Chapter 2
Managerial Accounting and Cost Concepts

Solutions to Questions

2-1 The three major elements of product costs in a manufacturing company are direct materials, direct labor, and manufacturing overhead.

2-2

a. Direct materials are an integral part of a finished product and their costs can be conveniently traced to it.

b. Indirect materials are generally small items of material such as glue and nails. They may be an integral part of a finished product but their costs can be traced to the product only at great cost or inconvenience.

c. Direct labor consists of labor costs that can be easily traced to particular products. Direct labor is also called "touch labor."

d. Indirect labor consists of the labor costs of janitors, supervisors, materials handlers, and other factory workers that cannot be conveniently traced to particular products. These labor costs are incurred to support production, but the workers involved do not directly work on the product.

e. Manufacturing overhead includes all manufacturing costs except direct materials and direct labor. Consequently, manufacturing overhead includes indirect materials and indirect labor as well as other manufacturing costs.

2-3 A product cost is any cost involved in purchasing or manufacturing goods. In the case of manufactured goods, these costs consist of direct materials, direct labor, and manufacturing overhead. A period cost is a cost that is taken directly to the income statement as an expense in the period in which it is incurred.

2-4

a. Variable cost: The variable cost per unit is constant, but total variable cost changes in direct proportion to changes in volume.
b. Fixed cost: The total fixed cost is constant within the relevant range. The *average* fixed cost per unit varies inversely with changes in volume.
c. Mixed cost: A mixed cost contains both variable and fixed cost elements.

2-5

a. Unit fixed costs decrease as volume increases.
b. Unit variable costs remain constant as volume increases.
c. Total fixed costs remain constant as volume increases.
d. Total variable costs increase as volume increases.

2-6

a. Cost behavior: Cost behavior refers to the way in which costs change in response to changes in a measure of activity such as sales volume, production volume, or orders processed.
b. Relevant range: The relevant range is the range of activity within which assumptions about variable and fixed cost behavior are valid.

2-7 An activity base is a measure of whatever causes the incurrence of a variable cost. Examples of activity bases include units produced, units sold, letters typed, beds in a hospital, meals served in a cafe, service calls made, etc.

2-8 The linear assumption is reasonably valid providing that the cost formula is used only within the relevant range.

2-9 A discretionary fixed cost has a fairly short planning horizon—usually a year. Such costs arise from annual decisions by management to spend on certain fixed cost items, such as advertising, research, and management development. A committed fixed cost has a long planning horizon—generally many years. Such costs relate to a company's investment in facilities, equipment, and basic organization. Once such costs have been incurred, they are "locked in" for many years.

2-10 Yes. As the anticipated level of activity changes, the level of fixed costs needed to support operations may also change. Most fixed costs are adjusted upward and downward in large steps, rather than being absolutely fixed at one level for all ranges of activity.

2-11 The high-low method uses only two points to determine a cost formula. These two points are likely to be less than typical because they represent extremes of activity.

2-12 The formula for a mixed cost is $Y = a + bX$. In cost analysis, the "a" term represents the fixed cost and the "b" term represents the variable cost per unit of activity.

2-13 The term "least-squares regression" means that the sum of the squares of the deviations from the plotted points on a graph to the regression line is smaller than could be obtained from any other line that could be fitted to the data.

2-14 The contribution approach income statement organizes costs by behavior, first deducting variable expenses to obtain contribution margin, and then deducting fixed expenses to obtain net operating income. The traditional approach organizes costs by function, such as production, selling, and administration. Within a functional area, fixed and variable costs are intermingled.

2-15 The contribution margin is total sales revenue less total variable expenses.

2-16 A differential cost is a cost that differs between alternatives in a decision. An opportunity cost is the potential benefit that is given up when one alternative is selected over another. A sunk cost is a cost that has already been incurred and cannot be altered by any decision taken now or in the future.

2-17 No, differential costs can be either variable or fixed. For example, the alternatives might consist of purchasing one machine rather than another to make a product. The difference between the fixed costs of purchasing the two machines is a differential cost.

Exercise 2-1 (10 minutes)

1. The wages of employees who build the sailboats: direct labor cost.

2. The cost of advertising in the local newspapers: marketing and selling cost.

3. The cost of an aluminum mast installed in a sailboat: direct materials cost.

4. The wages of the assembly shop's supervisor: manufacturing overhead cost.

5. Rent on the boathouse: a combination of manufacturing overhead, administrative, and marketing and selling cost. The rent would most likely be prorated on the basis of the amount of space occupied by manufacturing, administrative, and marketing operations.

6. The wages of the company's bookkeeper: administrative cost.

7. Sales commissions paid to the company's salespeople: marketing and selling cost.

8. Depreciation on power tools: manufacturing overhead cost.

Exercise 2-2 (15 minutes)

	Product Cost	*Period Cost*
1. The cost of the memory chips used in a radar set	X	
2. Factory heating costs	X	
3. Factory equipment maintenance costs	X	
4. Training costs for new administrative employees		X
5. The cost of the solder that is used in assembling the radar sets	X	
6. The travel costs of the company's salespersons		X
7. Wages and salaries of factory security personnel	X	
8. The cost of air-conditioning executive offices		X
9. Wages and salaries in the department that handles billing customers		X
10. Depreciation on the equipment in the fitness room used by factory workers	X	
11. Telephone expenses incurred by factory management	X	
12. The costs of shipping completed radar sets to customers		X
13. The wages of the workers who assemble the radar sets	X	
14. The president's salary		X
15. Health insurance premiums for factory personnel	X	

Exercise 2-3 (15 minutes)

1.

	Cups of Coffee Served in a Week		
	1,800	*1,900*	*2,000*
Fixed cost	$1,100	$1,100	$1,100
Variable cost	468	494	520
Total cost	$1,568	$1,594	$1,620
Average cost per cup served*	$0.871	$0.839	$0.810

* Total cost ÷ cups of coffee served in a week

2. The average cost of a cup of coffee declines as the number of cups of coffee served increases because the fixed cost is spread over more cups of coffee.

Exercise 2-4 (20 minutes)

1.

	Occupancy-Days	*Electrical Costs*
High activity level (August) ..	3,608	$8,111
Low activity level (October)..	186	1,712
Change.....	3,422	$6,399

Variable cost = Change in cost ÷ Change in activity
= $6,399 ÷ 3,422 occupancy-days
= $1.87 per occupancy-day

Total cost (August).....	$8,111
Variable cost element ($1.87 per occupancy-day × 3,608 occupancy-days)	6,747
Fixed cost element	$1,364

2. Electrical costs may reflect seasonal factors other than just the variation in occupancy days. For example, common areas such as the reception area must be lighted for longer periods during the winter. This will result in seasonal effects on the fixed electrical costs.

   Additionally, fixed costs will be affected by how many days are in a month. In other words, costs like the costs of lighting common areas are variable with respect to the number of days in the month, but are fixed with respect to how many rooms are occupied during the month.

   Other, less systematic, factors may also affect electrical costs such as the frugality of individual guests. Some guests will turn off lights when they leave a room. Others will not.

Exercise 2-5 (15 minutes)

1. Traditional income statement

Redhawk, Inc.
Traditional Income Statement

Sales ($15 per unit × 10,000 units)		$150,000
Cost of goods sold ($12,000 + $90,000 – $22,000)		80,000
Gross margin		70,000
Selling and administrative expenses:		
Selling expenses (($2 per unit × 10,000 units) + $20,000)	40,000	
Administrative expenses (($1 per unit × 10,000 units) + $15,000)	25,000	65,000
Net operating income		$ 5,000

2. Contribution format income statement

Redhawk, Inc.
Contribution Format Income Statement

Sales		$150,000
Variable expenses:		
Cost of goods sold ($12,000 + $90,000 – $22,000)	$80,000	
Selling expenses ($2 per unit × 10,000 units)	20,000	
Administrative expenses ($1 per unit × 10,000 units)	10,000	110,000
Contribution margin		40,000
Fixed expenses:		
Selling expenses	20,000	
Administrative expenses	15,000	35,000
Net operating income		$ 5,000

Exercise 2-6 (15 minutes)

	Cost	*Cost Object*	*Direct Cost*	*Indirect Cost*
1.	The salary of the head chef	The hotel's restaurant	X	
2.	The salary of the head chef	A particular restaurant customer		X
3.	Room cleaning supplies	A particular hotel guest		X
4.	Flowers for the reception desk	A particular hotel guest		X
5.	The wages of the doorman	A particular hotel guest		X
6.	Room cleaning supplies	The housecleaning department	X	
7.	Fire insurance on the hotel building	The hotel's gym		X
8.	Towels used in the gym	The hotel's gym	X	

Note: The room cleaning supplies would most likely be considered an indirect cost of a particular hotel guest because it would not be practical to keep track of exactly how much of each cleaning supply was used in the guest's room.

Exercise 2-7 (15 minutes)

Item	*Differential Cost*	*Opportunity Cost*	*Sunk Cost*
1. Cost of the new flat-panel displays.....	X		
2. Cost of the old computer terminals.....			X
3. Rent on the space occupied by the registration desk.....			
4. Wages of registration desk personnel.....			
5. Benefits from a new freezer.....		X	
6. Costs of maintaining the old computer terminals.....	X		
7. Cost of removing the old computer terminals.....	X		
8. Cost of existing registration desk wiring.....			X

Note: The costs of the rent on the space occupied by the registration desk and the wages of registration desk personnel are neither differential costs, opportunity costs, nor sunk costs. These are costs that do not differ between the alternatives and are therefore irrelevant in the decision, but they are not sunk costs since they occur in the future.

Exercise 2-8 (20 minutes)

1. The company's variable cost per unit would be:

$$\frac{\$150{,}000}{60{,}000 \text{ units}} = \$2.50 \text{ per unit.}$$

In accordance with the behavior of variable and fixed costs, the completed schedule is:

	Units produced and sold		
	60,000	80,000	100,000
Total costs:			
Variable costs	$150,000	$200,000	$250,000
Fixed costs	360,000	360,000	360,000
Total costs	$510,000	$560,000	$610,000
Cost per unit:			
Variable cost	$2.50	$2.50	$2.50
Fixed cost	6.00	4.50	3.60
Total cost per unit	$8.50	$7.00	$6.10

2. The company's income statement in the contribution format is:

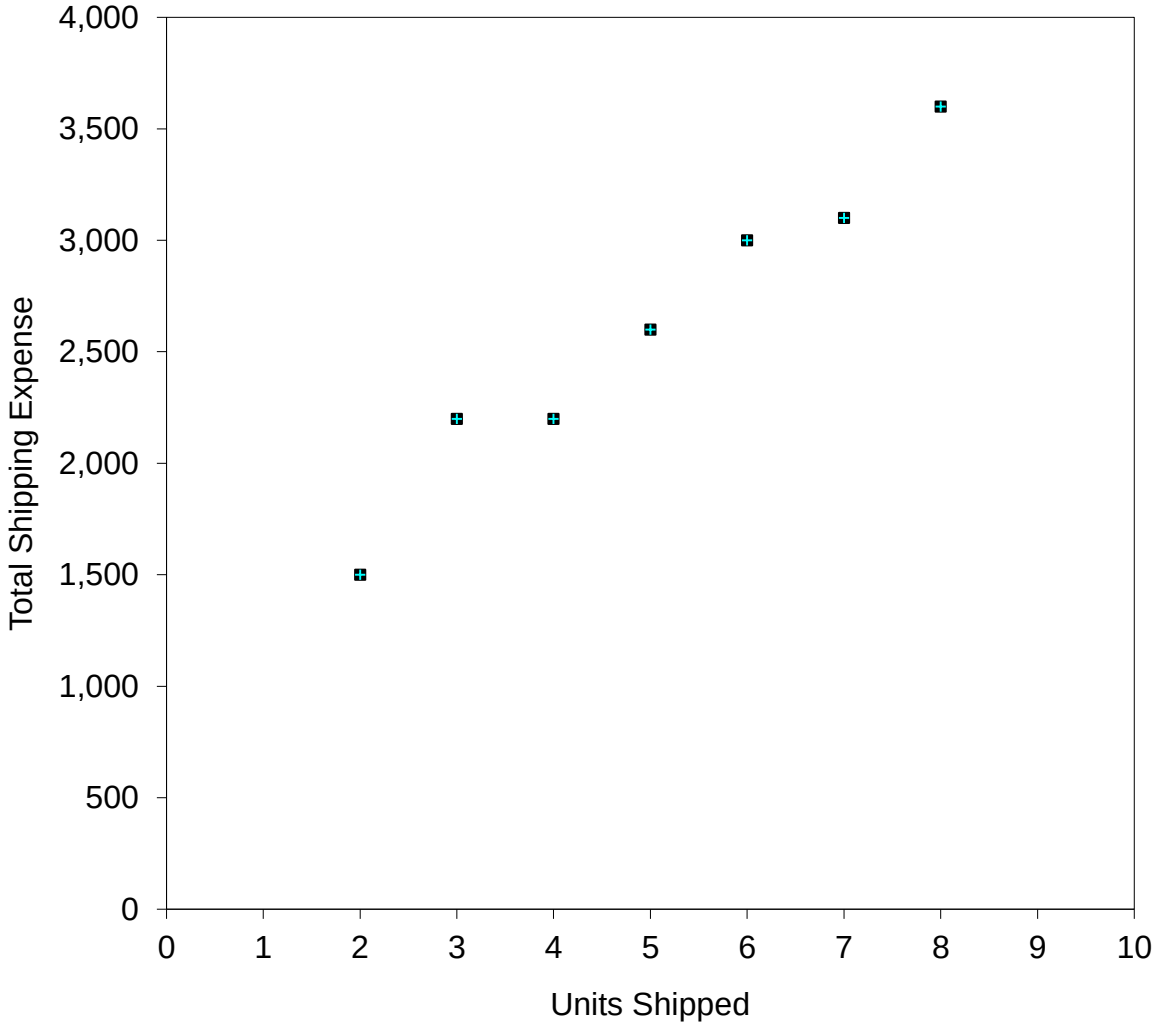
Sales (90,000 units × $7.50 per unit)	$675,000
Variable expenses (90,000 units × $2.50 per unit)	225,000
Contribution margin	450,000
Fixed expenses	360,000
Net operating income	$ 90,000

Exercise 2-9 (30 minutes)

Name of the Cost	*Variable Cost*	*Fixed Cost*	*Product Cost*			*Period (Selling and Admin.) Cost*	*Opportunity Cost*	*Sunk Cost*
			Direct Materials	*Direct Labor*	*Mfg. Overhead*			
Rental revenue forgone, $40,000 per year							X	
Direct materials cost, $40 per unit	X		X					
Supervisor's salary, $2,500 per month		X			X			
Direct labor cost, $18 per unit	X			X				
Rental cost of warehouse, $1,000 per month		X				X		
Rental cost of equipment, $3,000 per month		X			X			
Depreciation of the building, $10,000 per year		X			X			X
Advertising cost, $50,000 per year		X				X		
Shipping cost, $10 per unit	X					X		
Electrical costs, $2 per unit	X				X			
Return earned on investments, $6,000 per year							X	

Exercise 2-10 (45 minutes)

1. The scattergraph appears below:



Yes, there is an approximately linear relationship between the number of units shipped and the total shipping expense.

Exercise 2-10 (continued)

2.

	Units Shipped	*Shipping Expense*
High activity level	8	$3,600
Low activity level	2	1,500
Change	6	$2,100

Variable cost element:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$2{,}100}{6 \text{ units}} = \$350 \text{ per unit}$$

Fixed cost element:

Shipping expense at the high activity level	$3,600
Less variable cost element ($350 per unit × 8 units).....	2,800
Total fixed cost	$ 800

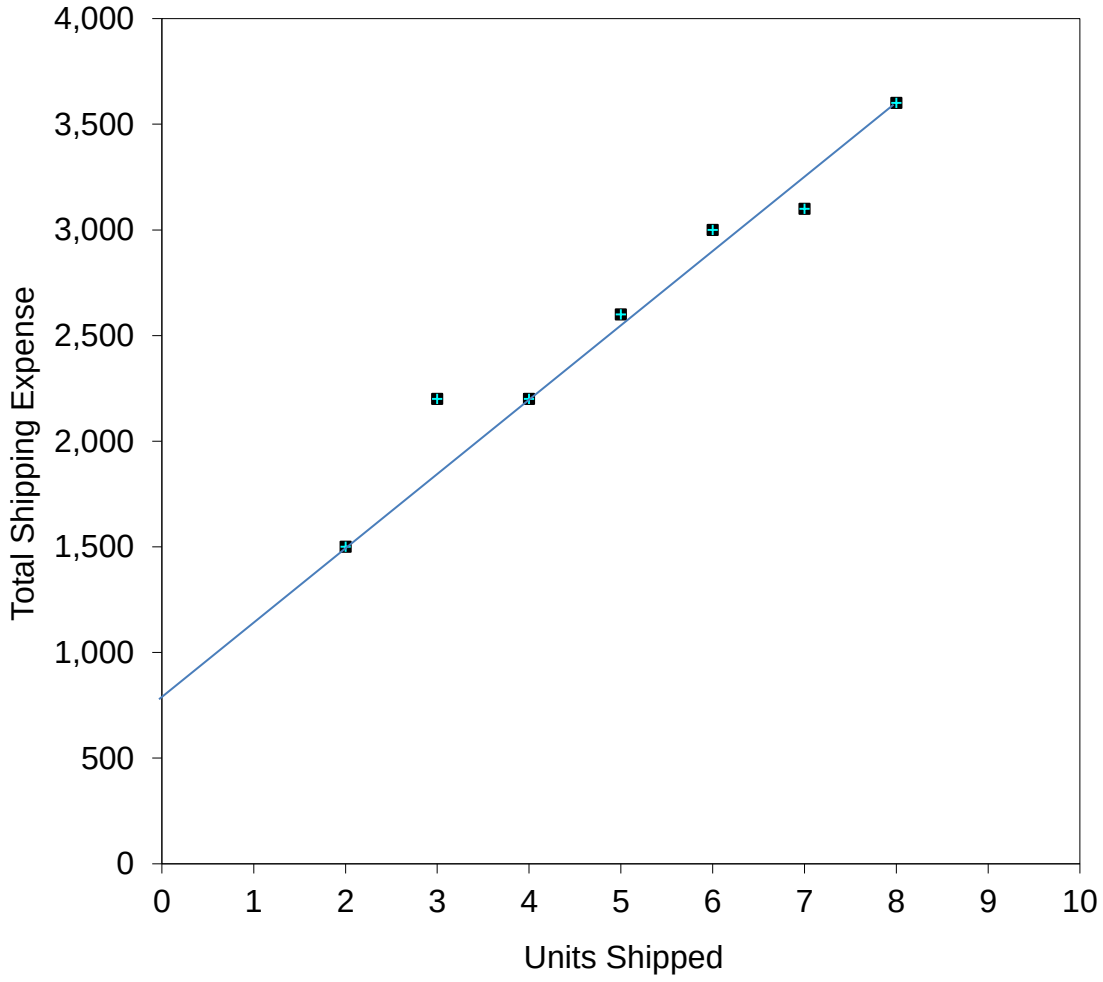
The cost formula is $800 per month plus $350 per unit shipped, or:

Y = $800 + $350X,

where X is the number of units shipped.

The scattergraph on the following page shows the straight line drawn through the high and low data points.

Exercise 2-10 (continued)



3. The high-low estimate of fixed costs is $210.71 lower than the estimate provided by least-squares regression. The high-low estimate of the variable cost per unit is $32.14 lower than the estimate provided by least-squares regression. A straight line that minimized the sum of the squared errors would intersect the Y-axis at $1,010.71 instead of $800. It would also have a flatter slope because the estimated variable cost per unit is lower than the high-low method.

4. The cost of shipping units is likely to depend on the weight and volume of the units shipped and the distance traveled as well as on the number of units shipped. In addition, higher cost shipping might be necessary to meet a deadline.

Exercise 2-11 (20 minutes)

1. Traditional income statement

Haaki Shop, Inc.
Traditional Income Statement

Sales		$800,000
Cost of goods sold ($80,000 + $320,000 – $100,000)		300,000
Gross margin		500,000
Selling and administrative expenses:		
Selling expenses (($50 per unit × 2,000 surfboards*) + $150,000)	250,000	
Administrative expenses (($20 per unit × 2,000 units) + $120,000)	160,000	410,000
Net operating income		$ 90,000

*$800,000 sales ÷ $400 per surfboard = 2,000 surfboards.

2. Contribution format income statement

Haaki Shop, Inc.
Contribution Format Income Statement

Sales		$800,000
Variable expenses:		
Cost of goods sold ($80,000 + $320,000 – $100,000)	$300,000	
Selling expenses ($50 per unit × 2,000 surfboards)	100,000	
Administrative expenses ($20 per unit × 2,000 surfboards)	40,000	440,000
Contribution margin		360,000
Fixed expenses:		
Selling expenses	150,000	
Administrative expenses	120,000	270,000
Net operating income		$ 90,000

Exercise 2-11 (continued)

2. Since 2,000 surfboards were sold and the contribution margin totaled $360,000 for the quarter, the contribution of each surfboard toward fixed expenses and profits was $180 ($360,000 ÷ 2,000 surfboards = $180 per surfboard).

Exercise 2-12 (20 minutes)

1.

	Miles Driven	*Total Annual Cost**
High level of activity	120,000	$13,920
Low level of activity	80,000	10,880
Change	40,000	$ 3,040

* 120,000 miles × $0.116 per mile = $13,920
80,000 miles × $0.136 per mile = $10,880

Variable cost per mile:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$3,040}{40,000 \text{ miles}} = \$0.076 \text{ per mile}$$

Fixed cost per year:

Total cost at 120,000 miles	$13,920
Less variable cost element:	
120,000 miles × $0.076 per mile	9,120
Fixed cost per year	$ 4,800

2. Y = $4,800 + $0.076X

3.

Fixed cost	$ 4,800
Variable cost: 100,000 miles × $0.076 per mile	7,600
Total annual cost	$12,400

Exercise 2-13 (30 minutes)

1.

	X-rays Taken	*X-ray Costs*
High activity level (February).....	7,000	$29,000
Low activity level (June)	3,000	17,000
Change.....	4,000	$12,000

Variable cost per X-ray:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$12{,}000}{4{,}000 \text{ X-rays}} = \$3.00 \text{ per X-ray}$$

Fixed cost per month:

X-ray cost at the high activity level	$29,000
Less variable cost element:	
7,000 X-rays × $3.00 per X-ray	21,000
Total fixed cost.....	$ 8,000

The cost formula is $8,000 per month plus $3.00 per X-ray taken or:

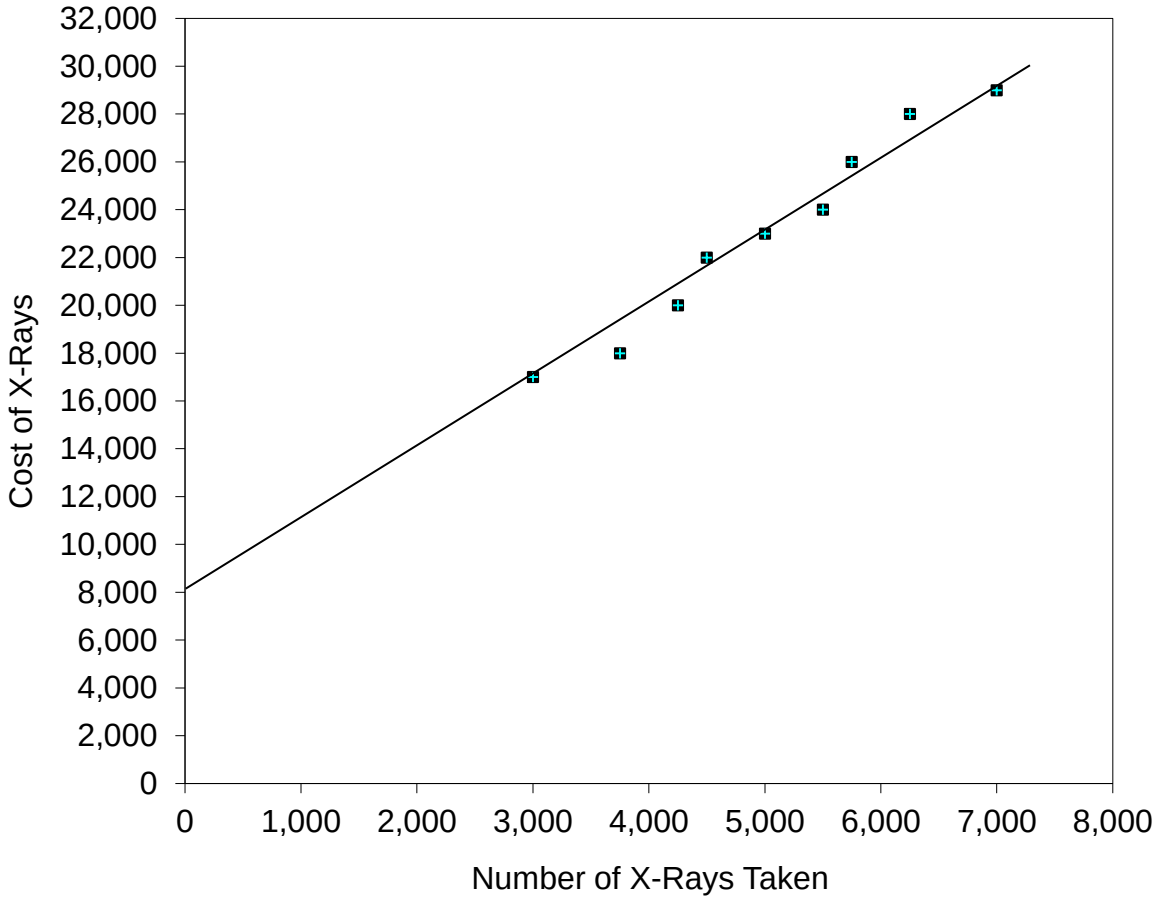
$$Y = \$8{,}000 + \$3.00X$$

2. Expected X-ray costs when 4,600 X-rays are taken:

Variable cost: 4,600 X-rays × $3.00 per X-ray.....	$13,800
Fixed cost	8,000
Total cost.....	$21,800

Exercise 2-13 (continued)

3. The scattergraph appears below.



Exercise 2-13 (continued)

4. The high-low estimate of fixed costs is $1,470.59 higher than the estimate provided by least-squares regression. The high-low estimate of the variable cost per unit is $0.29 lower than the estimate provided by least-squares regression. A straight line that minimized the sum of the squared errors would intersect the Y-axis at $6,529.41 instead of $8,000. It would also have a steeper slope because the estimated variable cost per unit is higher than the high-low method.

5. Expected X-ray costs when 4,600 X-rays are taken:

Variable cost: 4,600 X-rays × $3.29 per X-ray.....	$15,134
Fixed cost (rounded).....	6,529
Total cost.....	$21,663

Problem 2-14 (45 minutes)

1.

House Of Organs, Inc.
Traditional Income Statement
For the Month Ended November 30

Sales (60 organs × $2,500 per organ)		$150,000
Cost of goods sold (60 organs × $1,500 per organ)		90,000
Gross margin		60,000
Selling and administrative expenses:		
Selling expenses:		
Advertising	$ 950	
Delivery of organs (60 organs × $60 per organ)	3,600	
Sales salaries and commissions [$4,800 + (4% × $150,000)]	10,800	
Utilities	650	
Depreciation of sales facilities	5,000	
Total selling expenses	21,000	
Administrative expenses:		
Executive salaries	13,500	
Depreciation of office equipment	900	
Clerical [$2,500 + (60 organs × $40 per organ)]	4,900	
Insurance	700	
Total administrative expenses	20,000	
Total selling and administrative expenses		41,000
Net operating income		$ 19,000

Problem 2-14 (continued)

2.

House Of Organs, Inc.
Contribution Format Income Statement
For the Month Ended November 30

	Total	*Per Unit*
Sales (60 organs × $2,500 per organ)	$150,000	$2,500
Variable expenses:		
Cost of goods sold (60 organs × $1,500 per organ)	90,000	1,500
Delivery of organs (60 organs × $60 per organ)	3,600	60
Sales commissions (4% × $150,000)	6,000	100
Clerical (60 organs × $40 per organ)	2,400	40
Total variable expenses	102,000	1,700
Contribution margin	48,000	$ 800
Fixed expenses:		
Advertising	950	
Sales salaries	4,800	
Utilities	650	
Depreciation of sales facilities	5,000	
Executive salaries	13,500	
Depreciation of office equipment	900	
Clerical	2,500	
Insurance	700	
Total fixed expenses	29,000	
Net operating income	$ 19,000	

3. Fixed costs remain constant in total but vary on a per unit basis with changes in the activity level. For example, as the activity level increases, fixed costs decrease on a per unit basis. Showing fixed costs on a per unit basis on the income statement make them appear to be variable costs. That is, management might be misled into thinking that the per unit fixed costs would be the same regardless of how many organs were sold during the month. For this reason, fixed costs should be shown only in totals on a contribution-type income statement.

Problem 2-15 (30 minutes)

1. a. 6
   b. 11
   c. 1
   d. 4
   e. 2
   f. 10
   g. 3
   h. 7
   i. 9

2. Without an understanding of the underlying cost behavior patterns, it would be difficult, if not impossible for a manager to properly analyze the firm's cost structure. The reason is that all costs don't behave in the same way. One cost might move in one direction as a result of a particular action, and another cost might move in an opposite direction. Unless the behavior pattern of each cost is clearly understood, the impact of a firm's activities on its costs will not be known until *after* the activity has occurred.

Problem 2-16 (20 minutes)

Item	*Description*	*Direct or Indirect Cost of the Immunization Center*		*Direct or Indirect Cost of Particular Patients*		*Variable or Fixed with Respect to the Number of Immunizations Administered*	
		Direct	*Indirect*	*Direct*	*Indirect*	*Variable*	*Fixed*
a.	The salary of the head nurse in the Immunization Center	X			X		X
b.	Costs of incidental supplies consumed in the Immunization Center such as paper towels	X			X	X	
c.	The cost of lighting and heating the Immunization Center	X			X		X
d.	The cost of disposable syringes used in the Immunization Center	X		X		X	
e.	The salary of the Central Area Well-Baby Clinic's Information Systems manager		X		X		X
f.	The costs of mailing letters soliciting donations to the Central Area Well-Baby Clinic		X		X		X
g.	The wages of nurses who work in the Immunization Center*	X			X		X
h.	The cost of medical malpractice insurance for the Central Area Well-Baby Clinic		X		X		X
i.	Depreciation on the fixtures and equipment in the Immunization Center	X			X		X

* The wages of the nurses could be variable and a direct cost of serving particular patients.

Problem 2-17 (30 minutes)

1. Maintenance cost at the 80,000 machine-hour level of activity can be isolated as follows:

	Level of Activity	
	60,000 MH	*80,000 MH*
Total factory overhead cost ..	274,000 pesos	312,000 pesos
Deduct:		
Indirect materials @ 1.50 pesos per MH*	90,000	120,000
Rent.....	130,000	130,000
Maintenance cost	54,000 pesos	62,000 pesos

* 90,000 pesos ÷ 60,000 MHs = 1.50 pesos per MH

2. High-low analysis of maintenance cost:

	Machine-Hours	*Maintenance Cost*
High activity level	80,000	62,000 pesos
Low activity level	60,000	54,000
Change observed.....	20,000	8,000 pesos

$$\text{Variable cost} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{8{,}000 \text{ pesos}}{20{,}000 \text{ MHs}} = 0.40 \text{ peso per MH}$$

Fixed cost element:

Total cost at the high level of activity	54,000 pesos
Less variable cost element (60,000 MHs × 0.40 pesos per MH)	24,000
Fixed cost element	30,000 pesos

Therefore, the cost formula is 30,000 pesos per year, plus 0.40 peso per machine-hour or

$$Y = 30{,}000 \text{ pesos} + 0.40 \text{ peso } X.$$

Problem 2-17 (continued)

3. Total factory overhead cost at 65,000 machine-hours is:

Indirect materials (65,000 MHs × 1.50 pesos per MH)		97,500 pesos
Rent		130,000
Maintenance:		
Variable cost element (65,000 MHs × 0.40 peso per MH)	26,000 pesos	
Fixed cost element	30,000	56,000
Total factory overhead cost		283,500 pesos

Problem 2-18 (45 minutes)

1. Cost of goods sold..... Variable
   Shipping expense..... Mixed
   Advertising expense ..... Fixed
   Salaries and commissions ..... Mixed
   Insurance expense ..... Fixed
   Depreciation expense ..... Fixed

2. Analysis of the mixed expenses:

	Units	*Shipping Expense*	*Salaries and Comm. Expense*
High level of activity	4,500	£56,000	£143,000
Low level of activity	3,000	44,000	107,000
Change.....	1,500	£12,000	£ 36,000

Variable cost element:

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$\text{Shipping expense: } \frac{£12{,}000}{1{,}500 \text{ units}} = £8 \text{ per unit}$$

$$\text{Salaries and comm. expense: } \frac{£36{,}000}{1{,}500 \text{ units}} = £24 \text{ per unit}$$

Fixed cost element:

	Shipping Expense	*Salaries and Comm. Expense*
Cost at high level of activity ...	£56,000	£143,000
Less variable cost element:		
4,500 units × £8 per unit	36,000	
4,500 units × £24 per unit...		108,000
Fixed cost element	£20,000	£ 35,000

Problem 2-18 (continued)

The cost formulas are:

Shipping expense: £20,000 per month plus £8 per unit or

$$Y = £20,000 + £8X.$$

Salaries and Comm. expense: £35,000 per month plus £24 per unit or

$$Y = £35,000 + £24X.$$

3.

Frankel Ltd.
Income Statement
For the Month Ended June 30

Sales revenue		£630,000
Variable expenses:		
Cost of goods sold (4,500 units × £56 per unit)	£252,000	
Shipping expense (4,500 units × £8 per unit)	36,000	
Salaries and commissions expense (4,500 units × £24 per unit)	108,000	396,000
Contribution margin		234,000
Fixed expenses:		
Shipping expense	20,000	
Advertising	70,000	
Salaries and commissions	35,000	
Insurance	9,000	
Depreciation	42,000	176,000
Net operating income		£ 58,000

Problem 2-19 (45 minutes)

1. High-low method:

	Number of Ingots	*Power Cost*
High activity level	130	$6,000
Low activity level	40	2,400
Change	90	$3,600

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

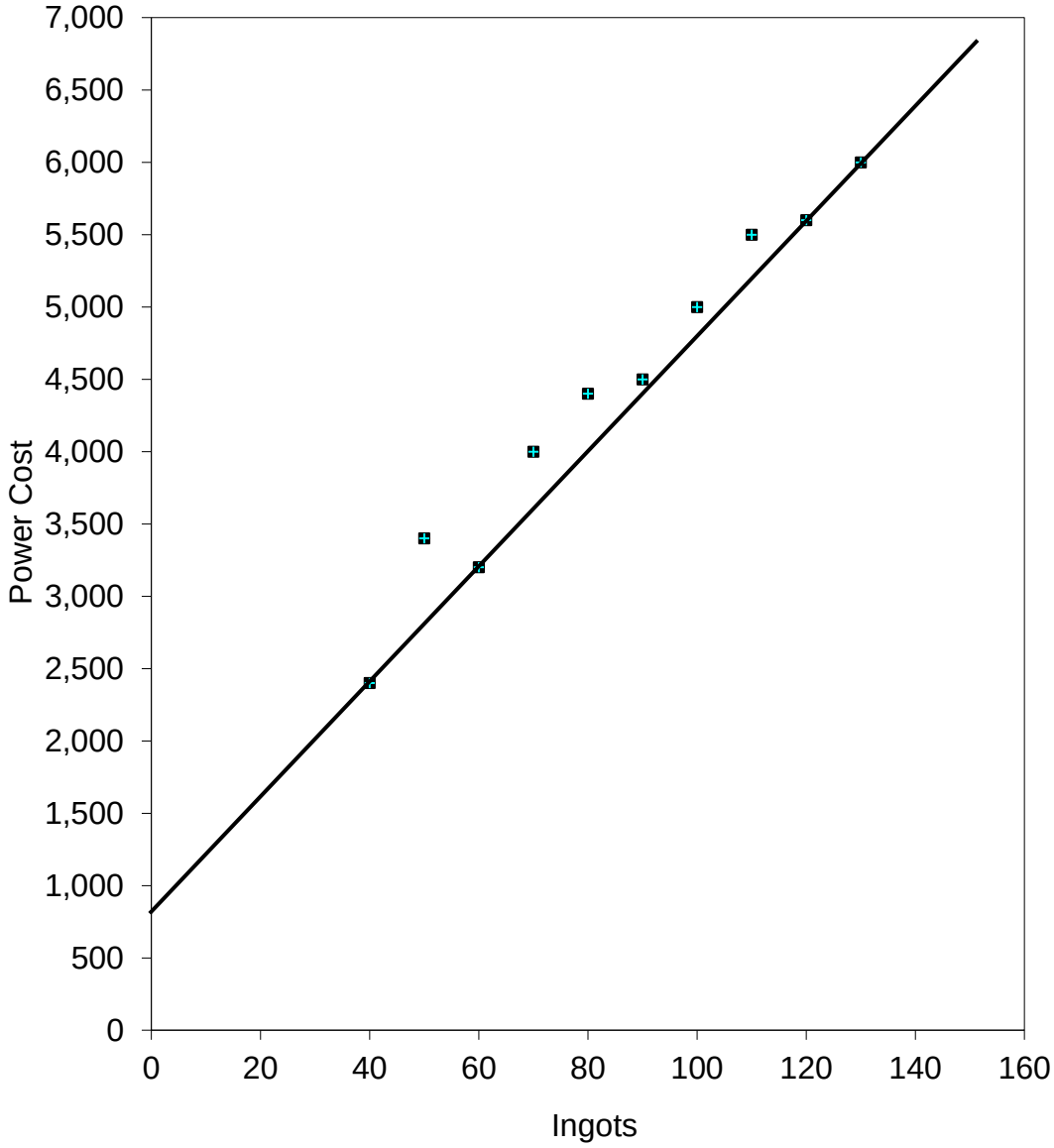
$$= \frac{\$3,600}{90 \text{ ingots}} = \$40 \text{ per ingot}$$

Fixed cost:	Total power cost at high activity level	$6,000
	Less variable element:	
	130 ingots × $40 per ingot	5,200
	Fixed cost element	$ 800

Therefore, the cost formula is: Y = $800 + $40X.

2. The scattergraph with a straight line drawn through the high and low data points is shown at the top of the next page.

Problem 2-19 (continued)



3. The high-low estimate of fixed costs is $385.45 lower than the estimate provided by least-squares regression. The high-low estimate of the variable cost per unit is $2.18 higher than the estimate provided by least-squares regression. A straight line that minimized the sum of the squared errors would intersect the Y-axis at $1,185.45 instead of $800. It would also have a flatter slope because the estimated variable cost per unit is lower than the high-low method.

Problem 2-20 (30 minutes)

1. Mr. Richart's first action was to direct that discretionary expenditures be delayed until the first of the new year. Providing that these "discretionary expenditures" can be delayed without hampering operations, this is a good business decision. By delaying expenditures, the company can keep its cash a bit longer and thereby earn a bit more interest. There is nothing unethical about such an action. The second action was to ask that the order for the parts be cancelled. Since the clerk's order was a mistake, there is nothing unethical about this action either.

   The third action was to ask the accounting department to delay recognition of the delivery until the bill is paid in January. This action is dubious. Asking the accounting department to ignore transactions strikes at the heart of the integrity of the accounting system. If the accounting system cannot be trusted, it is very difficult to run a business or obtain funds from outsiders. However, in Mr. Richart's defense, the purchase of the raw materials really shouldn't be recorded as an expense. He has been placed in an extremely awkward position because the company's accounting policy is flawed.

2. The company's accounting policy with respect to raw materials is incorrect. Raw materials should be recorded as an asset when delivered rather than as an expense. If the correct accounting policy were followed, there would be no reason for Mr. Richart to ask the accounting department to delay recognition of the delivery of the raw materials. This flawed accounting policy creates incentives for managers to delay deliveries of raw materials until after the end of the fiscal year. This could lead to raw materials shortages and poor relations with suppliers who would like to record *their* sales before the end of the year.

   The company's "manage-by-the-numbers" approach does not foster ethical behavior—particularly when managers are told to "do anything so long as you hit the target profits for the year." Such "no excuses" pressure from the top too often leads to unethical behavior when managers have difficulty meeting target profits.

Problem 2-21 (45 minutes)

1. Maintenance cost at the 70,000 machine-hour level of activity can be isolated as follows:

	Level of Activity	
	40,000 MH	*70,000 MH*
Total factory overhead cost	$170,200	$241,600
Deduct:		
Utilities cost @ $1.30 per MH*.....	52,000	91,000
Supervisory salaries	60,000	60,000
Maintenance cost	$ 58,200	$ 90,600

*$52,000 ÷ 40,000 MHs = $1.30 per MH

2. High-low analysis of maintenance cost:

	Machine-Hours	*Maintenance Cost*
High activity level	70,000	$90,600
Low activity level	40,000	58,200
Change	30,000	$32,400

Variable cost per unit of activity:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$32,400}{30,000 \text{ MHs}} = \$1.08 \text{ per MH}$$

Total fixed cost:

Total maintenance cost at the low activity level	$58,200
Less the variable cost element (40,000 MHs × $1.08 per MH)	43,200
Fixed cost element	$15,000

Therefore, the cost formula is $15,000 per month plus $1.08 per machine-hour or:

$$Y = \$15,000 + \$1.08X$$

Problem 2-21 (continued)

3.

	Variable Rate per Machine-Hour	*Fixed Cost*
Maintenance cost	$1.08	$15,000
Utilities cost	1.30	
Supervisory salaries cost....	____	60,000
Totals	$2.38	$75,000

Thus, the cost formula is: Y = $75,000 + $2.38X.

4. Total overhead cost at an activity level of 45,000 machine-hours:

Fixed costs.....	$ 75,000
Variable costs: $2.38 per MH × 45,000 MHs.....	107,100
Total overhead costs.....	$182,100

Problem 2-22 (30 minutes)

Note to the Instructor: Some of the answers below are debatable.

Cost Item	*Variable or Fixed*	*Selling Cost*	*Administrative Cost*	*Manufacturing (Product) Cost*	
				Direct	*Indirect*
1. Depreciation, executive jet	F		X		
2. Costs of shipping finished goods to customers	V	X			
3. Wood used in manufacturing furniture	V			X	
4. Sales manager's salary	F	X			
5. Electricity used in manufacturing furniture	V				X
6. Secretary to the company president	F		X		
7. Aerosol attachment placed on a spray can produced by the company	V			X	
8. Billing costs	V	X*			
9. Packing supplies for shipping products overseas	V	X			
10. Sand used in manufacturing concrete	V			X	
11. Supervisor's salary, factory	F				X
12. Executive life insurance	F		X		
13. Sales commissions	V	X			
14. Fringe benefits, assembly line workers	V			X**	
15. Advertising costs	F	X			
16. Property taxes on finished goods warehouses	F	X			
17. Lubricants for production equipment	V				X

*Could be an administrative cost.

**Could be an indirect cost.

Problem 2-23 (45 minutes)

1. High-low method:

	Units Sold	*Shipping Expense*
High activity level	25,000	$232,000
Low activity level	16,000	160,000
Change	9,000	$72,000

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{\$72,000}{9,000 \text{ units}} = \$8 \text{ per unit}$$

Fixed cost element:

Total shipping expense at high activity level.....	$232,000
Less variable element:	
25,000 units × $8 per unit	200,000
Fixed cost element	$ 32,000

Therefore, the cost formula is: Y = $32,000 + $8X.

Problem 2-23 (continued)

2.

Alden Company
Budgeted Income Statement
For the First Quarter of Year 3

Sales (21,000 units × $50 per unit)		$1,050,000
Variable expenses:		
Cost of goods sold (21,000 units × $20 per unit)	$420,000	
Shipping expense (21,000 units × $8.00 per unit)	168,000	
Sales commission ($1,050,000 × 0.05)	52,500	
Total variable expenses		640,500
Contribution margin		409,500
Fixed expenses:		
Shipping expenses	32,000	
Advertising expense	170,000	
Administrative salaries	80,000	
Depreciation expense	50,000	
Total fixed expenses		332,000
Net operating income		$ 77,500

Problem 2-24 (45 minutes)

1.

	Cost Behavior		*Selling or Administrative*	*Product Cost*	
Cost Item	*Variable*	*Fixed*	*Cost*	*Direct*	*Indirect*
Direct materials used (wood, glass)	$430,000			$430,000	
Administrative office salaries		$110,000	$110,000		
Factory supervision		70,000			$ 70,000
Sales commissions	60,000		60,000		
Depreciation, factory building		105,000			105,000
Depreciation, admin. office equipment .		2,000	2,000		
Indirect materials, factory	18,000				18,000
Factory labor (cutting and assembly) ...	90,000			90,000	
Advertising		100,000	100,000		
Insurance, factory.....		6,000			6,000
Administrative office supplies.....	4,000		4,000		
Property taxes, factory		20,000			20,000
Utilities, factory	45,000				45,000
Total costs	$647,000	$413,000	$276,000	$520,000	$264,000

Problem 2-24 (continued)

2. The average product cost per bookcase will be:

Direct.....	$520,000
Indirect.....	264,000
Total.....	$784,000

$784,000 ÷ 4,000 bookcases = $196 per bookcase

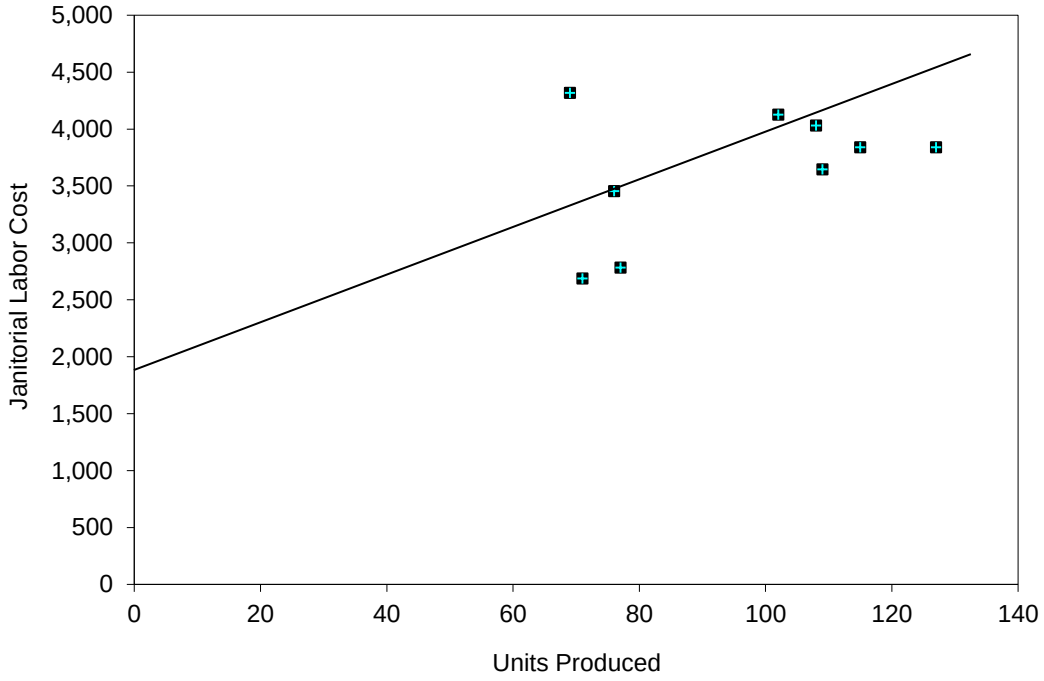
3. The average product cost per bookcase would increase if the production drops. This is because the fixed costs would be spread over fewer units, causing the average cost per unit to rise.

4. a. Yes, there probably would be a disagreement. The president is likely to want a price of at least $196, which is the average cost per unit to manufacture 4,000 bookcases. He may expect an even higher price than this to cover a portion of the administrative costs as well. The neighbor will probably be thinking of cost as including only materials used, or perhaps materials and direct labor.

   b. The term is opportunity cost. Since the company is operating at full capacity, the president must give up the full, regular price to sell a bookcase to the neighbor. Therefore, the president's cost is really the full, regular price.

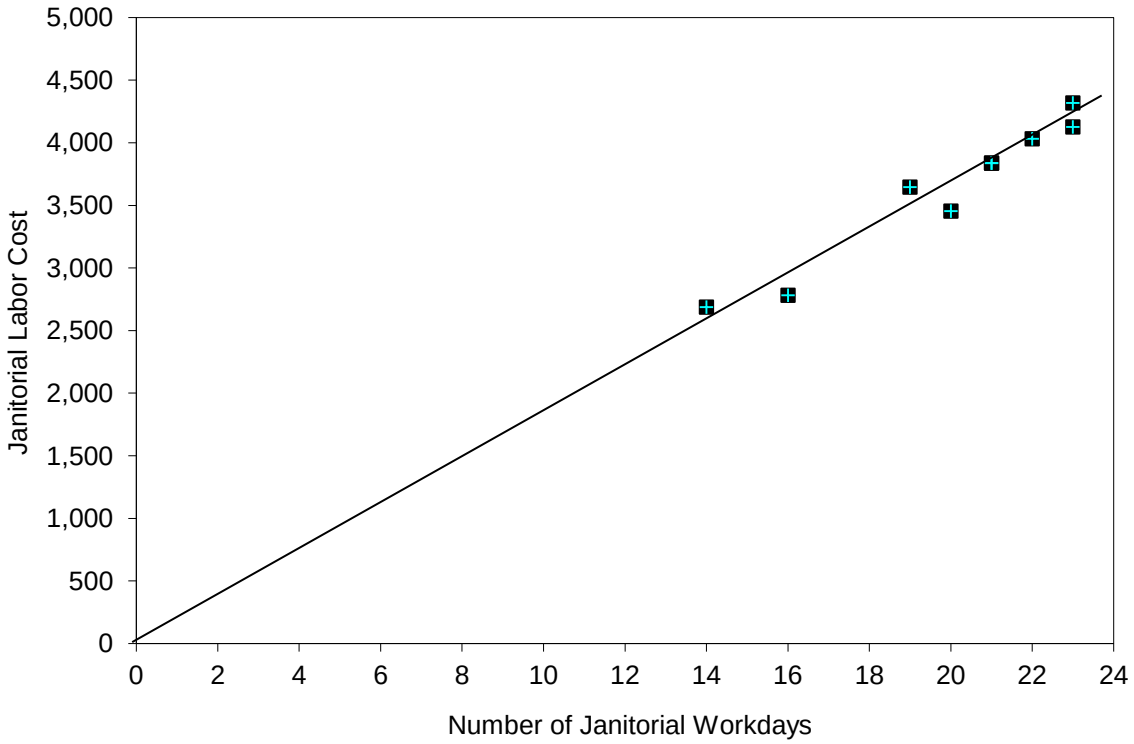
Case 2-25 (30 minutes)

1. The scattergraph of janitorial labor cost versus the number of units produced is presented below:



Case 2-25 (continued)

2. The scattergraph of the janitorial labor cost versus the number of janitorial workdays is presented below:



Case 2-25 (continued)

3. The number of workdays should be used as the activity base rather than the number of units produced. There are several reasons for this. First, the scattergraphs reveal that there is a much stronger relationship (i.e., higher correlation) between janitorial costs and number of workdays than between janitorial costs and number of units produced. Second, from the description of the janitorial costs, one would expect that variations in those costs have little to do with the number of units produced. Two janitors each work an eight-hour shift—apparently irrespective of the number of units produced or how busy the company is. Variations in the janitorial labor costs apparently occur because of the number of workdays in the month and the number of days the janitors call in sick. Third, for planning purposes, the company is likely to be able to predict the number of working days in the month with much greater accuracy than the number of units that will be produced.

   Note that the scattergraph in part (1) seems to suggest that the janitorial labor costs are variable with respect to the number of units produced. This is false. Janitorial labor costs do vary, but the number of units produced isn't the cause of the variation. However, since the number of units produced tends to go up and down with the number of workdays and since the janitorial labor costs are driven by the number of workdays, it *appears* on the scattergraph that the number of units drives the janitorial labor costs to some extent. Analysts must be careful not to fall into this trap of using the wrong measure of activity as the activity base just because it appears there is some relationship between cost and the measure of activity. Careful thought and analysis should go into the selection of the activity base.

Case 2-26 (60 minutes)

1. High-low method:

	Hours	*Cost*
High level of activity.....	25,000	$99,000
Low level of activity	10,000	64,500
Change	15,000	$34,500

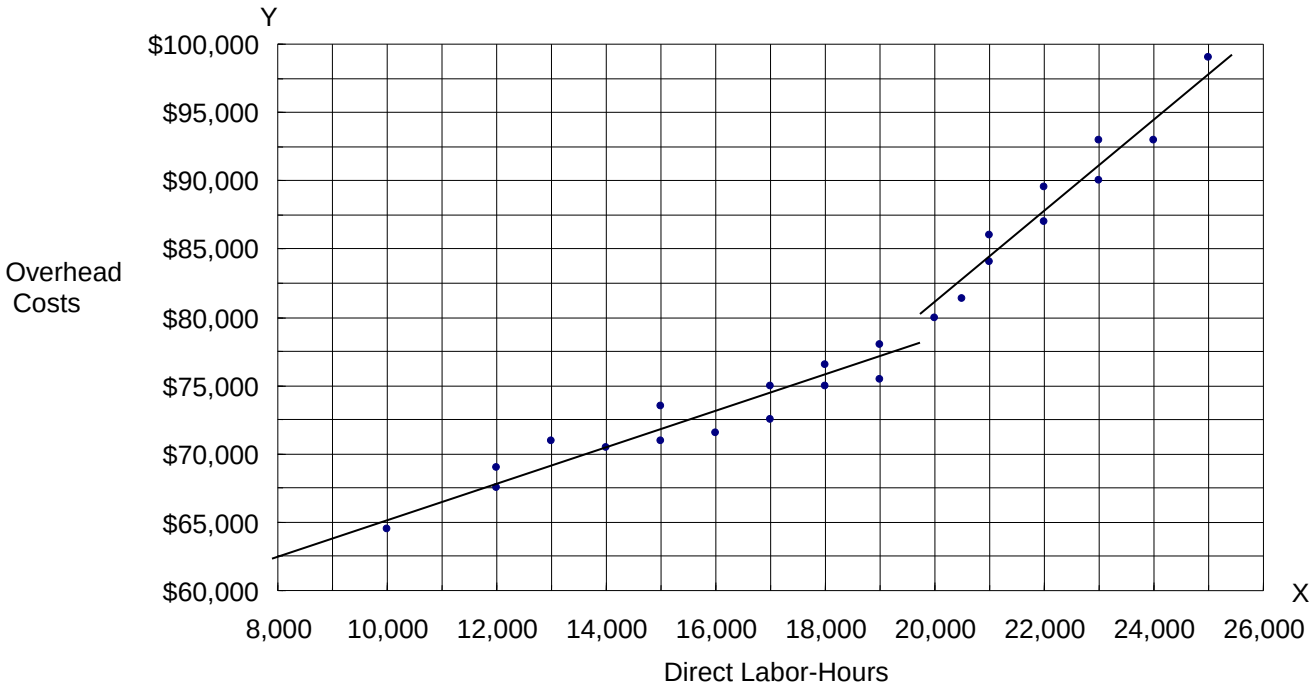
Variable element: $34,500 ÷ 15,000 DLH = $2.30 per DLH

Fixed element:

Total cost—25,000 DLH	$99,000
Less variable element:	
25,000 DLH × $2.30 per DLH.....	57,500
Fixed element.....	$41,500

Therefore, the cost formula is: Y = $41,500 + $2.30X.

2. The scattergraph is shown below:



Case 2-26 (continued)

2. The scattergraph shows that there are two relevant ranges—one below 19,500 DLH and one above 19,500 DLH. The change in equipment lease cost from a fixed fee to an hourly rate causes the slope of the regression line to be steeper above 19,500 DLH, and to be discontinuous between the fixed fee and hourly rate points.

3. The cost formulas computed with the high-low and regression methods are faulty since they are based on the assumption that a single straight line provides the best fit to the data. Creating two data sets related to the two relevant ranges will enable more accurate cost estimates.

4. High-low method:

	Hours	*Cost*
High level of activity.....	25,000	$99,000
Low level of activity	20,000	80,000
Change	5,000	$19,000

Variable element: $19,000 ÷ 5,000 DLH = $3.80 per DLH

Fixed element:

Total cost—25,000 DLH	$99,000
Less variable element:	
25,000 DLH × $3.80 per DLH.....	95,000
Fixed element.....	$4,000

Expected overhead costs when 22,500 machine-hours are used:

Variable cost: 22,500 hours × $3.80 per hour	$85,500
Fixed cost	4,000
Total cost.....	$89,500

5. The high-low estimate of fixed costs is $6,090 lower than the estimate provided by least-squares regression. The high-low estimate of the variable cost per machine hour is $0.27 higher than the estimate provided by least-squares regression. A straight line that minimized the sum of the squared errors would intersect the Y-axis at $10,090 instead of $4,000. It would also have a flatter slope because the estimated variable cost per unit is lower than the high-low method.

Appendix 2A
Least-Squares Regression Computations

Exercise 2A-1 (20 minutes)

1.

Month	*Rental Returns (X)*	*Car Wash Costs (Y)*
January.....	2,310	$10,113
February	2,453	$12,691
March	2,641	$10,905
April.....	2,874	$12,949
May	3,540	$15,334
June	4,861	$21,455
July	5,432	$21,270
August.....	5,268	$19,930
September	4,628	$21,860
October	3,720	$18,383
November	2,106	$9,830
December	2,495	$11,081

The least-squares regression results are as follows:

Intercept (fixed cost).....	$2,296
Slope (variable cost per unit)	$3.74
R^2	0.92

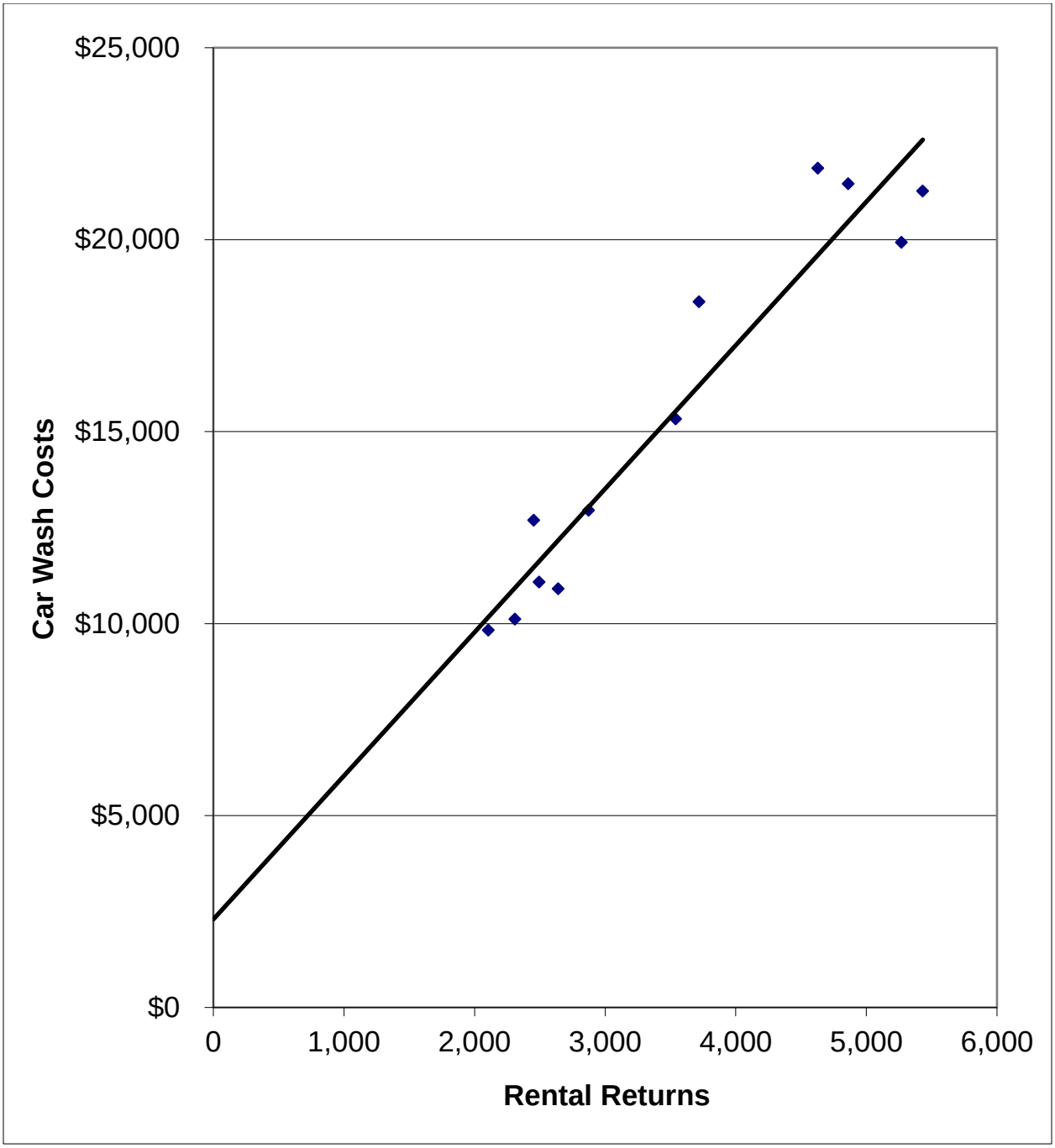
Therefore, the cost formula is $2,296 per month plus $3.74 per rental return or:

$$Y = \$2,296 + \$3.74X$$

Note that the R^2 is 0.92, which means that 92% of the variation in glazing costs is explained by the number of units glazed. This is a very high R^2 and indicates a very good fit.

Exercise 2A-1 (continued)

While not a requirement of the exercise, it is always a good to plot the data on a scattergraph. The scattergraph can help spot nonlinearities or other problems with the data. In this case, the regression line (shown below) is a reasonably good approximation to the relationship between car wash costs and rental returns.



Exercise 2A-2 (30 minutes)

1.

Week	*Units (X)*	*Total Glazing Cost (Y)*
1	8	$270
2	5	$200
3	10	$310
4	4	$190
5	6	$240
6	9	$290

The least-squares regression results are as follows:

Intercept (fixed cost).....	$107.50
Slope (variable cost per unit)	$20.36
R^2	0.98

Therefore, the cost formula is $107.50 per week plus $20.36 per unit or:

$$Y = \$107.50 + \$20.36X$$

Note that the R^2 is 0.98, which means that 98% of the variation in glazing costs is explained by the number of units glazed. This is a very high R^2 and indicates a very good fit.

2. $Y = \$107.50 + \$20.36X$

3. Total expected glazing cost if 7 units are processed:

Variable cost: 7 units × $20.36 per unit	$142.52
Fixed cost	107.50
Total expected cost.....	$250.02

Problem 2A-3 (45 minutes)

1.

Number of Leagues (X)	*Total Cost (Y)*
5	$13,000
2	$7,000
4	$10,500
6	$14,000
3	$10,000

The least-squares regression results are as follows:

Intercept (fixed cost).....	$4,100
Slope (variable cost per unit)	$1,700
R^2	0.96

Therefore, the variable cost per league is $1,700 and the fixed cost is $4,100 per year.

Note that the R^2 is 0.96, which means that 96% of the variation in cost is explained by the number of leagues. This is a very high R^2 and indicates a very good fit.

2. Y = $4,100 + $1,700X

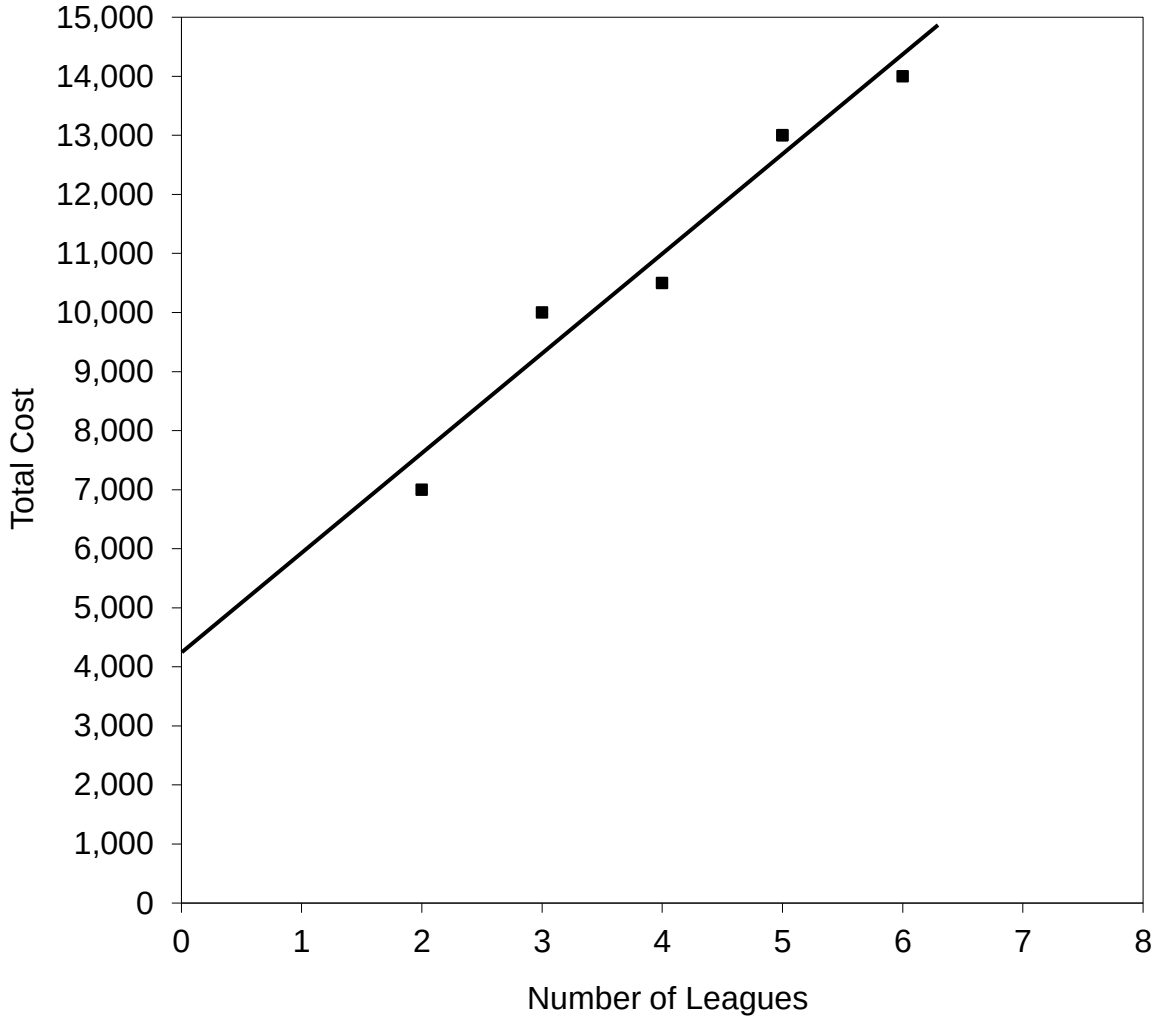
3. The expected total cost for 7 leagues would be:

Fixed cost	$ 4,100
Variable cost (7 leagues × $1,700 per league).....	11,900
Total cost	$16,000

The problem with using the cost formula from (2) to estimate total cost in this particular case is that an activity level of 7 leagues may be outside the relevant range—the range of activity within which the fixed cost is approximately $4,100 per year and the variable cost is approximately $1,700 per league. These approximations appear to be reasonably accurate within the range of 2 to 6 leagues, but they may be invalid outside this range.

Problem 2A-3 (continued)

4.



Problem 2A-4 (45 minutes)

1. a.

Quarter	*Tons Mined (X)*	*Utilities Cost (Y)*
Year 1:		
1st	15,000	$50,000
2nd	11,000	$45,000
3rd	21,000	$60,000
4th	12,000	$75,000
Year 2:		
1st	18,000	$100,000
2nd	25,000	$105,000
3rd	30,000	$85,000
4th	28,000	$120,000

The least-squares regression results are as follows:

Intercept (fixed cost).....	$28,352
Slope (variable cost per unit)	$2.58
R^2	0.47

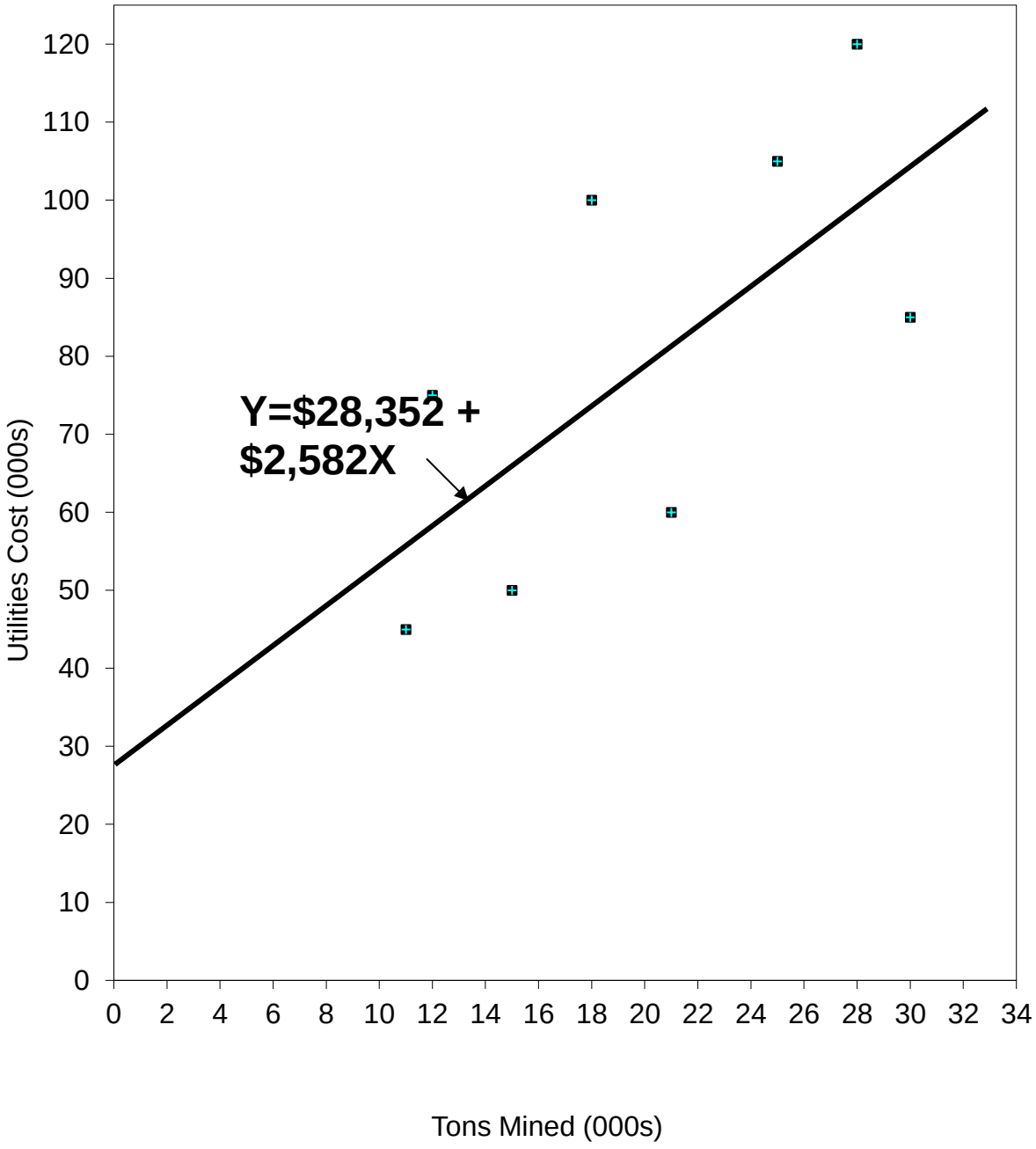
Therefore, the cost formula using tons mined as the activity base is $28,352 per quarter plus $2.58 per ton mined, or

$$Y = \$28,352 + \$2.58X.$$

Note that the R^2 is 0.47, which means that only 47% of the variation in utility costs is explained by the number of tons mined.

Problem 2A-4 (continued)

b. The scattergraph plot of utility costs versus tons mined appears below:



Problem 2A-4 (continued)

2. a.

Quarter	*DLHs (X)*	*Utilities Cost (Y)*
Year 1:		
1st	5,000	$50,000
2nd	3,000	$45,000
3rd	4,000	$60,000
4th	6,000	$75,000
Year 2:		
1st	10,000	$100,000
2nd	9,000	$105,000
3rd	8,000	$85,000
4th	11,000	$120,000

The least-squares regression results are as follows:

Intercept (fixed cost).....	$17,000
Slope (variable cost per unit)	$9.00
R^2	0.93

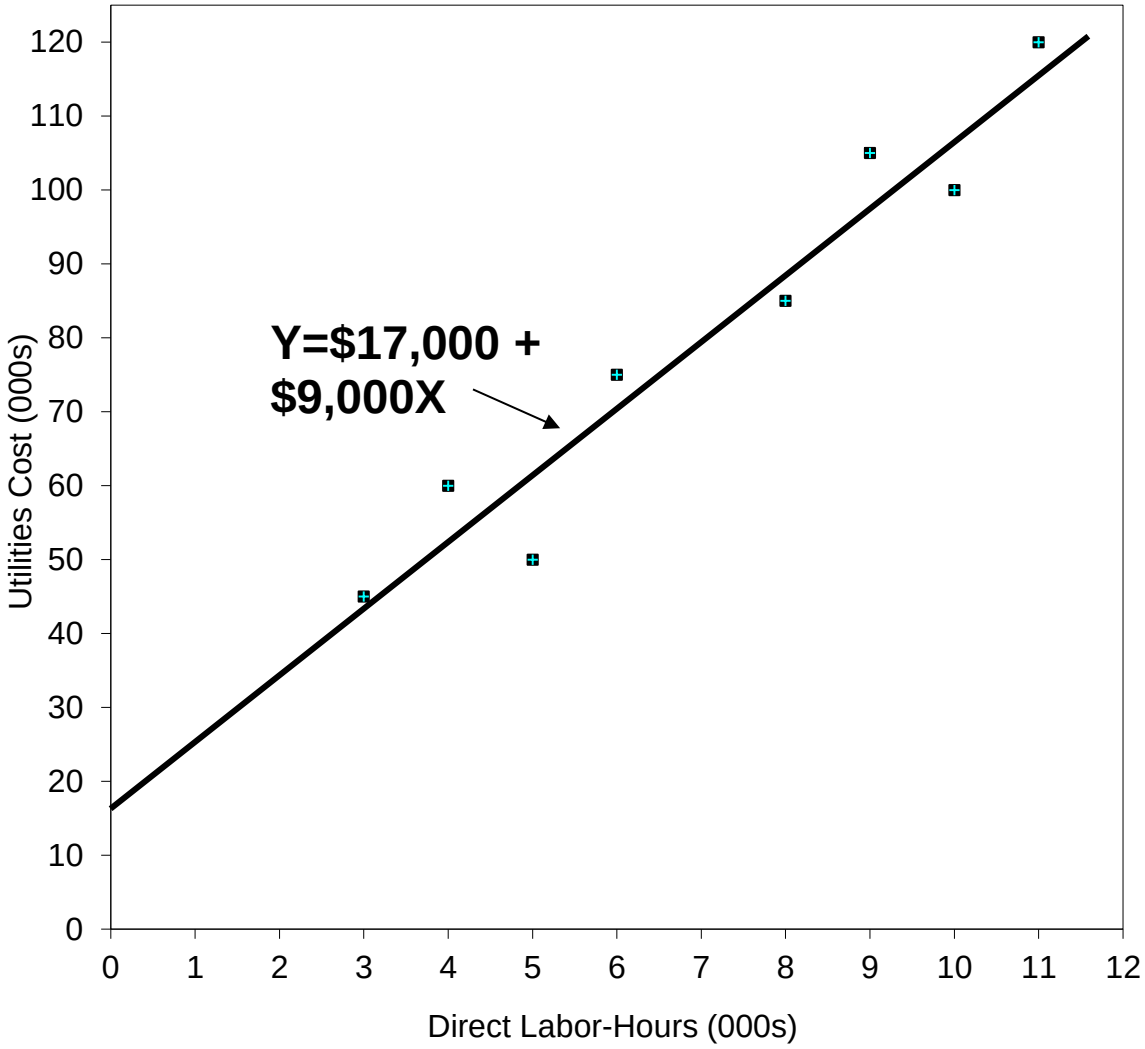
Therefore, the cost formula using direct labor-hours as the activity base is $17,000 per quarter plus $9.00 per direct labor-hour, or

$$Y = \$17{,}000 + \$9.00X.$$

Note that the R^2 is 0.93, which means that 93% of the variation in utility costs is explained by the number of direct labor-hours. This is a very high R^2 and is an indication of a good fit.

Problem 2A-4 (continued)

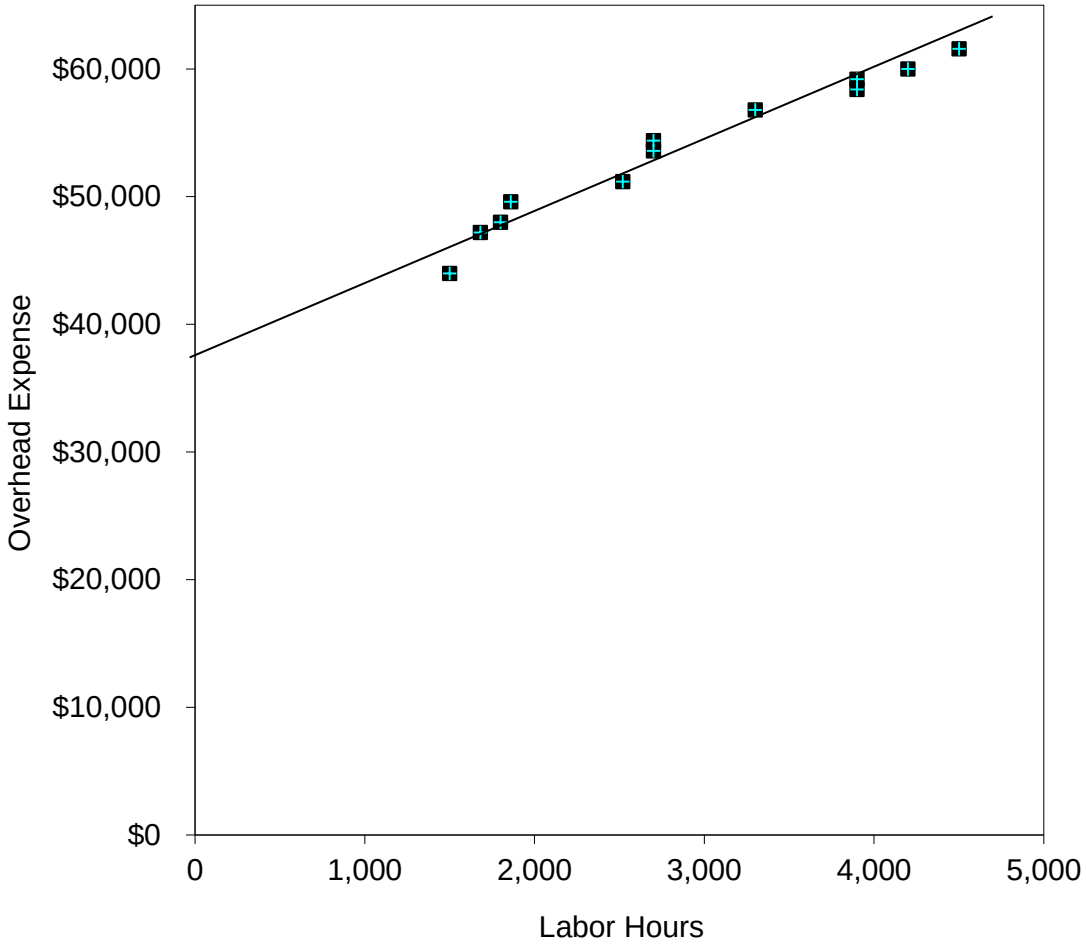
b. The scattergraph plot of utility costs versus direct labor-hours appears below:



3. The company should probably use direct labor-hours as the activity base, since the fit of the regression line to the data is much tighter than it is with tons mined. The R^2 for the regression using direct labor-hours as the activity base is twice as large as for the regression using tons mined as the activity base. However, managers should look more closely at the costs and try to determine why utilities costs are more closely tied to direct labor-hours than to the number of tons mined.

CASE 2A-5 (60 minutes)

1. The scattergraph is shown below.



The scattergraph reveals several interesting points about the behavior of overhead costs:

- The relation between overhead expense and labor hours is approximated reasonably well by a straight line. (However, there appears to be a slight downward bend in the plot as the labor hours increase—evidence of increasing returns to scale. This is a common occurrence in practice. See Noreen & Soderstrom, "Are overhead costs strictly proportional to activity?" *Journal of Accounting and Economics*, vol. 17, 1994, pp. 255-278.)

CASE 2A-5 (continued)

- The data points are all fairly close to the straight line. This indicates that most of the variation in overhead expenses is explained by labor hours. As a consequence, there probably wouldn't be much benefit to investigating other possible cost drivers for the overhead expenses.
- Most of the overhead expense appears to be fixed. Jasmine should ask herself if this is reasonable. Does the company have large fixed expenses such as rent, depreciation, and salaries?

2. The least-squares regression method yields estimates of $5.27 per labor hour for the variable cost and $38,501 per month for the fixed cost. The adjusted R^2 is 96%.

3. Using the least-squares regression estimate of the variable overhead cost, the total variable cost per guest is computed as follows:

Food and beverages.....	$17.00
Labor (0.5 hour @ $10 per hour).....	5.00
Overhead (0.5 hour @ $5.27 per hour) .	2.64
Total variable cost per guest.....	$24.64

The total contribution from 120 guests paying $45 each is computed as follows:

Sales (120 guests @ $45.00 per guest).....	$5,400.00
Variable cost (120 guests @ $24.64 per guest)...	2,956.80
Contribution to profit.....	$2,443.20

Fixed costs are not included in the above computation because there is no indication that any additional fixed costs would be incurred as a consequence of catering the cocktail party. If additional fixed costs were incurred, they should also be subtracted from revenue.

4. Assuming that no additional fixed costs are incurred as a result of catering the charity event, any price greater than the variable cost per guest of $24.64 would contribute to profits.

CASE 2A-5 (continued)

5. We would favor bidding slightly less than $42 to get the contract. Any bid above $24.64 would contribute to profits and a bid at the normal price of $45 is unlikely to land the contract. And apart from the contribution to profit, catering the event would show off the company's capabilities to potential clients. The danger is that a price that is lower than the normal bid of $45 might set a precedent for the future or it might initiate a price war among caterers. However, the price need not be publicized and the lower price could be justified to future clients because this is a charity event. Another possibility would be for Jasmine to maintain her normal price but throw in additional services at no cost to the customer. Whether to compete on price or service is a delicate issue that Jasmine will have to decide after getting to know the personality and preferences of the customer.