CHAPTER 5

Cost-Volume-Profit

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.

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Cost Management

2. (a) The activity index is 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. Unit variable costs remain the same at every level of activity.

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Cost Management and Business Economics

3. Fixed costs remain the same in total regardless of changes in the activity level. In contrast, fixed costs per unit vary inversely with changes in activity. As volume increases, fixed costs per unit decline and vice versa.

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

4. (a) The relevant range is the range of activity over which a company expects to operate during the year.
(b) J.P.'s claim is incorrect. The behavior of both fixed and variable costs is linear only over a certain range of activity. CVP analysis is based on the assumption that both fixed and variable costs remain linear within the relevant range.

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

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.

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

6. Apartment rent is fixed because the cost per month remains the same regardless of how much Adam uses the apartment. Rent on a Hertz rental truck is a mixed cost because the cost usually includes a per day charge (a fixed cost) plus an activity charge based on miles driven (a variable cost).

LO1 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

7. For CVP analysis, mixed costs must be classified into their fixed cost and variable cost components. One approach to the classification of mixed costs is the high-low method. Another is regression analysis.

LO2 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

8. Unit variable cost is $1.30, or [($165,000 – $100,000) ÷ (90,000 – 40,000)]. At any level of activity, fixed costs are $48,000 per month [$165,000 – (90,000 x $1.30)].

LO2 BT: AP Difficulty: Easy TOT: 3 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics
[(($165,000 - $100,000) ÷ (90,000 – 40,000) = $1.30); ($165,000 – (90,000 x $1.30) = $48,000)]
[((Hi. cost – Low cost) ÷ (Hi. act. – Low act.) = Unit VC); (Hi. cost – (Hi. act. x Unit VC) = FC)]

9. No, not true. Only two of the basic components of cost-volume-profit (CVP) analysis, unit selling prices and unit variable cost, relate to unit data. The other components, volume, total fixed costs, and sales mix, are not based on per-unit amounts.

LO3 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

Questions Chapter 5 (Continued)

10. There is no truth in Faye's statement. Contribution margin is sales less variable costs. It is the revenue that remains to cover fixed costs and to produce net income (profit) for the company.

LO3 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

11. Unit contribution margin is $14 ($40 – $26). The contribution margin ratio is 35% ($14 ÷ $40).

LO3 BT: AP Difficulty: Easy TOT: 2 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis
[(($40 - $26) = $14); ($14 ÷ $40 = 35%)]
[((USP – UVC = UCM); (UCM ÷ USP = CM ratio)]

12. False. Knowledge of the break-even point is useful to management in deciding whether to introduce new product lines, change sales prices on established products, reduce variable and/or fixed costs, and enter new market areas.

LO4 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

13. $26,000 ÷ 25% = $104,000

LO4 BT: AP Difficulty: Easy TOT: 2 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis
($26,000 ÷ 25% = $104,000)
(FC ÷ CM ratio = BEP in sales $)

14. (a) The break-even 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 break-even point is determined at the intersection of the total revenue and total cost lines.

(b) The break-even point in units is obtained by drawing a vertical line from the break-even point to the horizontal axis. The break-even point in sales dollars is obtained by drawing a horizontal line from the break-even point to the vertical axis.

LO4 BT: C Difficulty: Easy TOT: 4 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

15. Margin of safety is the difference between actual or expected sales and sales at the break-even point. Expected sales = 1,250 x $12 = $15,000; Margin of safety = $15,000 – $13,200 = $1,800; Margin of safety ratio = $1,800 ÷ $15,000 = 12%.

LO5 BT: AP Difficulty: Easy TOT: 3 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis
[(1,250 x $12 = $15,000); ($15,000 - $13,200 = $1,800); ($1,800 ÷ $15,000 = 12%)]
[(Expect. unit sales x USP = Expect. sales $); (Expect. sales $ - BEP sales $ = MOS); (MOS ÷ Expect. sales $ = MOS ratio)]

16. At the break-even point, the contribution margin is equal to the fixed costs. The contribution margin ratio is:

$$\frac{\$180,000}{\$500,000} = 36\%$$

The sales revenue required to achieve net income of $90,000 is as follows:

$$\frac{\$180,000 + \$90,000}{.36} = \$750,000$$

LO5 BT: AP Difficulty: Easy TOT: 4 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis
[($180,000 ÷ $500,000 = 36%); (($180,000 + $90,000) ÷ 36% = $750,000)]
[(FC ÷ BEP sales $ = CM ratio); ((FC + Target NI) ÷ CM ratio = Sales $)]

Questions Chapter 5 (Continued)

17.

PACE COMPANY
CVP Income Statement

Sales		$900,000
Variable costs		
Cost of goods sold ($600,000 x .70)	$420,000	
Operating expenses ($200,000 x .70)	140,000	
Total variable expenses		560,000
Contribution margin		$340,000

LO3 BT: AP Difficulty: Easy TOT: 5 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis
[$900,000 – ($600,000 x .70) – ($200,000 x .70) = $340,000]
[Sales – (CGS x VC ratio) – (Oper. exp. x VC ratio) = CM]

***18.** The inherent weakness of the high-low method is that the cost equation created by using this method is based on just two of the sample data points (high point and low point). A more representative cost equation can be derived from using regression analysis. It's primary advantages are that the resulting cost equation is based on all of the sample data points, thereby creating a more accurate cost equation and better decision-making.

LO2, 6 BT: C Difficulty: Easy TOT: 5 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

***19.** The cost equation line will minimize the sum of the squared differences between the line and the individual sample data points.

LO6 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Quantitative Methods

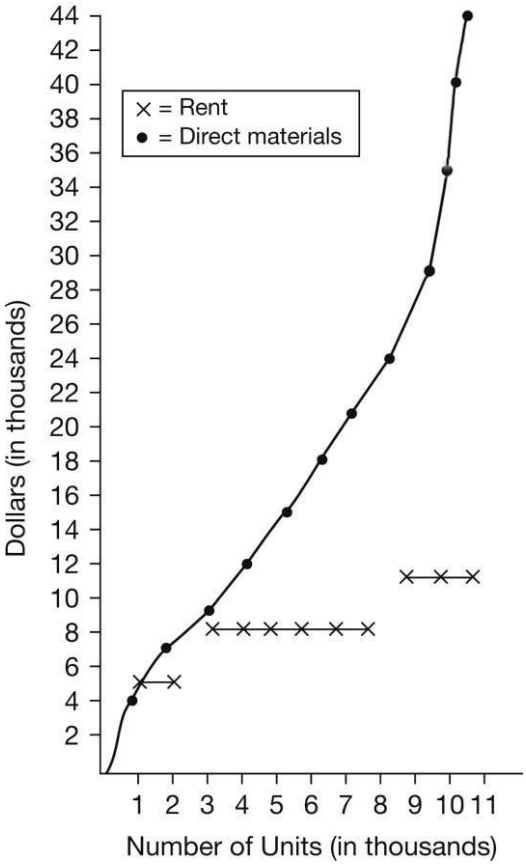
***20.** If the mixed cost being analyzed is not a linear function, regression analysis can provide misleading results. Regression analysis can also be influenced by "outliers", i.e., data points that differ significantly from the rest of the observations. These must be adjusted for or eliminated. Finally, regression analysis is most accurate when there are a large number of data points. However, collecting data points is time consuming and expensive. So, in some cases there are just not enough data points to make a reliable estimate.

LO6 BT: C Difficulty: Easy TOT: 2 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Quantitative Methods

SOLUTIONS TO EXERCISES

EXERCISE 5.2

(a)



EXERCISE 5.2 (Continued)

(b) The relevant range is 3,000 – 8,000 units of output since a straight-line relationship exists for both direct materials and rent within this range.

(c) Unit variable cost for direct materials

Within the relevant range (3,000 – 8,000 units)

$$= \frac{\text{Cost}}{\text{Units}}$$

$$= \frac{\$15{,}000^*}{5{,}000^*} = \$3 \text{ per unit}$$

***Any costs and units within the relevant range could have been used to calculate the same unit variable cost of $3.**

(d) Fixed cost within the relevant range = $8,000

EXERCISE 5.4

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 5.5

(a) Maintenance Costs:

$$\frac{\$4,620 - \$2,640}{8,000 - 3,500} = \frac{\$1,980}{4,500} = \$.44 \text{ variable cost per machine hour}$$

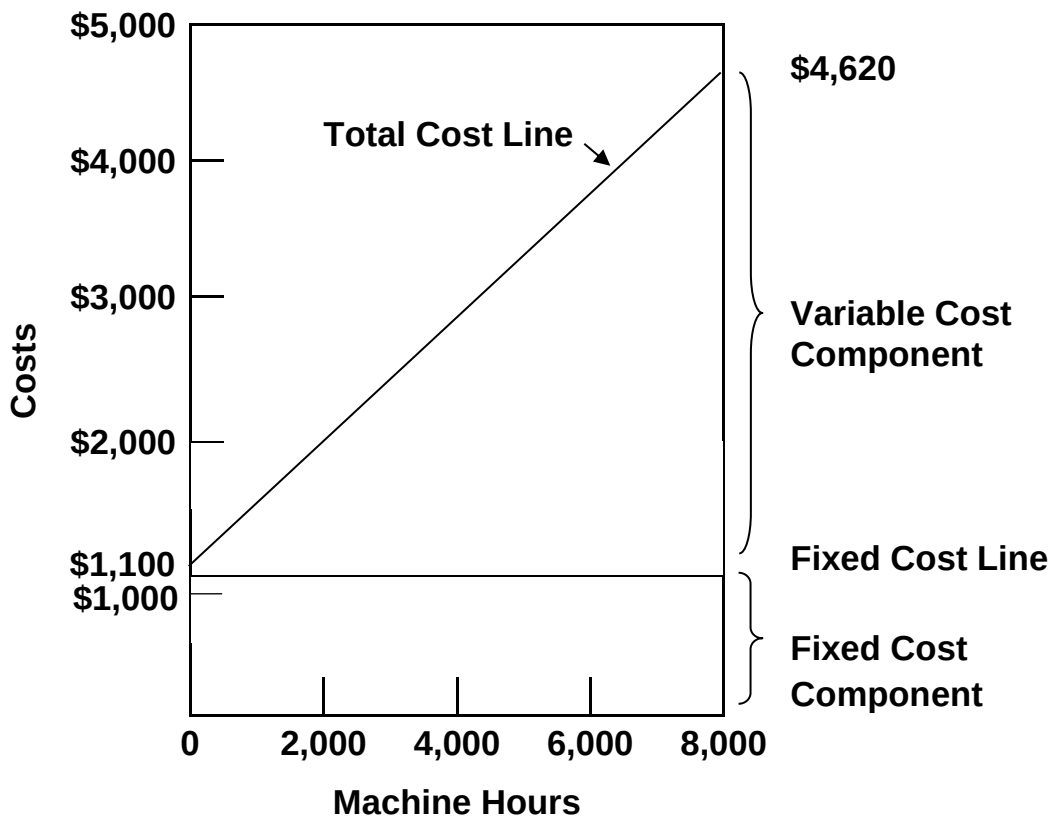
	Activity Level	
	High	Low
Total cost	$4,620	$2,640
Less: Variable costs		
8,000 x $.44	3,520	
3,500 x $.44		1,540
Total fixed costs	$1,100	$1,100

Thus, maintenance costs are $1,100 per month plus $.44 per machine hour.

[(($4,620 - $2,640) ÷ (8,000 – 3,500) = $.44 per MH); ($4,620 – (8,000 x $.44) = $1,100); (Maint. Costs = $1,100 + $.44 per MH)]

[((Hi. cost – Low cost) ÷ (Hi. act. – Low act.) = VC per MH); (Hi. cost – (Hi. act. x VC per MH) = FC); (Maint. costs = FC + (VC per MH x MH))]

(b)



LO1, 2 BT: AP Difficulty: Moderate TOT: 8 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

EXERCISE 5.6

(a)

Cost	Fixed	Variable	Mixed
Direct materials		X	
Direct labor		X	
Utilities			X
Property taxes	X		
Indirect labor		X	
Supervisory salaries	X		
Maintenance			X
Depreciation (Straight-Line)	X		

(b) **Fixed costs** = $1,000 + $1,900 + $2,400 + $300 + $200
= $5,800

Variable costs to produce 3,000 units = $7,500 + $18,000 + $4,500
= $30,000

Unit variable cost = $30,000/3,000 units
= $10 per unit

[($7,500 + $18,000 + $4,500) ÷ 3,000 = $10]; [(Var. DM + Var. DL + Ind. DL) ÷ No. units = VC per unit]

Variable cost portion of mixed cost = Total cost – Fixed portion

Utilities:
Variable cost to produce 3,000 units = $2,100 – $300
= $1,800

Unit variable cost = $1,800/3,000 units
= $.60 per unit

[Utilities: ($2,100 - $300 = $1,800); ($1,800 ÷ 3,000 = $.60 per unit)]
[(Tot. cost – FC = VC); (VC ÷ No. units = VC per unit)]

Maintenance:
Variable cost to produce 3,000 units = $1,100 – $200
= $900

Unit variable cost = $900/3,000 units
= $.30 per unit

[Maint.: ($1,100 - $200 = $900); ($900 ÷ 3,000 = $.30 per unit)]
[(Tot. cost – FC = VC); (VC ÷ No. units = Unit VC)]

Cost to produce 5,000 units = (Unit variable costs x Units produced) + Fixed costs
= ($10 + $.60 + $.30) x 5,000) + $5,800
= $54,500 + $5,800
= $60,300

EXERCISE 5.6 (Continued)

[Production costs: (($10 + $.60 + $.30) x 5,000) + ($1,000 + $1,900 + $2,400 + $300 + $200) = $60,300]
+ ((DM per unit + DL per unit + Ind. labor per unit + Util. per unit + Maint. per unit) x No. units) + (Prop. tax. + Super. sal. + Depr. + Fix. util. + Fix. maint.) = Tot. production costs]
LO1 BT: AP Difficulty: Moderate TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

EXERCISE 5.7

MEMO

To: Marty Moser

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 that underlie 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. **Costs can be classified accurately 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.

LO3 BT: K Difficulty: Easy TOT: 5 min. AACSB: None AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

EXERCISE 5.8

(a)

ALL THAT BLOOMS
CVP Income Statement
For the Month Ended July 31, 2022

	Total	Per Unit	Percent of Sales
Sales	**$7,200**	**$60**	**100%**
Variable costs (120* x ($12 + $10 + $2))	**2,880**	**24**	**40%**
Contribution margin	**4,320**	**$36**	**60%**
Fixed costs ($1,400 + $200 + $2,000)	**3,600**		
Net income	**$ 720**		

*$7,200 ÷ $60 = 120
[(120 x $60) – (120 x $24) – ($1,400 + $200 + $2,000) = $720; $60 – $24 = $36; 100% – 40% = 60%]
[(Units sold x USP) – (Units sold x UVC) – FC = Net inc.; USP – UVC = UCM; (USP as a % USP) – (UVC as a % USP) = CM ratio

EXERCISE 5.8 (Continued)

(b)(1) Contribution margin per lawn = $60 – ($12 + $10 + $2)

Contribution margin per lawn = $36

Contribution margin ratio = $36 ÷ $60 = 60%

Fixed costs = $1,400 + $200 + $2,000 = $3,600

Break-even point in lawns = $3,600 ÷ $36 = 100

[($60 – ($12 + $10 + $2) = $36); ($36 ÷ $60 = 60%); (($1,400 + $200 + $2,000) ÷ $36 = 100)]
[(USP – (Weed & feed mat. per lawn + DL per lawn + Fuel per lawn) = CM per lawn); (CM per lawn ÷ USP = CM ratio); ((Depr. + Advert. + Ins.) ÷ CM per lawn = BEP in lawns)]

(2) Break-even point in dollars = 100 lawns x $60 per lawn
= $6,000 per month
OR
Fixed costs ÷ Contribution margin ratio = $3,600 ÷ .60
= $6,000 per month

[($1,400 + $200 + $2,000) ÷ 60% = $6,000]
[(Depr. + Advert. + Ins.) ÷ CM ratio = BEP in sales $]
LO3, 4 BT: AP Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.9

(a) Contribution margin per room = $60 – ($14 + $28)

Contribution margin per room = $18

Contribution margin ratio = $18 ÷ $60 = 30%

Fixed costs = $5,900 + $1,100 + $1,000 + $100 = $8,100

Break-even point in rooms = $8,100 ÷ $18 = 450

[($60 – ($14 + $28) = $18); ($18 ÷ $60 = 30%); (($5,900 + $1,100 + $1,000 + $100) ÷ $18 = 450)]
[(USP – (Maid serv. per room + Other costs per room) = CM per room); (CM per room ÷ USP = CM ratio); ((Sal. + Util. + Depr. + Maint.) ÷ CM per room = BEP in rooms)]

(b) Break-even point in dollars = 450 rooms x $60 per room
= $27,000 per month
OR
Fixed costs ÷ Contribution margin ratio = $8,100 ÷ .30
= $27,000 per month

[(($5,900 + $1,100 + $1,000 + $100) ÷ 30% = $27,000)]
[((Sal. + Util. + Depr. + Maint.) ÷ CM ratio = BEP in $)]
LO3, 4 BT: AP Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.10

(a) Contribution margin in dollars:

Sales = 560 x $120 =	**$67,200**
Variable costs = $67,200 x .60 =	**40,320**
Contribution margin	**$26,880**

Unit contribution margin: **$120 – $72 ($120 x 60%) = $48.**

Contribution margin ratio: **$48 ÷ $120 = 40%.**

[(560 x $120) – ($67,200 x 60%) = $26,880); ($120 – ($120 x 60%) = $48); ($48 ÷ $120 = 40%)]
[((No. of clients x USP) – (Sales x VC %) = CM); (USP – (USP x VC %) = UCM); (UCM ÷ USP = CM ratio)]

(b) Break-even sales in dollars: $\frac{\$21,024}{40\%} = \$52,560.$

Break-even sales in units: $\frac{\$21,024}{\$48} = 438.$

[($21,024 ÷ 40% = $52,560); ($21,024 ÷ $48 = 438)]
[(FC ÷ CM ratio = BEP in sales $); (FC ÷ UCM = BEP in units)]
LO3, 4 BT: AP Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.11

(a) (1) Contribution margin ratio = $\frac{\$27,000}{\$36,000} = 75\%$

Break-even point in dollars = $\frac{\$18,000}{75\%} = \$24,000$

(2) Revenue per passenger = $\frac{\$36,000}{1,500 \text{ pass.}} = \$24$

[1: ($27,000 ÷ $36,000 = 75%); ($18,000 ÷ 75% = $24,000); 2: ($36,000 ÷ 1,500 = $24); ($24,000 ÷ $24 = 1,000)]
[1: (CM ÷ Sales = CM ratio); (FC ÷ CM ratio = BEP in $): 2: (Sales ÷ No. of pass. = Rev. per pass.); (Rev. per pass. X CM ratio = CM per pass.); (Tot. FC ÷ CM per pass. = No. of pass. at BEP)]

(b) At the break-even point, fixed costs and contribution margin are equal to $18,000.

LO3, 4 BT: AP Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.12

(a) Unit contribution margin $= \dfrac{\text{Fixed costs}}{\text{Break-even sales in units}}$

$= \dfrac{\$112{,}000}{(\$350{,}000 \div \$5)}$

$= \$1.60$

Unit variable cost = Unit selling price – Unit contribution margin
= $5.00 – $1.60
= $3.40

OR

70,000 x $5.00 = 70,000X + $112,000
where X = Unit variable cost
Unit variable cost = $3.40

Contribution margin ratio = $1.60 ÷ $5.00 = 32%

[($112,000 ÷ ($350,000 ÷ $5) = $1.60); ($5.00 - $1.60 = $3.40); ($1.60 ÷ $5.00 = 32%)]

[(FC ÷ (BEP in $ ÷ USP) = UCM); (USP – UCM = UVC); (UCM ÷ USP = CM ratio)]

(b) Fixed costs ÷ Contribution margin ratio = Break-even sales in dollars
Fixed costs ÷ .32 = $420,000
= $134,400 ($420,000 x .32)

Since fixed costs were $112,000 in 2021, the increase in 2022 is $22,400 ($134,400 – $112,000).

[($420,000 x 32% = $134,400); ($134,400 - $112,000 = $22,400)]
[(BEP in $ x CM ratio = 2020 FC); (2020 FC – 2019 FC = Incr. in FC)]
LO3, 4 BT: AN Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.14
(a)

RISKY CORPORATION
GAAP Income Statement
For the Year Ended December 31, 2022

Sales		**$3,000,000**
Cost of goods sold ($600,000 + $800,000)		**1,400,000**
Gross profit		**1,600,000**
Operating expenses:		
Selling expenses ($120,000 + 60,000)	**$180,000**	
Administrative expenses ($240,000 + $80,000)	**320,000**	**500,000**
Net income		**$1,100,000**

[$3,000,000 – ($600,000 + $800,000) – ($120,000 + $60,000) – ($240,000 + $80,000) = $1,100,000]
[Sales – CGS – (Sell. exp. + Admin. exp.) = Net inc.]

(b)

RISKY CORPORATION
CVP Income Statement
For the Year Ended December 31, 2022

	Total		Per Unit	Percent of Sales
Sales (200,000* x $15)		**$3,000,000**	**$15.00**	**100%**
Variable costs:				
Cost of goods sold	**$ 600,000**			
Selling expenses	**120,000**			
Administrative expenses	**240,000**	**960,000**	**4.80****	**32%**
Contribution margin		**2,040,000**	**10.20**	**68%**
Fixed costs:				
Cost of goods sold	**800,000**			
Selling expenses	**60,000**			
Administrative expenses	**80,000**	**940,000**		
Net income		**$1,100,000**		

*$3,000,000 ÷ $15 = 200,000
**$960,000 ÷ 200,000 = $4.80

[(200,000 x $15) – ($600,000 + $120,000 + $240,000) – ($800,000 + $60,000 + $80,000) = $1,100,000; $15.00 – $4.80 = $10.20; 100% – 32% = 68%]]
[Units sold x USP) – (VCGS + Var. Sell. exp. x Var. admin. exp.) – (Fix. CGS + Fix sell. exp. + Fix. admin. exp.) = Net inc.; USP – UVC = UCM: USP as a % of USP – UVC as a % of USP = CM ratio]
LO3 BT: AP Difficulty: Easy TOT: 15 min. AACSB: Analytic AICPA FC: Reporting IMA: Quantitative Methods

EXERCISE 5.15

(a) Units sold in 2021 = $\frac{\$570{,}000 + \$210{,}000}{\$140 - \$90}$ = 15,600 units

[($570,000 + $210,000) ÷ ($140 - $90) = 15,600 units]
[(FC + Net inc.) ÷ (USP – UVC) = No. units sold]

(b) Units needed in 2022 = $\frac{\$570{,}000 + \$272{,}400\ *}{\$140 - \$90}$ = 16,848 units

***$210,000 + $62,400 = $272,400**

[($570,000 + ($210,000 + $62,400)) ÷ ($140 - $90) = 16,848 units]
[(FC + (2021 Net inc. + Desired incr. in net inc.)) ÷ (USP – UVC) = Units to be sold]

(c) $\frac{\$570{,}000 + \$272{,}400}{X - \$90}$ = 15,600 units, where X = new selling price

$$\$842{,}400 = 15{,}600X - \$1{,}404{,}000$$

$$\$2{,}246{,}400 = 15{,}600X$$

$$X = \$144$$

[($570,000 + $272,400) ÷ (X - $90) = 15,600 units); (X = $144)]
[(FC + Desired net inc.) ÷ (USP – UVC) = No. units sold in 2021); (USP = $144)]
LO4, 5 BT: AN Difficulty: Moderate TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.16

1. Unit sales price = $400,000 ÷ 5,000 units = $80
Increase selling price to $88, or ($80 x 110%).
Net income = $440,000 – $240,000 – $90,000 = $110,000.

[($400,000 ÷ 5,000 units = $80); ($80 x 110% = $88); (($88 x 5,000) - $240,000 - $90,000 = $110,000)]
[(Sales ÷ No. units sold = USP); (USP x Incr. in sales price = New USP); ((New USP x No. units sold) – VC – FC = Net inc.)]

2. Reduce variable costs to 55% of sales.
Net income = $400,000 – $220,000 – $90,000 = $90,000.

Alternative 1, increasing selling price, will produce the higher net income.
[$400,000 – ($400,000 x 55%) - $90,000 = $90,000]
[Sales – (Sales x VC ratio) – FC = Net inc.]
LO5 BT: AN Difficulty: Moderate TOT: 8 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.17

(a) 1. Break-even sales in units:

$4.00Q - ($4.00 x .625)Q - $600,000 = $0
$1.50Q = $600,000
Q = 400,000 units

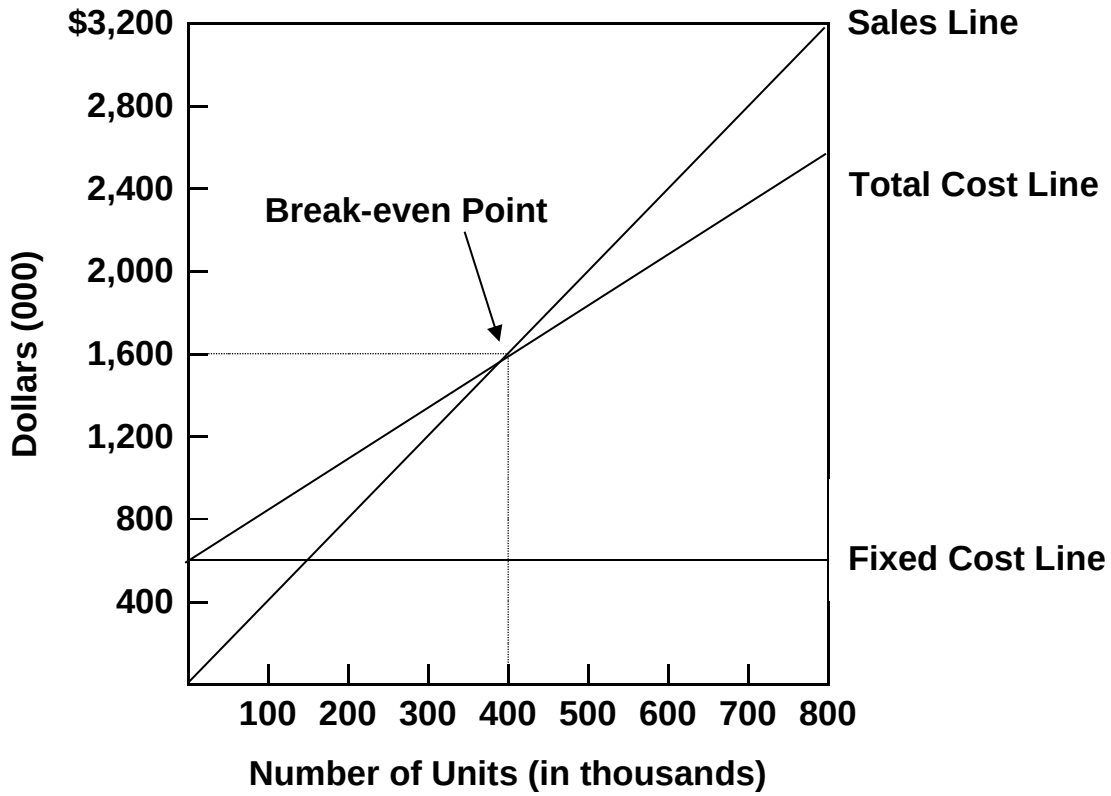
[($4Q - ($4.00 x .625)Q - $600,000 = $0); ($1.50Q = $600,000); (Q = 400,000 units)]
[((USP x Qty.) – (UVC x Qty.) – FC = Net inc.); (UCM x Qty. = FC); (Qty. = BEP in units)]

2. Break-even sales in dollars:

X = .625X + $600,000
.375X = $600,000
X = $1,600,000 or $600,000 ÷ 37.5%

[(1.00X - .625X - $600,000 = $0); (.375X = $600,000); (X = $1,600,000)]
[(Sales as % of sales – VC as % of sales – FC = Net inc.); (CM as % of sales = FC); (Sales = Sales at BEP)]

(b)



(c) 1. Margin of safety in dollars: $2,000,000 – $1,600,000 = $400,000

($2,000,000 - $1,600,000 = $400,000)
(Act. sales – BEP sales = MOS)

2. Margin of safety ratio: $400,000 ÷ $2,000,000 = 20%

($400,000 ÷ $2,000,000 = 20%)
(MOS ÷ Act. sales = MOS %)
LO4, 5 BT: AP Difficulty: Easy TOT: 12 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

EXERCISE 5.18

(a) Contribution ratio = Contribution margin ÷ Sales
($40 – $24) ÷ $40 = 40%

[($40 - $24) ÷ $40 = 40%]
[(USP – UVC) ÷ USP = CM ratio)

(b) Break-even in dollars: $19,500 ÷ 40% = $48,750

($19,500 ÷ 40% = $48,750)
(FC ÷ CM ratio = BEP in $)

(c) Margin of safety = (2,500 X $40) – $48,750 = $51,250
Margin of safety ratio = $51,250 ÷ (2,500 x $40) = 51.25%

[((2,500 x $40) - $48,750 = $51,250); ($51,250 ÷ (2,500 x $40) = 51.25%)]
[((No. units sold x USP) – BEP sales $ = MOS); (MOS ÷ (No. units sold x USP) = MOS %)]

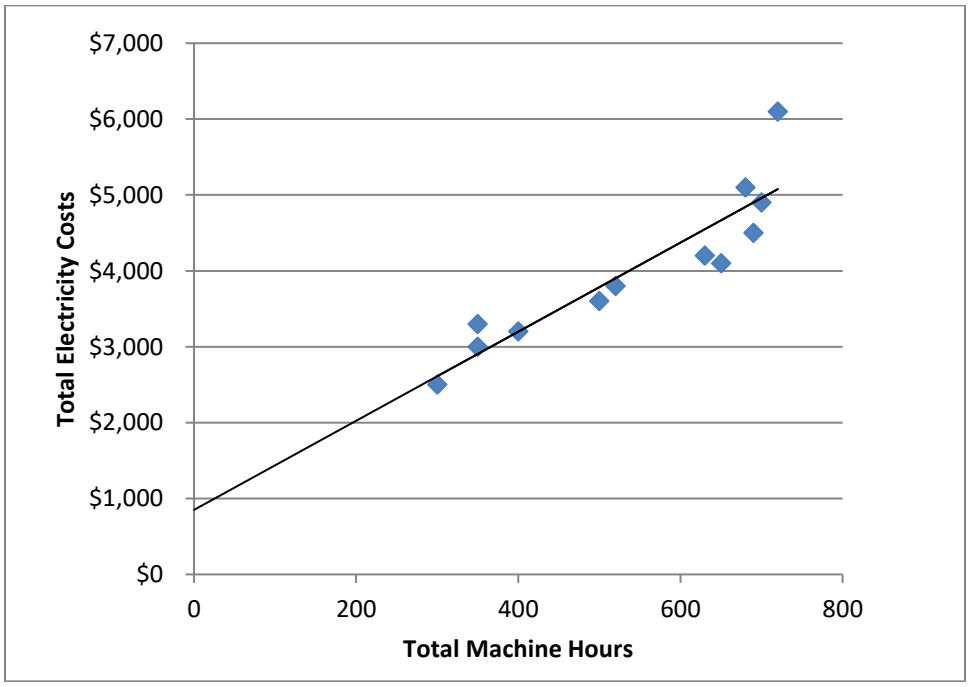
(d) Current contribution margin $40 – $24 = $16
Total contribution margin is $16 x 2,500 = $40,000
30% increase in contribution margin is $40,000 x 30% = $12,000
Total increase in sales required: $12,000 ÷ 40% = $30,000

[($40 - $24 = $16); ($16 x 2,500 = $40,000); ($40,000 x 30% = $12,000); ($12,000 ÷ 40% = $30,000)]
[(USP – UVC = UCM); (UCM x No. units sold = Tot. CM); (Tot. CM x % incr. req. = Incr. in CM); (Incr. in CM ÷ CM ratio = Incr. in sales req.)]
LO3, 4, 5 BT: AP Moderate TOT: 10 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

*EXERCISE 5.19

(a) Using Excel regression analysis the intercept and slope are:
Intercept (fixed costs): $850.468
Slope (unit variable costs): $5.86971/machine hour

(b)



EXERCISE 5.19 (Continued)

(c) Electricity costs = $850.47 + (500 x $5.87) = $3,785.47
$3,785.47 - $3,600 = $185.47 over the cost observed for March.

[($850.47 + (500 x $5.87) = $3,785.47); ($3,785.47 - $3,600 = $185.47]
[(FC + (est. hrs. x UVC) = Est. elec. costs);(Est. elec. costs – Observed costs = Amt. over observed)]
LO6 BT: AP Difficulty: Moderate TOT: 15 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Quantitative Methods

SOLUTIONS TO PROBLEMS

PROBLEM 5.1

(a) Electricity Costs:

$$\frac{\$5,860 - \$2,500}{720 - 300} = \frac{\$3,360}{420} = \$8 \text{ Variable cost per machine hour}$$

	720 Machine Hours	300 Machine Hours
Total costs	$5,860	$2,500
Less: Variable costs		
720 x $8	5,760	
300 x $8		2,400
Total fixed costs	$ 100	$ 100

Thus, electricity costs are $100 per month plus $8 per machine hour.

(b) Estimated cost at 500 MH: $100 + (500 x $8) = $4,100

This estimate exceeds the observed cost at 500 MH by $500 ($4,100 - $3,600).

(c) Estimated cost at 700 MH: $100 + (700 x $8) = $5,700

This estimate exceeds the observed cost at 700 MH by $800 ($5,700 - $4,900).

LO1,2 BT: AP Difficulty: Easy TOT: 15 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

PROBLEM 5.2

(a)

Variable costs (per haircut)	
Barbers' commission	$4.50
Barber supplies	.30
Utilities	.20
Total variable cost per haircut	$5.00

Fixed costs (per month)	
Barbers' salaries (4 x $1,250)	$5,000
Manager's extra salary	500
Advertising	200
Rent	1,100
Utilities	175
Magazines	25
Total fixed costs	$7,000

(b) $10.00Q - $5.00Q - $7,000 = $0

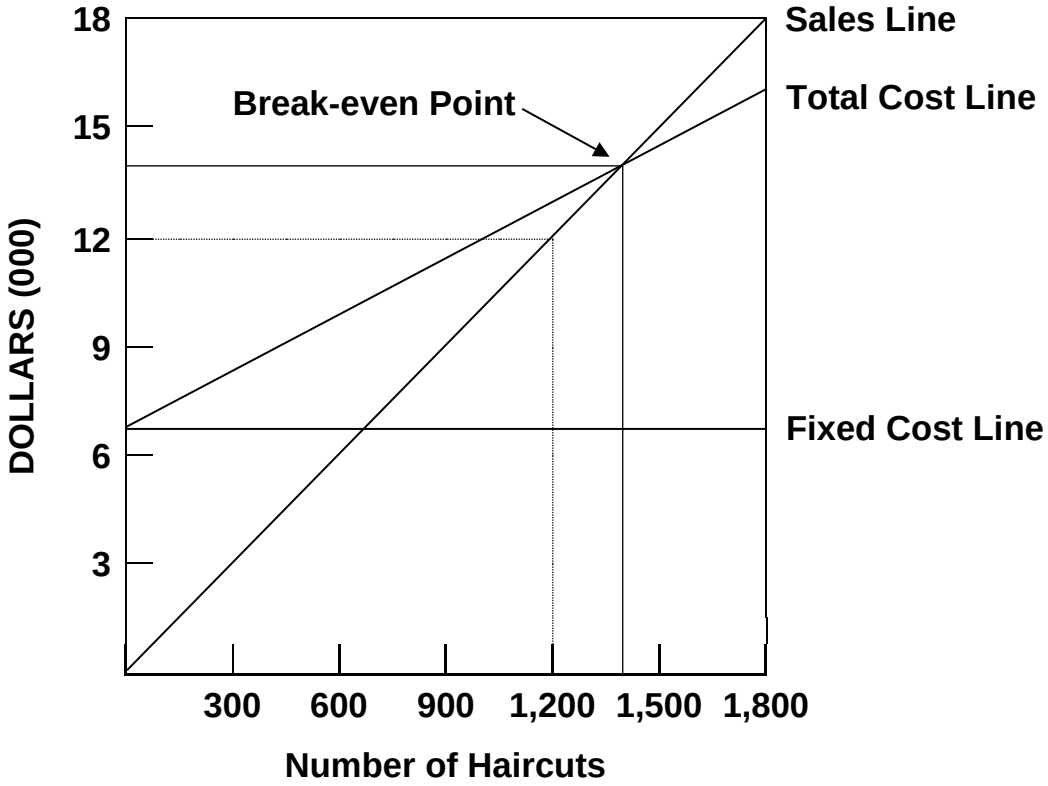
$ 5.00Q = $7,000

Q = 1,400 haircuts

1,400 haircuts x $10 = $14,000

[($10Q - $5Q - $7,000 = $0); (Q = 1,400 haircuts) (1,400 haircuts x $10 = $14,000)
[((USP x No. haircuts) – (UVC x No. haircuts) – FC = Net inc.); (BEP in haircuts x USP = BEP in $)
(No. haircuts = BEP)]

(c)



(d) Net income = (1,600 x $10) – [($5.00 x 1,600) + $7,000]

= $1,000

[(1,600 x $10) – (1,600 x $5) - $7,000 = $1,000]
[(No. haircuts x USP) – (No. haircuts x UVC) – FC = Net inc.]
LO1, 2, 3, 4 BT: AN Difficulty: Easy TOT: 25 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Business Economics

PROBLEM 5.3

(a)

JORGE COMPANY
CVP Income Statement (Estimated)
For the Year Ending December 31, 2022

			Per unit	Percent of Sales
Sales (3,600,000 x $0.50)		$1,800,000	$0.50	100%
Variable expenses				
Cost of goods sold	$1,170,000*			
Selling expenses	70,000			
Administrative expenses	20,000			
Total variable expenses		1,260,000	0.35	70%
Contribution margin		540,000	0.15	30%
Fixed expenses				
Manufacturing overhead	280,000			
Selling expenses	65,000			
Administrative expenses	60,000			
Total fixed expenses		405,000		
Net income		$ 135,000		

***Direct materials $430,000 + direct labor $360,000 + variable manufacturing overhead $380,000.**

[$1,800,000 – (($430,000 + $360,000 + $380,000) + $70,000 + $20,000) – ($280,000 + $65,000 + $60,000) = $135,000); $0.50 – ($1,260,000 ÷ 3,600,000) = $0.15; ($0.50 ÷ $0.50) – ($0.35 ÷ $0.50) = 30%]]
[Sales – ((DM + DL + VOH) + Var. sell. exp. + Var. admin. exp.) – (Fix. CGS + Fix. sell. exp. + Fix. admin. exp.) = Net inc.); USP – UVC = UCM; (USP as a % of USP) – (UVC as a % of USP) = CM ratio]

(b) Variable costs = 70% of sales ($1,260,000 ÷ $1,800,000) or $.35 per bottle ($.50 x 70%). Total fixed costs = $405,000.

(1) $.50Q - $.35Q - $405,000 = $0
$.15Q = $405,000
Q = 2,700,000 units

(2) 2,700,000 x $.50 = $1,350,000

[($1,260,000 ÷ $1,800,000 = 70%); (70% x $.50 = $.35); ($280,000 + $65,000 + $60,000 = $405,000); ($.50Q - $.35Q - $405,000 = $0); (Q = 2,700,000); (2,700,000 x $.50 = $1,350,000)]
[(Tot. VC ÷ Sales = VC %); (VC % x USP = UVC); (Fix. CGS + Fix. sell. exp. + Fix. admin. exp. = Tot. FC); ((USP x No. units sold) – (UVC x No. units sold) – FC = Net inc.); (No. units sold = BEP in units); (BEP in units x USP = BEP in $)]

PROBLEM 5.3 (Continued)

(c) Contribution margin ratio = ($.50 – $.35) ÷ $.50
= 30% (or 1 – .70)

Margin of safety ratio = ($1,800,000 – $1,350,000) ÷ $1,800,000
= 25%

[(($.50 - $.35) ÷ $.50 = 30%); (($1,800,000 - $1,350,000) ÷ $1,800,000 = 25%)]
[((USP – UVC) ÷ USP = CM ratio); ((Est. sales $ – BEP sales $) ÷ Est. sales $ = MOS %)]

(d) Required sales = $\frac{\$405,000 + \$180,000}{.30}$ = $1,950,000

[($405,000 + $180,000) ÷ 30% = $1,950,000]
[(FC + Desired net inc.) ÷ CM ratio = Req. sales $]
LO3, 4, 5 BT: AP Difficulty: Moderate TOT: 40 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

PROBLEM 5.4

(a) Sales were $2,500,000, variable expenses were $1,750,000 (70% of sales), and fixed expenses were $840,000. Therefore, the break-even point in dollars is:

$$\frac{\$840,000}{.30} = \$2,800,000$$

[(($2,500,000 - $1,750,000) ÷ $2,500,000 = 30%); ($840,000 ÷ 30% = $2,800,000)]
[((Sales – VC) ÷ Sales = CM ratio); (FC ÷ CM ratio = BEP in $)]

(b) 1. The effect of this alternative is to increase the selling price per unit to $6 ($5 x 120%). Total sales become $3,000,000 (500,000 x $6). Thus, the contribution margin ratio changes to 42% [($3,000,000 – $1,750,000) ÷ $3,000,000]. The new break-even point is:

$$\frac{\$840,000}{.42} = \$2,000,000$$

[(($5 x 120% = $6); (500,000 x $6 = $3,000,000); (($3,000,000 - $1,750,000) ÷ $3,000,000 = 42%); ($840,000 ÷ 42% = $2,000,000)]
[((old USP x % incr. = New USP); (No. units sold x New USP = New sales); ((New sales – VC) ÷ New sales = New CM ratio); (FC ÷ New CM ratio = New BEP in sales $)]

2. The effects of this alternative are to change total fixed costs to $760,000 ($840,000 – $80,000) and to change the contribution margin to 25% [($2,500,000 – $1,750,000 – $125,000) ÷ $2,500,000]. The new break-even point is:

$$\frac{\$760,000}{.25} = \$3,040,000$$

[($840,000 – ($140,000 - $60,000) = $760,000); (($2,500,000 - $1,750,000 – ($2,500,000 x 5%)) ÷ $2,500,000 = 25%); ($760,000 ÷ 25% = $3,040,000)]
[(Old FC – (Old sales sal. – New sales sal.) = New FC); ((Sales – VC – (Sales x Comm. %)) ÷ Sales = New CM ratio); (New FC ÷ New CM ratio = New BEP in sales $)]

Alternative 1 is the recommended course of action because it has a lower break-even point.

LO4 BT: E Difficulty: Easy TOT: 25 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

PROBLEM 5.5

(a)

BARGAIN SHOE STORE
CVP Income Statement

	Current	New	
Sales (20,000 x $40)	$800,000	$950,000	(25,000 x $38)
Variable expenses (20,000 x $25)	500,000	625,000	(25,000 x $25)
Contribution margin	300,000	325,000	
Fixed expenses	270,000	299,000	
Net income	$ 30,000	$ 26,000	

(b) Current break-even point: $40Q - $25Q - $270,000 = $0
$15Q = $270,000
Q = 18,000 pairs of shoes

New break-even point: $38Q - $25Q - ($270,000 + $29,000) = $0
$13Q = $299,000
Q = 23,000 pairs of shoes

[($40Q - $25Q - $270,000 = $0); (Q = 18,000 pairs); ($38Q - $25Q – ($270,000 + $29,000) = $0); (Q = 23,000 pairs)]
[(((USP x No. pairs sold) – (UVC x No. pairs sold) – FC = Net inc.): No. pairs sold = BEP in pairs); ((New USP x No. pairs sold) – (UVC x No. pairs sold) – (Old FC + Incr. in FC) = Net inc.); No. of pairs sold = New BEP in pairs)]

(c) Current margin of safety ratio $= \frac{(20{,}000 \times \$40) - (18{,}000 \times \$40)}{(20{,}000 \times \$40)}$

$= 10\%$

New margin of safety ratio $= \frac{(25{,}000 \times \$38) - (23{,}000 \times \$38)}{(24{,}000 \times \$38)}$

$= 8\%$

[(((20,000 x $40) – (18,000 x $40)) ÷ (20,000 x $40) = 10%); (((25,000 x $38) – (23,000 x $38) ÷ (25,000 x 38) = 8%)]
[(((Current pairs sold x Current USP) – (Current BEP in pairs x Current USP)) ÷ (Current pairs sold x Current USP) = Current MOS %); (((New pairs sold x New USP) – (New BEP pairs x New USP)) ÷ (New pairs sold x New USP) = New MOS %)]

The proposed changes will raise the break-even point 5,000 units (23,000 – 18,000). This is a significant increase. Margin of safety is 2% (10% - 8%) lower and net income is $4,000 lower. The recommendation is to not accept the proposed changes.

LO3, 4, 5 BT: E Difficulty: Moderate TOT: 30 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

PROBLEM 5.6

(a) (1)

	Current Year
Sales (100,000 x $16)	**$1,600,000**
Variable costs	
Direct materials	**490,000**
Direct labor	**290,000**
Manufacturing overhead ($380,000 x .70)	**266,000**
Selling expenses ($250,000 x .40)	**100,000**
Administrative expenses ($270,000 x .20)	**54,000**
Total variable costs	**1,200,000**
Contribution margin	**$ 400,000**

	Current Year		Projected Year
Sales	**$1,600,000**	**x 1.1**	**$1,760,000**
Variable costs			
Direct materials	**490,000**	**x 1.1**	**539,000**
Direct labor	**290,000**	**x 1.1**	**319,000**
Manufacturing overhead	**266,000**	**x 1.1**	**292,600**
Selling expenses	**100,000**	**x 1.1**	**110,000**
Administrative expenses	**54,000**	**x 1.1**	**59,400**
Total variable costs	**1,200,000**	**x 1.1**	**1,320,000**
Contribution margin	**$ 400,000**	**x 1.1**	**$ 440,000**

[Current: $1,600,000 – ($490,000 + $290,000 + ($380,000 x 70%) + ($250,000 x 40%) + ($270,000 x 20%)) = $400,000]
[Current: Sales – (DM + DL + (MOH x VC %) + (Sell. exp. x VC %) + (Admin. exp. x VC %) = CM]
[Projected: ($1,600,000 x 1.1) – (($490,000 x 1.1) + ($290,000 x 1.1) + ($266,000 x 1.1) + ($100,000 x 1.1) + ($54,000 x 1.1)) = ($400,000 x 1.1)]
[Projected: (Current sales x incr.) – ((DM x incr.) + (DL x incr.) + (MOH x incr.) + (Sell. exp. x incr.) + (Admin. exp. x incr.)) = (CM x incr.)]

(2)

Fixed Costs	Current Year	Projected year
Manufacturing overhead ($380,000 x .30)	**$114,000**	**$114,000**
Selling expenses ($250,000 x .60)	**150,000**	**150,000**
Administrative expenses ($270,000 x .80)	**216,000**	**216,000**
Total fixed costs	**$480,000**	**$480,000**

[Current & projected: ($380,000 x 30%) + ($250,000 x 60%) + ($270,000 x 80%) = $480,000]
[Current & projected: (MOH x FC %) + (Sell. exp. x FC %) + (Admin. exp. x FC %) = Tot. FC]

PROBLEM 5.6 (Continued)

(b) Unit selling price = $1,600,000 ÷ 100,000 = $16
Unit variable cost = $1,200,000 ÷ 100,000 = $12
Unit contribution margin = $16 – $12 = $4
Contribution margin ratio = $4 ÷ $16 = 25%

Break-even point in units	=	Fixed costs	÷	Unit contribution margin
120,000 units	=	$480,000	÷	$4

Break-even point in dollars	=	Fixed costs	÷	Contribution margin ratio
$1,920,000	=	$480,000	÷	.25

[($1,600,000 ÷ 100,000 = $16); ($1,200,000 ÷ 100,000 = $12); ($16 - $12 = $4); ($4 ÷ $16 = 25%); ($480,000 ÷ $4 = 120,000); ($480,000 ÷ 25% = $1,920,000)]
[(Sales ÷ No. units sold = USP); (VC ÷ No. units sold = UVC); (USP – UVC – UCM); (UCM ÷ USP = CM ratio); (FC ÷ UCM = BEP in units); (FC ÷ CM ratio = BEP in sales $)]

(c) Sales dollars required for target net income = (Fixed costs + Target net income) ÷ Contribution margin ratio

$2,500,000	=	($480,000 +	$145,000) ÷	.25

[($480,000 + $145,000) ÷ 25% = $2,500,000]
[(FC + Desired net inc.) ÷ CM ratio = Req. sales $]

(d) Margin of safety ratio = (Expected sales – Break-even sales) ÷ Expected sales

23.2%	=	($2,500,000	– $1,920,000) ÷	$2,500,000

[($2,500,000 - $1,920,000) ÷ $2,500,000 = 23.2%]
[(Req. sales $ - BEP in sales $) ÷ Req. sales $ = MOS %]
LO3, 4, 5 BT: AN Difficulty: Moderate TOT: 30 min. AACSB: Analytic AICPA FC: Measurement, Analysis and Interpretation IMA: Decision Analysis

CT 5.5 ETHICS CASE

(a) The stakeholders in this situation are:

- **Scott Bestor, accountant for Westfield Company.**
- **The dislocated personnel of Westfield.**
- **The senior management who made the decision.**
- **Shareholders and creditors**

(b) Scott is hiding an error and is knowingly deceiving the company's management and its shareholders and creditors with inaccurate data.

(c) Scott'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?

LO N/A BT: E Difficulty: Easy TOT: 10 min. AACSB: Ethics AICPA FC: Measurement, Analysis and Interpretation AICPA PC: Ethical Conduct, Communication IMA: Business Applications

CT 5.6 ALL ABOUT YOU

(a) The variable gasoline cost of going one mile in the hybrid car would be $0.05 ($2.50/50). The variable gasoline cost of going one mile in the traditional car would be $0.08 ($2.50/30).

(b) The savings per mile of driving the hybrid vehicle would be $0.03 ($0.08 – $0.05).

(c) In order to break even on your investment, you would need to drive 150,000 miles. This is determined by dividing the additional fixed cost of $4,500 by the cost savings per mile of $0.03.

(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.

LO1, 2, 3 BT: E Difficulty: Easy TOT: 10 min. AACSB: Analytic AICPA PC: Measurement, Analysis and Interpretation IMA: Decision Analysis