Cost-Volume-Profit

Managerial Accounting
Fifth Edition
Weygandt • Kimmel • Kieso
study objectives

1. Distinguish between variable and fixed costs.
2. Explain the significance of the relevant range.
3. Explain the concept of mixed costs.
4. List the five components of cost-volume-profit analysis.
5. Indicate what contribution margin is and how it can be expressed.
6. Identify the three ways to determine the break-even point.
7. Give the formulas for determining sales required to earn target net income.
8. Define margin of safety, and give the formulas for computing it.
preview of chapter 5

Cost-Volume-Profit

Cost Behavior Analysis
- Variable costs
- Fixed costs
- Relevant range
- Mixed costs
- Identifying variable and fixed costs

Cost-Volume-Profit Analysis
- Basic components
- CVP income statement
- Break-even analysis
- Target net income
- Margin of safety
Cost Behavior Analysis

Cost Behavior Analysis is the study of how specific costs respond to changes in the level of business activity.

- Some costs change; others remain the same.
- Helps management plan operations and decide between alternative courses of action.
- Applies to all types of businesses and entities.
Starting point is measuring key business activities.

Activity levels may be expressed in terms of:

- Sales dollars (in a retail company)
- Miles driven (in a trucking company)
- Room occupancy (in a hotel)
- Dance classes taught (by a dance studio)

Many companies use more than one measurement base.
Changes in the level or volume of activity should be correlated with changes in costs.

Activity level selected is called activity or volume index.

The activity index:

- Identifies the activity that causes changes in the behavior of costs.
- Allows costs to be classified as variable, fixed, or mixed.
Variable Costs

- Costs that vary in total directly and proportionately with changes in the activity level.
- **Example:** If the activity level increases 10 percent, total variable costs increase 10 percent.
- **Example:** If the activity level decreases by 25 percent, total variable costs decrease by 25 percent.
- Variable costs remain the same per unit at every level of activity.
**Illustration:** Damon Company manufactures radios that contain a $10 digital clock. The activity index is the number of radios produced. As Damon manufactures each radio, the total cost of the clocks increases by $10. **As part (a) of Illustration 5-1 shows,** total cost of the clocks will be $20,000 if Damon produces 2,000 radios, and $100,000 when it produces 10,000 radios. We also can see that a variable cost remains the same per unit as the level of activity changes.

**SO 1** Distinguish between variable and fixed costs.
**Cost Behavior Analysis**

**Illustration:** Damon Company manufactures radios that contain a $10 digital clock. The activity index is the number of radios produced. As Damon manufactures each radio, the total cost of the clocks increases by $10. **As part (b)** of Illustration 5-1 shows, the unit cost of $10 for the clocks is the same whether Damon produces 2,000 or 10,000 radios.

**SO 1** Distinguish between variable and fixed costs.
SO 1  Distinguish between variable and fixed costs.
Cost Behavior Analysis

Fixed Costs

- Costs that remain the same in total regardless of changes in the activity level.

- Per unit cost varies inversely with activity: As volume increases, unit cost declines, and vice versa.

Examples:

- Property taxes
- Insurance
- Rent
- Depreciation on buildings and equipment
**Illustration:** Damon Company leases its productive facilities at a cost of $10,000 per month. Total fixed costs of the facilities will remain constant at every level of activity, as part (a) of Illustration 5-2 shows.

**SO 1** Distinguish between variable and fixed costs.
**Illustration:** Damon Company leases its productive facilities at a cost of $10,000 per month. Total fixed costs of the facilities will remain constant at every level of activity. But, on a per unit basis, the cost of rent will decline as activity increases, as part (b) of Illustration 5-2 shows. At 2,000 units, the unit cost is $5 ($10,000 / 2,000). When Damon produces 10,000 radios, the unit cost is only $1 ($10,000 / 10,000).

**SO 1** Distinguish between variable and fixed costs.
**Cost Behavior Analysis**

**Fixed Costs**

*(a) Total Fixed Costs (Rent Expense)*

*(b) Fixed Costs per Unit (Rent Expense)*

**SO 1 Distinguish between variable and fixed costs.**
Variable costs are costs that:

a. Vary in total directly and proportionately with changes in the activity level.

b. Remain the same per unit at every activity level.

c. Neither of the above.

d. Both (a) and (b) above.
Cost Behavior Analysis

Relevant Range

- Throughout the range of possible levels of activity, a straight-line relationship usually does not exist for either variable costs or fixed costs.

- The relationship between variable costs and changes in activity level is often curvilinear.

- For fixed costs, the relationship is also nonlinear - some fixed costs will not change over the entire range of activities while other fixed costs may change.

SO 2 Explain the significance of the relevant range.
**Cost Behavior Analysis**

## Relevant Range

**SO 2** Explain the significance of the relevant range.
**Cost Behavior Analysis**

**Relevant Range** - Range of activity over which a company expects to operate during a year.

*Illustration 5-4*

SO 2  Explain the significance of the relevant range.
The relevant range is:

a. The range of activity in which variable costs will be curvilinear.

b. The range of activity in which fixed costs will be curvilinear.

c. The range over which the company expects to operate during a year.

d. Usually from zero to 100% of operating capacity.

Review Question

SO 2 Explain the significance of the relevant range.
**Mixed Costs**

- Costs that have **both** a variable cost element and a fixed cost element.

- Change **in total but not proportionately** with changes in activity level.

*SO 3* Explain the concept of mixed costs.
K Christel, LLP, reports the following total costs at two levels of production.

Classify each cost as variable, fixed, or mixed.

<table>
<thead>
<tr>
<th>Cost</th>
<th>10,000 Units</th>
<th>20,000 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$20,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>17,000</td>
<td>34,000</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>3,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Rent</td>
<td>6,000</td>
<td>6,000</td>
</tr>
</tbody>
</table>

**SO 3** Explain the concept of mixed costs.
**Cost Behavior Analysis**

**Mixed Costs - High-Low Method**

- Mixed costs must be classified into their **fixed** and **variable** elements.

- High-Low Method uses the total costs incurred at both the high and the low levels of activity to classify mixed costs.

- The difference in costs between the high and low levels represents variable costs, since only variable costs change as activity levels change.
**Cost Behavior Analysis**

**Mixed Costs - High-Low Method**

- **STEP 1:** Determine **variable cost per unit** using the following formula:

\[
\text{Variable Cost per Unit} = \frac{\text{Change in Total Costs}}{\text{High minus Low Activity Level}}
\]

*Illustration 5-6*

**SO 3** Explain the concept of mixed costs.
Mixed Costs - High-Low Method

Illustration: Metro Transit Company has the following maintenance costs and mileage data for its fleet of buses over a 4-month period.

<table>
<thead>
<tr>
<th>Month</th>
<th>Miles Driven</th>
<th>Total Cost</th>
<th>Month</th>
<th>Miles Driven</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>20,000</td>
<td>$30,000</td>
<td>March</td>
<td>35,000</td>
<td>$49,000</td>
</tr>
<tr>
<td>February</td>
<td>40,000</td>
<td>48,000</td>
<td>April</td>
<td>50,000</td>
<td>63,000</td>
</tr>
</tbody>
</table>

Change in Costs: \[(63,000 - 30,000)\] = \$33,000

High minus Low: \[(50,000 - 20,000)\] = \$33,000 / 30,000 = \$1.10 cost per unit

SO 3 Explain the concept of mixed costs.
**Cost Behavior Analysis**

**Mixed Costs - High-Low Method**

**STEP 2:** Determine the **fixed cost** by subtracting the total variable cost at either the high or the low activity level from the total cost at that level.

**Illustration 5-8**

<table>
<thead>
<tr>
<th>METRO TRANSIT</th>
<th>Activity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Total cost</td>
<td></td>
</tr>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Variable costs</td>
<td></td>
</tr>
<tr>
<td>$63,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>$50,000 × $1.10</td>
<td>55,000</td>
</tr>
<tr>
<td>$20,000 × $1.10</td>
<td>22,000</td>
</tr>
<tr>
<td>Total fixed costs</td>
<td>$8,000</td>
</tr>
</tbody>
</table>

SO 3 Explain the concept of mixed costs.
Mixed Costs - High-Low Method

Maintenance costs are therefore $8,000 per month plus $1.10 per mile. This is represented by the following formula:

\[
\text{Maintenance costs} = \text{Fixed costs} + (\$1.10 \times \text{Miles driven})
\]

Example: At 45,000 miles, estimated maintenance costs would be:

<table>
<thead>
<tr>
<th>Fixed</th>
<th>$8,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>$(1.10 \times 45,000)</td>
</tr>
</tbody>
</table>

\[
\text{Total Cost} = \text{Fixed Cost} + \text{Variable Cost} = 8,000 + 49,500 = 57,500
\]
Review Question

Mixed costs consist of a:

a. Variable cost element and a fixed cost element.
b. Fixed cost element and a controllable cost element.
c. Relevant cost element and a controllable cost element.
d. Variable cost element and a relevant cost element.
K Christel, LLP, accumulates the following data concerning a mixed cost, using units produced as the activity level.

<table>
<thead>
<tr>
<th>Units Produced</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>9,800</td>
</tr>
<tr>
<td>April</td>
<td>8,500</td>
</tr>
<tr>
<td>May</td>
<td>7,000</td>
</tr>
<tr>
<td>June</td>
<td>7,600</td>
</tr>
<tr>
<td>July</td>
<td>8,100</td>
</tr>
</tbody>
</table>

(a) Compute the variable and fixed cost elements using the high-low method.

(b) Estimate the total cost if the company produces 6,000 units.
(a) Compute the variable and fixed cost elements using the high-low method.

**Variable cost:**

\[
\frac{($14,740 - $11,100)}{(9,800 - 7,000)} = $1.30 \text{ per unit}
\]

**Fixed cost:**

\[
$14,740 - $12,740 ($1.30 \times 9,800 \text{ units}) = $2,000
\]

or

\[
$11,100 - $9,100 ($1.30 \times 7,000) = $2,000
\]
Cost Behavior Analysis

(b) Estimate the total cost if the company produces 6,000 units.

Total cost (6,000 units): $2,000 + $7,800 ($1.30 \times 6,000) = \$9,800

SO 3 Explain the concept of mixed costs.
Cost-Volume-Profit Analysis

- Study of the *effects of changes of costs and volume* on a company’s profits
- A critical factor in management decisions
- Important in profit planning

SO 4 List the five components of cost-volume-profit analysis.
SO 4 List the five components of cost-volume-profit analysis.
Basic Components - Assumptions

- Behavior of both costs and revenues is linear throughout the relevant range of the activity index.
- All costs can be classified as either variable or fixed with reasonable accuracy.
- Changes in activity are the only factors that affect costs.
- All units produced are sold.
- When more than one type of product is sold, the sales mix will remain constant.
Which of the following is **NOT** involved in CVP analysis?

a. Sales mix.
b. Unit selling prices.
c. Fixed costs per unit.
d. Volume or level of activity.
**Cost-Volume-Profit Analysis**

**CVP Income Statement**

- A statement for internal use.
- Classifies costs and expenses as fixed or variable.
- Reports contribution margin in the body of the statement.

  **Contribution margin** – amount of revenue remaining after deducting variable costs

- Reports the same net income as a traditional income statement.

**SO 5** Indicate what contribution margin is and how it can be expressed.
Illustration: Vargo Video produces a high-definition digital camcorder with 15 optical zoom and a wide-screen, high-resolution LCD monitor. Relevant data for the camcorders sold by this company in June 2011 are as follows.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit selling price of camcorder</td>
<td>$500</td>
</tr>
<tr>
<td>Unit variable costs</td>
<td>$300</td>
</tr>
<tr>
<td>Total monthly fixed costs</td>
<td>$200,000</td>
</tr>
<tr>
<td>Units sold</td>
<td>1,600</td>
</tr>
</tbody>
</table>
**Cost-Volume-Profit Analysis**

**CVP Income Statement**

**Illustration:** The CVP income statement for Vargo Video therefore would be reported as follows.

<table>
<thead>
<tr>
<th>VARGO VIDEO COMPANY</th>
<th>Total</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the Month Ended June 30, 2011</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (1,600 camcorders)</td>
<td>$800,000</td>
<td>$500</td>
</tr>
<tr>
<td>Variable costs</td>
<td>480,000</td>
<td>300</td>
</tr>
<tr>
<td><strong>Contribution margin</strong></td>
<td><strong>320,000</strong></td>
<td><strong>$200</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td><strong>$120,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

*SO 5* Indicate what contribution margin is and how it can be expressed.
Contribution margin is available to **cover fixed costs** and to **contribute to income**.

The formula for **contribution margin per unit** and the computation for Vargo Video are:

\[
\text{Unit Selling Price} - \text{Unit Variable Costs} = \text{Contribution Margin per Unit}
\]

<table>
<thead>
<tr>
<th>Unit Selling Price</th>
<th>Unit Variable Costs</th>
<th>Contribution Margin per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500</td>
<td>$300</td>
<td>$200</td>
</tr>
</tbody>
</table>
### CVP Income Statement

#### Contribution Margin per Unit

Vargo’s CVP income statement assuming a zero net income.

<table>
<thead>
<tr>
<th>VARGO VIDEO COMPANY</th>
<th>Total</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the Month Ended June 30, 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales (1,000 camcorders)</td>
<td>$500,000</td>
<td>$500</td>
</tr>
<tr>
<td>Variable costs</td>
<td>300,000</td>
<td>300</td>
</tr>
<tr>
<td><strong>Contribution margin</strong></td>
<td><strong>200,000</strong></td>
<td><strong>$200</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td>$ 0</td>
<td></td>
</tr>
</tbody>
</table>

**SO 5** Indicate what contribution margin is and how it can be expressed.
## CVP Income Statement

### Contribution Margin per Unit

Assume that Vargo sold one more camcorder, for a total of 1,001 camcorders sold.

<table>
<thead>
<tr>
<th>VARGO VIDEO COMPANY</th>
<th>Total</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the Month Ended June 30, 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales (1,001 camcorders)</td>
<td>$500,500</td>
<td>$500</td>
</tr>
<tr>
<td>Variable costs</td>
<td>300,300</td>
<td>300</td>
</tr>
<tr>
<td><strong>Contribution margin</strong></td>
<td><strong>200,200</strong></td>
<td><strong>$200</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td><strong>$ 200</strong></td>
<td></td>
</tr>
</tbody>
</table>
Cost-Volume-Profit Analysis

CVP Income Statement

Contribution Margin Ratio

- Shows the percentage of each sales dollar available to apply toward fixed costs and profits.
- The formula for contribution margin ratio and the computation for Vargo Video are:

<table>
<thead>
<tr>
<th>Contribution Margin per Unit</th>
<th>÷</th>
<th>Unit Selling Price</th>
<th>=</th>
<th>Contribution Margin Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200</td>
<td>÷</td>
<td>$500</td>
<td>=</td>
<td>40%</td>
</tr>
</tbody>
</table>

Illustration 5-15

SO 5 Indicate what contribution margin is and how it can be expressed.
### CVP Income Statement

#### Contribution Margin Ratio

Assume current sales are $500,000, what is the effect of a $100,000 (200-unit) increase in sales?

<table>
<thead>
<tr>
<th>VARGO VIDEO COMPANY</th>
<th>CVP Income Statements</th>
<th>Illustration 5-16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For the Month Ended June 30, 2011</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Change</td>
<td>With Change</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Per Unit</td>
</tr>
<tr>
<td>Sales</td>
<td>$500,000</td>
<td>$500</td>
</tr>
<tr>
<td>Variable costs</td>
<td>300,000</td>
<td>300</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>200,000</td>
<td>$200</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>Net income</td>
<td>$0</td>
<td></td>
</tr>
</tbody>
</table>

**SO 5** Indicate what contribution margin is and how it can be expressed.
**Cost-Volume-Profit Analysis**

**Review Question**

Contribution margin:

a. Is revenue remaining after deducting variable costs.

b. May be expressed as contribution margin per unit.

c. Is selling price less cost of goods sold.

d. Both (a) and (b) above.

SO 5 Indicate what contribution margin is and how it can be expressed.
Cost-Volume-Profit Analysis

Break-Even Analysis

- Process of finding the break-even point level of activity at which total revenues equal total costs (both fixed and variable).

- Can be computed or derived
  - from a mathematical equation,
  - by using contribution margin, or
  - from a cost-volume profit (CVP) graph.

- Expressed either in sales units or in sales dollars.

SO 6 Identify the three ways to determine the break-even point.
Cost-Volume-Profit Analysis

Break-Even Analysis

Mathematical Equation

- Break-even occurs where total sales equal variable costs plus fixed costs; i.e., net income is zero.

Illustration 5-18

Computation of break-even point in units.

<table>
<thead>
<tr>
<th>Sales</th>
<th>Variable Costs</th>
<th>Fixed Costs</th>
<th>Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500Q</td>
<td>$300Q</td>
<td>$200,000</td>
<td>$0</td>
</tr>
<tr>
<td>$200Q = $200,000</td>
<td>Q = 1,000 units</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where

- Q = sales volume in units
- $500 = selling price
- $300 = variable cost per unit
- $200,000 = total fixed costs

SO 6 Identify the three ways to determine the break-even point.
At the break-even point, contribution margin must equal total fixed costs

\[ CM = \text{total revenues} - \text{variable costs} \]

The break-even point can be computed using either contribution margin per unit or contribution margin ratio.

**SO 6 Identify the three ways to determine the break-even point.**
Cost-Volume-Profit Analysis

Break-Even Analysis

Contribution Margin Technique

When the BEP in units is desired, contribution margin per unit is used in the following formula which shows the computation for Vargo Video:

\[
\text{Break-even Point in Units} = \frac{\text{Fixed Costs}}{\text{Contribution Margin per Unit}}
\]

Illustration 5-19

<table>
<thead>
<tr>
<th>Fixed Costs</th>
<th>Contribution Margin per Unit</th>
<th>Break-even Point in Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200,000</td>
<td>$200</td>
<td>1,000 units</td>
</tr>
</tbody>
</table>

SO 6 Identify the three ways to determine the break-even point.
When the BEP in dollars is desired, contribution margin ratio is used in the following formula which shows the computation for Vargo Video:

\[ \text{Fixed Costs} \div \text{Contribution Margin Ratio} = \text{Break-even Point in Dollars} \]

\[ \frac{200,000}{40\%} = 500,000 \]
Because this graph also shows costs, volume, and profits, it is referred to as a cost-volume-profit (CVP) graph.

**SO 6 Identify the three ways to determine the break-even point.**
Cost-Volume-Profit Analysis

Review Question

Gossen Company is planning to sell 200,000 pliers for $4 per unit. The contribution margin ratio is 25%. If Gossen will break even at this level of sales, what are the fixed costs?

a. $100,000.
b. $160,000.
c. $200,000.
d. $300,000.

SO 6 Identify the three ways to determine the break-even point.
K Christel, LLP, has a unit selling price of $400, variable costs per unit of $240, and fixed costs of $180,000. Compute the break-even point in units using (a) a mathematical equation and (b) contribution margin per unit.

Illustration 5-17

<table>
<thead>
<tr>
<th>Sales = Variable Costs + Fixed Costs + Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$400Q = $240Q + $180,000</td>
</tr>
</tbody>
</table>

SO 6 Identify the three ways to determine the break-even point.
K Christel, LLP, has a unit selling price of $400, variable costs per unit of $240, and fixed costs of $180,000. Compute the break-even point in units using (a) a mathematical equation and (b) contribution margin per unit.

\[
\text{Fixed Costs} \div \text{Contribution Margin per Unit} = \text{Break-even Point in Units}
\]

\[
\frac{180,000}{160} = 1,125 \text{ per unit}
\]
Target Net Income

- Level of sales necessary to achieve a specified income.

- Can be determined from each of the approaches used to determine break-even sales/units:
  - from a mathematical equation,
  - by using contribution margin, or
  - from a cost-volume profit (CVP) graph.

- Expressed either in sales units or in sales dollars.

SO 7 Give the formulas for determining sales required to earn target net income.
Target Net Income

Mathematical Equation

Using the formula for the break-even point, simply include the desired net income as a factor.

Illustration 5-23

\[
\text{Required Sales} = \text{Variable Costs} + \text{Fixed Costs} + \text{Target Net Income}
\]

\[
\begin{align*}
$500Q &= $300Q + $200,000 + $120,000 \\
$200Q &= $320,000 \\
Q &= 1,600
\end{align*}
\]

where

- \( Q \) = sales volume
- \$500 = selling price
- \$300 = variable costs per unit
- \$200,000 = total fixed costs
- \$120,000 = target net income
Cost-Volume-Profit Analysis

Target Net Income

Contribution Margin Technique

To determine the required sales in units for Vargo Video:

\[
\frac{\text{Fixed Costs + Target Net Income}}{\text{Contribution Margin per Unit}} = \text{Required Sales in Units}
\]

\[
\frac{($200,000 + $120,000)}{\$200} = 1,600 \text{ units}
\]
**Cost-Volume-Profit Analysis**

**Target Net Income**

**Contribution Margin Technique**

To determine the required **sales in dollars** for Vargo Video:

\[
\text{Fixed Costs} + \frac{\text{Target Net Income}}{\text{Contribution Margin Ratio}} = \text{Required Sales in Dollars}
\]

\[
\frac{($200,000 + $120,000)}{40\%} = $800,000
\]

**Illustration 5-25**

**SO 7** Give the formulas for determining sales required to earn target net income.
Cost-Volume-Profit Analysis

Review Question

The mathematical equation for computing required sales to obtain target net income is:
Required sales =

a. Variable costs + Target net income.
b. Variable costs + Fixed costs + Target net income.
c. Fixed costs + Target net income.
d. No correct answer is given.

SO 7 Give the formulas for determining sales required to earn target net income.
**Margin of Safety**

- Difference between **actual or expected sales** and sales at the **break-even point**.
- Measures the “cushion” that management has if expected sales fail to materialize.
- May be expressed in **dollars** or as a **ratio**.
- Assuming actual/expected sales are $750,000:

<table>
<thead>
<tr>
<th>Actual (Expected) Sales</th>
<th>Break-even Sales</th>
<th>Margin of Safety in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>$750,000</td>
<td>$500,000</td>
<td>$250,000</td>
</tr>
</tbody>
</table>

**SO 8** Define **margin of safety**, and give the **formulas** for computing it.
Margin of Safety Ratio

- Computed by dividing the margin of safety in dollars by the actual or expected sales.

- Assuming actual/expected sales are $750,000:

\[
\text{Margin of Safety Ratio} = \frac{\text{Margin of Safety in Dollars}}{\text{Actual (Expected) Sales}}
\]

\[
\text{Margin of Safety Ratio} = \frac{\$250,000}{\$750,000} = 33\%
\]

- The higher the dollars or percentage, the greater the margin of safety.

**SO 8** Define margin of safety, and give the formulas for computing it.
Marshall Company had actual sales of $600,000 when break-even sales were $420,000. What is the margin of safety ratio?

a. 25%.
b. 30%.
c. 33 1/3%.
d. 45%.

SO 8 Define margin of safety, and give the formulas for computing it.
K Christel, LLP, makes travel bags that sell for $56 each. For the coming year, management expects fixed costs to total $320,000 and variable costs to be $42 per unit. Compute the following:
(a) break-even point in dollars using the contribution margin (CM) ratio; (b) the margin of safety assuming actual sales are $1,382,400; and (c) the sales dollars required to earn net income of $410,000.

**SO 8** Define margin of safety, and give the formulas for computing it.
Cost-Volume-Profit Analysis

Do it! Compute: (a) **break-even point in dollars** using the contribution margin (CM) ratio.

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**Unit selling price**

$56

**Unit variable costs**

$42

**Contribution margin per unit**

$14

**Contribution margin ratio**

25%

**Fixed costs**

$320,000

**Break-even sales in dollars**

$1,280,000

---

SO 8 Define margin of safety, and give the formulas for computing it.
Compute: (b) the margin of safety assuming actual sales are $1,382,400.
Cost-Volume-Profit Analysis

Do it! Compute: (c) the sales dollars required to earn net income of $410,000.
Ford plans to sell at least seven different models of hybrid cars, about 250,000 vehicles annually, by the end of the decade.

Hybrid vehicles typically cost $3,000 to $5,000 more than their conventional counterparts, although for some models the premium is higher.
Some companies, such as Bank of America and Timberland, have offered $3,000 to employees who purchase hybrids. Google offered $5,000 to employees who purchased cars that get at least 45 miles per gallon.

The most fuel-efficient hybrids—the Toyota Prius and the Honda Civic—can save about $660 per year in fuel costs relative to a similar conventional car.

Each gallon of gasoline that is not consumed reduces carbon dioxide emissions by 19 pounds.

The federal government initially provided tax credits of up to $3,400 to buyers of hybrids.
As the graph below indicates, sales of hybrid cars continued to show a steady increase between 2004 and 2008. Many analysts believe that hybrid car sales are directly related to gasoline prices. This is reflected in the recent sluggish sales of hybrid cars, as gasoline prices have dramatically dropped from the 2004–2008 price levels.

Gas prices are depleting your wallet so fast that you might even have to give up your old car and resort to walking or riding your bike on occasion. Will making the investment in a hybrid slow the outflow from your wallet and spare your feet?

**YES:** At 44 miles per gallon, I can drive forever without ever having to fill up.

**NO:** Because of the premium price charged for hybrids, I will never drive enough miles to break even on my investment.
Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit.

Instructions

a) Compute break-even point in units using the mathematical equation.

b) Compute break-even point in dollars using the contribution margin (CM) ratio.

c) Compute the margin of safety percentage assuming actual sales are $500,000.

d) Compute the sales required in dollars to earn net income of $165,000.
Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit. Compute break-even point in units using the mathematical equation.

\[ \text{Units} = \frac{\text{Fixed Costs}}{\text{Selling Price per Unit} - \text{Variable Cost per Unit}} = \frac{220,000}{20 - 9} = \frac{220,000}{11} = 20,000 \text{ units} \]
Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit. Compute break-even point in dollars using the contribution margin (CM) ratio.

Contribution margin per unit =

Contribution margin ratio =

Break-even point in dollars =

=
Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit. Compute the margin of safety percentage assuming actual sales are $500,000.

Margin of safety = \[ \frac{\text{Actual Sales} - \text{Break-even Sales}}{\text{Actual Sales}} \] = \[ \boxed{20\%} \]
Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit. Compute the sales required in dollars to earn net income of $165,000.

\[ 20Q = 9Q + 220,000 + \] 

\[ 11Q = \] 

\[ Q = 35,000 \text{ units} \]

35,000 units \times 20 = 700,000 \text{ required sales}
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