

CHAPTER 22

Cost-Volume-Profit Relationships

ASSIGNMENT CLASSIFICATION TABLE

<u>Study Objectives</u>	<u>Questions</u>	<u>Brief Exercises</u>	<u>Exercises</u>	<u>A Problems</u>	<u>B Problems</u>
1. Distinguish between variable and fixed costs.	1, 2, 3, 6	1	1, 2, 3	1A	1B
2. Explain the significance of the relevant range.	4, 5	2			
3. Explain the concept of mixed costs.	6, 7, 8	3, 4	1, 2, 3	1A	1B
4. List the five components of cost-volume-profit analysis.	9		4		
5. Indicate what contribution margin is and how it can be expressed.	10, 11	5	5, 7, 8	1A, 2A, 3A, 5A	1B, 2B, 3B, 5B
6. Identify the three ways to determine the break-even point.	12, 13, 14	6	5, 6, 7, 8, 9	1A, 2A, 3A, 4A, 5A	1B, 2B, 3B, 4B, 5B
7. Give the formulas for determining sales required to earn target net income.	16	7	9, 10	2A, 5A	2B, 5B
8. Define margin of safety, and give the formulas for computing it.	15	8	5, 6	2A, 4A, 5A	2B, 4B, 5B
9. Describe the essential features of a cost-volume-profit income statement.	17	9	11	2A, 4A	2B, 4B
*10. Explain the difference between absorption costing and variable costing.	18, 19	10	12, 13	6A	6B

***Note:** All **asterisked** Questions, Exercises, and Problems relate to material contained in the appendix to the chapter.

ASSIGNMENT CHARACTERISTICS TABLE

Problem Number	Description	Difficulty Level	Time Allotted (min.)
1A	Determine variable and fixed costs, compute break-even point, prepare a CVP graph, and determine net income.	Simple	20–30
2A	Prepare a CVP income statement, compute break-even point, contribution margin ratio, margin of safety ratio, and sales for target net income.	Moderate	30–40
3A	Compute break-even point under alternative courses of action.	Simple	20–30
4A	Compute break-even point and margin of safety ratio, and prepare CVP income statement before and after changes in business environment.	Moderate	20–30
5A	Compute break-even point and margin of safety ratio, and prepare a CVP income statement before and after changes in business environment.	Moderate	20–30
*6A	Prepare income statements under absorption and variable costing.	Moderate	30–40
1B	Determine variable and fixed costs, compute break-even point, prepare a CVP graph, and determine net income.	Simple	20–30
2B	Prepare a CVP income statement, compute break-even point, contribution margin ratio, margin of safety ratio, and sales for target net income.	Moderate	30–40
3B	Compute break-even point under alternative courses of action.	Simple	20–30
4B	Compute break-even point and margin of safety ratio, and prepare CVP income statement before and after changes in business environment.	Moderate	20–30
5B	Compute break-even point and margin of safety ratio, and prepare a CVP income statement before and after changes in business environment.	Moderate	20–30
*6B	Prepare income statements under absorption and variable costing.	Moderate	30–40

BLOOM'S TAXONOMY TABLE

Correlation Chart between Bloom's Taxonomy, Study Objectives and End-of-Chapter Exercises and Problems

Study Objective	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
1. Distinguish between variable and fixed costs.	E22-3	Q22-1 Q22-6 Q22-2 BE22-1 Q22-3 E22-1		E22-2 P22-1A P22-1B		
2. Explain the significance of the relevant range.		Q22-4 Q22-5		BE22-2		
3. Explain the concept of mixed costs.	E22-3	Q22-6 BE22-1 Q22-7 E22-1	Q22-8 BE22-4	BE22-3 P22-1A E22-2 P22-1B		
4. List the five components of cost-volume-profit analysis.	E22-4	Q22-9				
5. Indicate what contribution margin is and how it can be expressed.		Q22-10	Q22-11 E22-5 E22-7	BE22-5 P22-1B P22-1A P22-2B P22-2A		P22-3A P22-5B P22-3B P22-5A
6. Identify the three ways to determine the break-even point.		Q22-12 Q22-14	Q22-13 BE22-6 E22-5 E22-9	E22-6 P22-1B P22-1A P22-2B P22-2A		P22-3A P22-4B P22-4A P22-5A P22-3B P22-5B
7. Give the formulas for determining sales required to earn target net income.			Q22-16 BE22-7 E22-9	P22-2A P22-2B		P22-5A P22-5B
8. Define margin of safety, and give the formulas for computing it.			Q22-15 BE22-8 E22-5	E22-6 P22-5A P22-2A P22-5B P22-2B		P22-4A P22-4B
9. Describe the essential features of a cost-volume-profit income statement.			Q22-17 BE22-9 E22-11	P22-2A P22-2B		P22-4A P22-4B
*10. Explain the difference between absorption costing and variable costing.		Q22-18 Q22-19	E22-12 E22-13	BE22-10		P22-6A P22-6B
Broadening Your Perspective		Communication	Real-World Focus Exploring the Web	Decision Making Across the Organization		Managerial Analysis Ethics Case All About You

ANSWERS TO QUESTIONS

1. (a) Cost behavior analysis is the study of how specific costs respond to changes in the level of activity within a company.
(b) Cost behavior analysis is important to management in planning business operations and in deciding between alternative courses of action.
2. (a) The activity index identifies the activity that causes changes in the behavior of costs. Once the index is determined, it is possible to classify the behavior of costs in response to changes in activity levels into three categories: variable, fixed, or mixed.
(b) Variable costs may be defined in total or on a per-unit basis. Variable costs in total vary directly and proportionately with changes in the activity level. Variable costs per unit remain the same at every level of activity.
3. Fixed costs remain the same in total regardless of changes in the activity level. In contrast, fixed costs per unit vary inversely with activity. As volume increases, fixed costs per unit decline and vice versa.
4. (a) The relevant range is the range of activity that a company expects to operate during the year.
(b) Disagree. The behavior of both fixed and variable costs are linear only over a certain range of activity.
5. This is true. Most companies operate within the relevant range. Within this range, it is possible to establish a linear (straight-line) relationship for both variable and fixed costs. If a relevant range cannot be established, segregation of costs into fixed and variable becomes extremely difficult.
6. Apartment rent is fixed because the cost per month remains the same regardless of how much Ryan uses the apartment. Rent on a Hertz rental truck is a mixed or semivariable cost because the cost usually includes a per diem charge (a fixed cost) plus an activity charge based on miles driven (a variable cost).
7. For CVP analysis, mixed costs must be classified into their fixed and variable elements. One approach to the classification of mixed costs is the high-low method.
8. Variable cost per unit is \$1.20, or $(\$60,000 \div 50,000)$. At any level of activity, fixed costs are \$52,000 per month [$\$160,000 - (90,000 \times \$1.20)$].
9. No. Only two of the basic components of cost-volume-profit (CVP) analysis, unit selling prices and variable cost per unit, relate to unit data. The other components, volume and total fixed costs, are not based on per-unit amounts.
10. There is no truth in Jill's statement. Contribution margin is sales less variable costs. It is the revenue that remains to cover fixed costs and to produce income (profit) for the company.
11. Contribution margin is \$12 ($\$40 - \28). The contribution margin ratio is 30% ($\$12 \div \40).
12. Disagree. Knowledge of the break-even point is useful to management in deciding whether to introduce new product lines, change sales prices on established products, and enter new market areas.
13. $\$25,000 \div 25\% = \$100,000$

Questions Chapter 22 (Continued)

14. (a) The breakeven point involves the plotting of three lines over the full range of activity: the total revenue line, the total fixed cost line, and the total cost line. The breakeven point is determined at the intersection of the total revenue and total cost lines.
 (b) The breakeven point in units is obtained by drawing a vertical line from the breakeven point to the horizontal axis. The breakeven point in sales dollars is obtained by drawing a horizontal line from the breakeven point to the vertical axis.

15. Margin of safety is the difference between actual or expected sales and sales at the breakeven point. $1,250 \times \$12 = \$15,000$; $\$15,000 - \$12,000 = \$3,000$; $\$3,000 \div \$15,000 = 20\%$.

16. At breakeven sales, the contribution margin is:

$$\frac{\$180,000}{\$600,000} = 30\%$$

The sales volume to achieve net income of \$60,000 is as follows:

$$\frac{\$180,000 + \$60,000}{.30} = \$800,000$$

17.

MALLON COMPANY
CVP Income Statement

Sales		\$900,000
Variable expenses		
Cost of goods sold.....	\$350,000	
Operating expenses	<u>140,000</u>	
Total variable expenses		<u>490,000</u>
Contribution margin		<u>\$410,000</u>

- *18. Under absorption costing, both variable and fixed manufacturing costs are considered to be product costs. Under variable costing, only variable manufacturing costs are product costs and fixed manufacturing costs are expensed when incurred.
- *19. (a) The rationale for variable costing centers on the purpose of fixed manufacturing costs, which is to have productive facilities available for use. Since these costs are incurred whether a company operates at zero or 100% capacity, it is argued that they should be expensed when they are incurred. Variable costing is useful in product costing internally by management and it is useful in controlling manufacturing costs.
 (b) Variable costing cannot be used in product costing in financial statements prepared in accordance with generally accepted accounting principles because it does not comply with the matching principle and thus understates inventory costs.

SOLUTIONS TO BRIEF EXERCISES

BRIEF EXERCISE 22-1

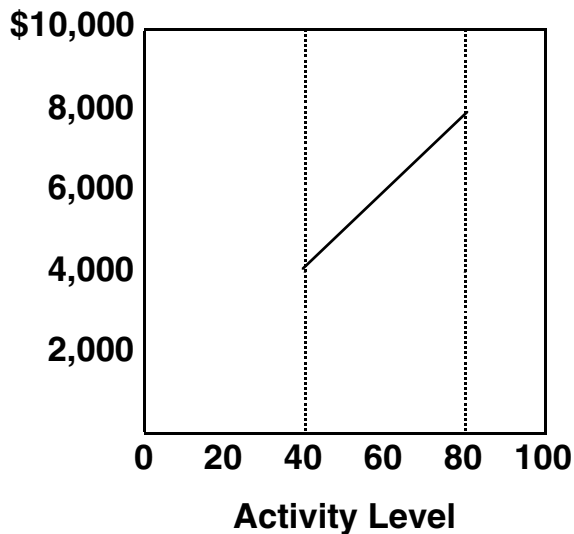
Indirect labor is a variable cost because it increases in total directly and proportionately with the change in the activity level.

Supervisory salaries is a fixed cost because it remains the same in total regardless of changes in the activity level.

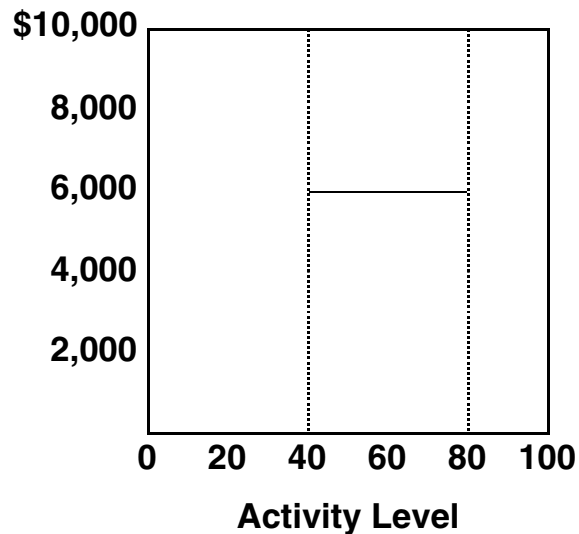
Maintenance is a mixed cost because it increases in total but not proportionately with changes in the activity level.

BRIEF EXERCISE 22-2

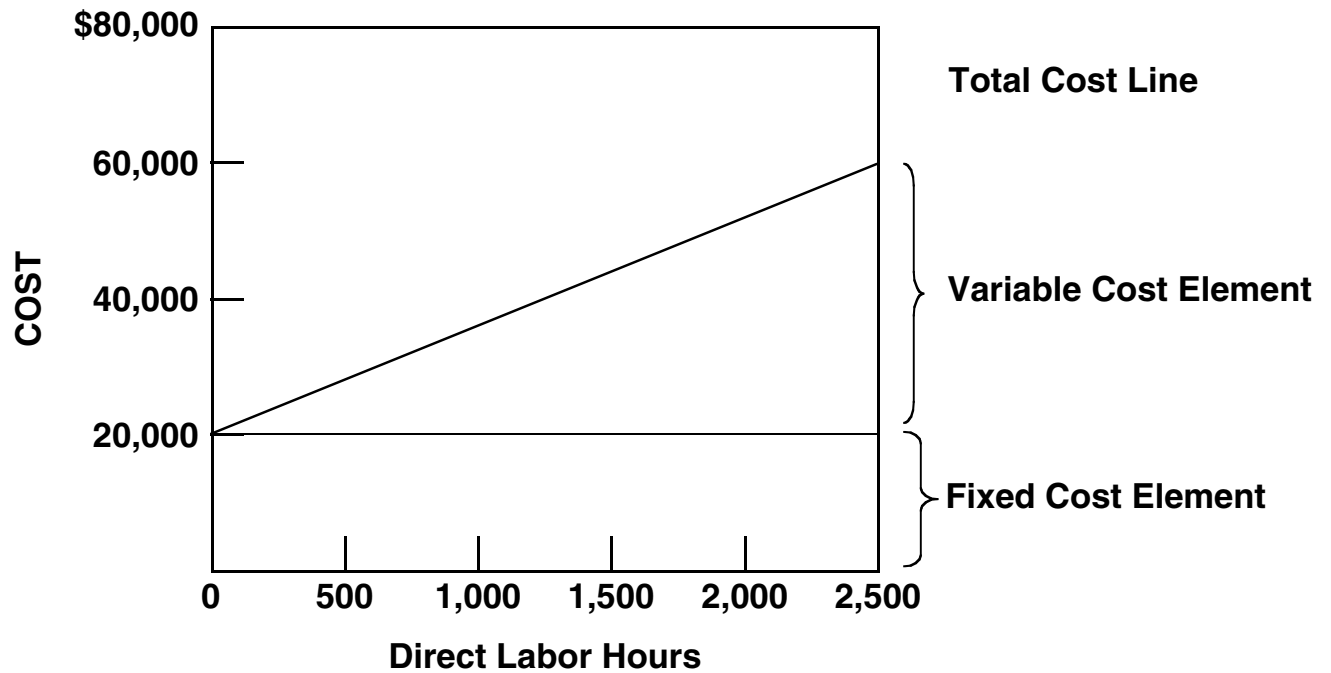
VARIABLE COST
Relevant Range



FIXED COST
Relevant Range



BRIEF EXERCISE 22-3



BRIEF EXERCISE 22-4

High	Low	Difference
\$15,000	\$13,600	\$1,400
8,500	7,500	1,000

$\$1,400 \div 1,000 = \1.40 —Variable cost per mile.

	High	Low
Total cost	\$15,000	\$13,600
Less: Variable costs		
8,500 X \$1.40	11,900	
7,500 X \$1.40		10,500
Total fixed costs	<u>\$ 3,100</u>	<u>\$ 3,100</u>

The mixed cost is \$3,100 plus \$1.40 per mile.

BRIEF EXERCISE 22-5

1. (a) $\$80 = (\$250 - \$170)$
(b) $32\% (\$80 \div \$250)$
2. (c) $\$300 = (\$500 - \$200)$
(d) $40\% (\$200 \div \$500)$
3. (e) $\$1,000 = (\$300 \div 30\%)$
(f) $\$700 (\$1,000 - \$300)$

BRIEF EXERCISE 22-6

- (a) $\$400Q = \$260Q + \$210,000 + \0
 $\$140Q = \$210,000$
 $Q = 1,500$ units
- (b) Contribution margin per unit $\$140$, or $(\$400 - \$260)$
 $X = \$210,000 \div \140
 $X = 1,500$ units

BRIEF EXERCISE 22-7

$$X = .70X + \$210,000 + \$60,000$$
$$.30X = \$270,000$$
$$X = \$900,000$$

If variable costs are 70% of sales, the contribution margin ratio is $(\$1 - \$0.70) \div \$1 = .30$. Then, $(\$210,000 + \$60,000) \div .30 = \$900,000$.

BRIEF EXERCISE 22-8

$$\text{Margin of safety} = \$1,200,000 - \$900,000 = \$300,000$$
$$\text{Margin of safety ratio} = \$300,000 \div \$1,200,000 = 25\%$$

BRIEF EXERCISE 22-9

DILTS MANUFACTURING INC.
Income Statement
For the Quarter Ended March 31, 2008

Sales		\$1,800,000
Variable expenses		
Cost of goods sold	\$760,000	
Selling expenses	95,000	
Administrative expenses	<u>79,000</u>	
Total variable expenses		<u>934,000</u>
Contribution margin		866,000
Fixed expenses		
Cost of goods sold	540,000	
Selling expenses	60,000	
Administrative expenses	<u>66,000</u>	
Total fixed expenses		<u>666,000</u>
Net income		<u>\$ 200,000</u>

***BRIEF EXERCISE 22-10**

MEMO

To: Chief financial officer

From: Student

Re: Absorption and variable costing

Under absorption costing, fixed manufacturing overhead is a product cost, while under variable costing, fixed manufacturing overhead is a period cost (expensed as incurred).

Since units produced (50,000) exceeded units sold (47,000) last month, income under absorption costing will be higher than under variable costing. Some fixed overhead (3,000 units X \$3 = \$9,000) will be assigned to ending inventory and therefore not expensed under absorption costing, whereas all fixed overhead is expensed under variable costing. Therefore, absorption costing net income will be higher than variable costing net income by \$9,000.

SOLUTIONS TO EXERCISES

EXERCISE 22-1

- (a) The determination as to whether a cost is variable, fixed, or mixed can be made by comparing the cost in total and on a per-unit basis at two different levels of production.

Variable Costs	Vary in total but remain constant on a per-unit basis.
Fixed Costs	Remain constant in total but vary on a per-unit basis.
Mixed Costs	Contain both a fixed element and a variable element. Vary both in total and on a per-unit basis.

- (b) Using these criteria as a guideline, the classification is as follows:

Direct materials	Variable	Rent	Fixed
Direct labor	Variable	Maintenance	Mixed
Utilities	Mixed	Supervisory salaries	Fixed

EXERCISE 22-2

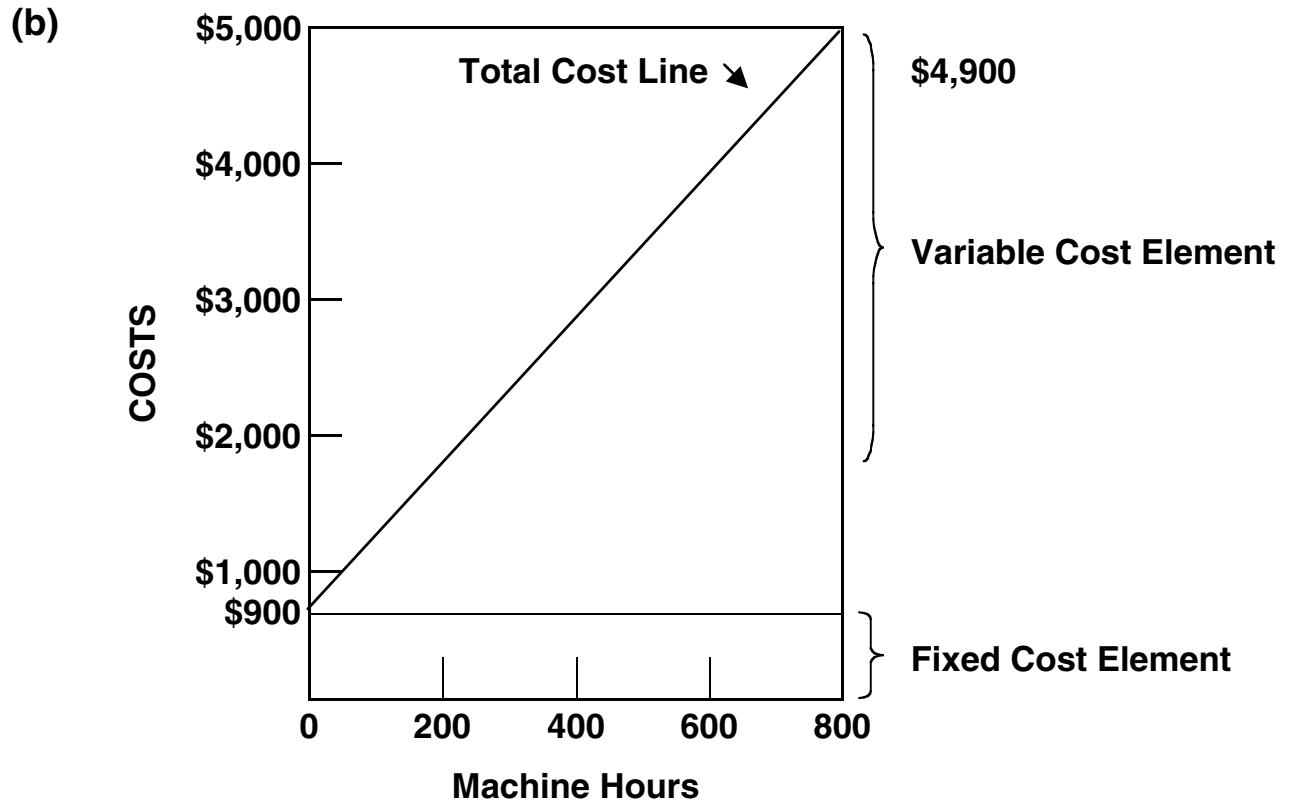
- (a) Maintenance Costs:

$$\frac{\$4,900 - \$2,400}{800 - 300} = \frac{\$2,500}{500} = \$5 \text{ variable cost per machine hour}$$

	<u>800 Machine Hours</u>	<u>300 Machine Hours</u>
Total costs	\$4,900	\$2,400
Less: Variable costs		
800 X \$5	4,000	
300 X \$5		<u>1,500</u>
Total fixed costs	<u>\$ 900</u>	<u>\$ 900</u>

Thus, maintenance costs are \$900 per month plus \$5 per machine hour.

EXERCISE 22-2 (Continued)



EXERCISE 22-3

- | | |
|--|-----------|
| 1. Wood used in the production of furniture. | Variable. |
| 2. Fuel used in delivery trucks. | Variable. |
| 3. Straight-line depreciation on factory building. | Fixed. |
| 4. Screws used in the production of furniture. | Variable. |
| 5. Sales staff salaries. | Fixed. |
| 6. Sales commissions. | Variable. |
| 7. Property taxes. | Fixed. |
| 8. Insurance on buildings. | Fixed. |
| 9. Hourly wages of furniture craftsmen. | Variable. |
| 10. Salaries of factory supervisors. | Fixed. |
| 11. Utilities expense. | Mixed. |
| 12. Telephone bill. | Mixed. |

EXERCISE 22-4

MEMO

To: Jim Thome
From: Student
Re: Assumptions underlying CVP analysis

CVP analysis is a useful tool in analyzing the effects of changes in costs and volume on a company's profits. However, there are some assumptions which underline CVP analysis. When these assumptions are not valid, the results of CVP analysis may be inaccurate.

The five assumptions are:

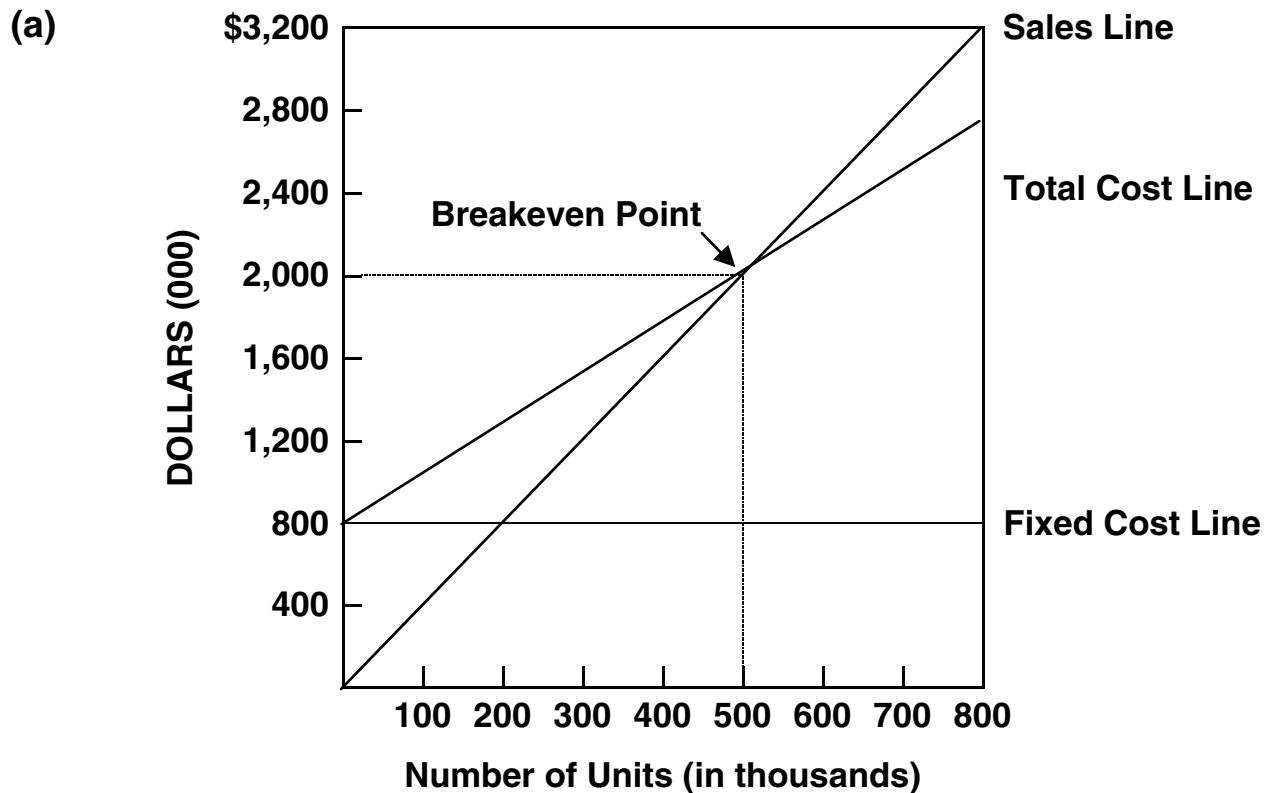
1. The behavior of both costs and revenues is linear throughout the relevant range of the activity index.
2. All costs can be classified with reasonable accuracy as either fixed or variable.
3. Changes in activity are the only factors that affect costs.
4. All units produced are sold.
5. When more than one type of product is sold, the sales mix will remain constant.

If you want further explanation of any of these assumptions, please contact me.

EXERCISE 22-5

- (a) Contribution margin (in dollars):
- | | |
|-----------------------------------|-----------------|
| Sales = (2,700 X \$30) = | \$81,000 |
| Variable costs = \$81,000 X .70 = | <u>56,700</u> |
| Contribution margin | <u>\$24,300</u> |
- Variable cost (per unit): \$30 X .70 = \$21.
Contribution margin (per unit): \$30 – \$21 (\$30 X 70%) = \$9.
Contribution margin (ratio): \$9 ÷ \$30 = 30%.
- (b) Breakeven sales (in dollars):
- $$\frac{\$18,000}{30\%} = \$60,000.$$
- Breakeven sales (in units):
- $$\frac{\$18,000}{\$9} = 2,000 \text{ units.}$$
- (c) Margin of safety (in dollars): \$81,000 – \$60,000 = \$21,000.
Margin of safety (ratio): \$21,000 ÷ \$81,000 = 26%(rounded).

EXERCISE 22-6



(b) (1) Breakeven sales in units:

$$\begin{aligned} \$4X &= \$2.40X + \$800,000 \\ \$1.60X &= \$800,000 \\ X &= 500,000 \text{ units} \end{aligned}$$

(2) Breakeven sales in dollars:

$$\begin{aligned} X &= .60X + \$800,000 \\ .40X &= \$800,000 \\ X &= \$2,000,000 \end{aligned}$$

(c) (1) Margin of safety in dollars: $\$2,500,000 - \$2,000,000 = \$500,000$

(2) Margin of safety ratio: $\$500,000 \div \$2,500,000 = 20\%$

EXERCISE 22-7

$$\begin{aligned} \text{(a) Unit contribution margin} &= \frac{\text{Fixed costs}}{\text{Breakeven sales in units}} \\ &= \frac{\$105,000}{(\$350,000 \div \$7)} \\ &= \$2.10 \end{aligned}$$

$$\begin{aligned} \text{Variable cost per unit} &= \text{Unit selling price} - \text{Unit contribution margin} \\ &= \$7.00 - \$2.10 \\ &= \$4.90 \end{aligned}$$

OR

$$\begin{aligned} 50,000 \times \$7.00 &= 50,000X + \$105,000 \\ \text{where } X &= \text{Variable cost per unit} \\ \text{Variable cost per unit} &= \$4.90 \end{aligned}$$

$$\text{Contribution margin ratio} = \$2.10 \div \$7.00 = 30\%$$

$$\begin{aligned} \text{(b) Fixed costs} &= \text{Breakeven sales in units} \times \text{Unit contribution margin} \\ &= (\$420,000 \div \$7.00) \times \$2.10 \\ &= \$126,000 \end{aligned}$$

OR

$$\begin{aligned} \text{Fixed costs} &= \text{Breakeven sales} \times \text{Contribution margin ratio} \\ &= \$420,000 \times 30\% \\ &= \$126,000 \end{aligned}$$

Since fixed costs were \$105,000 in 2008, the increase in 2009 is \$21,000 (\$126,000 – \$105,000).

EXERCISE 22-8

(a)

NIU COMPANY
CVP Income Statement
For the Month Ended September 30, 2008

	<u>Total</u>	<u>Per Unit</u>
Sales (620 video game consoles)	\$248,000	\$400
Variable costs	<u>167,400</u>	<u>270</u>
Contribution margin	80,600	<u>\$130</u>
Fixed costs	<u>52,000</u>	
Net income.....	<u>\$ 28,600</u>	

(b) **Sales = Variable costs + Fixed costs**
 \$400X = \$270X + \$52,000
 \$130X = 52,000
 X = 400 units

(c)

NIU COMPANY
CVP Income Statement
For the Month Ended September 30, 2008

	<u>Total</u>	<u>Per Unit</u>
Sales (400 video game consoles).....	\$160,000	\$400
Variable costs	<u>108,000</u>	<u>270</u>
Contribution margin.....	52,000	<u>\$130</u>
Fixed costs.....	<u>52,000</u>	
Net income	<u>\$ -0-</u>	

EXERCISE 22-9

(a) **Sales = Variable cost + Fixed cost + Target net income**
 \$150X = \$90X + \$570,000 + \$150,000
 \$60X = \$720,000
 X = 12,000 units

EXERCISE 22-9 (Continued)

OR

$$\text{Units sold in 2008} = \frac{\$570,000 + \$150,000}{\$150 - \$90} = \underline{12,000} \text{ units}$$

$$(b) \text{ Units needed in 2009} = \frac{\$570,000 + \$210,000^*}{\$150 - \$90} = \underline{13,000} \text{ units}$$

$$*\$150,000 + \$60,000 = \$210,000$$

$$(c) \frac{\$570,000 + \$210,000}{X - \$90} = 12,000 \text{ units, where } X = \text{new selling price}$$

$$\$780,000 = 12,000X - \$1,080,000$$

$$\$1,860,000 = 12,000X$$

$$X = \underline{\$155}$$

EXERCISE 22-10

1. Unit sales price = $\$350,000 \div 5,000 \text{ units} = \70
Increase selling price to \$77, or ($\$70 \times 110\%$).
Net income = $\$385,000 - \$210,000 - \$90,000 = \$85,000$.
2. Reduce variable costs to 55% of sales.
Net income = $\$350,000 - \$192,500 - \$90,000 = \$67,500$.
3. Reduce fixed costs to \$80,000, or ($\$90,000 - \$10,000$).
Net income = $\$350,000 - \$210,000 - \$80,000 = \$60,000$.

Alternative 1, increasing selling price, will produce the highest net income.

EXERCISE 22-11

POLZIN COMPANY
CVP Income Statement (Current)
For the Year Ended December 31, 2008

	Total	Per Unit
Sales (60,000 X \$25)	\$1,500,000	\$25
Variable expenses (60,000 X \$14).....	840,000	14
Contribution margin.....	660,000	<u>\$11</u>
Fixed expenses	500,000	
Net income	\$ 160,000	

POLZIN COMPANY
CVP Income Statement (with changes)
For the Year Ended December 31, 2008

	Total	Per Unit
Sales [64,200 units (1) X \$23.60 (2)].....	\$1,515,120	\$23.60
Variable expenses [64,200 X \$11.20 (3)].....	719,040	11.20
Contribution margin (64,200 X \$12.40)	796,080	<u>\$12.40</u>
Fixed expenses (\$500,000 + \$60,000).....	560,000	
Net income	\$ 236,080	

- (1) (60,000 X 107%).
- (2) \$25.00 – (\$2.80 X 50%) = \$23.60.
- (3) \$14.00 – (\$14 X 20%) = \$11.20.

***EXERCISE 22-12**

	Type of Cost Manufacturing Cost per Unit	Variable Costing
(a)	Direct materials	\$1,000
	Direct labor	1,500
	Variable manufacturing overhead	300
	Fixed manufacturing overhead	0
	Total cost	\$2,800

***EXERCISE 22-12 (Continued)**

**(b) TITUS EQUIPMENT COMPANY
Income Statement
For the Year Ended December 31, 2008
(Variable Costing)**

Sales (1,300 X \$4,500)		\$5,850,000
Variable expenses		
Variable cost of goods sold		
Inventory, January 1	\$ 0	
Variable manufacturing costs	<u>4,200,000</u>	(1)
Cost of goods available for sale	4,200,000	
Inventory, December 31	<u>560,000</u>	(2)
Variable cost of goods sold	3,640,000	
Variable selling and administrative expenses	<u>91,000</u>	(3)
Total variable expenses		<u>3,731,000</u>
Contribution margin		<u>2,119,000</u>
Fixed expenses		
Manufacturing overhead	1,400,000	
Selling and administrative expenses	<u>100,000</u>	
Total fixed expenses		<u>1,500,000</u>
Income from operations		<u>\$ 619,000</u>

(1) 1,500 X \$2,800

(2) 200 X \$2,800

(3) 1,300 X \$70

***EXERCISE 22-13**

**(a) COWELL CORPORATION
Income Statement
For the Month Ended October 31, 2008
(Absorption Costing)**

Sales (20,000 X \$50).....	\$1,000,000
Cost of goods sold (20,000 X \$34*).....	<u>680,000</u>
Gross profit	320,000
Fixed costs	<u>30,000</u>
Net income.....	<u>\$ 290,000</u>

*\$10 + \$8 + \$6 + (\$250,000 ÷ 25,000)

**(b) COWELL CORPORATION
Income Statement
For the Month Ended October 31, 2008
(Variable Costing)**

Sales (20,000 X \$50).....	\$1,000,000
Cost of goods sold (20,000 X \$24).....	<u>480,000</u>
Contribution margin	520,000
Fixed costs (\$250,000 + \$30,000)	<u>280,000</u>
Net income.....	<u>\$ 240,000</u>

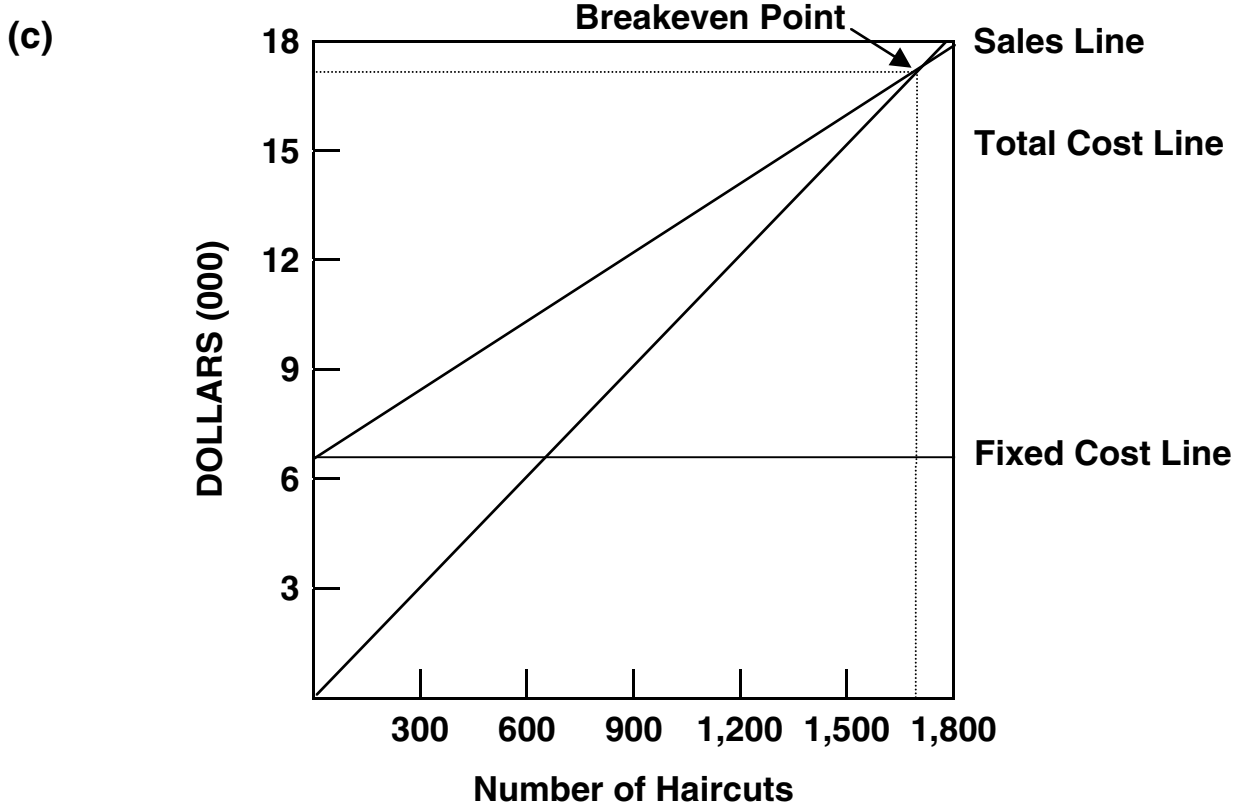
(c) Under variable costing, all fixed manufacturing costs (\$250,000) are expensed. Under absorption costing, some of the fixed manufacturing costs have been deferred to a later period [5,000 X (\$250,000/25,000) = \$50,000].

SOLUTIONS TO PROBLEMS

PROBLEM 22-1A

(a) Variable costs (per haircut)		Fixed costs (per month)	
Barbers' commission	\$5.50	Barbers' salaries	\$5,000
Barber supplies	.30	Manager's extra salary	500
Utilities	.20	Advertising	200
Total variable cost per haircut	\$6.00	Rent	900
		Utilities	175
		Magazines	25
		Total fixed	\$6,800

(b) $\$10.00X = \$6.00X + \$6,800$ $1,700 \text{ haircuts} \times \$10 = \$17,000$
 $\$ 4.00X = \$6,800$
 $X = 1,700 \text{ haircuts}$



(d) Net income = $\$19,000 - [(\$6.00 \times 1,900) + \$6,800]$
 $= \$800$

PROBLEM 22-2A

(a)

UTECH COMPANY
CVP Income Statement (Estimated)
For the Year Ending December 31, 2008

Net sales		\$1,800,000
Variable expenses		
Cost of goods sold	\$1,098,000*	
Selling expenses	70,000	
Administrative expenses	20,000	
Total variable expenses		<u>1,188,000</u>
Contribution margin		612,000
Fixed expenses		
Cost of goods sold	283,000	
Selling expenses	65,000	
Administrative expenses	60,000	
Total fixed expenses		<u>408,000</u>
Net income		<u>\$ 204,000</u>

*Direct materials \$430,000 + direct labor \$352,000 + variable manufacturing overhead \$316,000.

(b) Variable costs = 66% of sales (\$1,188,000 ÷ \$1,800,000) or \$.33 per bottle (\$.50 X 66%). Total fixed costs = \$408,000.

$$\begin{aligned} (1) \quad & \$.50X = \$.33X + \$408,000 \\ & \$.17X = \$408,000 \\ & X = 2,400,000 \text{ units} \end{aligned}$$

$$(2) \quad 2,400,000 \times \$.50 = \$1,200,000$$

(c) Contribution margin ratio = $(\$.50 - \$.33) \div \$.50$
 = 34%

Margin of safety ratio = $(\$1,800,000 - \$1,200,000) \div \$1,800,000$
 = 33% (rounded)

(d) Required sales

$$X = \frac{\$408,000 + \$238,000}{.34} = \$1,900,000$$

PROBLEM 22-3A

- (a) Sales were \$2,400,000, variable expenses were \$1,560,000 (65% of sales), and fixed expenses were \$980,000. Therefore, the breakeven point in dollars is:

$$\frac{\$980,000}{.35} = \$2,800,000$$

- (b) 1. The effect of this alternative is to increase the selling price per unit to \$4.80 (\$4 X 120%). Total sales become \$2,880,000 (600,000 X \$4.80). Thus, the contribution margin ratio changes to 46% [(\$2,880,000 – \$1,560,000) ÷ \$2,880,000]. The new breakeven point is:

$$\frac{\$980,000}{.46} = \$2,130,435 \text{ (rounded)}$$

2. The effects of this alternative are to change total fixed costs to \$830,000 (\$980,000 – \$150,000) and to change the contribution margin to 30% [(\$2,400,000 – \$1,560,000 – \$120,000) ÷ \$2,400,000]. The new breakeven point is:

$$\frac{\$830,000}{.30} = \$2,766,667 \text{ (rounded)}$$

3. The effects of this alternative are variable and fixed cost of goods sold become \$1,134,000 and \$966,000 respectively. As a result, total variable cost becomes \$1,254,000 (\$1,134,000 + \$72,000 + \$48,000) and total fixed cost becomes \$1,286,000 (\$966,000 + \$168,000 + \$152,000). The new breakeven point is:

$$\begin{aligned} X &= (\$1,254,000 \div \$2,400,000)X + \$1,286,000 \\ X &= .52X + \$1,286,000 \\ .48X &= \$1,286,000 \\ X &= \$2,679,167 \text{ (rounded)} \end{aligned}$$

Alternative 1 is the recommended course of action because it has the lowest breakeven point.

PROBLEM 22-4A

(a) Current breakeven point: $\$40X = \$22X + \$270,000$
 (where X = pairs of shoes)

$$\begin{aligned} \$18X &= \$270,000 \\ X &= 15,000 \text{ pairs of shoes} \end{aligned}$$

New breakeven point: $\$38X = \$22X + (\$270,000 + \$34,000)$
 $\$16X = \$304,000$
 $X = 19,000$ pairs of shoes

(b) Current margin of safety percentage = $\frac{(20,000 \times \$40) - (15,000 \times \$40)}{(20,000 \times \$40)}$
 = 25%

New margin of safety percentage = $\frac{(24,000 \times \$38) - (19,000 \times \$38)}{(24,000 \times \$38)}$
 = 21% (rounded)

(c) **VALUE SHOE STORE**
CVP Income Statement

	Current	New	
Sales (20,000 X \$40)	\$800,000	\$912,000	(24,000 X \$38)
Variable expenses (20,000 X \$22)	440,000	528,000	(24,000 X \$22)
Contribution margin	360,000	384,000	
Fixed expenses	270,000	304,000	
Net income	\$ 90,000	\$ 80,000	

The proposed changes will raise the breakeven point 4,000 units. This is a significant increase. Margin of safety is 4% lower and net income is \$10,000 lower. The recommendation is to not accept the proposed changes.

PROBLEM 22-5A

(a) (1)

	<u>Current Year</u>
Net sales	\$1,600,000
Variable costs	
Direct materials	511,000
Direct labor	285,000
Manufacturing overhead (\$360,000 X .70)	252,000
Selling expenses (\$240,000 X .40)	96,000
Administrative expenses (\$280,000 X .20)	56,000
Total variable costs	<u>1,200,000</u>
Contribution margin	<u>\$ 400,000</u>

	<u>Current Year</u>		<u>Projected Year</u>
Sales	\$1,600,000	X 1.1	\$1,760,000
Variable costs			
Direct materials	511,000	X 1.1	562,100
Direct labor	285,000	X 1.1	313,500
Manufacturing overhead	252,000	X 1.1	277,200
Selling expenses	96,000	X 1.1	105,600
Administrative expenses	56,000	X 1.1	61,600
Total variable costs	<u>1,200,000</u>	X 1.1	<u>1,320,000</u>
Contribution margin	<u>\$ 400,000</u>	X 1.1	<u>\$ 440,000</u>

(2)

	<u>Current Year</u>	<u>Projected year</u>
Fixed Costs		
Manufacturing overhead (\$360,000 X .30)	\$108,000	\$108,000
Selling expenses (\$240,000 X .60)	144,000	144,000
Administrative expenses (\$280,000 X .80)	224,000	224,000
Total fixed costs	<u>\$476,000</u>	<u>\$476,000</u>

PROBLEM 22-5A (Continued)

(b) Unit selling price = $\$1,600,000 \div 100,000 = \16
Unit variable cost = $\$1,200,000 \div 100,000 = \12
Unit contribution margin = $\$16 - \$12 = \$4$
Contribution margin ratio = $\$4 \div \$16 = .25$

Break-even point in units = Fixed costs \div Unit contribution margin
119,000 units = $\$476,000 \div \4

Break-even point in dollars = Fixed costs \div Contribution margin ratio
 $\$1,904,000 = \$476,000 \div .25$

(c) Sales dollars
required for = (Fixed costs + Target net income) \div Contribution margin ratio
target net income
 $\$3,144,000 = (\$476,000 + \$310,000) \div .25$

(d) Margin of safety = (Expected sales – Break-even sales) \div Expected sales
ratio
39.4% = $(\$3,144,000 - \$1,904,000) \div \$3,144,000$

(e) (1)

	<u>Projected Year</u>
Net sales	\$1,600,000
Variable costs	
Direct materials	511,000
Direct labor (\$285,000 – \$104,000)	181,000
Manufacturing overhead (\$360,000 X .30)	108,000
Selling expenses (\$240,000 X .90)	216,000
Administrative expenses (\$280,000 X .20)	56,000
Total variable costs	<u>1,072,000</u>
Contribution margin	<u>\$ 528,000</u>

PROBLEM 22-5A (Continued)

(2) Contribution margin ratio = $\$528,000 \div \$1,600,000 = .33$

(3) Break-even point in dollars = $\$500,000 \div .33 = \$1,515,152$ (rounded)

Fixed cost

Manufacturing overhead ($\\$360,000 \times .70$)	\$252,000
Selling expenses ($\\$240,000 \times .10$)	24,000
Administrative expenses ($\\$280,000 \times .80$)	<u>224,000</u>
Total fixed costs	<u>\$500,000</u>

The break-even point in dollars declined from \$1,904,000 to \$1,515,152. This means that overall the company's risk has declined because it doesn't have to generate as much in sales. The two changes actually had opposing effects on the break-even point. By changing to a more commission based approach to compensating its sales staff the company reduced its fixed costs, and therefore reduced its break-even point. In contrast, the purchase of the new equipment increased the company's fixed costs (by increasing its equipment depreciation) and reduced its variable direct labor cost, both of which would increase the break-even point.

***PROBLEM 22-6A**

(a)

**TLR COMPANY
Income Statement
For the Year Ended December 31
(Variable Costing)**

	2008	2009
Sales.....	<u>\$5,000,000</u>	<u>\$6,000,000</u>
Variable expenses		
Variable cost of goods sold		
Inventory, January 1.....	0	150,000
Variable manufacturing costs	<u>900,000</u> (1)	<u>750,000</u> (4)
Cost of goods available for sale.....	900,000	900,000
Inventory, December 31	<u>150,000</u> (2)	<u>0</u>
Variable cost of goods sold.....	750,000	900,000
Variable selling expenses	<u>500,000</u> (3)	<u>600,000</u> (5)
Total variable expenses	<u>1,250,000</u>	<u>1,500,000</u>
Contribution margin.....	<u>3,750,000</u>	<u>4,500,000</u>
Fixed expenses		
Manufacturing overhead.....	2,100,000	2,100,000
Administrative.....	<u>500,000</u>	<u>500,000</u>
Total fixed expenses	<u>2,600,000</u>	<u>2,600,000</u>
Income from operations	<u>\$1,150,000</u>	<u>\$1,900,000</u>

2008 Computations

- (1) $6,000 \times \$1,000 \times .15$
- (2) $1,000 \times \$1,000 \times .15$
- (3) $5,000 \times \$1,000 \times .10$

2009 Computations

- (4) $5,000 \times \$1,000 \times .15$
- (5) $6,000 \times \$1,000 \times .10$

***PROBLEM 22-6A (Continued)**

**(b) TLR COMPANY
Income Statement
For the Year Ended December 31
(Absorption Costing)**

	<u>2008</u>	<u>2009</u>
Sales	<u>\$5,000,000</u>	<u>\$6,000,000</u>
Cost of goods sold		
Inventory, January 1	0	500,000
Cost of goods manufactured	<u>3,000,000</u> (1)	<u>2,850,000</u> (3)
Cost of goods available for sale	3,000,000	3,350,000
Inventory, December 31	<u>500,000</u> (2)	<u>0</u>
Cost of goods sold	<u>2,500,000</u>	<u>3,350,000</u>
Gross profit	<u>2,500,000</u>	<u>2,650,000</u>
Operating expenses		
Selling expenses	500,000	600,000
Administrative expenses	<u>500,000</u>	<u>500,000</u>
Total operating expenses	<u>1,000,000</u>	<u>1,100,000</u>
Income from operations	<u>\$1,500,000</u>	<u>\$1,550,000</u>

<u>2008 Computations</u>	<u>2009 Computations</u>
(1) $6,000 \times [(\$1,000 \times .15) + (\$2,100,000 \div 6,000)]$	(3) $5,000 \times [(\$1,000 \times .15) + (\$2,100,000 \div 5,000)]$
(2) $1,000 \times [(\$1,000 \times .15) + (\$2,100,000 \div 6,000)]$	

(c) The variable costing and the absorption costing income from operations can be reconciled as follows:

	<u>2008</u>	<u>2009</u>
Variable costing income	\$1,150,000	\$1,900,000
Fixed manufacturing overhead expensed with variable costing	\$2,100,000	\$2,100,000
Less: Fixed manufacturing overhead expensed with absorption costing	<u>(1,750,000)</u> ⁽¹⁾	<u>(2,450,000)</u> ⁽²⁾
Difference	<u>350,000</u>	<u>(350,000)</u>
Absorption costing income	<u>\$1,500,000</u>	<u>\$1,550,000</u>

⁽¹⁾In 2008, with absorption costing \$1,750,000 $\left(\$2,100,000 \times \frac{5,000 \text{ units sold}}{6,000 \text{ units manufactured}} \right)$ of the fixed manufacturing overhead is expensed as part of cost of goods sold, and \$350,000 $\left(\$2,100,000 \times \frac{1,000 \text{ units in inventory}}{6,000 \text{ units manufactured}} \right)$ is included in the ending inventory.

***PROBLEM 22-6A (Continued)**

⁽²⁾In 2009, with absorption costing \$2,450,000 of fixed manufacturing overhead is expensed as part of cost of goods sold. This includes the fixed manufacturing overhead for 2009 of \$2,100,000 plus \$350,000 of fixed manufacturing overhead from 2008 that was included in the beginning inventory for 2009.

- (d) Income is more sensitive to change in sales under variable costing as seen in the increase in income from operations in 2009 when 1,000 additional units were sold. In contrast, under absorption costing, income is also strongly influenced by production as seen in the higher income from operations in 2008 when production exceeded sales by 1,000 units.**

PROBLEM 22-1B

(a) Variable costs (per haircut)

Barbers' commission	\$3.00
Rent	.60
Barber supplies	.40
Total variable	<u>\$4.00</u>

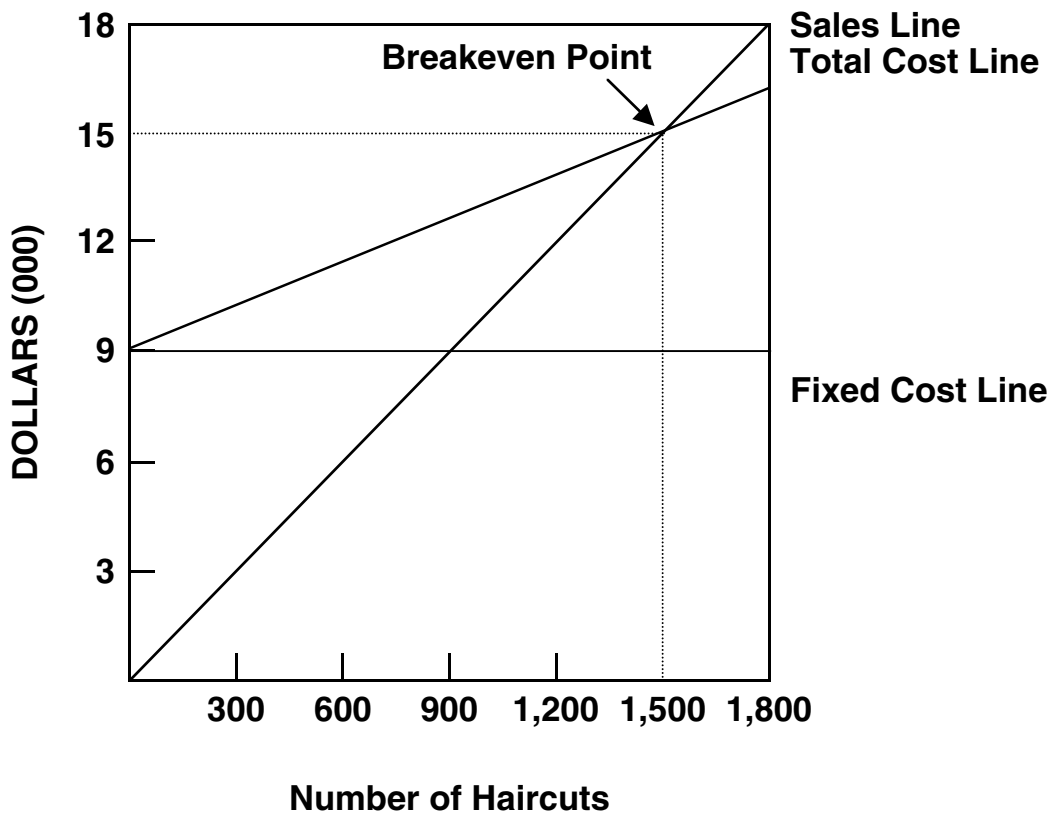
Fixed costs (per month)

Barbers' salaries	\$7,400
Rent	700
Depreciation	500
Utilities	300
Advertising	100
Total fixed	<u>\$9,000</u>

(b) $\$10X = \$4X + \$9,000$
 $\$6X = \$9,000$
 $X = 1,500$ haircuts

1,500 haircuts X \$10 = \$15,000

(c)



(d) Net income = \$17,000 - [(\$4.00 X 1,700) + \$9,000]
= \$1,200

PROBLEM 22-2B

(a)

WILKS COMPANY
CVP Income Statement (Estimated)
For the Year Ending December 31, 2008

Net sales		\$2,000,000
Variable expenses		
Cost of goods sold	\$1,220,000 (1)	
Selling expenses	100,000	
Administrative expenses	40,000	
Total variable expenses		<u>1,360,000</u>
Contribution margin		<u>640,000</u>
Fixed expenses		
Cost of goods sold	220,000	
Selling expenses	150,000	
Administrative expenses	78,000	
Total fixed expenses		<u>448,000</u>
Net income		<u>\$ 192,000</u>

(1) Direct materials \$360,000 + direct labor \$590,000 + variable manufacturing overhead \$270,000.

(b) Variable costs = 68% of sales (\$1,360,000 ÷ \$2,000,000) or \$.34 per bottle (\$.50 X 68%). Total fixed costs = \$448,000.

$$\begin{aligned} (1) \quad & \$.50X = \$.34X + \$448,000 \\ & \$.16X = \$448,000 \\ & X = 2,800,000 \text{ units (breakeven)} \end{aligned}$$

$$(2) \quad 2,800,000 \times \$.50 = \$1,400,000$$

(c) Contribution margin ratio = $(\$.50 - \$.34) \div \$.50$
= 32%

Margin of safety ratio = $(\$2,000,000 - \$1,400,000) \div \$2,000,000$
= 30%

(d) Required sales

$$X = \frac{\$448,000 + \$272,000}{.32} = \$2,250,000$$

PROBLEM 22-3B

- (a) Sales were \$1,500,000 and variable expenses were \$900,000, which means contribution margin was \$600,000 and CM ratio was 40%. Fixed expenses were \$760,000. Therefore, the breakeven point in dollars is:

$$\frac{\$760,000}{.40} = \$1,900,000$$

- (b) 1. The effect of this alternative is to increase the selling price per unit to \$30 (\$25 X 120%). Total sales become \$1,800,000 (60,000 X \$30). Thus, the contribution margin ratio changes to 50% (\$900,000 ÷ \$1,800,000). The new breakeven point is:

$$\frac{\$760,000}{.50} = \$1,520,000$$

2. The effects of this alternative are to change total fixed costs to \$590,000 (\$760,000 – \$170,000) and to change the contribution margin to .34 [(\$1,500,000 – \$900,000 – \$90,000) ÷ \$1,500,000]. The new breakeven point is:

$$\frac{\$590,000}{.34} = \$1,735,294 \text{ (rounded)}$$

3. The effects of this alternative are: (1) variable and fixed cost of goods sold become \$600,000 each, (2) total variable costs become \$720,000 (\$600,000 + \$65,000 + \$55,000), and (3) total fixed costs are \$940,000 (\$600,000 + \$275,000 + \$65,000). The new breakeven point is:

$$\begin{aligned} X &= (\$720,000 \div \$1,500,000)X + \$940,000 \\ X &= .48X + \$940,000 \\ .52X &= \$940,000 \\ X &= \$1,807,692 \text{ (rounded)} \end{aligned}$$

Alternative 1 is the recommended course of action using breakeven analysis because it has the lowest breakeven point.

PROBLEM 22-4B

(a) Current breakeven point: $\$30X = \$13X + \$204,000$
 (where X = pairs of shoes)

$$\begin{aligned} \$17X &= \$204,000 \\ X &= 12,000 \text{ pairs of shoes} \end{aligned}$$

New breakeven point: $\$28X = \$13X + (\$204,000 + \$51,000)$
 $\$15X = \$255,000$
 $X = 17,000$ pairs of shoes

(b) Current margin of safety percentage = $\frac{(16,000 \times \$30) - (12,000 \times \$30)}{(16,000 \times \$30)}$
 = 25%

New margin of safety percentage = $\frac{(21,000 \times \$28) - (17,000 \times \$28)}{(21,000 \times \$28)}$
 = 19% (rounded)

(c) **THRIFTY SHOE STORE**
CVP Income Statement

	Current	New	
Sales (16,000 X \$30)	\$480,000	\$588,000	(21,000 X \$28)
Variable expenses (16,000 X \$13)	208,000	273,000	(21,000 X \$13)
Contribution margin	272,000	315,000	
Fixed expenses	204,000	255,000	
Net income	\$ 68,000	\$ 60,000	

No, the changes should not be made because net income will be lower than the net income currently earned. In addition, the breakeven point would be higher by 5,000 units and the margin of safety percentage would decrease from 25% to 19%.

PROBLEM 22-5B

(a) (1)

	<u>Current Year</u>
Net sales	\$2,400,000
Variable costs	
Direct materials	626,500
Direct labor	507,500
Manufacturing overhead (\$540,000 X .50)	270,000
Selling expenses (\$360,000 X .30)	108,000
Administrative expenses (\$420,000 X .40)	<u>168,000</u>
Total variable costs	<u>1,680,000</u>
Contribution margin	<u>\$ 720,000</u>

	<u>Current Year</u>		<u>Projected Year</u>
Sales	\$2,400,000	X 1.2	\$2,880,000
Variable costs			
Direct materials	626,500	X 1.2	751,800
Direct labor	507,500	X 1.2	609,000
Manufacturing overhead	270,000	X 1.2	324,000
Selling expenses	108,000	X 1.2	129,600
Administrative expenses	<u>168,000</u>	X 1.2	<u>201,600</u>
Total variable costs	<u>1,680,000</u>	X 1.2	<u>2,016,000</u>
Contribution margin	<u>\$ 720,000</u>	X 1.2	<u>\$ 864,000</u>

(2)

Fixed Costs	<u>Current Year</u>	<u>Projected year</u>
Manufacturing overhead (\$540,000 X .50)	\$270,000	\$270,000
Selling expenses (\$360,000 X .70)	252,000	252,000
Administrative expenses (\$420,000 X .60)	<u>252,000</u>	<u>252,000</u>
Total fixed costs	<u>\$774,000</u>	<u>\$774,000</u>

PROBLEM 22-5B (Continued)

- (b) Unit selling price = $\$2,400,000 \div 200,000 = \12.00
Unit variable cost = $\$1,680,000 \div 200,000 = \8.40
Unit contribution margin = $\$12.00 - \$8.40 = \$3.60$
Contribution margin ratio = $\$3.60 \div \$12.00 = .30$

$$\begin{array}{lcl} \text{Break-even point in units} & = & \text{Fixed costs} \div \text{Unit contribution margin} \\ 215,000 \text{ units} & = & \$774,000 \div \$3.60 \end{array}$$

$$\begin{array}{lcl} \text{Break-even point in dollars} & = & \text{Fixed costs} \div \text{Contribution margin ratio} \\ \$2,580,000 & = & \$774,000 \div .30 \end{array}$$

(c) Sales dollars
required for target net income = $(\text{Fixed costs} + \text{Target net income}) \div \text{Contribution margin ratio}$

$$\begin{array}{lcl} \$4,646,667 & = & (\$774,000 + \$620,000) \div .30 \end{array}$$

(d) Margin of safety ratio = $(\text{Expected sales} - \text{Break-even sales}) \div \text{Expected sales}$

$$\begin{array}{lcl} 44.5\% & = & (\$4,646,667 - \$2,580,000) \div 4,646,667 \end{array}$$

(e) (1)

	<u>Projected Year</u>
Net sales	\$2,400,000
Variable costs	
Direct materials	626,500
Direct labor (\$507,500 – \$240,000)	267,500
Manufacturing overhead (\$540,000 X .30)	162,000
Selling expenses (\$360,000 X .80)	288,000
Administrative expenses (\$420,000 X .40)	<u>168,000</u>
Total variable costs	<u>1,512,000</u>
Contribution margin	<u>\$ 888,000</u>

PROBLEM 22-5B (Continued)

(2) Contribution margin ratio = $\$888,000 \div \$2,400,000 = .37$

(3) Break-even point in dollars = $\$702,000 \div .37 = \$1,897,297$ (rounded)

Fixed costs

Manufacturing overhead ($\\$540,000 \times .70$)	\$378,000
Selling expenses ($\\$360,000 \times .20$)	72,000
Administrative expenses ($\\$420,000 \times .60$)	<u>252,000</u>
Total fixed costs	<u>\$702,000</u>

The break-even point in dollars declined from \$2,580,000 to \$1,897,297. This means that overall the company's risk has declined because it doesn't have to generate as much in sales. The two changes actually had opposing effects on the break-even point. By changing to a more commission based approach to compensating its sales staff the company reduced its fixed costs, and therefore reduced its break-even point. In contrast, the purchase of the new equipment increased the company's fixed costs (by increasing its equipment depreciation) and reduced its variable direct labor cost, both of which would increase the break-even point.

***PROBLEM 22-6B**

(a)

**YANCEY METAL COMPANY
Income Statement
For the Year Ended December 31
(Variable Costing)**

	<u>2008</u>	<u>2009</u>
Sales	<u>\$2,400,000</u>	<u>\$3,000,000</u>
Variable expenses		
Variable cost of goods sold		
Inventory, January 1	0	150,000
Variable manufacturing costs	<u>750,000 (1)</u>	<u>600,000 (4)</u>
Cost of goods available for sale	750,000	750,000
Inventory, December 31	<u>150,000 (2)</u>	<u>0</u>
Variable cost of goods sold	600,000	750,000
Variable selling expenses	<u>280,000 (3)</u>	<u>350,000 (5)</u>
Total variable expenses	<u>880,000</u>	<u>1,100,000</u>
Contribution margin	<u>1,520,000</u>	<u>1,900,000</u>
Fixed expenses		
Manufacturing overhead	1,100,000	1,100,000
Administrative	<u>230,000</u>	<u>230,000</u>
Total fixed expenses	<u>1,330,000</u>	<u>1,330,000</u>
Income from operations	<u>\$ 190,000</u>	<u>\$ 570,000</u>

2008 Computations

- (1) 50,000 X \$15
- (2) 10,000 X \$15
- (3) 40,000 X \$7

2009 Computations

- (4) 40,000 X \$15
- (5) 50,000 X \$7

***PROBLEM 22-6B (Continued)**

**(b) YANCEY METAL COMPANY
Income Statement
For the Year Ended December 31
(Absorption Costing)**

	<u>2008</u>	<u>2009</u>
Sales	<u>\$2,400,000</u>	<u>\$3,000,000</u>
Cost of goods sold		
Inventory, January 1	0	370,000
Cost of goods manufactured	<u>1,850,000</u> (1)	<u>1,700,000</u> (3)
Cost of goods available for sale	1,850,000	2,070,000
Inventory, December 31	<u>370,000</u> (2)	0
Cost of goods sold	<u>1,480,000</u>	<u>2,070,000</u>
Gross profit	<u>920,000</u>	<u>930,000</u>
Operating expenses		
Selling expenses	280,000	350,000
Administrative expenses	<u>230,000</u>	<u>230,000</u>
Total operating expenses	<u>510,000</u>	<u>580,000</u>
Income from operations	<u>\$ 410,000</u>	<u>\$ 350,000</u>

	<u>2008 Computations</u>		<u>2009 Computations</u>
(1)	50,000 X [\$15 + (\$1,100,000 ÷ 50,000)]	(3)	40,000 X [\$15 + (\$1,100,000 ÷ 40,000)]
(2)	10,000 X \$37		

(c) The variable costing and the absorption costing income from operations can be reconciled as follows:

	<u>2008</u>	<u>2009</u>
Variable costing income	\$190,000	\$570,000
Fixed manufacturing overhead expensed with variable costing	\$1,100,000	\$1,100,000
Less: Fixed manufacturing overhead expensed with absorption costing	<u>(880,000)</u> ⁽¹⁾	<u>(1,320,000)</u> ⁽²⁾
Difference	<u>220,000</u>	<u>(220,000)</u>
Absorption costing income	<u>\$410,000</u>	<u>\$350,000</u>

⁽¹⁾In 2008, with absorption costing \$880,000 $\left(\$1,100,000 \times \frac{40,000 \text{ units sold}}{50,000 \text{ units manufactured}} \right)$ of the fixed manufacturing overhead is expensed as part of cost of goods sold, and \$220,000 $\left(\$1,100,000 \times \frac{10,000 \text{ units in inventory}}{50,000 \text{ units manufactured}} \right)$ is included in the ending inventory.

***PROBLEM 22-6B (Continued)**

⁽²⁾In 2009, with absorption costing \$1,320,000 of fixed manufacturing overhead is expensed as part of cost of goods sold. This includes the fixed manufacturing overhead for 2009 of \$1,100,000 plus \$220,000 of fixed manufacturing overhead from 2008 that was included in the beginning inventory for 2009.

- (d) **Income is more sensitive to changes in sales under variable costing as seen in the increase in income from operations in 2009 when 10,000 additional units were sold. In contrast, under absorption costing, income is also strongly affected by changes in production as seen in the higher income from operations in 2008 when production exceeded sales by 10,000 units.**

(1) Capital-Intensive		(2) Labor-Intensive	
Fixed manufacturing costs	\$2,508,000	Fixed manufacturing costs	\$1,538,000
Incremental selling expenses	<u>502,000</u>	Incremental selling expenses	<u>502,000</u>
Total fixed costs	<u>\$3,010,000</u>	Total fixed costs	<u>\$2,040,000</u>
Selling price	\$30.00	Selling price	\$30.00
Variable costs		Variable costs	
Direct materials	\$5.00	Direct materials	\$5.50
Direct labor	6.00	Direct labor	8.00
Variable overhead	3.00	Variable overhead	4.50
Selling expenses	<u>2.00</u>	Selling expenses	<u>2.00</u>
Contribution margin	<u>\$14.00</u>	Contribution margin	<u>\$10.00</u>
Total fixed costs (1)	\$3,010,000	Total fixed costs (1)	\$2,040,000
Contribution margin per unit (2)	<u>\$14.00</u>	Contribution margin per unit (2)	<u>\$10.00</u>
Breakeven in units (1) ÷ (2)	<u>215,000</u>	Breakeven in units (1) ÷ (2)	<u>204,000</u>

- (b) Gagliano Company would be indifferent between the two manufacturing methods at the volume (X) where total costs are equal.

$$\begin{aligned}
 \$16X + \$3,010,000 &= \$20X + \$2,040,000 \\
 \$4X &= \$970,000 \\
 X &= 242,500 \text{ units}
 \end{aligned}$$

- (c) Gagliano should employ the capital-intensive manufacturing method if annual sales are expected to exceed 242,500 units and the labor-intensive manufacturing method if annual sales are not expected to exceed 242,500 units. The labor-intensive method is more profitable for sales up to 242,500 units because the fixed costs are lower. The capital-intensive method is more profitable for sales above 242,500 units because its contribution margin is higher.

(a) The variable costs per unit are:

Cost of goods sold ($\$600,000 \div 200,000$)	\$3.00
Selling expenses ($\$140,000 \div 200,000$)	.70
Administrative expenses ($\$40,000 \div 200,000$)	<u>.20</u>
Total	<u>\$3.90</u>

The breakeven points are:

$$X = (\$3.90 \div \$6.00) X + \$460,000$$

$$X = .65X + \$460,000$$

$$.35X = \$460,000$$

$$X = \$1,314,286 \text{ (rounded)}$$

$$\$6.00X = \$3.90X + \$460,000$$

$$\$2.10X = \$460,000$$

$$X = 219,048 \text{ units (rounded)}$$

(b) Variable unit cost of goods sold = \$3.25

$$(\$600,000 \div 200,000 = \$3.00; \$3.00 + \$.25)$$

Sales volume = 260,000 units (200,000 X 130%)

Total sales = 260,000 X \$6.25 = \$1,625,000

Net income computation:

Sales.....		\$1,625,000
Variable expenses		
Cost of goods sold	\$845,000	
(260,000 X \$3.25)		
Selling expenses	182,000	
(260,000 X \$.70)		
Administrative expenses		
(260,000 X \$.20)	<u>52,000</u>	
Total variable expenses		<u>1,079,000</u>
Contribution margin.....		546,000
Fixed expenses		
Cost of goods sold	\$200,000	
Selling expenses	140,000	
Administrative expenses	<u>120,000</u>	
Total fixed expenses		<u>460,000</u>
Net income		<u>\$ 86,000</u>

BYP 22-2 (Continued)

$$\begin{aligned}
 X &= (\$1,079,000 \div \$1,625,000)X + \$460,000 \\
 X &= .66X + \$460,000 \\
 .34X &= \$460,000 \\
 X &= \$1,352,941 \text{ (rounded)}
 \end{aligned}$$

Profits and the break-even point would both increase.

(c)	Sales [320,000 (1) X (\$6.00 – \$.30)]	\$1,824,000
	Variable expenses	
	Cost of goods sold	\$960,000
	(320,000 X \$3.00)	
	Selling expenses (320,000 X \$.79)	252,800
	Administrative expenses	
	(320,000 X \$.20)	<u>64,000</u>
	Total variable expenses	<u>1,276,800</u>
	Contribution margin	547,200
	Fixed expenses	
	Cost of goods sold	\$200,000
	Selling expenses	175,000
	(\$140,000 + \$35,000)	
	Administrative expenses	<u>120,000</u>
	Total fixed expenses	<u>495,000</u>
	Net income.....	<u><u>\$ 52,200</u></u>

(1) Sales volume = 200,000 X 160% = 320,000

$$\begin{aligned}
 X &= (\$1,276,800 \div \$1,824,000)X + \$495,000 \\
 X &= .70X + \$495,000 \\
 .30X &= \$495,000 \\
 X &= \$1,650,000
 \end{aligned}$$

Profits and the break-even point would both increase.

- (d) Terri’s plan should be accepted. It produces a higher net income and a lower breakeven point than Jerry’s plan.**

- (a) Sweeteners and packaging are a variable cost to Coca-Cola because their use is directly proportional to the amount of product produced. If the unit cost of a variable cost item increases, the contribution margin will decline. This will lead to a decline in net income unless the company can increase its selling price, increase the number of units it sells, or reduce other costs.
- (b) This description makes the marketing expenditures sound like they are a variable cost, since it suggests that they vary with the amount of units sold. However, unlike variable costs, the relationship of marketing costs is not directly proportional to sales, since other factors also influence units sold. Thus, it is not a pure variable cost. However, it is also not a fixed cost, in that there usually is a relationship between marketing expenditures and sales. For CVP purposes, it might best be handled as a mixed cost, having both a fixed and variable component.
- (c) The first measure, gallon shipments of concentrates and syrups, is the activity index, since it best reflects the company's production and sales activity at the wholesale level, its primary line of business. The second measure, unit cases of finished product, indicates the amount of activity by Coke's primary customers, the bottlers. Coke also keeps track of this since it provides information about what is happening at the retail level.

- (a) The description of the production process is as follows:

The production of hard candy begins with the blending, cooking, and kneading of ingredients. Workers add flavoring and coloring when the candy is kneaded. The candy is then pressed out and a roll of thick chocolate is placed in the middle of the candy. Workers then roll each end of the product over the middle to form a pillow shape. The roll is stretched by hand at the chicken bone machine so that the width of the roll is the width of the average chicken bone, a difficult procedure. Next, the elongated roll is fed into the cutting machine. The end result is a candy which tastes of sweet cinnamon and has a luscious surprise of chocolate in the middle.

- (b) The following costs might be identified as variable: labor (stretching chicken bones, feeding into cutting machine), materials (flavoring, coloring, chocolate).

The following costs might be identified as fixed: depreciation of machinery, indirect labor, and utilities.

To: My Roommate
From: Your Roommate
Subject: Cost-Volume-Profit Questions

In response to your request for help, I provide you the following:

- (a) The mathematical formula for breakeven sales is:**

$$\text{Breakeven Sales} = \text{Variable Costs} + \text{Fixed Costs}$$

Breakeven sales in dollars is found by expressing variable costs as a percentage of unit selling price. For example, if the percentage is 70%, the breakeven formula becomes $X = .70X + \text{Fixed Costs}$. The answer will be in sales dollars.

Breakeven sales in units is found by using unit selling price and unit variable costs in the formula. For example, if the selling price is \$300 and variable costs are \$210, the breakeven formula becomes $\$300X = \$210X + \text{Fixed Costs}$. The answer will be in sales units.

- (b) The formulas for contribution margin per unit and contribution margin ratio differ as shown below:**

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

$$\text{Contribution Margin per Unit} \div \text{Unit Selling Price} = \text{Contribution Margin Ratio}$$

You can see that CM per Unit is used in computing the CM ratio.

- (c) When contribution margin is used to determine breakeven sales, total fixed costs are divided by either the contribution margin ratio or contribution margin per unit. Using the CM ratio results in determining the breakeven point in dollars. Using CM per unit results in determining the breakeven point in units.**

BYP 22-5 (Continued)

The formula for determining breakeven sales in dollars is:

$$\text{Fixed Costs} \div \text{Contribution Margin Ratio} = \text{Breakeven Sales in Dollars}$$

The formula for determining breakeven sales in units is:

$$\text{Fixed Costs} \div \text{Contribution Margin per Unit} = \text{Breakeven Sales in Units}$$

I hope this memo answers your questions.

- (a) The stakeholders in this situation are:
- ▶ Kenny Hampton, accountant of Bartley Company.
 - ▶ The dislocated personnel of Bartley.
 - ▶ The senior management who made the decision.
- (b) Kenny is hiding an error and is knowingly deceiving the company's management with inaccurate data.
- (c) Kenny's alternatives are:
- ▶ Keep quiet.
 - ▶ Confess his mistake to management.

The students' recommendations should recognize the practical aspects of the situation but they should be idealistic and ethical. If the students can't be totally ethical when really nothing is at stake, how can they expect to be ethical under real-world pressures?

- (a) The variable gasoline cost of going one mile in the hybrid car would be \$0.075 ($\$3.00/40$). The variable gasoline cost of going one mile in the traditional car would be \$0.10 ($\$3.00/30$).**
- (b) The savings per mile of driving the hybrid vehicle would be \$0.025 ($\$0.10 - \0.075).**
- (c) In order to break-even on your investment you would need to drive 120,000 miles. This is determined by dividing the additional fixed cost of \$3,000 by the contribution margin per mile of \$0.025.**
- (d) There are many other factors that you would want to consider in your analysis. For example, do the vehicles differ in their expected repair bills, insurance costs, licensing fees, or ultimate resale value. Also, some states and some employers offer rebates for the purchase of hybrid vehicles. In addition, your decision might be influenced by non-financial factors, such as a desire to reduce emissions.**