Chapter 9--Break-Even Point and Cost-Volume-Profit Analysis

LEARNING OBJECTIVES

LO 1	Why is variable costing more useful than absorption costing in determining the break-even point and doing cost-volume-profit analysis?
LO 2	How is the break-even point determined using the formula approach, graph approach, and income statement approach?
LO 3	How can a company use cost-volume-profit (CVP) analysis?
LO 4	How do break-even and CVP analysis differ for single-product and multiproduct firms?
LO 5	How are margin of safety and operating leverage concepts used in business?
LO 6	What are the underlying assumptions of CVP analysis?

QUESTION GRID

True/False

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
1	x			x					
2	x			x					
3	x			x					
4	x			x					
5	x			x					
6	x			x					
7	x			x					
8	x			x					
9	x			x					
10	x			x					
11	x			x					
12	x				x				
13	x				x				
14	x					x			
15	x					x			
16		x				x			
17		x				x			
18		x				x			
19		x				x			
20		x				x			
21		x				x			
22		x				x			
23		x				x			
24		x					x		
25		x						x	
26		x						x	
27		x						x	
28		x							x

Completion

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
1	x			x					
2	x				x				
3	x					x			
4		x						x	
5		x						x	
6		x						x	
7		x						x	

Multiple Choice

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
1	x			x					x
2	x				x				x
3	x				x				x
4	x				x				x
5	x				x				
6	x				x				
7	x				x				x
8	x				x				
9	x				x				
10	x				x				
11	x				x				
12	x				x				
13	x				x				
14	x				x				
15		x			x				
16		x			x				
17	x				x				x
18	x				x				
19	x				x				
20	x				x				x
21	x						x		x
22	x					x			
23	x							x	
24	x							x	
25		x						x	
26		x						x	
27		x						x	
28		x						x	
29		x				x			
30	x							x	
31		x				x			
32		x				x			
33		x						x	
34		x				x			
35		x				x			
36		x						x	
37		x				x			
38		x					x		
39		x					x		
40		x					x		
41		x						x	
42		x				x			
43		x				x			
44		x				x			
45		x						x	
46		x						x	
47	x					x			
48	x					x			
49		X				x			
50			x			x			
51		X				x			
52		X				x			
53		X				x			
54	x					x			
55		X				x			
56	x					x			

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
57	x					x			
58		x				x			
59	x					x			
60	x					x			

Short Answer

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
1		x			x				x
2		x					x		
3		x						x	
4		x							x

Problem

	Difficulty Level			Learning Objectives					
	Easy	Moderate	Difficult	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
1		x					x		
2		x					x		
3		x					x		
4		x				x			
5		x						x	
6		x					x		
7		x					x		
8		x				x			
9		x				x			
10		x					x		
11		x					x		

TRUE/FALSE

1. A company's break-even point is the level where total revenues equal total costs.

   ANS: T DIF: Easy OBJ: 9-1

2. Absorption costing is more useful than variable costing in determining a company's break-even point.

   ANS: F DIF: Easy OBJ: 9-1

3. Variable costing is more useful than absorption costing in determining a company's break-even point.

   ANS: T DIF: Easy OBJ: 9-1

4. Total variable costs vary directly with levels of production.

   ANS: T DIF: Easy OBJ: 9-1

5. Variable costs per unit vary directly with levels of production.

   ANS: F DIF: Easy OBJ: 9-1

6. Variable costs per unit remain unchanged with levels of production.

   ANS: T DIF: Easy OBJ: 9-1

7. Total fixed costs remain unchanged with levels of production.

   ANS: T DIF: Easy OBJ: 9-1

8. Total fixed costs vary inversely with levels of production.

   ANS: F DIF: Easy OBJ: 9-1

9. Fixed costs per unit vary inversely with levels of production.

   ANS: T DIF: Easy OBJ: 9-1

10. Fixed costs per unit remain constant with levels of production.

    ANS: F DIF: Easy OBJ: 9-1

11. Break-even point may be expressed in terms of units or dollars.

    ANS: T DIF: Easy OBJ: 9-1

12. Dividing total fixed costs by the contribution margin ratio yields break-even point in sales dollars.

    ANS: T DIF: Easy OBJ: 9-2

13. Dividing total fixed costs by the contribution margin ratio yields break-even point in units.

ANS: F DIF: Easy OBJ: 9-2

14. After the break-even point is reached, each dollar of contribution margin is a dollar of before-tax profit.

ANS: T DIF: Easy OBJ: 9-3

15. After the break-even point is reached, each dollar of contribution margin is a dollar of after-tax profit.

ANS: F DIF: Easy OBJ: 9-3

16. When using CVP analysis to determine sales level for a desired amount of profit, the profit is treated as an additional cost to be covered.

ANS: T DIF: Moderate OBJ: 9-3

17. When computing profit on an after-tax basis, it is necessary to divide the pretax profit by the effective tax rate.

ANS: F DIF: Moderate OBJ: 9-3

18. When computing profit on an after-tax basis, it is necessary to divide the pretax profit by (1 - effective tax rate).

ANS: T DIF: Moderate OBJ: 9-3

19. On a CVP graph, the total cost line intersects the y-axis at zero.

ANS: F DIF: Moderate OBJ: 9-3

20. On a CVP graph, the total variable cost line intersects the y-axis at zero.

ANS: T DIF: Moderate OBJ: 9-3

21. On a CVP graph, the total revenue line intersects the y-axis at zero.

ANS: T DIF: Moderate OBJ: 9-3

22. On a CVP graph, the total fixed cost line parallels the x-axis.

ANS: T DIF: Moderate OBJ: 9-3

23. Incremental analysis focuses on factors that change from one decision to another.

ANS: T DIF: Easy OBJ: 9-3

24. In a multi-product environment, CVP analysis makes the assumption that a company's sales mix is constant.

ANS: T DIF: Moderate OBJ: 9-4

25. The margin of safety is an effective measure of risk for a company.

    ANS: T DIF: Moderate OBJ: 9-5

26. There is an inverse relationship between degree of operating leverage and the margin of safety.

    ANS: T DIF: Moderate OBJ: 9-5

27. The margin of safety is computed by dividing 1 by the degree of operating leverage.

    ANS: T DIF: Moderate OBJ: 9-5

28. In CVP analysis, sales and production are assumed to be equal.

    ANS: T DIF: Moderate OBJ: 9-6

COMPLETION

1. The level of activity where a company's total revenues equal total costs is referred to as the _____.

   ANS: break-even point

   DIF: Easy OBJ: 9-1

2. Contribution margin divided by revenue is referred to as the _____.

   ANS: contribution margin ratio

   DIF: Easy OBJ: 9-2

3. A process that focuses only on factors that change from one course of action to another is referred to as _____.

   ANS: incremental analysis

   DIF: Easy OBJ: 9-3

4. The excess of budgeted or actual sales over sales at break-even point is referred to as _____.

   ANS: margin of safety

   DIF: Moderate OBJ: 9-5

5. The relationship between a company's variable costs and fixed costs is referred to as its _____.

   ANS: operating leverage

   DIF: Moderate OBJ: 9-5

6. The _____ is computed by dividing the contribution margin by profit before tax.

   ANS: degree of operating leverage

   DIF: Moderate OBJ: 9-5

7. The formula for margin of safety is _____.

   ANS: 1 ÷ Degree of Operating Leverage

   DIF: Moderate OBJ: 9-5

MULTIPLE CHOICE

1. CVP analysis requires costs to be categorized as
   a. either fixed or variable.
   b. fixed, mixed, or variable.
   c. product or period.
   d. standard or actual.

   ANS: A DIF: Easy OBJ: 9-1,9-6

2. With respect to fixed costs, CVP analysis assumes total fixed costs
   a. per unit remain constant as volume changes.
   b. remain constant from one period to the next.
   c. vary directly with volume.
   d. remain constant across changes in volume.

   ANS: D DIF: Easy OBJ: 9-2,9-6

3. CVP analysis relies on the assumptions that costs are either strictly fixed or strictly variable. Consistent with these assumptions, as volume decreases total
   a. fixed costs decrease.
   b. variable costs remain constant.
   c. costs decrease.
   d. costs remain constant.

   ANS: C DIF: Easy OBJ: 9-2,9-6

4. According to CVP analysis, a company could **never** incur a loss that exceeded its total
   a. variable costs.
   b. fixed costs.
   c. costs.
   d. contribution margin.

   ANS: C DIF: Easy OBJ: 9-2,9-6

5. CVP analysis is based on concepts from
   a. standard costing.
   b. variable costing.
   c. job order costing.
   d. process costing.

   ANS: B DIF: Easy OBJ: 9-2

6. Cost-volume-profit analysis is a technique available to management to understand better the interrelationships of several factors that affect a firm's profit. As with many such techniques, the accountant oversimplifies the real world by making assumptions. Which of the following is **not** a major assumption underlying CVP analysis?
   a. All costs incurred by a firm can be separated into their fixed and variable components.
   b. The product selling price per unit is constant at all volume levels.
   c. Operating efficiency and employee productivity are constant at all volume levels.
   d. For multi-product situations, the sales mix can vary at all volume levels.

   ANS: D DIF: Easy OBJ: 9-2

7. In CVP analysis, linear functions are assumed for
   a. contribution margin per unit.
   b. fixed cost per unit.
   c. total costs per unit.
   d. all of the above.

   ANS: A DIF: Easy OBJ: 9-2,9-6

8. Which of the following factors is involved in studying cost-volume-profit relationships?
   a. product mix
   b. variable costs
   c. fixed costs
   d. all of the above

   ANS: D DIF: Easy OBJ: 9-2

9. Cost-volume-profit relationships that are curvilinear may be analyzed linearly by considering only
   a. fixed and mixed costs.
   b. relevant fixed costs.
   c. relevant variable costs.
   d. a relevant range of volume.

   ANS: D DIF: Easy OBJ: 9-2

10. After the level of volume exceeds the break-even point
    a. the contribution margin ratio increases.
    b. the total contribution margin exceeds the total fixed costs.
    c. total fixed costs per unit will remain constant.
    d. the total contribution margin will turn from negative to positive.

    ANS: B DIF: Easy OBJ: 9-2

11. Which of the following will **decrease** the break-even point?

	Decrease in fixed cost	Increase in direct labor cost	Increase in selling price
a.	yes	yes	yes
b.	yes	no	yes
c.	yes	no	no
d.	no	yes	no

    ANS: B DIF: Easy OBJ: 9-2

12. At the break-even point, fixed costs are always
    a. less than the contribution margin.
    b. equal to the contribution margin.
    c. more than the contribution margin.
    d. more than the variable cost.

    ANS: B DIF: Easy OBJ: 9-2

13. The method of cost accounting that lends itself to break-even analysis is
    a. variable.
    b. standard.
    c. absolute.
    d. absorption.

    ANS: A DIF: Easy OBJ: 9-2

14. Given the following notation, what is the break-even sales level in units?

    SP = selling price per unit, FC = total fixed cost, VC = variable cost per unit
    a. SP/(FC/VC)
    b. FC/(VC/SP)
    c. VC/(SP - FC)
    d. FC/(SP - VC)

    ANS: D DIF: Easy OBJ: 9-2

15. Consider the equation X = Sales - [(CM/Sales) × (Sales)]. What is X?
    a. net income
    b. fixed costs
    c. contribution margin
    d. variable costs

    ANS: D DIF: Moderate OBJ: 9-2

16. If a firm's net income does **not** change as its volume changes, the firm('s)
    a. must be in the service industry.
    b. must have no fixed costs.
    c. sales price must equal $0.
    d. sales price must equal its variable costs.

    ANS: D DIF: Moderate OBJ: 9-2

17. Break-even analysis assumes over the relevant range that
    a. total variable costs are linear.
    b. fixed costs per unit are constant.
    c. total variable costs are nonlinear.
    d. total revenue is nonlinear.

    ANS: A DIF: Easy OBJ: 9-2,9-6

18. To compute the break-even point in units, which of the following formulas is used?
    a. FC/CM per unit
    b. FC/CM ratio
    c. CM/CM ratio
    d. (FC+VC)/CM ratio

    ANS: A DIF: Easy OBJ: 9-2

19. A firm's break-even point in dollars can be found in one calculation using which of the following formulas?
    a. FC/CM per unit
    b. VC/CM
    c. FC/CM ratio
    d. VC/CM ratio

    ANS: C DIF: Easy OBJ: 9-2

20. The contribution margin ratio **always** increases when the
    a. variable costs as a percentage of net sales increase.
    b. variable costs as a percentage of net sales decrease.
    c. break-even point increases.
    d. break-even point decreases.

    ANS: B DIF: Easy OBJ: 9-2,9-6

21. In a multiple-product firm, the product that has the highest contribution margin per unit will
    a. generate more profit for each $1 of sales than the other products.
    b. have the highest contribution margin ratio.
    c. generate the most profit for each unit sold.
    d. have the lowest variable costs per unit.

    ANS: C DIF: Easy OBJ: 9-4,9-6

22. _____ focuses only on factors that change from one course of action to another.
    a. Incremental analysis
    b. Margin of safety
    c. Operating leverage
    d. A break-even chart

    ANS: A DIF: Easy OBJ: 9-3

23. The margin of safety would be negative if a company('s)
    a. was presently operating at a volume that is below the break-even point.
    b. present fixed costs were less than its contribution margin.
    c. variable costs exceeded its fixed costs.
    d. degree of operating leverage is greater than 100.

    ANS: A DIF: Easy OBJ: 9-5

24. The margin of safety is a key concept of CVP analysis. The margin of safety is the
    a. contribution margin rate.
    b. difference between budgeted contribution margin and actual contribution margin.
    c. difference between budgeted contribution margin and break-even contribution margin.
    d. difference between budgeted sales and break-even sales.

    ANS: D DIF: Easy OBJ: 9-5

25. Management is considering replacing an existing sales commission compensation plan with a fixed salary plan. If the change is adopted, the company's
    a. break-even point must increase.
    b. margin of safety must decrease.
    c. operating leverage must increase.
    d. profit must increase.

    ANS: C DIF: Moderate OBJ: 9-5

26. As projected net income increases the
    a. degree of operating leverage declines.
    b. margin of safety stays constant.
    c. break-even point goes down.
    d. contribution margin ratio goes up.

    ANS: A DIF: Moderate OBJ: 9-5

27. A managerial preference for a very low degree of operating leverage might indicate that
    a. an increase in sales volume is expected.
    b. a decrease in sales volume is expected.
    c. the firm is very unprofitable.
    d. the firm has very high fixed costs.

    ANS: B DIF: Moderate OBJ: 9-5

Thompson Company

Below is an income statement for Thompson Company:

Sales	$400,000
Variable costs	(125,000)
Contribution margin	$275,000
Fixed costs	(200,000)
Profit before taxes	$ 75,000

28. Refer to Thompson Company. What is Thompson's degree of operating leverage?
    a. 3.67
    b. 5.33
    c. 1.45
    d. 2.67

    ANS: A
    $(275,000/75,000) = 3.67

    DIF: Moderate OBJ: 9-5

29. Refer to Thompson Company. Based on the cost and revenue structure on the income statement, what was Thompson's break-even point in dollars?
    a. $200,000
    b. $325,000
    c. $300,000
    d. $290,909

    ANS: D

CM Percentage = $(275/400) = .6875 .6875x - $800,000 = 0 x = $290,909

    DIF: Moderate OBJ: 9-3

30. Refer to Thompson Company. What was Thompson's margin of safety?
    a. $200,000
    b. $75,000
    c. $100,000
    d. $109,091

    ANS: D

Margin of Safety = $(400,000 - 290,909) = $109,091

    DIF: Easy OBJ: 9-5

31. Refer to Thompson Company. Assuming that the fixed costs are expected to remain at $200,000 for the coming year and the sales price per unit and variable costs per unit are also expected to remain constant, how much profit before taxes will be produced if the company anticipates sales for the coming year rising to 130 percent of the current year's level?
    a. $97,500
    b. $195,000
    c. $157,500
    d. A prediction cannot be made from the information given.

    ANS: C

Contribution Margin * 1.20 = New Contribution Margin $275,000 * 1.20 = $357,500 Contribution Margin - Fixed Costs = Profit $(357,500 - 200,000) = $157,500

    DIF: Moderate OBJ: 9-3

Value Pro

Value Pro produces and sells a single product. Information on its costs follow:

Variable costs:	
SG&A	$2 per unit
Production	$4 per unit
Fixed costs:	
SG&A	$12,000 per year
Production	$15,000 per year

32. Refer to Value Pro. Assume Value Pro produced and sold 5,000 units. At this level of activity, it produced a profit of $18,000. What was Value Pro's sales price per unit?
    a. $15.00
    b. $11.40
    c. $9.60
    d. $10.00

    ANS: A

Profit + Fixed Costs = Contribution Margin
$18,000 + $27,000 = $45,000

$45,000 / 5,000 units = $9 contribution margin per unit

Contribution Margin + Variable Costs = Sales Price/Unit
$(9 + (4 + 2)) = $15/Unit

    DIF: Moderate OBJ: 9-3

33. Refer to Value Pro. In the upcoming year, Value Pro estimates that it will produce and sell 4,000 units. The variable costs per unit and the total fixed costs are expected to be the same as in the current year. However, it anticipates a sales price of $16 per unit. What is Value Pro's projected margin of safety for the coming year?
    a. $7,000
    b. $20,800
    c. $18,400
    d. $13,000

    ANS: B

Profit at 4,000 units
Gross Sales = $16 * 4,000 units = $64,000
Contribution Margin = $(16 - 6) = $10/unit
($10*4,000) - $27,000 = $(40,000 - 27,000) = $13,000

Breakeven
0.625x - $27,000 = $0
x = $43,200

$(64,000 - 43,200) = $20,800

    DIF: Moderate OBJ: 9-5

34. Harris Manufacturing incurs annual fixed costs of $250,000 in producing and selling a single product. Estimated unit sales are 125,000. An after-tax income of $75,000 is desired by management. The company projects its income tax rate at 40 percent. What is the maximum amount that Harris can expend for variable costs per unit and still meet its profit objective if the sales price per unit is estimated at $6?
    a. $3.37
    b. $3.59
    c. $3.00
    d. $3.70

    ANS: C

Before Tax Income:	$75,000 / 0.60 =	$125,000
Fixed Costs:		250,000
Contribution Margin:		$375,000
Projected Sales		$750,000
less: Contribution Margin		375,000
Variable Costs		$375,000
$375,000 / 125,000 units		$3/unit

    DIF: Moderate OBJ: 9-3

Folk Company

The following information relates to financial projections of Folk Company:

Projected sales	60,000 units
Projected variable costs	$2.00 per unit
Projected fixed costs	$50,000 per year
Projected unit sales price	$7.00

35. Refer to Folk Company. How many units would Folk Company need to sell to earn a profit before taxes of $10,000?
    a. 25,714
    b. 10,000
    c. 8,571
    d. 12,000

    ANS: D

Contribution Margin per Unit: $5
$5x - $50,000 - $10,000
$5x = $60,000
x = 12,000 units

    DIF: Moderate OBJ: 9-3

36. Refer to Folk Company. If Folk Company achieves its projections, what will be its degree of operating leverage?
    a. 6.00
    b. 1.20
    c. 1.68
    d. 2.40

    ANS: B

Net profit = (60,000 units * $5/unit) - $50,000
= $300,000 - $50,000
= $250,000
DOL = $(300,000/120,000) = 1.20

    DIF: Moderate OBJ: 9-5

37. Unique Company manufactures a single product. In the prior year, the company had sales of $90,000, variable costs of $50,000, and fixed costs of $30,000. Unique expects its cost structure and sales price per unit to remain the same in the current year, however total sales are expected to increase by 20 percent. If the current year projections are realized, net income should exceed the prior year's net income by:
    a. 100 percent.
    b. 80 percent.
    c. 20 percent.
    d. 50 percent.

    ANS: B

Contribution margin: $40,000
Net profit: $(40,000 - 30,000) = $10,000

20% CM increase: $40,000 * 1.20 = $48,000
Net profit: $(48,000 - 30,000) = $18,000

Increase in profit $8,000

$8,000/$10,000 = 80%

    DIF: Moderate OBJ: 9-3

Eclectic Corporation

Eclectic Corporation manufactures and sells two products: A and B. The operating results of the company are as follows:

	Product A	Product B
Sales in units	2,000	3,000
Sales price per unit	$10	$5
Variable costs per unit	7	3

In addition, the company incurred total fixed costs in the amount of $9,000.

38. Refer to Eclectic Corporation.. How many total units would the company have needed to sell to break even?
    a. 3,750
    b. 750
    c. 3,600
    d. 1,800

    ANS: A

Let B = 1.5A

3A + 2(1.5A) - $9,000 = $0
6A - $9,000 = $0
A = 1,500
B = 2,250

Total units = 3,750

    DIF: Moderate OBJ: 9-4

39. Refer to Eclectic Corporation. If the company would have sold a total of 6,000 units, consistent with CVP assumptions how many of those units would you expect to be Product B?
    a. 3,000
    b. 4,000
    c. 3,600
    d. 3,500

    ANS: C

A + 1.5A = 6,000 units
2.5A = 6,000 units
A = 2,400 units
B = 3,600 units

    DIF: Moderate OBJ: 9-4

40. Refer to Eclectic Corporation. How many units would the company have needed to sell to produce a profit of $12,000?
    a. 8,750
    b. 20,000
    c. 10,000
    d. 8,400

    ANS: A

3A + 2(1.5A) - $9,000 = $12,000
6A = $21,000
A = 3,500 units
B = 5,250 units
Total = 8,750 units

    DIF: Moderate OBJ: 9-4

Brittany Company

Below is an income statement for Brittany Company:

Sales	$300,000
Variable costs	(150,000)
Contribution margin	$150,000
Fixed costs	(100,000)
Profit before taxes	$ 50,000

41. Refer to Brittany Company. What was the company's margin of safety?
    a. $50,000
    b. $100,000
    c. $150,000
    d. $25,000

    ANS: B

Margin of safety = Sales - BEP Sales
CM = .50
BEP Sales = .50x - $100,000 = 0
= .50x = $100,000
x = $200,000
$(300,000 - 200,000) = $100,000

    DIF: Moderate OBJ: 9-5

42. Refer to Brittany Company. If the unit sales price for Brittany's sole product was $10, how many units would it have needed to sell to produce a profit of $40,000?
    a. 27,500
    b. 29,000
    c. 28,000
    d. can't be determined from the information given

    ANS: C

Contribution Margin at $40,000 profit: $(40,000 + 100,000) = $140,000
Contribution Margin Ratio: 0.50
$140,000 / .50 = $280,000
$280,000 / $10 = 28,000 units

    DIF: Moderate OBJ: 9-3

43. A firm estimates that it will sell 100,000 units of its sole product in the coming period. It projects the sales price at $40 per unit, the CM ratio at 60 percent, and profit at $500,000. What is the firm budgeting for fixed costs in the coming period?
    a. $1,600,000
    b. $2,400,000
    c. $1,100,000
    d. $1,900,000

    ANS: D

Profit + Fixed Cost = (100,000 units * $60/unit CM) Fixed Cost = (100,000 units * $24/unit CM) - Profit = $2,400,000 - $500,000 = $1,900,000

    DIF: Moderate OBJ: 9-3

44. Sombrero Company manufactures a western-style hat that sells for $10 per unit. This is its sole product and it has projected the break-even point at 50,000 units in the coming period. If fixed costs are projected at $100,000, what is the projected contribution margin ratio?
    a. 80 percent
    b. 20 percent
    c. 40 percent
    d. 60 percent

    ANS: B

Fixed Costs=Contribution Margin at Breakeven Point = $100,000 Breakeven Sales: $500,000 CM Ratio: $(100,000/500,000) = 20%

    DIF: Moderate OBJ: 9-3

Brandon Company

Brandon Company manufactures a single product. Each unit sells for $15. The firm's projected costs are listed below:

Variable costs per unit:	
Production	$5
SG&A	$1
Fixed costs:	
Production	$40,000
SG&A	$60,000
Estimated volume	20,000 units

45. Refer to Brandon Company. What is Brandon's projected margin of safety for the current year?
    a. $133,333
    b. $150,000
    c. $80,000
    d. $100,000

    ANS: A

Contribution Margin = $9/unit Contribution Margin Ratio = 60% Breakeven Point = $100,000/.60 = $166,667 Sales Volume = 20,000 units * $15/unit = $300,000 Margin of Safety = $(300,000 - 166,667) = $133,333

    DIF: Moderate OBJ: 9-5

46. Refer to Brandon Company. What is Brandon's projected degree of operating leverage for the current year?
    a. 2.25
    b. 1.80
    c. 3.75
    d. 1.67

    ANS: A

Contribution Margin = $180,000 Net Income = 80,000 Degree of Operating Leverage = $180,000/80,000 = 2.55

    DIF: Moderate OBJ: 9-5

Alpha, Beta, and Epsilon Companies

Below are income statements that apply to three companies: Alpha, Beta, and Epsilon:

	Alpha Co.	Beta Co.	Epsilon Co.
Sales	$100	$100	$100
Variable costs	(10)	(20)	(30)
Contribution margin	$ 90	$ 80	$ 70
Fixed costs	(30)	(20)	(10)
Profit before taxes	$ 60	$ 60	$ 60

47. Refer to Alpha, Beta, and Epsilon Companies. Within the relevant range, if sales go up by $1 for each firm, which firm will experience the greatest increase in profit?
    a. Alpha Company
    b. Beta Company
    c. Epsilon Company
    d. can't be determined from the information given

    ANS: A

Alpha Company will have the greatest increase in profit, because it has the greatest contribution margin per unit.

    DIF: Easy OBJ: 9-3

48. Refer to Alpha, Beta, and Epsilon Companies. Within the relevant range, if sales go up by one unit for each firm, which firm will experience the greatest increase in net income?
    a. Alpha Company
    b. Beta Company
    c. Epsilon Company
    d. can't be determined from the information given

    ANS: D
    Price per unit is not given.

    DIF: Easy OBJ: 9-3

49. Refer to Alpha, Beta, and Epsilon Companies. At sales of $100, which firm has the highest margin of safety?
    a. Alpha Company
    b. Beta Company
    c. Epsilon Company
    d. They all have the same margin of safety.

    ANS: C
    Epsilon Company has the lowest amount of fixed costs to be covered.

    DIF: Moderate OBJ: 9-3

50. Mike is interested in entering the catfish farming business. He estimates if he enters this business, his fixed costs would be $50,000 per year and his variable costs would equal 30 percent of sales. If each catfish sells for $2, how many catfish would Mike need to sell to generate a profit that is equal to 10 percent of sales?
    a. 40,000
    b. 41,667
    c. 35,000
    d. No level of sales can generate a 10 percent net return on sales.

    ANS: B
    Let x = sales in dollars
    x - .30x - $50,000 = .10x
    .60x = $50,000
    x = $83,333 Units = $83,333/$2 per unit = 41,667 units

    DIF: Difficult OBJ: 9-3

51. The following information pertains to Saturn Company's cost-volume-profit relationships:

Break-even point in units sold	1,000
Variable costs per unit	$500
Total fixed costs	$150,000

How much will be contributed to profit before taxes by the 1,001st unit sold?
a. $650
b. $500
c. $150
d. $0

ANS: C

Fixed Cost = Contribution Margin
= $150,000
Contribution Margin/Unit = Contribution Margin/Units
$150,000/1,000 units = $150/unit

DIF: Moderate OBJ: 9-3

52. Information concerning Averie Corporation's Product A follows:

Sales	$300,000
Variable costs	240,000
Fixed costs	40,000

Assuming that Averie increased sales of Product A by 20 percent, what should the profit from Product A be?
a. $20,000
b. $24,000
c. $32,000
d. $80,000

ANS: C

Contribution margin at $300,000 in sales = $60,000
Increase contribution margin by 20% = $60,000 * 1.20 = $72,000
Contribution margin - fixed costs = Profit
$(72,000 - 40,000) = $32,000

DIF: Moderate OBJ: 9-3

53. Ledbetter Company reported the following results from sales of 5,000 units of Product A for June:

Sales	$200,000
Variable costs	(120,000)
Fixed costs	(60,000)
Operating income	$ 20,000

Assume that Ledbetter increases the selling price of Product A by 10 percent in July. How many units of Product A would have to be sold in July to generate an operating income of $20,000?
a. 4,000
b. 4,300
c. 4,545
d. 5,000

ANS: A

If sales price per unit is increased by 10 percent, less units will have to be sold to generate gross revenues of $200,000.
Sales price per unit = $200,000/5,000 units = $40/unit
$40/unit * 1.10 = $44/unit
$(200,000 / 44/unit) = 4,545 units

DIF: Moderate OBJ: 9-3

54. On a break-even chart, the break-even point is located at the point where the total
a. revenue line crosses the total fixed cost line.
b. revenue line crosses the total contribution margin line.
c. fixed cost line intersects the total variable cost line.
d. revenue line crosses the total cost line.

ANS: D DIF: Easy OBJ: 9-3

55. In a CVP graph, the slope of the total revenue line indicates the
a. rate at which profit changes as volume changes.
b. rate at which the contribution margin changes as volume changes.
c. ratio of increase of total fixed costs.
d. total costs per unit.

ANS: B DIF: Moderate OBJ: 9-3

56. In a CVP graph, the area between the total cost line and the total revenue line represents total
a. contribution margin.
b. variable costs.
c. fixed costs.
d. profit.

ANS: D DIF: Easy OBJ: 9-3

57. In a CVP graph, the area between the total cost line and the total fixed cost line yields the
a. fixed costs per unit.
b. total variable costs.
c. profit.
d. contribution margin.

ANS: B DIF: Easy OBJ: 9-3

58. If a company's fixed costs were to increase, the effect on a profit-volume graph would be that the
    a. contribution margin line would shift upward parallel to the present line.
    b. contribution margin line would shift downward parallel to the present line.
    c. slope of the contribution margin line would be more pronounced (steeper).
    d. slope of the contribution margin line would be less pronounced (flatter).

    ANS: B DIF: Moderate OBJ: 9-3

59. If a company's variable costs per unit were to increase but its unit selling price stays constant, the effect on a profit-volume graph would be that the
    a. contribution margin line would shift upward parallel to the present line.
    b. contribution margin line would shift downward parallel to the present line.
    c. slope of the contribution margin line would be pronounced (steeper).
    d. slope of the contribution margin line would be less pronounced (flatter).

    ANS: D DIF: Easy OBJ: 9-3

60. The most useful information derived from a cost-volume-profit chart is the
    a. amount of sales revenue needed to cover enterprise variable costs.
    b. amount of sales revenue needed to cover enterprise fixed costs.
    c. relationship among revenues, variable costs, and fixed costs at various levels of activity.
    d. volume or output level at which the enterprise breaks even.

    ANS: C DIF: Easy OBJ: 9-3

SHORT ANSWER

1. How do changes in volume affect the break-even point?

   ANS:
   Within the relevant range, the break-even point does not change. This is due to the linearity assumptions that apply to total revenues, fixed costs, and variable costs.

   DIF: Moderate OBJ: 9-2,9-6

2. What major assumption do multi-product firms need to make in using CVP analysis that single-product firms need not make?

   ANS:
   The assumption that must be imposed is a constant sales mix. A multi-product firm assumes that (within the relevant range) the sales mix is constant. This permits CVP analysis to be performed using a unit of the constant sales mix.

   DIF: Moderate OBJ: 9-4

3. What important information is conveyed by the margin of safety calculation in CVP analysis?

   ANS:
   The break-even point in CVP analysis is critical because it divides profitable levels of operation from unprofitable levels of operation. The margin of safety gives managers an idea of the extent to which sales can fall before operations will become unprofitable.

   DIF: Moderate OBJ: 9-5

4. What are the major assumptions of CVP analysis?

   ANS:
   1. All revenue and variable cost behavior patterns are constant per unit and linear within the relevant range.
   2. Total contribution margin (total revenue divided by total variable cost) is linear within the relevant range and increases proportionally with output.
   3. Total fixed cost is constant within the relevant range. This assumption, in part, indicates that no capacity additions will be made during the period under consideration.
   4. Mixed costs can be accurately separated into their fixed and variable elements.
   5. Sales and production are equal; thus, there is no material fluctuation in inventory levels. This assumption is necessary because fixed cost can be allocated to inventory at a different rate each year. Thus, variable costing information must be available. Because CVP and variable costing both focus on cost behavior, they are distinctly compatible with one another.
   6. In a multi-product firm, the sales mix remains constant. This assumption is necessary so that a weighted average contribution margin can be computed.
   7. Labor productivity, production technology, and market conditions will not change. If any of these changes were to occur, costs would change correspondingly, and selling prices might change

   DIF: Moderate OBJ: 9-6

PROBLEM

1. The Coontz Company sells two products, A and B, with contribution margin ratios of 40 and 30 percent and selling prices of $5 and $2.50 a unit. Fixed costs amount to $72,000 a month. Monthly sales average 30,000 units of product A and 40,000 units of product B.

   Required:
   a. Assuming that three units of product A are sold for every four units of product B, calculate the dollar sales volume necessary to break even.
   b. As part of its cost accounting routine, Coontz Company assigns $36,000 in fixed costs to each product each month. Calculate the break-even dollar sales volume for each product.
   c. Coontz Company is considering spending an additional $9,700 a month on advertising, giving more emphasis to product A and less emphasis to product B. If its analysis is correct, sales of product A will increase to 40,000 units a month, but sales of product B will fall to 32,000 units a month. Recalculate the break-even sales volume, in dollars, at this new product mix. Should the proposal to spend the additional $9,700 a month be accepted?

   ANS:

   a. $CM = (3 \times \$2) + (4 \times \$.75) = \$9$
      $SP = (3 \times \$5) = (4 \times \$2.50) = \$25$

      $BE = \frac{\$72,000}{\$9/\$25} = \$400,000$

   b. $A = \frac{\$36,000}{} = \$90,000$ $B = \frac{\$36,000}{} = \$120,000$

.4 .3

c. CM = (5 × $2) + (4 × $.75) = $13
SP = (5 × $5) + (4 × $2.50) = $35

BE = $\frac{\$72{,}000 + \$9{,}700}{\$13/35}$ = $219,962

	OLD			NEW	
CM	A = 30,000 × $2 =	$60,000	CM	A = 40,000 × $2 =	$ 80,000
	B = 40,000 × $.75 =	30,000		B = 32,000 × $.75	24,000
		$90,000			$104,000
- FC		(72,000)		- FC	(81,700)
OI		$18,000		OI	$ 22,300

At current sales levels increase advertising.

DIF: Moderate OBJ: 9-4

2. The Graves Company makes three products. The cost data for these three products is as follows:

	Product A	Product B	Product C
Selling price	$10	$20	$40
Variable costs	7	12	16

Total annual fixed costs are $840,000. The firm's experience has been that about 20 percent of dollar sales come from product A, 60 percent from B, and 20 percent from C.

Required:
a. Compute break-even in sales dollars.

b. Determine the number of units to be sold at the break-even point.

ANS:

		A	B	C
a.	SP	$10	$20	$40
	- VC	(7)	(12)	(16)
	= CM	$ 3	$ 8	$24
	CMR	30%	40%	60%

CMR = (.2 × 30%) + (.6 × 40%) + (.2 × 60%) = 42%

BE = $840,000/.42 = $2,000,000

b. A ($2,000,000 × .20)/$10 = 40,000 units

B ($2,000,000 × .60)/$20 = 60,000 units

C ($2,000,000 × .20)/$40 = 10,000 units

DIF: Moderate OBJ: 9-4

3. Anderson Company produces and sells two products: A and B in the ratio of 3A to 5B. Selling prices for A and B are, respectively, $1,200 and $240; respective variable costs are $480 and $160. The company's fixed costs are $1,800,000 per year.

   Compute the volume of sales in units of each product needed to:

   Required:
   a. break even.

   b. earn $800,000 of income before income taxes.

   c. earn $800,000 of income after income taxes, assuming a 30 percent tax rate.

   d. earn 12 percent on sales revenue in before-tax income.

   e. earn 12 percent on sales revenue in after-tax income, assuming a 30 percent tax rate.

   ANS:

A	SP	$1,200	B	SP	$240
	- VC	(480)		- VC	(160)
	CM	$ 720		CM	$ 80

   Weighted CM = (3 × $720) + (5 × $80) = $2,560

   a. $\frac{\$1,800,000}{\$2,560} = 703.125$

   A = 704 × 3 = 2,112 units
   B = 704 × 5 = 3,520

   b. $\frac{\$1,800,000 + \$800,000}{\$2,560} = 1015.625$

   A = 1,016 × 3 = 3,048 units
   B = 1,016 × 5 = 5,080

   c. $\$800,000/1 - .3 = \$1,142,857$

   $\frac{\$1,800,000 + \$1,142,857}{\$2,560} = 1,149.55$

   A = 1,150 × 3 = 3,450 units
   B = 1,150 × 5 = 5,750

   d. $SP = (3 \times \$1,200) + (5 \times \$240) = \$4,800$

   $X = \frac{\$1,800,000 + \$.12X}{\$2,560/\$4,800} = \$4,354,839$

   A = ($4,354,839 × .75)/$1200 = 2,722 units
   B = ($4,354,839 × .25/$240 = 4,537

   e. $X = \$1,800,000 + \frac{\$.12X}{1 - .3} = \$4,973,684$

   $\$2,560/\$4,800$

   A = ($4,973,684 × .75)/$1,200 = 3,109 units
   B = ($4,973,684 × .25/$240 = 5,181

   DIF: Moderate OBJ: 9-4

Bradley Corporation

Information relating to the current operations of Bradley Corporation follows:

Sales	$120,000
Variable costs	(36,000)
Contribution margin	$ 84,000
Fixed costs	(70,000)
Profit before taxes	$ 14,000

4. Refer to Bradley Corporation. Bradley's break-even point was 1,000 units. Compute Bradley's sales price per unit.

   ANS:
   The break-even point is found by dividing the fixed costs by the CM ratio.

   The CM ratio is:

   $84,000/$120,000 = 70%. Breakeven would then be:

   $70,000/.70 = $100,000. Since we also know that the break-even point is defined as 1,000 units, it must follow that the unit sales price is $100,000/1,000 = $100.

   DIF: Moderate OBJ: 9-3

5. Refer to Bradley Corporation. Compute Bradley's degree of operating leverage.

   ANS:
   The degree of operating leverage is computed as the contribution margin divided by profit before taxes: $84,000/$14,000 = 6.

   DIF: Moderate OBJ: 9-5

McKinney Corporation

McKinney Corporation manufactures and sells two products: A and B. The projected information on these two products for the coming year is presented below:

	Product A	Product B
Sales in units	4,000	1,000
Sales price per unit	$12	$8
Variable costs per unit	8	4

Total fixed costs for the company are projected at $10,000.

6. Refer to McKinney Corporation. Compute McKinney Corporation's projected break-even point in total units.

   ANS:
   The company anticipates a sales mix consisting of 4 units of Product A and 1 unit of Product B. The total contribution margin for one unit of sales mix would be $20. This consists of $16 of contribution margin from the 4 units of Product A and $4 of contribution margin from 1 unit of Product B.

The overall company break-even point is found by dividing total fixed costs by the contribution margin on one unit of sales mix: $10,000/$20 = 500 units. The 500 units of sales mix contain 500 × 5 units of product for a total of 2,500. Of the 2,500 total units, 2,000 are units of Product A and 500 are units of Product B.

DIF: Moderate OBJ: 9-4

7. Refer to McKinney Corporation. How many units would the company need to sell to produce an income before income taxes equal to 15 percent of sales?

ANS:
Again, using a unit of sales mix as the unit of analysis, one unit of sales mix sells for $56. Since the contribution margin is $20 on one unit of sales mix, the CM ratio on one unit of sales mix is $20/$56 = .3571. This implies that variable costs as a percentage of sales are equal to 1 - .3571 = .6429. Income before income taxes equal to 15 percent of sales can be found by solving a formula of the following type:

Sales - VC - FC = Income before income taxes

In this particular case, we solve the following formula:
Sales - (.6429 × Sales) - $10,000 = (.15 × Sales)

Solving for Sales, we get $48,286. We can find out how many units of sales mix are required to generate sales of $48,286 by dividing $48,286 by $56 = 863. These 863 units of sales mix each contain 5 units of product, so the correct answer would be 863 × 5 = 4,315 units of product, 3,452 of Product A and 863 of Product B.

DIF: Moderate OBJ: 9-4

Perry Corporation

Perry Corporation predicts it will produce and sell 40,000 units of its sole product in the current year. At that level of volume, it projects a sales price of $30 per unit, a contribution margin ratio of 40 percent, and fixed costs of $5 per unit.

8. Refer to Perry Corporation. What is the company's projected breakeven point in dollars and units?

ANS:
Given the CM ratio of 40 percent, and the Sales price per unit of $30, the CM per unit must be $30 × .40 = $12. The total fixed costs would be projected at $5 × 40,000 = $200,000. Breakeven would be: $200,000/$12 = 16,667 units. This would also equate to $500,000 of sales.

DIF: Moderate OBJ: 9-3

9. Refer to Perry Corporation. What would the company's projected profit be if it produced and sold 30,000 units?

ANS:

Projected profit would be:

Sales (30,000 × $30)	$900,000
Variable costs (30,000 × $18)	(540,000)
Contribution margin	$360,000

Fixed costs	(200,000)
Profit	$160,000

DIF: Moderate OBJ: 9-3

Castle Corporation

The following questions are based on the following data pertaining to two types of products manufactured by Castle Corporation:

	Per unit	
	Sales price	Variable costs
Product Y	$120	$ 70
Product Z	$500	$200

Fixed costs total $300,000 annually. The expected mix in units is 60 percent for Product Y and 40 percent for Product Z.

10. Refer to Castle Corporation. How much is Castle's break-even point sales in units?

ANS:
BEP units = FC/(unit SP - unit VC) or unit CM(UMC)
For multiple products, use the weighted CM with weights based on units of sales weights.

BEP = FC / [60% ($120 - $70) + 40% ($500 - $200)]
= $300,000/ ($30/u + $120/u) = 2,000 units

DIF: Moderate OBJ: 9-4

11. Refer to Castle Corporation. What is Castle's break-even point in sales dollars?

ANS:
BEP dollars = FC/CMR
For multiple products, use weighted CMR with weights based on sales dollars as weights or sales mix.
Sales mix is 60 percent and 40 percent in units or in dollars.
Weighted average CMR = WACM/WASale
WACMR = [60% ($120 - $70) + 40% ($500 - $200)] ÷ (60% × $120) + (40% × $500)
WACMR = [$30 + $120] ÷ [$72 + $200] = .551
BEP sales = 2,000 × $272 = $544,000

DIF: Moderate OBJ: 9-4