reliable, and easy to maintain. |
| 6. | Number of Orders | Each order is for different types of products but there is not diversity between them in terms of the time it takes to process the order. (If there was variability in the number of product types ordered, the best driver would be number of order line items.) |

2-28 (5-10 min.)

| | | | |
|---|---|---|---|
| 1. | Contribution margin | = $900,000 - $500,000 | = $400,000 |
| | Net income | = $400,000 - $330,000 | = $ 70,000 |
| 2. | Variable expenses | = $800,000 - $350,000 | = $450,000 |
| | Fixed expenses | = $350,000 - $ 80,000 | = $270,000 |
| 3. | Sales | = $600,000 + $360,000 | = $960,000 |
| | Net income | = $360,000 - $250,000 | = $110,000 |

2-29 (5-10 min.)

The $280,000 annual advertising fee is a fixed cost. The $6,000 cost for each advertisement is a variable cost.

If the total number of ads is 50 the total cost of advertising is

$280,000 + 50 × $6,000 = $580,000

If the number of ads is twice as many, the total cost is

$280,000 + 100 × $6,000 = $880,000.

The total cost of advertising does not double in response to a doubling of the number of ads because the fixed costs do not change.

2-30 (5-10 min.)

The $3,200,000 annual salaries of sales personnel is a fixed cost. The sales commissions, travel costs, and entertainment costs are variable costs.

If the total sales dollars is $24 million, the total cost of the selling activity is

$3,200,000 + .20 × $24,000,000 = $8,000,000

If the total sales dollars is only $12 million, the total cost of the selling activity is

$3,200,000 + .20 × $12,000,000 = $5,600,000.

The total cost of the selling activity does not decrease by 50% because the fixed costs do not change.

2-31 (10-20 min.)

1.
$$
\begin{aligned}
d &= c \times (a - b) \\
\$720{,}000 &= 120{,}000 \times (\$25 - b) \\
b &= \$19 \\
f &= d - e \\
&= \$720{,}000 - \$650{,}000 = \$70{,}000
\end{aligned}
$$

2.
$$
\begin{aligned}
d &= c \times (a - b) \\
&= 100{,}000 \times (\$10 - \$6) = \$400{,}000 \\
f &= d - e \\
&= \$400{,}000 - \$320{,}000 = \$80{,}000
\end{aligned}
$$

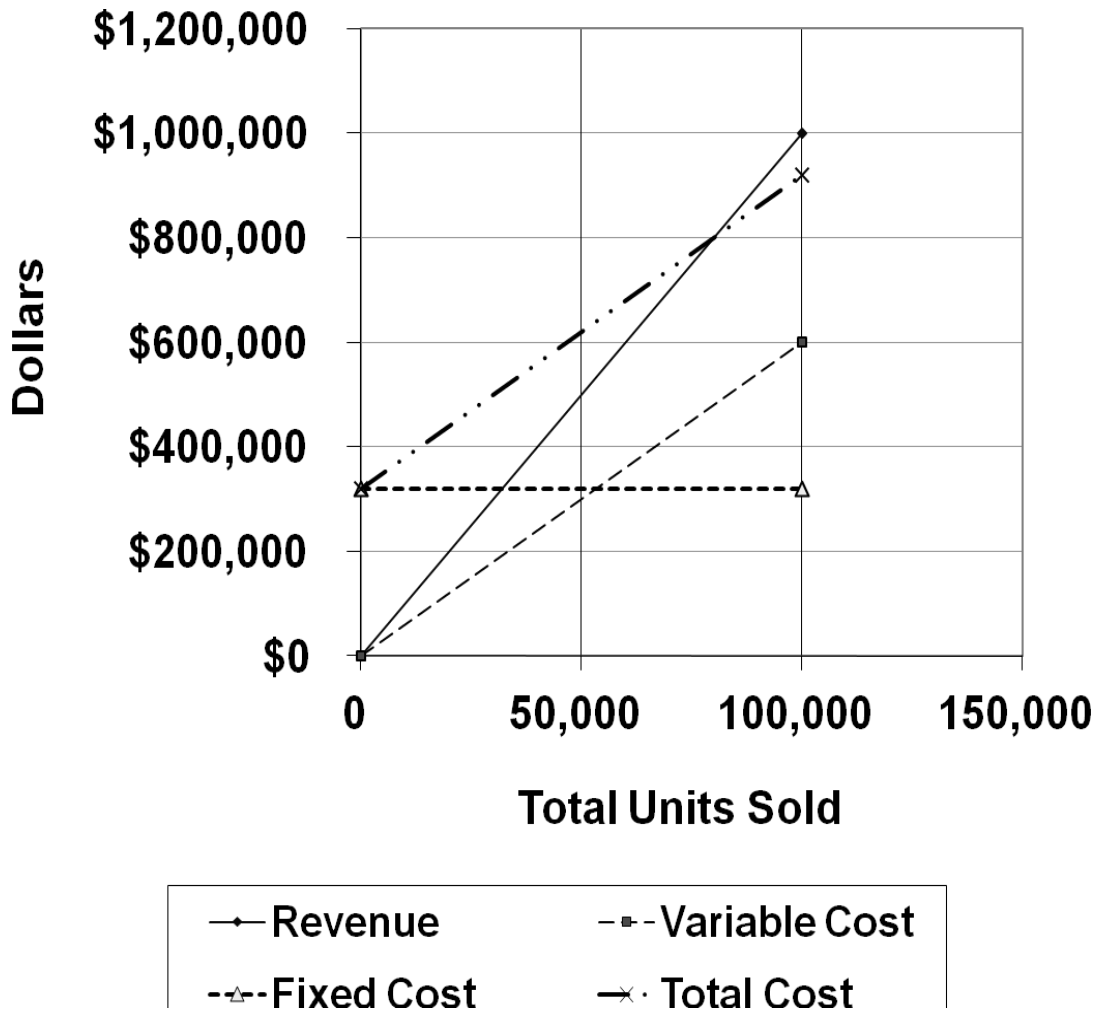
3.
$$
\begin{aligned}
c &= d \div (a - b) \\
&= \$100{,}000 \div \$5 = 20{,}000 \text{ units} \\
e &= d - f \\
&= \$100{,}000 - \$15{,}000 = \$85{,}000
\end{aligned}
$$

4.
$$
\begin{aligned}
d &= c \times (a - b) \\
&= 60{,}000 \times (\$30 - \$20) \\
&= \$600{,}000 \\
e &= d - f \\
&= \$600{,}000 - \$12{,}000 = \$588{,}000
\end{aligned}
$$

5.
$$
\begin{aligned}
d &= c(a - b) \\
\$160{,}000 &= 80{,}000(a - \$9) \\
a &= \$11 \\
f &= d - e \\
&= \$160{,}000 - \$110{,}000 = \$50{,}000
\end{aligned}
$$

2-32 (10 min.)

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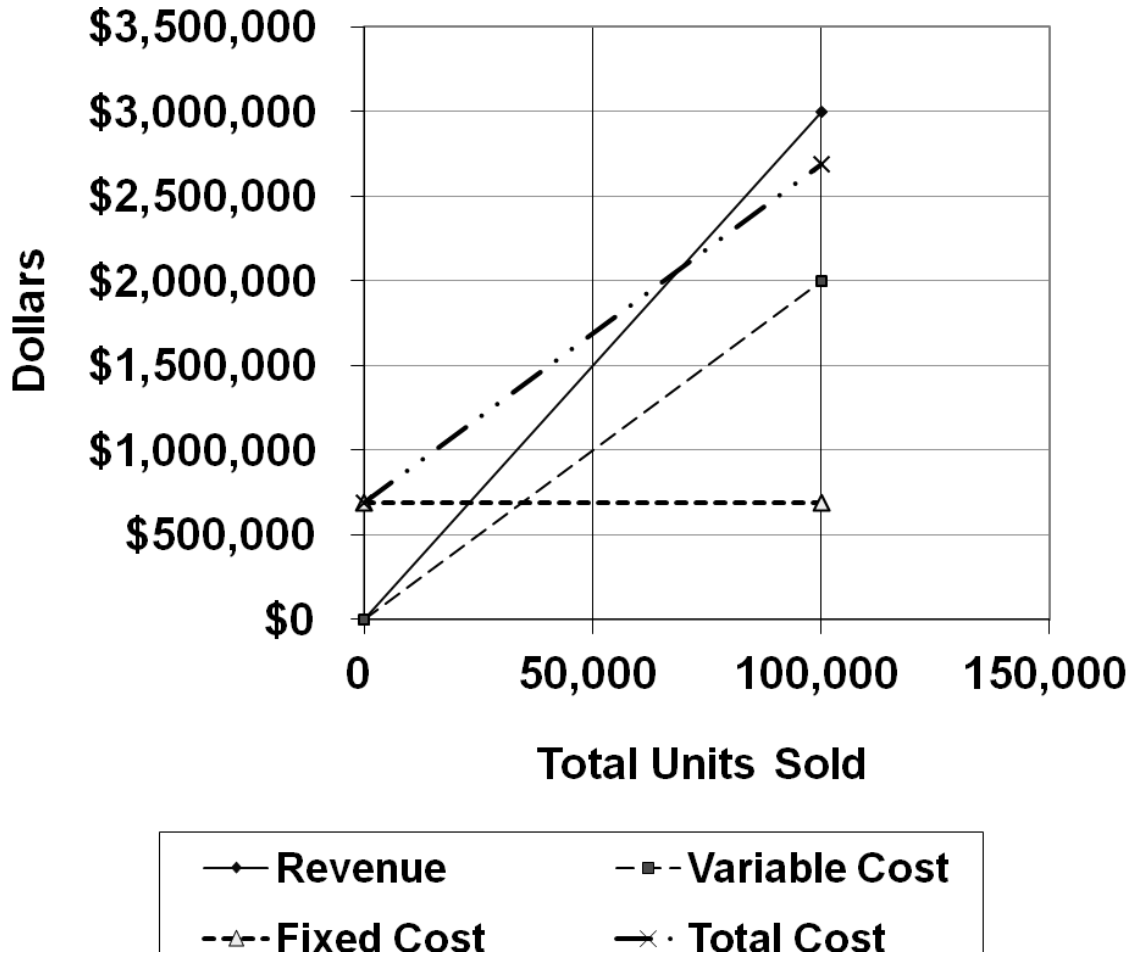
Using the graph above, the *estimated* breakeven point in total units sold is about 80,000. The *estimated* net income for 100,000 units sold is $80,000 ($1,000,000 - $920,000).

2-33 (10 min.)

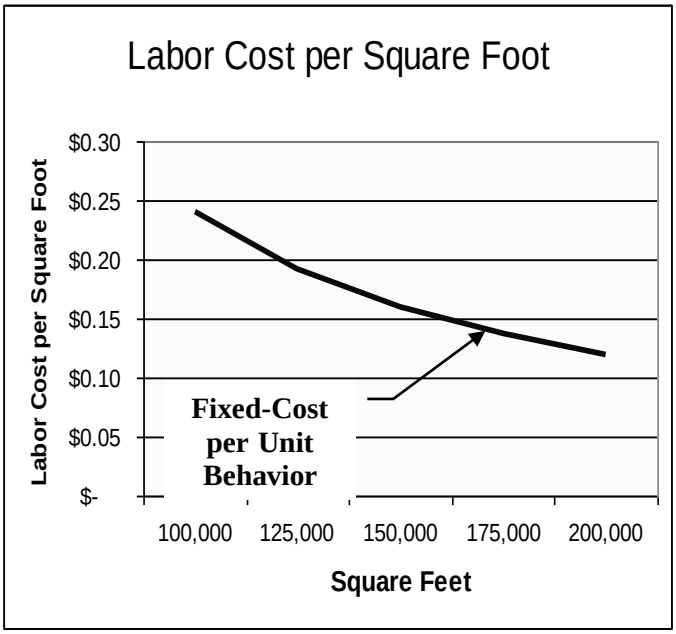


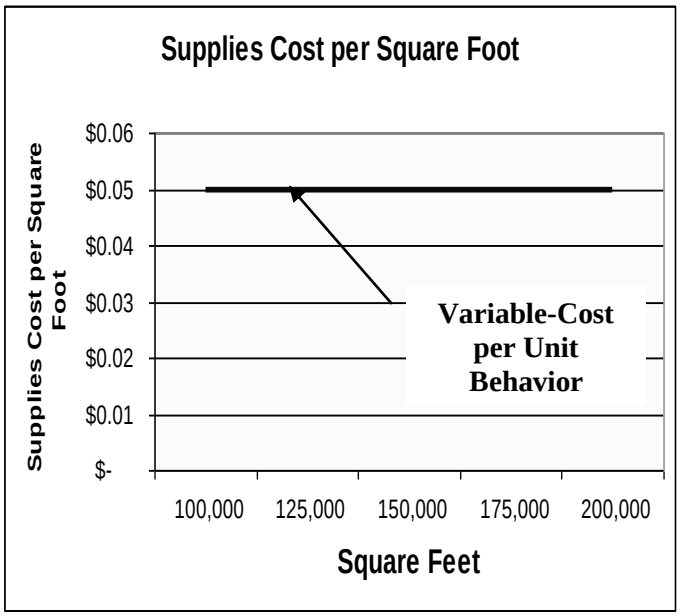

Using the graph above, the *estimated* breakeven point in total units sold is about 60,000 (actual breakeven volume is 58,800). The *estimated* net loss for 50,000 units sold is $88,000 (revenue of $1,500,000 – total cost of $1,588,000 or CM of $500,000 less fixed cost of $588,000).

2-34 (20–25 min.)

| Square Feet | Labor Cost | Labor Cost per Square Foot | Supplies Cost | Supplies Cost per Square Foot |
|---|---|---|---|---|
| 100,000 | $24,000 | $ 0.240 | $ 5,000 | $0.050 |
| 125,000 | 24,000 | $ 0.192 | 6,250 | 0.050 |
| 150,000 | 24,000 | $ 0.160 | 7,500 | 0.050 |
| 175,000 | 24,000 | $ 0.137 | 8,750 | 0.050 |
| 200,000 | 24,000 | $ 0.120 | 10,000 | 0.050 |



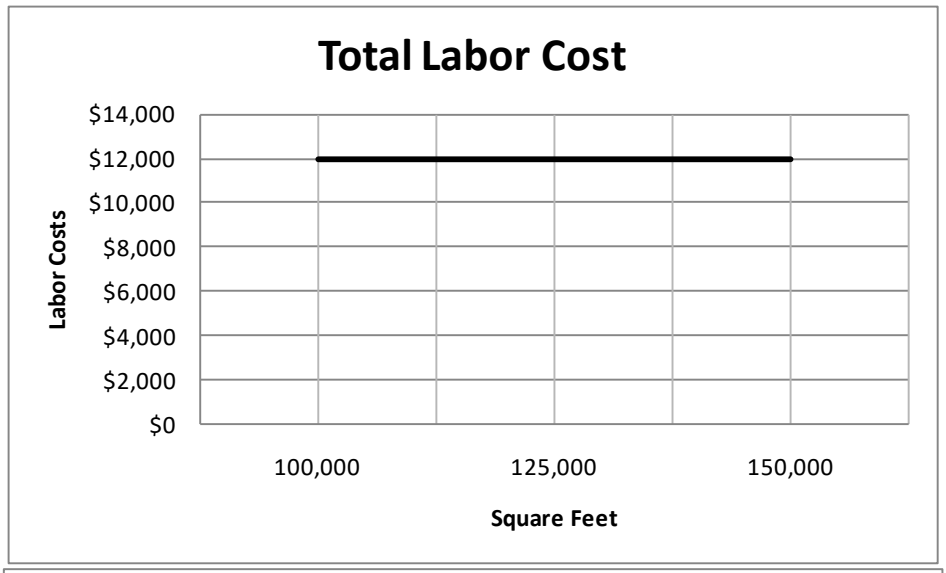



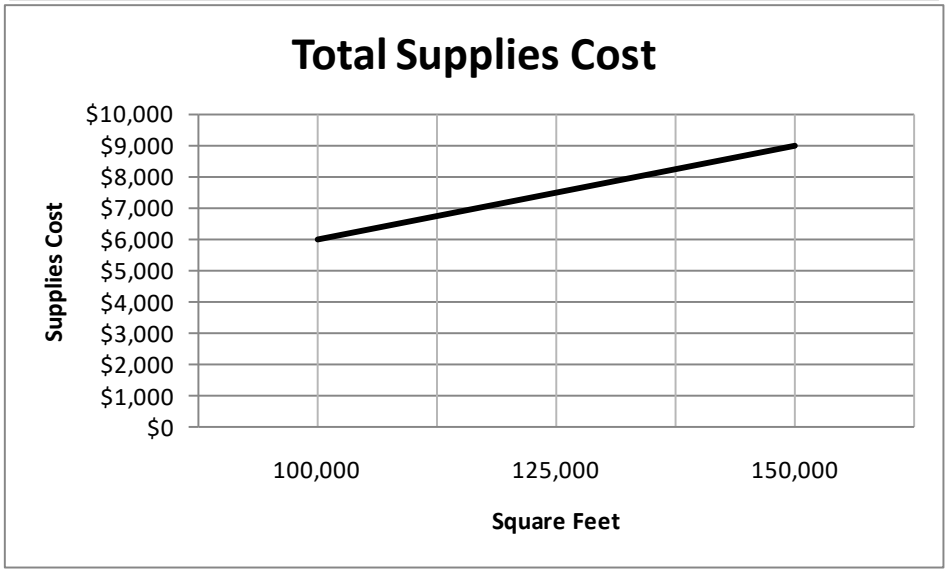

 

2-35 (20-25 min.)

| Square Feet | Labor Cost Per Square Foot (Estimated) | Total Labor Cost* | Supplies Cost per Square Foot | Supplies Cost |
|---|---|---|---|---|
| 100,000 | $0.12 | $12,000 | $0.06 | $ 6,000 |
| 125,000 | 0.10 | 12,500 | 0.06 | 7,500 |
| 150,000 | 0.08 | 12,000 | 0.06 | 9,000 |

* The estimates for labor cost per square foot yield slightly different total labor cost estimates. In the graph below, $12,000 is used.



2-36 (10 min.)

1.

| | | |
|---|---|---|
| Let TR | = | total revenue |
| TR - .20(TR) -$40,000,000 | = | 0 |
| .80(TR) | = | $40,000,000 |
| TR | = | $50,000,000 |

2. Daily revenue per patient = $50,000,000 ÷ 40,000 = $1,250. This may appear high, but it includes the room charge plus additional charges for drugs, x-rays, and so forth.

2-37 (10 min.)

1. The break-even point in total revenue is fixed cost divided by the contribution-margin ratio (CMR). CMR equals 1 – Variable-Cost Ratio.

Break-even Point = Fixed Cost ÷ CMR = $42,000,000 ÷ (1 – 0.7) = $140,000,000.

2.

a.

| | |
|---|---|
| Total revenue | $150,000,000 |
| Variable cost (.7 × 150,000,000) | 105,000,000 |
| Contribution margin | 45,000,000 |
| Fixed costs | 42,000,000 |
| Net profit | $ 3,000,000 |

b.

| | |
|---|---|
| Total revenue | $150,000,000 |
| Variable cost (1.1 × .7 × 150,000,000) | 115,500,000 |
| Contribution margin | 34,500,000 |
| Fixed costs | 42,000,000 |
| Net loss | $ (7,500,000) |

2-38 (15 min.)

1.

| | 100% Full | 50% Full |
|---|---|---|
| Room revenue @ $50 | $1,825,000 [a] | $ 912,500 [b] |
| Variable costs @ $10 | 365,000 | 182,500 |
| Contribution margin | 1,460,000 | 730,000 |
| Fixed costs | 1,200,000 | 1,200,000 |
| Net income (loss) | $ 260,000 | $ (470,000) |

[a] 100 × 365 = 36,500 rooms per year
36,500 × $50 = $1,825,000

[b] 50% of $1,825,000 = $912,500

2.

Let N = number of rooms
$50N -$10N - $1,200,000 = 0
N = $1,200,000 ÷ $40 = 30,000 rooms
Percentage occupancy = 30,000 ÷ 36,500 = 82.2%

2-39 (15 min.)

1. $23. To compute this, let X be the variable cost that generates $1 million in profits:

$$(\$48 - X) \times 800{,}000 - \$19{,}000{,}000 = \$1{,}000{,}000$$
$$(\$48 - X) = (\$1{,}000{,}000 + \$19{,}000{,}000) \div 800{,}000$$
$$\$48 - X = \$200 \div 8 = \$25$$
$$X = \$48 - \$25 = \$23$$

2. Loss of $600,000:

($48 - $25) × 800,000 - $19,000,000
= ($23 × 800,000) - $19,000,000
= $18,400,000 - $19,000,000
= ($600,000)

2-40 (15-20 min.)

1. Let R = pints of raspberries and 2R = pints of strawberries
sales - variable expenses - fixed expenses = zero net income

$$\$1.10(2R) + \$1.45(R) - \$.75(2R) - \$.95(R) - \$15,600 = 0$$
$$\$2.20R + \$1.45R - \$1.50R - \$.95R - \$15,600 = 0$$
$$\$1.2R - \$15,600 = 0$$

R = 13,000 pints of raspberries
2R = 26,000 pints of strawberries

2. Let S = pints of strawberries
($1.10 - $.75) × S - $15,600 = 0
.35S - $15,600 = 0
S = 44,571 pints of strawberries

3. Let R = pints of raspberries
($1.45 - $.95) × R - $15,600 = 0
$.50R - $15,600 = 0
R = 31,200 pints of raspberries

2-41 (10 min.)

1. $1.50N - $1.20N - $18,000 = $864 ÷ (1 - .25)
$.30N = $18,000 + ($864 ÷ .75)
$.30N = $18,000 + $1,152
N = $19,152 ÷ $.30 = 63,840 units

2. $1.50N - $1.20N - $18,000 = $1,440 ÷ (1 - .25)
$.30N = $18,000 +( $1,440 ÷ .75)
$.30N = $18,000 + $1,920
N = $19,920 ÷ $.30 = 66,400 units

2-42 (15 min.)

Several variations of the following general approach are possible:

$$\text{Sales} - \text{Variable expenses} - \text{Fixed expenses} = \frac{\text{Target after-tax net income}}{1 - \text{tax rate}}$$

$$S - .75S - \$440{,}000 = \frac{\$84{,}000}{(1-.3)}$$

$$.25S = \$440{,}000 + \$120{,}000$$

$$S = \$560{,}000 \div .25 = \$2{,}240{,}000$$

| Check: | | |
|---|---|---|
| | Sales | $2,240,000 |
| | Variable expenses (75%) | 1,680,000 |
| | Contribution margin | 560,000 |
| | Fixed expenses | 440,000 |
| | Income before taxes | $ 120,000 |
| | Income taxes @ 30% | 36,000 |
| | Net income | $ 84,000 |

2-43 (40-50 min.)

1. Several variations of the following general approach are possible:

Let N = Unit Sales.

Sales - Variable expenses - Fixed expenses = Profit
$3N – $2.2N – ($3,000 + $2,000 + $5,000) = $2,000
$.8N - $10,000 = $2,000
N = $12,000 ÷ $.8 = 15,000 glasses of beer

| | | |
|---|---|---|
| Check: | Sales (15,000 × $3) | $45,000 |
| | Variable expenses (15,000 × $2.2) | 33,000 |
| | Contribution margin | 12,000 |
| | Fixed expenses | 10,000 |
| | Profit | $ 2,000 |

2. $3N – $2.2N - $10,000 = .05 × ($3N)

N = $10,000 ÷ ($.8 - $.15) = 15,385 glasses of beer

3. $1,560 ÷ ($1.25 - $.70) = 2,836 hamburgers

4. (2,000 × $.55) + (3,000 × $.80) - $1,560 = $1,100 + $2,400 - $1,560 = $1,940

5. $1,560 ÷ ($.8 + $.55) = 1,156 new customers are needed to breakeven on the new business.

A sensitivity analysis would help provide Joe with an assessment of the financial risks associated with the new hamburger business. Suppose that Joe is confident that demand for hamburgers would range between break-even ± 500 new customers and that expected fixed costs will not change within this range. The contribution margin generated by each new customer is $1.35 so Joe will realize a maximum loss or profit from the new business in the range ± $1.35 × 500 = ± $675.

Another way to assess financial risk that Joe should be aware of is the company's operating leverage (the ratio of fixed to variable costs). A highly leveraged company has relatively high fixed costs and low variable costs. Such a firm is risky because small changes in volume lead to large changes in net income. This is good when volume increases but can be disastrous when volumes fall.

6. The additional cost of hamburger ingredients is .5 × $.70 = $.35. Any price above the current price of $1.25 plus $.35, or $1.70, will improve profits.

2-44 (30-40 min.)

1. The cost of labor and rent is fixed at $24,000 per month. Cleaning supplies cost varies in proportion to the number of times the store is cleaned. The cost per cleaning is $10,800 ÷ 60 = $180.

| Number of Times Store Is Cleaned | Labor & Rent Cost | Cleaning Supplies Cost at $180 per Cleaning | Total Cost | Cost per Cleaning |
|---|---|---|---|---|
| 35 | $24,000 | $6,300 | $30,300 | $865.71 |
| 40 | 24,000 | 7,200 | 31,200 | 780.00 |
| 45 | 24,000 | 8,100 | 32,100 | 713.33 |
| 50 | 24,000 | 9,000 | 33,000 | 660.00 |
| 55 | 24,000 | 9,900 | 33,900 | 616.36 |
| 60 | 24,000 | 10,800 | 34,800 | 580.00 |

The total cost of cleaning for the next quarter is:

| | | |
|---|---|---|
| Total cost | = | Total Fixed Cost + Total Variable Cost |
| | = | 3 × $24,000 + (50 + 46 + 35) × $180 per Cleaning |
| | = | $72,000 + $23,580 |
| | = | $95,580 |

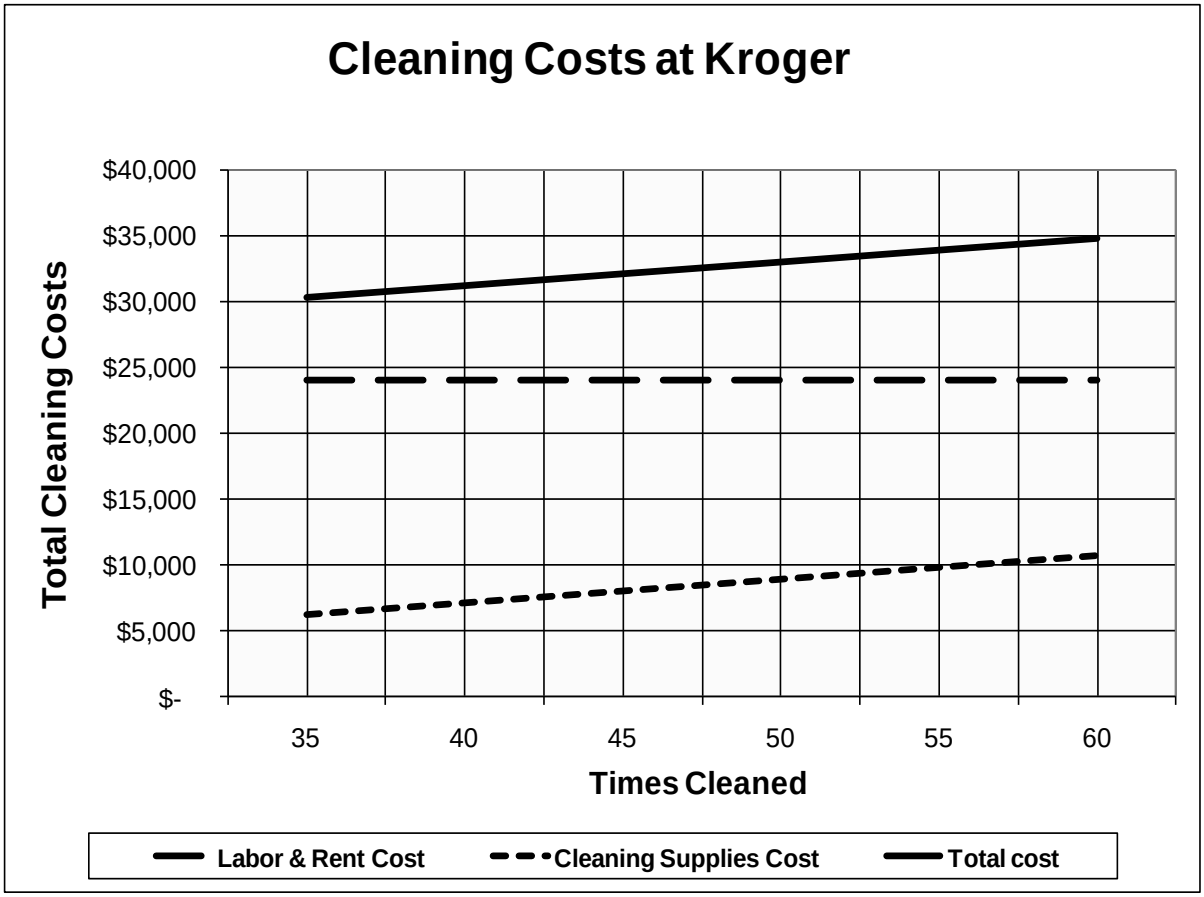
2. See the chart on the next page.

3.

| | Costs of Kroger Cleaning Store | | | |
|---|---|---|---|---|
| Number of Times Store Is Cleaned | Labor & Rent Cost | Cleaning Supplies Cost | Total Cost | Cleaning Cost |
| 35 | $24,000 | $ 6,300 | $30,300 | $23,800 |
| 46 | 24,000 | 8,280 | 32,280 | 31,280 |
| 50 | 24,000 | 9,000 | 33,000 | 34,000 |
| | | | $95,580 | $89,080 |

Kroger will save $95,580- $89,080 = $6,500 by using the outside cleaning company, as shown in the above schedule.

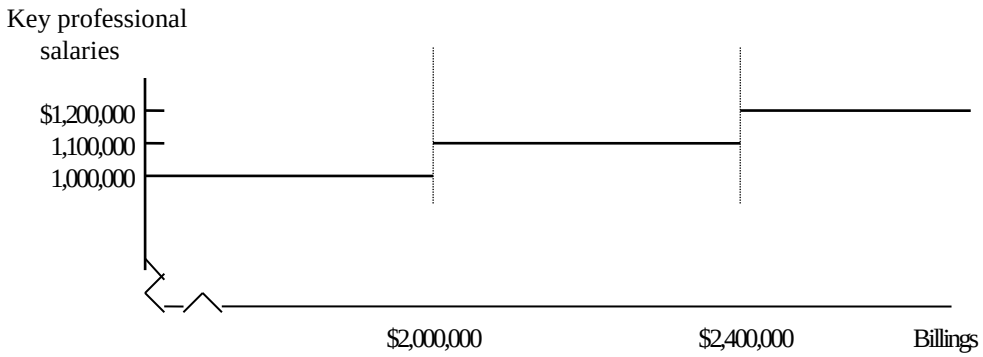


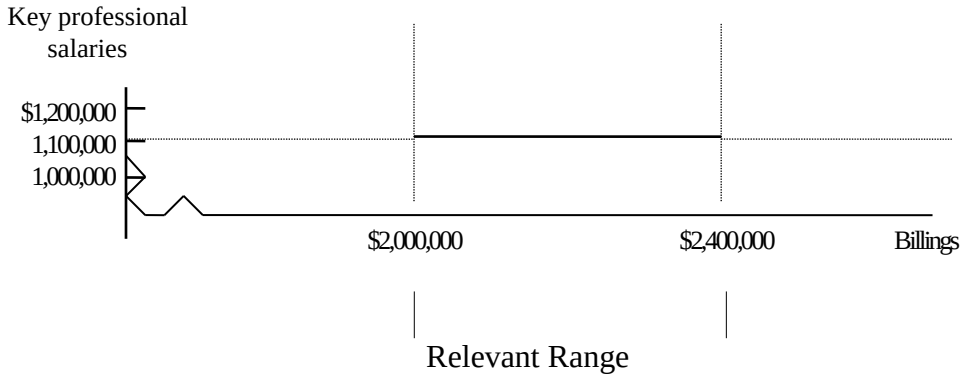
2-45 (10-15 min.)

The answer is $1,100,000.

Refined analysis:




Practical analysis:



2-46 (15-20 min.)

1. Microsoft: ($60,420 - $11,598) ÷ $60,420 = .81 or 81%

   Procter & Gamble: ($83,503 - $40,695) ÷ $83,503) = .51 or 51%

   There is very little variable cost for each unit of software sold by Microsoft, while the variable cost of the soap, cosmetics, foods, and other products of Procter & Gamble is substantial.

2. Microsoft: $10,000,000 × .81 = $8,100,000

   Procter & Gamble: $10,000,000 × .51 = $5,100,000

3. By assuming that changes in sales volume do not move the volume outside the relevant range, we know that the total contribution margin generated by any added sales will be added to the operating income. Thus, we can simply multiply the contribution margin percentage by the changes in sales to get the change in operating income.

   The main assumption we make is that the sales volume remains in the relevant range so that total fixed costs do not change and unit variable cost remain unchanged. This generally means that such predictions will apply only to small changes in volume – changes that do not cause either the addition or reduction of capacity.

2-47 (15-20 min.)

| | | | Film | Refreshments | Total |
|---|---|---|---|---|---|
| 1. | Revenue from admissions | | $2,250 | $270 [b] | $2,520 |
| | Variable costs | | 1,125 [a] | 162 [c] | 1,287 |
| | Contribution margin | | $1,125 | $108 | $1,233 |
| | Fixed costs: | | | | |
| | Auditorium rental | $330 | | | |
| | Labor | 435 | | | 765 |
| | Operating income | | | | $ 468 |

[a] .50 × $2,250 = $1,125

[b] .12 × $2,250 = $270

[c] .60 × $ 270 = $162

Some labor might be exclusively devoted to refreshments. Labor might be allocated, but such a discussion is not the major point of this chapter.

| | | | Film | Refreshments | Total |
|---|---|---|---|---|---|
| 2. | Revenue from admissions | | $1,400.00 | $168.00[b] | $1,568.00 |
| | Variable costs | | 750.00[a] | 100.80[c] | 850.80 |
| | Contribution margin | | $650.00 | $ 67.20 | $ 717.20 |
| | Fixed costs: | | | | |
| | Auditorium rental | $330 | | | |
| | Labor | 435 | | | 765.00 |
| | Operating income (loss) | | | | $ (47.80) |

[a] Guarantee is $750

[b] .12 × $1,400 = $168

[c] .60 × $168 = $100.80

3. The offer would shift the risk completely to the movie producer, whereas ordinarily the theater owner bears a great deal of the risk. The owner is assured of a specified income; the producer then reaps the reward or bears the cost of the actual attendance level.

2-48 (15 min.)

1. Let X = amount of additional fixed costs for advertising

$$(1{,}100{,}000 \times £13) + £300{,}000 - .30(1{,}100{,}000 \times £13) - (£7{,}000{,}000 + X) = 0$$

$$£14{,}300{,}000 + £300{,}000 - £4{,}290{,}000 - £7{,}000{,}000 - X = 0$$

$$X = £14{,}600{,}000 - £11{,}290{,}000$$

$$X = £3{,}310{,}000$$

2. Let Y = number of seats sold

$$£13Y + £300{,}000 - .30(£13)Y - £9{,}000{,}000 = £500{,}000$$

$$£9.10Y = £9{,}200{,}000$$

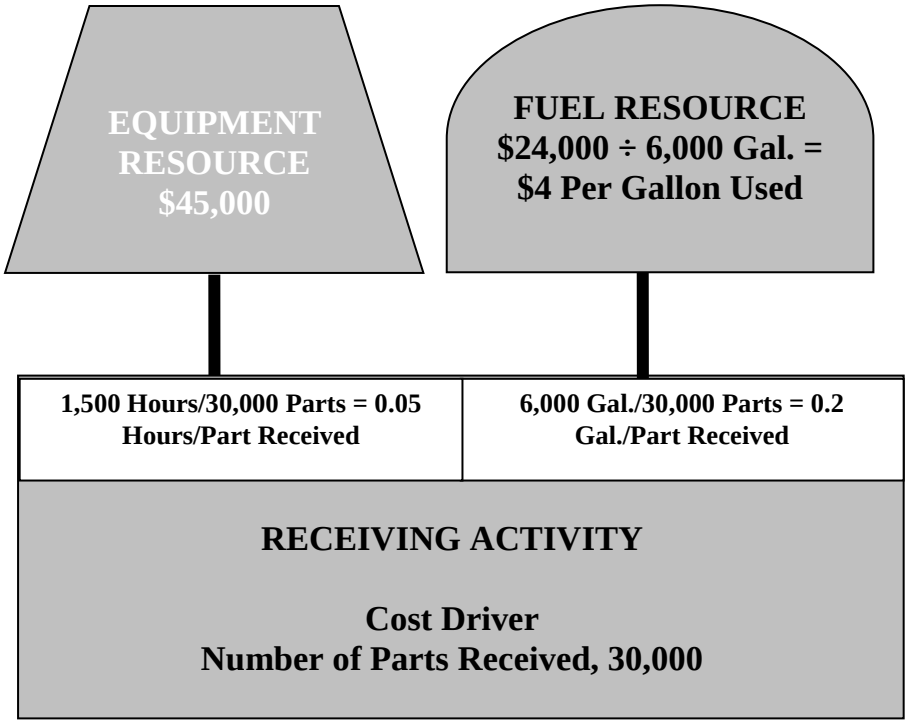
$$Y = 1{,}010{,}989 \text{ seats}$$

2-49 (45-55 min.)

1. Exhibit A shows the relationships between the receiving activity and the resources used. This information can now be used for cost control purposes. Knowing the rates gallons per part received and machine hours operated per part received will help operating managers predict costs. These rates are good measures of productivity in the receiving department.

Exhibit A




2. When the activity level increases, the use of resources will increase. Thus, the output measures or cost driver levels will increase – that is, total hours and total gallons. Normally, productivity rates such as gallons per part received and hours operated per part received will not change significantly unless there is action taken to improve efficiency or factors act to decrease efficiency.

An equation can be derived to predict total cost using the above concept.

Total Cost = Variable Cost of Fuel + Fixed Cost of Equipment
= (Number of Parts Received × Gallon/Part × Price/Gallon) + $45,000

The total cost of receiving 40,000 parts is

(40,000 parts × 0.2 Gallon/Part × $4/Gallon) + $45,000 = $77,000

3. The new fuel consumption rate will be .80 × 0.2 gallons/part received = 0.16 gallons per part received. The predicted cost of receiving 30,000 parts is

   (30,000 Parts × 0.16 Gallons/Part × $4.00 per Gallon) + $45,000
   = $19,200 + $45,000 = $64,200.

   The receiving department will not achieve the 10% cost reduction goal of $62,100 even though productivity in fuel usage improved by 20% The reason is the lack of cost reduction in the fixed equipment costs that dominate the total cost of receiving. Perhaps management should consider setting cost reduction goals in the light of knowledge of cost behavior.

4. The new model contains productivity measures that are controllable by operating managers who are responsible for costs incurred. As a result, management can expect higher levels exerted effort by managers as well as improvement in cost control.

5. One refinement is to note that total fuel usage is a function of both the efficiency in machine use as well as efficiency in fuel consumption. In terms of productivity metrics this can be expressed as follows:

Current model:
Total Fuel Cost = $/Gallon × Gallons/Part Received × Total Number of Parts Received.

Refined model:
Total Fuel Cost = $/Gallon × Gallons Used/Operating Hour × Operating Hours/Part Received × Total Number of Parts Received.

The refined model has two productivity measures instead of only one. Both these measures are controllable by operating managers in the receiving department. As a result, management can focus effort in two areas of potential improvement. For example, if there was a 20% improvement in both these productivity measures, the total fuel cost would be

Total fuel cost = $4/Gal. × .8 × 4 Gal./Hour Operated × .8 × .05* Hours Operated/Part Received × 30,000 Parts Received = $15,360.

* 1,500 operating hours/30,000 parts received

The predicted total cost of receiving would then be

$15,360 + $45,000 = $60,360 and the target goal would be achieved.

2-50 (20-30 min.)

Many shortcuts are available, but this solution uses the equation technique.

1. Let N = meals sold
Sales - Variable expenses - Fixed expenses = Profit before taxes
$19N - $10.60N - $21,000 = $8,400
N = $29,400 ÷ $8.40
N = 3,500 meals

2. $19N - $10.60N - $21,000 = $0
N = $21,000 ÷ $8.40
N = 2,500 meals

3. $23N - $12.50N - $29,925 = $8,400
N = $38,325 ÷ $10.50
N = 3,650 meals

4. Profit = ($23 × 3,150) – ($12.50 × 3,150) - $29,925
Profit = $3,150

5. Profit = ($23 × 3,450) –($12.50 × 3,450) - ($29,925 + $2,000)
Profit = $36,225 - $31,925
Profit = $4,300, an increase of $1,150.

A shortcut, incremental approach follows:

| | |
|---|---|
| Increase in contribution margin, 300 × $10.50 | $3,150 |
| Increase in fixed costs | 2,000 |
| Increase in profit | $1,150 |

2-51 (10-15 min.)

1. The break-even point is \$65 fixed cost ÷ \$2 per day = 32.5 days
2. The break-even point is about \$7 fixed cost ÷ [\$2 – (.40×\$2)] = 5.8 days
3. Let N = 50 days rented.

   Under the traditional system the total income is

   Revenue – variable cost – fixed cost = \$2×N - \$0×N - \$65
   = \$100 - \$65
   = \$35

   Under the new system the income is

   Revenue – variable cost – fixed cost = \$2×N – (.4×\$2×N) - \$7
   = \$100 - \$40 - \$7
   = \$ 53
4. Under the traditional system there would be a loss of \$53.

   \$2×6 - \$65 = (\$53)

   Under the new system there would be an income of 20 ¢.

   \$2×6 – (.4×\$2×6) - \$7 = \$.20

5. Blockbuster reduces its risk substantially under the new system because it reduces its fixed cost.

2-52 (10-15 min.) Amounts are in millions (rounded with slight rounding errors).

| | |
|---|---|
| Net sales (.8 × $83,503) | $66,802 |
| Variable costs: | |
| Cost of goods sold (.8 × $40,695) | 32,556 |
| Contribution margin | 34,246 |
| Fixed costs: | |
| Selling, administrative, and general expenses | 25,725 |
| Operating income | $8,521 |

The percentage decrease in operating income would be ($8,521 ÷ $17,083) - 1 = -.501 or 50.1%, compared with a 20% decrease in sales. The contribution margin would decrease by 20% or .20 × ($83,503 - $40,695) = $8,562 million. Because fixed costs would not change (assuming the new volume is within the relevant range), operating income would also decrease by $8,562 million, from $17,083 million to $8,521 million. If all costs had been variable, fixed costs would have decreased by an additional .20 × $25,725 = $5,145 million, making operating income $8,521 + $5,145 = $13,666 million, a 20% decrease under the 2008 operating income of $17,083 million. Because of the existence of fixed costs, the percentage decrease in operating income will exceed the percentage decrease in sales.

2-53 (15-25 min.)

1.

| | |
|---|---|
| Average revenue per person | $4.00 + 3($1.50) = $8.50 |
| Total revenue, 200 @ $8.50 = | $1,700 |
| Rent | 600 |
| Total available for prizes and operating income | $1,100 |

The church could award $1,100 and break even.

2.

| Number of persons | | 100 | 200 | 300 |
|---|---|---|---|---|
| Total revenue @ $8.50 | | $ 850 | $1,700 | $2,550 |
| Fixed costs | | | | |
| Rent | $ 600 | | | |
| Prizes | 1,100 | 1,700 | 1,700 | 1,700 |
| Operating income (loss) | | $ (850) | $ 0 | $ 850 |

Note how "leverage" works. Being highly leveraged means having relatively high fixed costs. In this case, there are no variable costs. Therefore, the revenue is the same as the contribution margin. As volume departs from the break-even point, operating income is affected at a significant rate of $8.50 per person.

3.

| Number of persons | | 100 | 200 | 300 |
|---|---|---|---|---|
| Revenue | | $ 850 | $1,700 | $2,550 |
| Variable costs | | 200 | 400 | 600 |
| Contribution margin | | $ 650 | $1,300 | $1,950 |
| Fixed costs: Rent | $ 200 | | | |
| Prizes | 1,100 | 1,300 | 1,300 | 1,300 |
| Operating income (loss) | | $ (650) | $ 0 | $ 650 |

Note how the risk is lower because of less leverage. Fixed costs are less, and some of the risk has been shifted to the hotel. Note too that lower risk brings lower rewards and lower punishments. The income and losses are $650 instead of the $850 shown in part (2).

2-54 (10-20 min.)

1. To compute eBay's operating income, we need to know its fixed and variable costs. We are given that its fixed costs are $37 million. We can calculate its variable costs in the first quarter of 2001 as follows:

| Operating expenses | - Fixed costs | = Variable costs |
|---|---|---|
| $123 million | - $37 million | = $86 million |

Since sales increased by 59% in 2002, variable costs should also have increased by 59%:

2002 variable costs = 1.59 × $86 million = $137 million

Therefore, we calculate 2002 operating income as follows:

operating income = revenues – variable cost – fixed cost
=$245 million - $137 million - $37 million = $71 million

This is a 129% increase in operating income:

($71 million ÷ $31 million) – 1 = 129%

2. When sales increased 59%, operating income increased by 129%. This is an example of leverage. The variable cost percentage is $86 ÷ $154 = 56%. Thus, the contribution margin percentage is 100% - 56% = 44%. Every dollar of sales generates $.44 of operating income. The sales increase of $245 million - $154 million = $91 million generated $91 million × 44% = $40 million of operating income, while the original $154 million of sales had generated only $31 million of operating income. This is because the same $37 million of fixed cost applied at both level of sales. The total contribution margin from the $154 million of sales, $154 million × .44 = $68 million, had to first cover the $37 million of fixed costs, leaving only $31 million of operating income. The additional $91 million of sales caused no additional fixed costs, so its total contribution margin all becomes operating income.

2-55 (15-25 min.)

1. Let N = number of hamburgers per month
$1.20N = $.70N + $1,560
$.50N = $1,560
N = 3,120 per month, or 3,120 ÷ 30 = 104 per day

2. Multiply the answers in (1) by $1.20

3,120 × $1.20 = $3,744 per month
104 × $1.20 = $124.80 per day

3.

| | |
|---|---|
| Hamburgers per month, 3,600 ÷ 2 | 1,800 |
| Revenue per month, 1,800 × $1.20 | $2,160 |
| Variable expenses, 1,800 × $.70 | 1,260 |
| Contribution margin, 1,800 × $.50 | $ 900 |
| Fixed expenses | 1,560 |
| Operating income (loss) | $ (660) |

4. Contribution margin on extra beers:

Per day, 60 × $.60 = $36
Per month, 30 × $36 = $1,080

Income would increase by $1,080, which more than offsets the $660 loss on the hamburger operation, making the net increase in operating income $1,080 - $660 = $420.

5.

| | |
|---|---|
| Operating loss on hamburgers | $(660) |
| Desired contribution margin on extra beers | 660 |
| Overall effect on operating income | $ 0 |

Desired number of extra beers to provide overall effect on operating income of zero:

Per month = $660 ÷ .60 = 1,100 beers
Per day = 1,100 ÷ 30 = 36.7 beers

Or, desired contribution margin per day is $660 ÷ 30 = $22
Daily number of beers = $22 ÷ $.60 = 36.7

Therefore, if Mac believed that the extra beers sold amounted to almost 37 daily instead of 60, the hamburger operation would have provided an overall effect on operating income of zero.

2-56 (15-20 min.) Note in requirements 2 and 3 how the percentage declines exceed the 15% budget reduction.

1. Let N = number of persons

Revenue - variable expenses - fixed expenses = 0

$$\$900{,}000 - \$5{,}000N - \$280{,}000 = 0$$
$$5{,}000N = \$900{,}000 - \$280{,}000$$
$$N = \$620{,}000 \div \$5{,}000$$
$$N = 124 \text{ persons}$$

2. Revenue is now .85($900,000)= $765,000

$$\$765{,}000 - \$5{,}000N - \$280{,}000 = 0$$
$$\$5{,}000N = \$765{,}000 - \$280{,}000$$
$$N = \$485{,}000 \div \$5{,}000$$
$$N = 97 \text{ persons}$$

Percentage drop: (124 - 97) ÷ 124 = 21.8%

3. Let y = supplement per person

$$\$765{,}000 - 124y - \$280{,}000 = 0$$
$$124y = \$765{,}000 - \$280{,}000$$
$$y = \$485{,}000 \div 124$$
$$y = \$3{,}911$$

Percentage drop: ($5,000 - $3,911) ÷ $5,000 = 21.8%

Regarding requirements 2 and 3, note that the cut in service can be measured by a formula:

% cut in service = % budget change ÷ % variable cost

The variable-cost ratio is $620,000 ÷ $900,000 = 68.9%

% cut in service = 15% ÷ 68.9% = 21.8%

2-57 (15-20 min.) Answers are in millions.

| | | | |
|---|---|---|---|
| 1. | Sales | | $9,416 |
| | Variable costs: | | |
| | Variable costs of goods sold | $5,847 | |
| | Variable other operating expenses | 896 | 6,743 |
| | Contribution margin | | $ 2,673 |

Contribution margin percentage = $2,673 ÷ $9,416 = 28.4%

The contribution margin equals sales less all variable costs, while gross margin equals sales less cost of goods sold. The variable costs include part of the costs of goods sold and also part of the other operating costs. Note that contribution margin can be either larger than or smaller than the gross margin. If most of the cost of goods sold and a good portion of the other operating costs are variable, then variable costs may exceed the cost of goods sold, and the contribution margin will be smaller than the gross margin. However, if a large portion of both the cost of goods sold and the other expenses are fixed, cost of goods sold may exceed the variable cost, resulting in the contribution margin exceeding gross margin.

2. Predicted sales increase = $9,416 × .10 = $941.6
Additional contribution margin = $941.6 × .284 = $267
Fixed costs do not change
Predicted 2009 operating loss = $(727) + $267 = $(460)
Percentage decrease in operating loss = $267 ÷ $(727) = 37%

3. Assumptions include:
- Expenses can be classified into variable and fixed categories that completely describe their behavior within the relevant range.
- Costs and revenues are linear within the relevant range.
- 2009 volume is within the relevant range.
- Efficiency and productivity are unchanged.
- Sales mix is unchanged.
- Changes in inventory levels are insignificant.

2-58 (20-30 min.)

Variable costs per box are ($.14 + $.22 + $.09), ($.14 + $.14 + $.09), and ($.14 + $.05 + $.09), or $.45, $.37, and $.28, respectively.

1. Let N = volume level in boxes that would earn same profit

$$\$7{,}840 + \$.45N = \$11{,}200 + \$.37N$$
$$\$.08N = \$3{,}360$$
$$N = 42{,}000 \text{ boxes}$$

2. As volume increases, the more expensive models would generate more profits. Compare the deluxe and jumbo models:

Let N = volume level in boxes that would earn same profit

$$\$20{,}200 + \$.28N = \$11{,}200 + .37N$$
$$\$.09N = \$9{,}000$$
$$N = 100{,}000 \text{ boxes}$$

Therefore, the decision rule is as shown below.

| Anticipated Annual Sales Between | Use Model |
|---|---|
| 0 - 42,000 | Standard |
| 42,000 - 100,000 | Deluxe |
| 100,000 and above | Jumbo |

The decision rule places volume well within the capacity of each model.

3. No, management cannot use theater capacity or average boxes sold because the number of seats per theater does not indicate the number of patrons attending nor the popcorn-buying habits in different geographic locations. Each theater may have a different "boxes sold per seat" average with significant variations. The decision rule does not take into account variations in demand that could affect model choice.

2-59 (10-15 min.)

1. Kellogg has the higher fixed cost, while Post has the higher variable cost. Thus, the contribution margin for Kellogg will be higher. Kellogg will have more risk. Its profits increase faster as sales increase, but its profits decrease faster (or losses increase faster) as sales decrease.

2. Post provides more inventive to its sales force to increase sales. For each $1 of increased sales, Post pays more of that increase to the sales force, while Kellogg retains more of the increase for the company's profit.

3. A possible negative of the increased inventive for the Post sales force to increase sales is a motivation to increase those short-term sales at any cost. That is, the Post sales force might be motivated to sell customers product they don't need or to record sales that are not yet final. Many companies have found that too much emphasis on sales volumes can cause managers to take unethical actions to increase their sales levels. A main reason given for the failure of audit firm Arthur Andersen is an excessive emphasis on revenue generation that caused too little concern with quality and integrity.

2-60 (20-25 min.)

1. Net income (loss) = 250,000($2) + 125,000($3) - $735,000
= $500,000 + $375,000 - $735,000
= $140,000

2. Let B = number of units of beef enchiladas to break even (B)
2B = number of units of chicken tacos to break even (C)

Total contribution margin - fixed expenses = zero net income

$$\begin{aligned} \$3B + \$2(2B) - \$735{,}000 &= 0 \\ \$7B &= \$735{,}000 \\ B &= 105{,}000 \\ 2B &= 210{,}000 = C \end{aligned}$$

The break-even point is 105,000 units of beef enchiladas plus 210,000 units of chicken tacos, a grand total of 315,000 units.

3. If tacos, break-even would be $735,000 ÷ $2 = 367,500 units.
If enchiladas, break-even would be $735,000 ÷ $3 = 245,000 units.

Note that as the mixes change from 1 enchilada to 2 tacos, to 0 tacos to 1 enchilada, and to 1 taco to 0 enchiladas, the break-even point changes from 315,000 to 245,000 to 367,500.

4. Net income (loss) = 236,250($2) + 78,750($3) - $735,000
= $472,500 + $236,250 - $735,000
= $(26,250)

Let B = number of units of beef enchiladas to break even (V)
3B = number of units of chicken tacos to break even (C)

Total contribution margin - fixed expenses = zero net income

$$\begin{aligned} \$3B + \$2(3B) - \$735{,}000 &= 0 \\ \$9B &= \$735{,}000 \\ B &= 81{,}667 \\ 3B &= 245{,}000 = C \end{aligned}$$

The major lesson of this problem is that changes in sales mix change break-even points and net incomes. The break-even point is 81,667 units of enchiladas plus 245,000 units of tacos, a total of 326,667 units; thus, the unfavorable change in mix results in a net loss of $26,250 at the old total break-even level of 315,000 units. In short, the break-even level is higher because the sales mix is less profitable when tacos represent a higher proportion of sales. In this example, the budgeted and actual total sales in number of units were identical, but the proportion of product having the higher contribution margin declined.

2-61 (20-25 min.)

1. Let S = number of self-pay patients (S)
4S = number of other patients (G)

$$\$1{,}000S + (\$800 \times 4S) - \$600S - (\$600 \times 4S) - \$54{,}000{,}000 = 0$$
$$\$1{,}000S + \$3{,}200S - \$600S - \$2{,}400S = \$54{,}000{,}000$$
$$\$1{,}200S = \$54{,}000{,}000$$
$$S = 45{,}000$$
$$4S = 180{,}000 = G$$

The break-even point is 45,000 self-pay patient days plus 45,000 × 4 = 180,000 other patient days, a grand total of 225,000 patient days.

2. Contribution margins:
S = \$1,000 - \$600 = \$400 per patient day
G = \$800 - \$600 = \$200 per patient day

Patient days:
S = .25 × 225,000 = 56,250
G = .75 × 225,000 = 168,750

Net income = (56,250 ×\$400) + (168,750×\$200) - \$54,000,000
= \$22,500,000 + \$33,750,000 - \$54,000,000 = \$2,250,000

Let S = number of self-pay patients (S)
3S = number of other patients (G)

$$\$1{,}000S + (\$800 \times 3S) - \$600S - \$600 \times 3S) - \$54{,}000{,}000 = 0$$
$$\$1{,}000S + \$2{,}400S - \$600S - \$1{,}800S = \$54{,}000{,}000$$
$$\$1{,}000S = \$54{,}000{,}000$$
$$S = 54{,}000$$
$$3S = 162{,}000 = G$$

The break-even point is now lower (216,000 patient days instead of 225,000 patient days). The more profitable mix produces a net income of \$2,250,000 at the 225,000 patient-day level.

2-62 (15-25 min.)

1. Let N = number of rooms

$$\$105N - \$25N - \$9{,}200{,}000 = \frac{\$720{,}000}{(1-.4)}$$

$$\$80N - \$9{,}200{,}000 = \$1{,}200{,}000$$

$$\$80N = \$10{,}400{,}000$$

$$N = 130{,}000 \text{ rooms}$$

$$\$80N - \$9{,}200{,}000 = \frac{\$360{,}000}{(1-.4)}$$

$$\$80N - \$9{,}200{,}000 = \$600{,}000$$

$$\$80N = \$9{,}800{,}000$$

$$N = 122{,}500 \text{ rooms}$$

2. $\$105N - \$25N - \$9{,}200{,}000 = 0$

$\$80N = \$9{,}200{,}000$

$N = 115{,}000$ rooms

Number of rooms at 100% capacity = 600 × 365 = 219,000
Percentage occupancy to break even = 115,000 ÷ 219,000 = 52.5%

3. Using the shortcut approach described in the chapter appendix:

Change in net income = Change in vol. in units × Cont. margin/unit × (1 - tax rate)
= 15,000 × $80 × (1 - .40)
= 15,000 × $48
= $720,000, a large increase because of a high contribution margin per dollar of revenue.

Note that a 10% increase in rooms sold increased net income by $720,000 ÷ $1,680,000 or 43%.

| | | |
|---|---|---|
| Rooms sold | 150,000 | 165,000 |
| Contribution margin @ $80 | $12,000,000 | $13,200,000 |
| Fixed expenses | 9,200,000 | 9,200,000 |
| Income before taxes | 2,800,000 | 4,000,000 |
| Income taxes @ 40% | 1,120,000 | 1,600,000 |
| Net income | $ 1,680,000 | $ 2,400,000 |

| | |
|---|---|
| Increase in net income | $720,000 |
| Percentage increase | 43% |

2-63 (15-25 min.)

Current contribution margin = $16 - $10 - $2 = $4.
New variable costs per disk will be 130% of $10 + $2 = $13 + $2 = $15.

1. a. Break-even point = $\frac{\$600{,}000}{\$16 - (\$10 + \$2)}$ = 150,000 CDs

2. d. Contribution margin: $16 - ($10 + $2) = $4

Increased after-tax income:

Change in net income = Change in vol. in units × Cont. margin/unit × (1 - tax rate)
= 20,000 × $4 × (1 - .40)
= $48,000 increase in income

3. a. Let N = target sales in units

$$\text{Target sales} - \text{Variable expenses} - \text{Fixed expenses} = \frac{\text{target after-tax net income}}{1 - \text{tax rate}}$$

$16N - $15N - $600,000 = $120,000 ÷ (1 - .4)
$16N - $15N - $600,000 = $200,000
N = 800,000 units
$16N = $12,800,000

4. b. Let P = new selling price
Current contribution ratio is $4 ÷ $16 = .25
New contribution ratio is (P - $15) ÷ P = .25
.25P = P - $15
.75P = $15
P = $15 ÷ .75
P = $20

2-64 (25-35 min.)

1. $\frac{\$12,150,000}{\$810} = 15,000$ patient-days

2. Variable costs = $\frac{\$3,300,000}{15,000} = \$220$ per patient-day

Contribution margin = $810 - $220 = $590 per patient-day

To recoup the specified fixed expenses:
$5,900,000 ÷ $590 = 10,000 patient-days

3. The fixed cost levels differ as the relevant range changes:

| Patient-Days | Non-Nursing Fixed Expenses | Nursing Fixed Expenses | Total Fixed Expenses |
|---|---|---|---|
| 10,000-12,000 | $5,900,000 | $1,350,000(a) | $7,250,000 |
| 12,001-16,000 | 5,900,000 | 1,575,000(b) | 7,475,000 |

(a) $45,000 × 30 = $1,350,000
(b) $45,000 × 35 = $1,575,000

To break even on a lower level of fixed costs:
$7,250,000 ÷ $590 = 12,288 patient-days

This answer exceeds the lower-level maximum; therefore, this answer is infeasible. The department must operate at a $7,475,000 level of fixed costs to break even: $7,475,000 ÷ $590 = 12,669 patient-days.

4. The nursing costs would have been variable instead of fixed. The contribution margin per patient-day would have been $810 - $220 - $200 = $390. The break-even point would be higher: $5,900,000 ÷ 390 = 15,128 patient-days.

Some instructors might want to point out that hospitals have been under severe pressures to reduce costs. More than ever, nursing costs are controlled as variable rather than fixed costs. For example, more part-time help is used, and nurses may be used for full shifts but only as volume requires.

2-65 (15-20 min.)

1. Old: (Contribution margin × 600,000) - $580,000 = Budgeted profit
[($3.10 - $2.10) × 600,000] - $580,000 = $20,000
New: (Contribution margin × 600,000) - $1,140,000 = Budgeted profit
[($3.10 - 1.10) × 600,000] - $1,140,000 = $60,000

2. Old: $580,000 ÷ $1.00 = 580,000 units
New: $1,140,000 ÷ $2.00 = 570,000 units

3. A fall in volume will be more devastating under the new system because the high fixed costs will not be affected by the fall in volume:

Old: ($1.00 × 500,000) - $580,000 = -$80,000 (an $80,000 loss)
New: ($2.00 × 500,000) - $1,140,000 = -$140,000 (a $140,000 loss)

The 100,000 unit fall in volume caused a $20,000 - (- $80,000) = $100,000 decrease in profits in the old environment and a $60,000 - ( - $140,000) = $200,000 decrease in the new environment.

4. Increases in volume create larger increases in profit in the new environment:

Old: ($1.00 × 700,000) - $580,000 = $120,000
New: ($2.00 × 700,000) - $1,140,000 = $260,000

The 100,000 unit increase in volume caused a $120,000 - $20,000 = $100,000 increase in profit under the old environment and a $260,000 - $60,000 = $200,000 increase under the new environment.

5. Changes in volume affect profits in the new environment (a high fixed cost, low variable cost environment) more than they affect profits in the old environment. Therefore, profits in the old environment are more stable and less risky. The higher risk new environment promises greater rewards when conditions are favorable, but also leads to greater losses when conditions are unfavorable, a more risky situation.

2-66 (25-30 min.) This case is based on real data that has been simplified so that the numbers are easier to handle.

1. Daily break-even volume is 85 dinners and 170 lunches:

First compute contribution margins on lunches and dinners:
Variable cost percentage = ($1,246,500 + $222,380) ÷ $2,098,400
= 70%
Contribution margin percentage = 1 - variable cost percentage
= 1 - 70% = 30%

Lunch contribution margin = .30 × $20 = $6
Dinner contribution margin = .30 × $40 = $12

Annual fixed cost is $170,940 + $451,500 = $622,440

Let X = number of dinners and 2X = number of lunches

($12×X) + ($6×2X) - $622,440 = 0
$24(X) = $622,440
X = 25,935 dinners annually to break even
2X = 51,870 lunches annually to break even

On a daily basis:
Dinners to break even = 25,935 ÷ 305 = 85 dinners daily
Lunches to break even = 85 × 2 = 170 lunches daily or
51,870 ÷ 305 = 170 lunches daily.

To determine the actual volume, let Y be a combination of 1 dinner and 2 lunches. The price of Y is $40 + (2 × $20) = $80, and total volume in units of Y is $2,098,400 ÷ $80 = 26,230 and daily volume is 26,230 ÷ 305 = 86. Therefore, 86 dinners and 2 × 86 = 172 lunches were served on an average day. This is 1 dinner and 2 lunches above the break-even volume.

2. The extra annual contribution margin from the 3 dinners and 6 lunches is:

| | |
|---|---|
| 3 × $40 × .30 × 305 = | $10,980 |
| + 6 × $20 × .30 × 305 = | 10,980 |
| Total | $21,960 |

The added contribution margin is greater than the $15,000 advertising expenditure. Therefore, the advertising expenditure would be warranted. It would increase operating income by $21,960 - $15,000 = $6,960.

3. Let Y again be a combination of 1 dinner and 2 lunches, priced at $80. Variable costs are .70 × $80 = $56, of which $56 × .25 = $14 is food cost. Cutting food costs by 20% reduces variable costs by .20 × $14 = $2.80, making the variable cost of Y $56 - $2.80 = $53.20 and the contribution margin $80 - $53.20 = $26.80. (This could also be determined by adding the $2.80 saving in food cost directly to the old contribution margin of $24.) The required annual volume in Y needed to keep operating income at $7,080 is:

$26.80 (Y) - $622,440 = $7,080
$26.80 (Y) = $629,520
Y = 23,490
Therefore, daily volume = 23,490 ÷ 305 = 77 (rounded)

If volume drops no more than 86 - 77 = 9 dinners and 172 - 154 = 18 lunches, using the less costly food is more profitable. However, there are many subjective factors to be considered. Volume may not fall in the short run, but the decline in quality may eventually affect repeat business and cause a long-run decline. Much may depend on the skill of the chef. If the quality difference is not readily noticeable, so that volume falls less than, say, 10%, saving money on the purchases of food may be desirable.

2-67 (25-30 min.)

1. Break-even in pounds = Annual fixed costs ÷ Contribution margin/pound

$$= \frac{\$566,250}{(5.00 - \$3.00)} = 283,125 \text{ pounds}$$

2. Contribution margin ratio = \$2.00 ÷ \$5.00 = 40%

Old variable cost = \$3.00

Only the cost of salmon is affected:
New variable cost = \$3.00 + (.15 ×\$2.50) = \$3.375

| | |
|---|---|
| Let S | = Selling price |
| Selling price - Variable costs | = Contribution margin |
| (S - \$3.375) | = .40S |
| .60S | = \$3.375 |
| S | = \$5.625 |

Check: (\$5.625 - \$3.375) ÷ \$5.625 = 40%

3. Current income before taxes:
= 390,000 × (\$5.00 - \$3.00) - \$566,250
= \$780,000 - \$566,250 = \$213,750

Current income after taxes:
= \$213,750 × .60 = \$128,250

The problem can be solved by using units and then converting to dollar sales.

Let N = sales in pounds

| | |
|---|---|
| Sales - Variable expenses - Fixed expenses | $= \frac{\text{Net income}}{1 - \text{tax rate}}$ |
| \$5.00N - [(\$3.00 + .15×\$2.50)]N - \$566,250 | =\$128,250 ÷ (1 - .4) |
| \$5.00N - \$3.375N - \$566,250 | = \$213,750 |
| \$1.625N | = \$780,000 |
| N | = 480,000 pounds |
| \$5.00N | = \$2,400,000 sales |

An alternative way to get the solution is:
New contribution margin ratio = (\$5.00- \$3.375) ÷ \$5.00 = .325
New variable-cost ratio = 1.000 - .325 = .675

| | |
|---|---|
| Let S | = Sales |
| S | = .675S + \$566,250 + [\$128,250 ÷ (1 - .4)] |
| .325S | = \$780,000 |
| S | = \$2,400,000 |

4. Strategies might include:
   (a) Increase selling price by the $.375 cost increase.
   (b) Decrease other variable costs by $.375 per pound.
   (c) Decrease fixed costs by $.375 × 390,000 = $146,250.
   (d) Increase unit sales by 480,000 - 390,000 = 90,000 pounds.
   (e) Some combination of the above.

2-68 (15-20 min.)

1. The following table shows the comparison between percentage increases in total revenue and income before taxes for the four major regions of Nike.

| Region | Percent Change in Revenue | Percent Change in Pre-tax Income |
|---|---|---|
| U.S. | 4% | 2% |
| EMEA | 19% | 22% |
| Asia Pacific | 26% | 36% |
| Americas | 21% | 24% |

   The term operating leverage means that a substantial portion of the resources used to generate income were fixed-cost resources and did not increase in response to increased revenue-generating activities.

2. While revenues increased, variable costs may have increased by an even greater amount so that the benefits of operating leverage were mitigated.

3. Nike's leverage is the ratio of its fixed costs to variable costs. You might expect a large percentage of Nike's costs to be cost of goods sold, which is primarily a variable cost, making operating leverage low. However, Nike also has many fixed costs. Many of Nike's fixed costs are related to its distribution function. Assets such as the distribution center, equipment, salaries of regular employees and management all contribute to a substantial fixed-cost component of total cost. Another significant component of fixed costs is the Nike World Campus in Beaverton, Oregon with 16 buildings and almost 6,000 management staff.

2-69 (30-40 min.) For the solution to this Excel Application Exercise, follow the step-by-step instructions provided in the textbook chapter.

2-70 (30 min. or more)

The purpose of this problem is to develop an intuitive feel for the costs involved in a simple production process and to assess whether various costs are fixed or variable. Then students must assess the market to determine a price so that they can compute a break-even point.

Completing this problem can be done quickly or it can take much time. It might even be done in class, with students suggesting the various costs and predicting their levels. A complete analysis might involve finding the actual prices of the resources needed to make the product or service. This could lead to time-consuming research. Whatever approach is taken, students are led to see the real-world application of what they are learning.

2-71 (30-40 min.) NOTE TO INSTRUCTOR: This solution is based on the web site as it was in late 2009. Be sure to examine the current web site before assigning this problem, as the information there may have changed.

1. Southwest Airlines serves over 70 cities. Answers to several of the questions will depend on the student's choices of location and dates. Fares available include business select, anytime, and "wanna get away". Different fares are offered because of the different costs incurred by SWA to serve customers who have different flying needs. Another factor causing different fares is the need to match products offered by competing airlines. Restrictions such as the requirement to make reservations at least 7 days in advance of travel are necessary to give SWA planning information in advance. Limiting the number of reduced-price wanna get away fares on each flight is necessary in order to keep open seats for customers who must travel on short notice.

2. It is likely that the only fares available are refundable any time. The lower-rate restricted fares are generally not available on short notice. Customers who need to travel with short notice are willing to pay more. Many business travelers fly with very short notice.

3. On a particular flight, price paid for a seat (assuming the same class seat) is not a cost driver. The various costs incurred by SWA will change only slightly – possibly the type of food served will vary as a function of the price paid for a seat on a particular trip, but little else.

4. Operating revenues and operating expenses are reported for the current and prior year along with the percentage change. The operating revenues increased from $9.861 billion in 2007 to $11.023 billion in 2008, an increase of 11.8%. Operating expenses increased from $9.070 billion in 2007 to $10.574 billion in 2008, an increase of 16.6%. With expenses rising faster than revenues, profits will fall – as shown by the 43.2% decrease in operating income.

5. To determine whether a particular cost or expense is fixed or variable, we must identify the cost driver with which costs might vary, the time period involved, and the relevant range. In this case, we are told that the cost driver is ASM. Assume that the period is one year, and the relevant range is the number of ASMs that can be available without adding to or subtracting from the current fleet of airplanes. Thus, adding ASMs means flying the existing airplanes for more hours.

   Costs that would probably vary with ASMs are salaries, wages, and benefits, employee retirement plans, fuel and oil, maintenance materials and repairs, landing fees and other rentals. Aircraft rentals and depreciation would probably be fixed costs. Some of these costs might be more directly caused by other cost drivers. For example, revenue passenger miles (RPM), that is number of passengers times the miles each flies, might drive agency commissions and possibly some salaries (for example, flight attendants whose number depends on how many passengers are on a particular flight).