

Chapter 5

Cost-Volume-Profit Relationships

Exercise 5-1 (20 minutes)

1. The new income statement would be:

	<i>Total</i>	<i>Per Unit</i>
Sales (8,050 units)	\$209,300	\$26.00
Variable expenses.....	<u>144,900</u>	<u>18.00</u>
Contribution margin....	64,400	<u>\$ 8.00</u>
Fixed expenses.....	<u>56,000</u>	
Net operating income .	<u>\$ 8,400</u>	

You can get the same net operating income using the following approach.

Original net operating income...	\$8,000
Change in contribution margin (50 units × \$8.00 per unit)	<u>400</u>
New net operating income	<u>\$8,400</u>

2. The new income statement would be:

	<i>Total</i>	<i>Per Unit</i>
Sales (7,950 units)	\$206,700	\$26.00
Variable expenses.....	<u>143,100</u>	<u>18.00</u>
Contribution margin.....	63,600	<u>\$ 8.00</u>
Fixed expenses.....	<u>56,000</u>	
Net operating income	<u>\$ 7,600</u>	

You can get the same net operating income using the following approach.

Original net operating income.....	\$8,000
Change in contribution margin (-50 units × \$8.00 per unit).....	<u>(400)</u>
New net operating income	<u>\$7,600</u>

Exercise 5-1 (continued)

3. The new income statement would be:

	<i>Total</i>	<i>Per Unit</i>
Sales (7,000 units)	\$182,000	\$26.00
Variable expenses.....	<u>126,000</u>	<u>18.00</u>
Contribution margin	56,000	<u><u>\$ 8.00</u></u>
Fixed expenses.....	<u>56,000</u>	
Net operating income ...	<u><u>\$ 0</u></u>	

Note: This is the company's break-even point.

Exercise 5-3 (15 minutes)

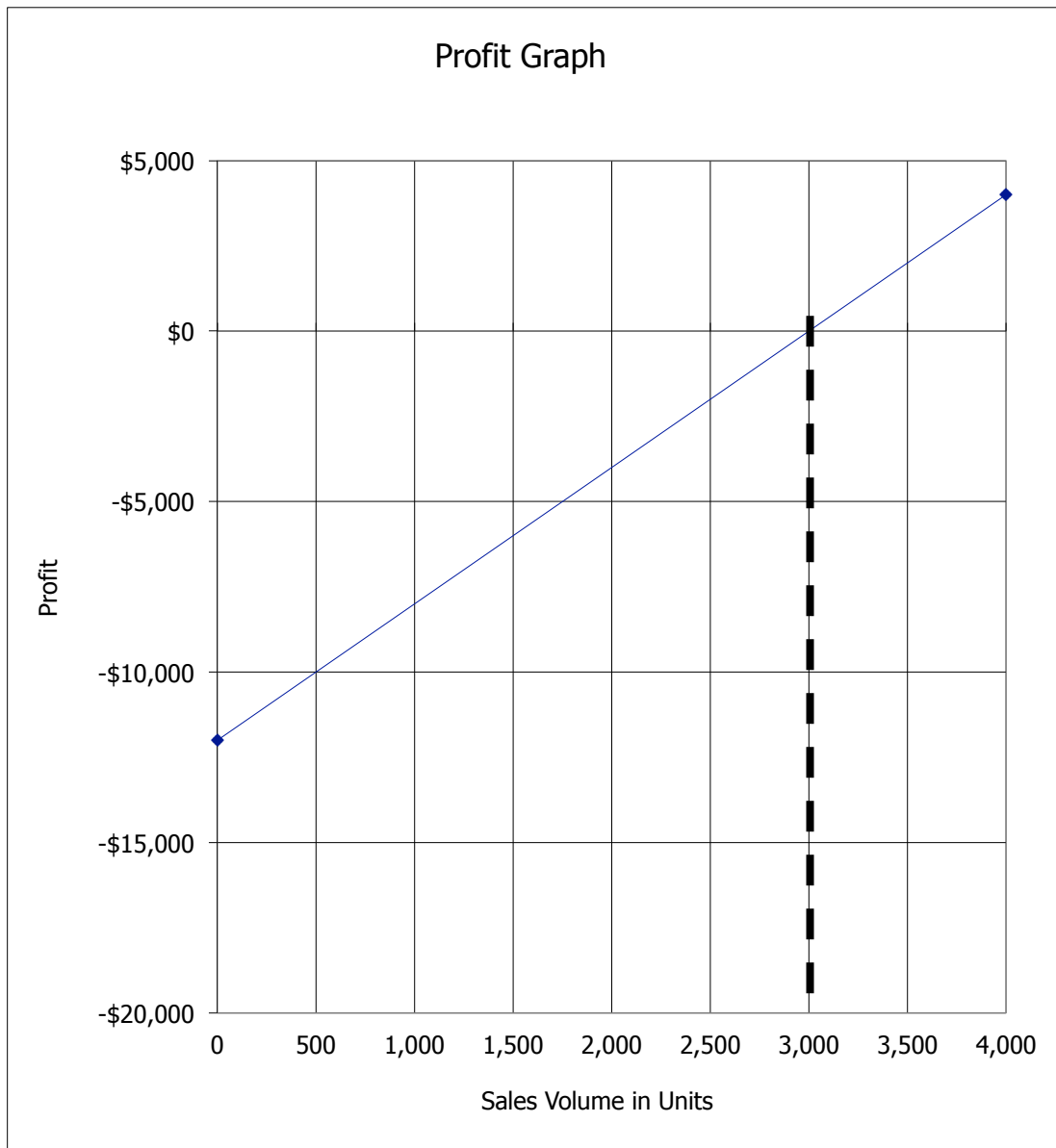
1. The profit graph is based on the following simple equation:

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\text{Profit} = (\$19 - \$15) \times Q - \$12,000$$

$$\text{Profit} = \$4 \times Q - \$12,000$$

To plot the graph, select two different levels of sales such as $Q=0$ and $Q=4,000$. The profit at these two levels of sales are $-\$12,000$ ($= \$4 \times 0 - \$12,000$) and $\$4,000$ ($= \$4 \times 4,000 - \$12,000$).



Exercise 5-3 (continued)

2. Looking at the graph, the break-even point appears to be 3,000 units.
This can be verified as follows:

$$\begin{aligned}\text{Profit} &= \text{Unit CM} \times Q - \text{Fixed expenses} \\ &= \$4 \times Q - \$12,000 \\ &= \$4 \times 3,000 - \$12,000 \\ &= \$12,000 - \$12,000 = \$0\end{aligned}$$

Exercise 5-4 (10 minutes)

1. The company's contribution margin (CM) ratio is:

Total sales	\$300,000
Total variable expenses.....	<u>240,000</u>
= Total contribution margin....	\$ 60,000
÷ Total sales.....	\$300,000
= CM ratio	20%

2. The change in net operating income from an increase in total sales of \$1,500 can be estimated by using the CM ratio as follows:

Change in total sales	\$1,500
× CM ratio	<u>20%</u>
= Estimated change in net operating income	<u>\$ 300</u>

This computation can be verified as follows:

Total sales	\$300,000
÷ Total units sold	<u>40,000</u> units
= Selling price per unit .	<u>\$7.50</u> per unit

Increase in total sales...	\$1,500
÷ Selling price per unit .	<u>\$7.50</u> per unit
= Increase in unit sales	200 units
Original total unit sales .	<u>40,000</u> units
New total unit sales	<u>40,200</u> units

	<i>Original</i>	<i>New</i>
Total unit sales.....	<u>40,000</u>	<u>40,200</u>
Sales	\$300,000	\$301,500
Variable expenses.....	<u>240,000</u>	<u>241,200</u>
Contribution margin	60,000	60,300
Fixed expenses.....	<u>45,000</u>	<u>45,000</u>
Net operating income ...	<u>\$ 15,000</u>	<u>\$ 15,300</u>

Exercise 5-5 (20 minutes)

1. The following table shows the effect of the proposed change in monthly advertising budget:

	<i>Current Sales</i>	<i>Sales With Additional Advertising Budget</i>	<i>Difference</i>
Sales	\$225,000	\$240,000	\$15,000
Variable expenses.....	<u>135,000</u>	<u>144,000</u>	<u>9,000</u>
Contribution margin.....	90,000	96,000	6,000
Fixed expenses.....	<u>75,000</u>	<u>83,000</u>	<u>8,000</u>
Net operating income ...	<u>\$ 15,000</u>	<u>\$ 13,000</u>	<u><u>\$(2,000)</u></u>

Assuming that there are no other important factors to be considered, the increase in the advertising budget should not be approved because it would lead to a decrease in net operating income of \$2,000.

Alternative Solution 1

Expected total contribution margin:	
\$240,000 × 40% CM ratio	\$96,000
Present total contribution margin:	
\$225,000 × 40% CM ratio	<u>90,000</u>
Incremental contribution margin.....	6,000
Change in fixed expenses:	
Less incremental advertising expense .	<u>8,000</u>
Change in net operating income	<u><u>\$(2,000)</u></u>

Alternative Solution 2

Incremental contribution margin:	
\$15,000 × 40% CM ratio	\$6,000
Less incremental advertising expense....	<u>8,000</u>
Change in net operating income	<u><u>\$(2,000)</u></u>

Exercise 5-5 (continued)

2. The \$3 increase in variable expenses will cause the unit contribution margin to decrease from \$30 to \$27 with the following impact on net operating income:

Expected total contribution margin with the higher-quality components:	
3,450 units × \$27 per unit.....	\$93,150
Present total contribution margin:	
3,000 units × \$30 per unit.....	<u>90,000</u>
Change in total contribution margin	<u><u>\$ 3,150</u></u>

Assuming no change in fixed expenses and all other factors remain the same, the higher-quality components should be used.

Exercise 5-6 (10 minutes)

1. The equation method yields the required unit sales, Q , as follows:

$$\begin{aligned}\text{Profit} &= \text{Unit CM} \times Q - \text{Fixed expenses} \\ \$6,000 &= (\$140 - \$60) \times Q - \$40,000 \\ \$6,000 &= (\$80) \times Q - \$40,000 \\ \$80 \times Q &= \$6,000 + \$40,000 \\ Q &= \$46,000 \div \$80 \\ Q &= 575 \text{ units}\end{aligned}$$

2. The formula approach yields the required unit sales as follows:

$$\begin{aligned}\text{Units sold to attain} &= \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Unit contribution margin}} \\ \text{the target profit} &= \frac{\$8,000 + \$40,000}{\$80 \text{ per unit}} \\ &= \frac{\$48,000}{\$80 \text{ per unit}} \\ &= 600 \text{ units}\end{aligned}$$

Exercise 5-7 (20 minutes)

1. The equation method yields the break-even point in unit sales, Q , as follows:

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\$0 = (\$8 - \$6) \times Q - \$5,500$$

$$\$0 = (\$2) \times Q - \$5,500$$

$$\$2Q = \$5,500$$

$$Q = \$5,500 \div \$2$$

$$Q = 2,750 \text{ baskets}$$

2. The equation method can be used to compute the break-even point in sales dollars as follows:

$$\text{CM ratio} = \frac{\text{Unit contribution margin}}{\text{Unit selling price}}$$

$$= \frac{\$2}{\$8} = 0.25$$

$$\text{Profit} = \text{CM ratio} \times \text{Sales} - \text{Fixed expenses}$$

$$\$0 = 0.25 \times \text{Sales} - \$5,500$$

$$0.25 \times \text{Sales} = \$5,500$$

$$\text{Sales} = \$5,500 \div 0.25$$

$$\text{Sales} = \$22,000$$

3. The formula method gives an answer that is identical to the equation method for the break-even point in unit sales:

$$\text{Unit sales to break even} = \frac{\text{Fixed expenses}}{\text{Unit CM}}$$

$$= \frac{\$5,500}{\$2 \text{ per basket}} = 2,750 \text{ baskets}$$

Exercise 5-7 (continued)

4. The formula method also gives an answer that is identical to the equation method for the break-even point in dollar sales:

$$\begin{aligned}\text{Dollar sales to break even} &= \frac{\text{Fixed expenses}}{\text{CM ratio}} \\ &= \frac{\$5,500}{0.25} = \$22,000\end{aligned}$$

Exercise 5-8 (10 minutes)

1. To compute the margin of safety, we must first compute the break-even unit sales.

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\$0 = (\$25 - \$15) \times Q - \$8,500$$

$$\$0 = (\$10) \times Q - \$8,500$$

$$\$10Q = \$8,500$$

$$Q = \$8,500 \div \$10$$

$$Q = 850 \text{ units}$$

Sales (at the budgeted volume of 1,000 units) ..	\$25,000
Break-even sales (at 850 units)	<u>21,250</u>
Margin of safety (in dollars)	<u>\$ 3,750</u>

2. The margin of safety as a percentage of sales is as follows:

Margin of safety (in dollars)	\$3,750
÷ Sales	\$25,000
Margin of safety percentage	15%

Exercise 5-9 (20 minutes)

1. The company's degree of operating leverage would be computed as follows:

Contribution margin	\$36,000
÷ Net operating income	<u>\$12,000</u>
Degree of operating leverage .	<u>3.0</u>

2. A 10% increase in sales should result in a 30% increase in net operating income, computed as follows:

Degree of operating leverage	3.0
× Percent increase in sales	<u>10%</u>
Estimated percent increase in net operating income ..	<u>30%</u>

3. The new income statement reflecting the change in sales is:

	<i>Amount</i>	<i>Percent of Sales</i>
Sales	\$132,000	100%
Variable expenses	<u>92,400</u>	<u>70%</u>
Contribution margin	<u>39,600</u>	<u>30%</u>
Fixed expenses	<u>24,000</u>	
Net operating income ...	<u>\$ 15,600</u>	
Net operating income reflecting change in sales	\$15,600	
Original net operating income (a)	<u>12,000</u>	
Change in net operating income (b)	<u>\$ 3,600</u>	
Percent change in net operating income (b ÷ a)	30%	