

**P6-12 Basics of CVP Analysis** Feather Friends, Inc., makes a high-quality wooden birdhouse that sells for \$20 per unit. Variable costs are \$8 per unit, and fixed costs total \$180,000 per year.

Answer the following independent questions:

1. What is the product's CM ratio?
2. Use the CM ratio to determine the break-even point in sales dollars.
3. Due to an increase in demand, the company estimates that sales will increase by \$75,000 during the next year. By how much should net income increase (or net loss decrease) assuming that fixed costs do not change?
4. Assume that the operating results for last year were:

Sales . . . . .	\$400,000
Less variable expenses	<u>160,000</u>
Contribution margin .	240,000
Less fixed expenses . .	<u>180,000</u>
Net income . . . . .	<u><u>\$ 60,000</u></u>

- a. Compute the degree of operating leverage at the current level of sales.
- b. The president expects sales to increase by 20% next year. By what percentage should net income increase?
5. Refer to the original data. Assume that the company sold 18,000 units last year. The sales manager is convinced that a 10% reduction in the selling price, combined with a \$30,000 increase in advertising, would cause annual sales in units to increase by one-third. Prepare two contribution income statements, one showing the results of last year's operations and one showing the results of operations if these changes are made. Would you recommend that the company do as the sales manager suggests?
6. Refer to the original data. Assume again that the company sold 18,000 units last year. The president does not want to change the selling price. Instead, he wants to increase the sales commission by \$1 per unit. He thinks that this move, combined with some increase in advertising, would increase annual sales by 25%. By how much could advertising be increased with profits remaining unchanged? Do not prepare an income statement; use the incremental analysis approach.

**Problem 6-12** (20 minutes)

1. The CM ratio is 60%:

Sales price .....	\$20	100%
Less variable expenses:	8	40
Contribution margin.....	<u>\$12</u>	<u>60%</u>

2.

$$\frac{\text{Fixed expenses, } \$180,000}{\text{CM ratio, } 0.60} = \$300,000 \text{ sales to break even.}$$

3. \$75,000 increased sales x 60% CM ratio = \$45,000 increased contribution margin. Since the fixed costs will not change, net income should also increase by \$45,000.

4. a.

$$\text{Degree of Operating Leverage} = \frac{\text{Contribution margin}}{\text{Net income}}$$

$$\frac{\$240,000}{\$60,000} = 4$$

b.  $4 \times 20\% = 80\%$  increase in net income.

5.	<u>Last Year: 18,000 units</u>		<u>Proposed: 24,000 units*</u>	
	<u>Amount</u>	<u>Per Unit</u>	<u>Amount</u>	<u>Per Unit</u>
Sales.....	\$360,000	\$20	\$432,000	\$18 **
Less variable expenses .....	144,000	8	192,000	8
Contribution margin.....	<u>216,000</u>	<u>\$12</u>	<u>240,000</u>	<u>\$10</u>
Less fixed expenses .....	<u>180,000</u>		<u>210,000</u>	
Net income.....	<u>\$ 36,000</u>		<u>\$ 30,000</u>	

\*18,000 units + 6,000 units = 24,000 units

\*\*\$20 X 0.9 = \$18

No, the changes should not be made.

6. Expected total contribution margin:	
18,000 units x 1.25 x \$11* .....	\$247,500
Present total contribution margin:	
18,000 units x \$12 .....	<u>216,000</u>
Incremental contribution margin, and the amount by which advertising can be increased with net income remaining unchanged .....	<u>\$ 31,500</u>

\*\$20 – (\$8 + \$1) = \$11

**P6-19 Various CVP Questions: Break-Even Point; Cost Structure; Target Sales**

Northwood Company manufactures basketballs. The company has a standard ball that sells for \$25. At present, the standard ball is manufactured in a small plant that relies heavily on direct labor workers. Thus, variable costs are high, totaling \$15 per ball.

Last year, the company sold 30,000 standard balls, with the following results:

Sales (30,000 standard balls)	\$750,000
Less variable expenses . . . . .	<u>450,000</u>
Contribution margin . . . . .	300,000
Less fixed expenses . . . . .	<u>210,000</u>
Net income . . . . .	<u><u>\$ 90,000</u></u>

Compute (a) the CM ratio and the break-even point in balls, and (b) the degree of operating leverage at last year's level of sales.

2. Due to an increase in labor rates, the company estimates that variable costs will increase by \$3 per ball next year. If this change takes place and the selling price per ball remains constant at \$25, what will be the new CM ratio and break-even point in balls?
3. Refer to the data in (2) above. If the expected change in variable costs takes place, how many balls will have to be sold next year to earn the same net income (\$90,000) as last year?
4. Refer again to the data in (2) above. The president feels that the company must raise the selling price on the standard balls. If Northwood Company wants to maintain *the same CM ratio as last year*, what selling price per ball must it charge next year to cover the increased labor costs?
5. Refer to the original data. The company is discussing the construction of a new, automated plant to manufacture the standard balls. The new plant would slash variable costs per ball by 40%, but it would cause fixed costs to double in amount per year. If the new plant is built, what would be the company's new CM ratio and new break-even point in balls?
6. Refer to the data in (5) above.
  - a. If the new plant is built, how many balls will have to be sold next year to earn the same net income (\$90,000) as last year?
  - b. Assume the new plant is built and that next year the company manufactures and sells 30,000 balls (the same number as sold last year). Prepare a contribution income statement and compute the degree of operating leverage.
  - c. If you were a member of top management, would you have voted in favor of constructing the new plant? Explain.

**Problem 6-19** (60 minutes)

1. a. Selling price .....	\$25	100%
Less variable expenses .....	<u>15</u>	<u>60</u>
Contribution margin .....	<u>\$10</u>	<u>40%</u>

Sales = Variable expenses + Fixed expenses + Profits

$$\$25Q = \$15Q + \$210,000 + \$0$$

$$\$10Q = \$210,000$$

$$Q = \$210,000 \div \$10$$

$$Q = 21,000 \text{ balls}$$

Alternative solution:

$$\frac{\text{Fixed expenses, } \$210,000}{\text{Unit contribution margin, } \$10} = 21,000 \text{ balls}$$

b. The degree of operating leverage would be:

$$\frac{\text{Contribution margin}}{\text{Net income}} = \text{Degree of operating leverage}$$

$$\frac{\$300,000}{\$90,000} = 3.33 \text{ (rounded)}$$

2. The new CM ratio will be:

Selling price .....	\$25	100%
Less variable expenses .....	<u>18</u>	<u>72</u>
Contribution margin .....	<u>\$ 7</u>	<u>28%</u>

The new break-even point will be:

$$\text{Sales} = \text{Variable expenses} + \text{Fixed expenses} + \text{Profits}$$

$$\$25Q = \$18Q + \$210,000 + \$0$$

$$\$7Q = \$210,000$$

$$Q = \$210,000 \div \$7$$

$$Q = 30,000 \text{ balls}$$

Alternative solution:

$$\frac{\text{Fixed expenses, } \$210,000}{\text{Unit contribution margin, } \$7} = 30,000 \text{ balls}$$

3. Sales = Variable expenses + Fixed expenses + Profits

$$\$25Q = \$18Q + \$210,000 + \$90,000$$

$$\$7Q = \$300,000$$

$$Q = \$300,000 \div \$7$$

$$Q = 42,857 \text{ balls (rounded)}$$

Alternative solution:

$$\frac{\text{Fixed expenses} + \text{Target profit}}{\text{Unit contribution margin}} = \text{Target sales}$$
$$\frac{\$210,000 + \$90,000}{\$7} = 42,857 \text{ balls}$$

Thus, sales will have to increase by 12,857 balls (42,857 balls, less 30,000 balls currently being sold) to earn the same amount of net income as last year. The computations above and in part (2) show quite clearly the dramatic effect that increases in variable costs can have on an organization. The effects on Northwood Company are summarized below:

	<b>Present</b>	<b>Expected</b>
Combination margin ratio.....	40%	28%
Break-even point (in balls) .....	21,000	30,000
Sales (in balls) needed to earn a \$90,000 profit.....	30,000	42,857

Note particularly that if variable costs do increase next year, then the company will just break even if it sells the same number of balls (30,000) as it did last year.

4. The contribution margin ratio last year was 40%. If we let P equal the new selling price, then:

$$P = \$18 + 0.40P$$

$$0.60P = \$18$$

$$P = \$18 \div 0.60$$

$$P = \$30$$

To verify: Selling price .....	\$30	100%
Less variable expenses .....	<u>18</u>	<u>60</u>
Contribution margin.....	<u><u>\$12</u></u>	<u><u>40%</u></u>

Therefore, to maintain a 40% CM ratio, a \$3 increase in variable costs would require a \$5 increase in the selling price.

5. The new CM ratio would be:

Selling price .....	\$25	100%
Less variable expenses .....	9*	36
Contribution margin .....	<u>\$16</u>	<u>64%</u>

\*\$15 – (\$15 × 40%) = \$9

The new break-even point would be:

Sales = Variable expenses + Fixed expenses + Profits

\$25Q = \$9Q + \$420,000 + \$0

\$16Q = \$420,000

Q = \$420,000 ÷ \$16.00

Q = 26,250 balls

Alternative solution:

$$\frac{\text{Fixed expenses, } \$420,000}{\text{Unit contribution margin, } \$16} = 26,250 \text{ balls}$$

Although this break-even figure is greater than the company's present break-even figure of 21,000 balls [see Part (1) above], it is less than the break-even point will be if the company does not automate and variable labor costs rise next year [see Part (2) above].



6. a. Sales = Variable expenses + Fixed expenses + Profits  
 $\$25Q = \$9Q + \$420,000 + \$90,000$   
 $\$16Q = \$510,000$   
 $Q = \$510,000 \div \$16$   
 $Q = 31,875$  balls

Alternative solution:

$$\frac{\text{Fixed expenses} + \text{Target profit}}{\text{Unit contribution margin}} = \text{Target sales}$$

$$\frac{\$420,000 + \$90,000}{\$16} = 31,875 \text{ balls}$$

Thus, the company will have to sell 1,875 more balls ( $31,875 - 30,000 = 1,875$ ) than now being sold to earn a profit of \$90,000 per year. However, this is still far less than the 42,857 balls that would have to be sold to earn a \$90,000 profit if the plant is not automated and variable labor costs rise next year [see Part (3) above].

b. The contribution income statement would be:

Sales (30,000 balls × \$25) .....	\$750,000
Less variable expenses (30,000 balls × \$9) .....	270,000
Contribution margin .....	<u>480,000</u>
Less fixed expenses .....	420,000
Net income .....	<u><u>\$ 60,000</u></u>

The degree of operating leverage would be:

$$\frac{\text{Contribution margin, } \$480,000}{\text{Net income, } \$60,000} = 8$$

- c. This problem shows the difficulty faced by many firms today. Variable costs for labor are rising, yet because of competitive pressures it is often difficult to pass these cost increases along in the form of a higher price for products. Thus, firms are forced to automate (to some degree) resulting in higher operating leverage, often a higher break-even point, and greater risk for the company.

There is no clear answer as to whether one should have voted in favor of constructing the new plant. However, this question provides an opportunity to bring out points such as in the preceding paragraph and it forces students to think about the issues involved.