CHAPTER 2
AN INTRODUCTION TO COST TERMS AND PURPOSES

2-1 Define cost object and give three examples.

A *cost object* is anything for which a separate measurement of costs is desired. Examples include a product, a service, a project, a customer, a brand category, an activity, and a department.

2-2 Define direct costs and indirect costs.

Direct costs of a cost object are related to the particular cost object and can be traced to that cost object in an economically feasible (cost-effective) way.

Indirect costs of a cost object are related to the particular cost object but cannot be traced to that cost object in an economically feasible (cost-effective) way.

Cost assignment is a general term that encompasses the assignment of both direct costs and indirect costs to a cost object. Direct costs are *traced* to a cost object, while indirect costs are *allocated* to a cost object.

2-3 Why do managers consider direct costs to be more accurate than indirect costs?

Managers believe that direct costs that are traced to a particular cost object are more accurately assigned to that cost object than are indirect allocated costs. When costs are allocated, managers are less certain whether the cost allocation base accurately measures the resources demanded by a cost object. Managers prefer to use more accurate costs in their decisions.

2-4 Name three factors that will affect the classification of a cost as direct or indirect.

Factors affecting the classification of a cost as direct or indirect include

- the materiality of the cost in question
- available information-gathering technology
- design of operations

2-5 Define variable cost and fixed cost. Give an example of each.

A *variable cost* changes in total in proportion to changes in the related level of total activity or volume. An example is sales commission paid as a percentage of each sales revenue dollar.

A *fixed cost* remains unchanged in total for a given time period, despite wide changes in the related level of total activity or volume. An example is the leasing cost of a machine that is unchanged for a given time period (such as a year) regardless of the number of units of product produced on the machine.

2-6 What is a cost driver? Give one example.

A *cost driver* is a variable, such as the level of activity or volume that causally affects total costs over a given time span. A change in the cost driver results in a change in the level of total costs.

For example, the number of vehicles assembled is a driver of the costs of steering wheels on a motor-vehicle assembly line.

2-7 What is the relevant range? What role does the relevant-range concept play in explaining how costs behave?

The *relevant range* is the band of normal activity level or volume in which there is a specific relationship between the level of activity or volume and the cost in question. Costs are described as variable or fixed with respect to a particular relevant range.

2-8 Explain why unit costs must often be interpreted with caution.

A unit cost is computed by dividing some amount of total costs (the numerator) by the related number of units (the denominator). In many cases, the numerator will include a fixed cost that will not change despite changes in the denominator. It is erroneous in those cases to multiply the unit cost by activity or volume change to predict changes in total costs at different activity or volume levels.

2-9 Describe how manufacturing-, merchandising-, and service-sector companies differ from one another.

Manufacturing-sector companies purchase materials and components and convert them into various finished goods, for example automotive and textile companies.

Merchandising-sector companies purchase and then sell tangible products without changing their basic form, for example retailing or distribution.

Service-sector companies provide services or intangible products to their customers, for example, legal advice or audits.

2-10 What are three different types of inventory that manufacturing companies hold?

Manufacturing companies have one or more of the following three types of inventory:

1. *Direct materials inventory*. Direct materials in stock and awaiting use in the manufacturing process.
2. *Work-in-process inventory*. Goods partially worked on but not yet completed. Also called *work in progress*.
3. *Finished goods inventory*. Goods completed but not yet sold.

2-11 Distinguish between inventoriable costs and period costs.

Inventoriable costs are all costs of a product that are considered as assets in the balance sheet when they are incurred and that become cost of goods sold when the product is sold. These costs are included in work-in-process and finished goods inventory (they are "inventoried") to accumulate the costs of creating these assets.

Period costs are all costs in the income statement other than cost of goods sold. These costs are treated as expenses of the accounting period in which they are incurred because they are

expected not to benefit future periods (because there is not sufficient evidence to conclude that such benefit exists). Expensing these costs immediately best matches expenses to revenues.

2-12 Define the following: direct material costs, direct manufacturing-labor costs, manufacturing overhead costs, prime costs, and conversion costs.

Direct material costs are the acquisition costs of all materials that eventually become part of the cost object (work in process and then finished goods) and can be traced to the cost object in an economically feasible way.

Direct manufacturing labor costs include the compensation of all manufacturing labor that can be traced to the cost object (work in process and then finished goods) in an economically feasible way.

Manufacturing overhead costs are all manufacturing costs that are related to the cost object (work in process and then finished goods) but cannot be traced to that cost object in an economically feasible way.

Prime costs are all direct manufacturing costs (direct material costs and direct manufacturing labor costs).

Conversion costs are all manufacturing costs other than direct material costs.

2-13 Describe the overtime-premium and idle-time categories of indirect labor.

Overtime premium is the wage rate paid to workers (for both direct labor and indirect labor) in excess of their straight-time wage rates.

Idle time is a subclassification of indirect labor that represents wages paid for unproductive time caused by lack of orders, machine breakdowns, material shortages, poor scheduling, and the like.

2-14 Define product cost. Describe three different purposes for computing product costs.

A product cost is the sum of the costs assigned to a product for a specific purpose. Purposes for computing a product cost include

- pricing and product mix decisions,
- contracting with government agencies, and
- preparing financial statements for external reporting under GAAP.

2-15 What are three common features of cost accounting and cost management?

Three common features of cost accounting and cost management are

- calculating the costs of products, services, and other cost objects
- obtaining information for planning and control and performance evaluation
- analyzing the relevant information for making decisions

2-16 Applewhite Corporation, a manufacturing company, is analyzing its cost structure in a project to achieve some cost savings. Which of the following statements is/are correct?

I. The cost of the direct materials in Applewhite's products is considered a variable cost.
II. The cost of the depreciation of Applewhite's plant machinery is considered a variable cost because Applewhite uses an accelerated depreciation method for both book and income tax purposes.
III. The cost of electricity for Applewhite's manufacturing facility is considered a fixed cost, even if the cost of the electricity has both variable and fixed components.

1. I, II, and III are correct.
2. I only is correct.
3. II and III only are correct.
4. None of the listed choices is correct.

SOLUTION

Choice "2" is correct.This question asks which of a series of statements about costs is/are correct. "All of the above" is an available option.Statement I says that the cost of the direct materials in Applewhite's products is considered a variable cost. The more Applewhite manufactures, the more the total cost of the direct materials will be. Statement I is correct.Statement II says that the cost of depreciation of Applewhite's plant machinery is considered a variable cost because Applewhite uses an accelerated depreciation method for both book and income tax purposes. Just because a cost changes over time (which is what using an accelerated depreciation method will cause) does not mean that the cost is variable. The fact that Applewhite may use the same method for book and tax purposes is irrelevant. Statement II is wrong.Statement III says that the cost of electricity for Applewhite's manufacturing facility is considered a fixed cost, even if the cost of the electricity has both variable and fixed components. The cost of the electricity would be considered a "mixed" cost, not a fixed cost. Statement III is wrong.

2-17 Comprehensive Care Nursing Home is required by statute and regulation to maintain a minimum 3 to 1 ratio of direct service staff to residents to maintain the licensure associated with the Nursing Home beds. The salary expense associated with direct service staff for the Comprehensive Care Nursing Home would most likely be classified as:

1. Variable cost.
2. Fixed cost.
3. Overhead costs.
4. Inventoriable costs.

SOLUTION

Choice "2" is correct.Costs that maintain production capacity and do not vary regardless of utilization are classified as fixed costs. In this instance, the salary costs of direct service staff are required to maintain capacity based on the number of residents (doctors) and will be incurred whether the facility is full or empty. The costs are fixed.Choice "1" is incorrect. Direct labor costs mandated by statute do not vary with production, they vary with the compliance requirement. Consequently direct labor costs, in this instance, are fixed, not variable.Choice "3"

is incorrect. Direct costs related to service provider salaries are considered to be direct costs of the service, not overhead costs.Choice "4" is incorrect. Comprehensive Care Nursing Home is a service company and does not have any inventory and therefore no inventoriable costs.

2-18 Frisco Corporation is analyzing its fixed and variable costs within its current relevant range. As its cost driver activity changes within the relevant range, which of the following statements is/are correct?

I. As the cost driver level increases, total fixed cost remains unchanged.
II. As the cost driver level increases, unit fixed cost increases.
III. As the cost driver level decreases, unit variable cost decreases.

1. I, II, and III are correct.
2. I and II only are correct.
3. I only is correct.
4. II and III only are correct.

SOLUTION

Choice "3" is correct.The question asks what happens to variable and fixed costs when cost driver activity changes (i.e., when the cost driver level increases or decreases). Statement I says that, as the cost driver level increases, total fixed cost remains unchanged. Statement I is correct. Total fixed cost will remain unchanged regardless of changes in the cost driver because total fixed cost is unaffected by changes in the cost driver.Statement II says that, as the cost driver level increases, unit fixed cost increases. This statement is asking about unit fixed cost like the previous statement asked about total fixed cost. While total fixed cost will remain unchanged regardless of changes in the cost driver, unit fixed cost will not. If the cost driver level increases, total fixed cost will remain the same, but the total number of units will increase, and unit fixed cost will decrease, not increase. Statement II is incorrect. Statement III says that as the cost driver level decreases, unit variable cost decreases. This statement is asking about unit variable cost like the previous statement asked about unit fixed cost. Unit variable cost will remain unchanged regardless of what happens to the cost driver. Statement III is incorrect.

2-19 Year 1 financial data for the ABC Company is as follows:

Sales	$5,000,000
Direct materials	850,000
Direct manufacturing labor	1,700,000
Variable manufacturing overhead	400,000
Fixed manufacturing overhead	750,000
Variable SG&A	150,000
Fixed SG&A	250,000

Under the absorption method, Year 1 Cost of Goods sold will be:

a. $2,550,000 **c.** $3,100,000
b. $2,950,000 **d.** $3,700,000

SOLUTION

Choice "d" is correct. Under the absorption method, Cost of Goods Sold is calculated by adding direct materials, direct manufacturing labor, variable manufacturing overhead, and fixed manufacturing overhead. Therefore, Cost of Goods Sold = $850,000 + $1,700,000 + $400,000 + $750,000 = $3,700,000.Choice "a" is incorrect. This calculation only takes into account direct materials and direct manufacturing labor.
Choice "b" is incorrect. This calculation incorrectly excludes fixed manufacturing overhead.
Choice "c" is incorrect. This calculation includes variable SG&A, but excludes fixed manufacturing overhead.

2-20 The following information was extracted from the accounting records of Roosevelt Manufacturing Company:

Direct materials purchased	80,000
Direct materials used	76,000
Direct manufacturing labor costs	10,000
Indirect manufacturing labor costs	12,000
Sales salaries	14,000
Other plant expenses	22,000
Selling and administrative expenses	20,000

What was the cost of goods manufactured?

1. $124,000 **3.** $154,000
2. $120,000 **4.** $170,000

SOLUTION

Explanation Choice "2" is correct.In this question, the problem is to calculate the cost of goods manufactured. Certain cost data are provided. The problem assumes beginning and ending work in process is zero. The cost of goods manufactured is calculated as indicated below:

Direct materials used	$ 76,000
Direct manufacturing labor costs	10,000
Indirect manufacturing labor costs	12,000
Other plant expenses	22,000
Total cost of goods manufactured	$120,000

2-21 Computing and interpreting manufacturing unit costs. Minnesota Office Products (MOP) produces three different paper products at its Vaasa lumber plant: Supreme, Deluxe, and Regular. Each product has its own dedicated production line at the plant. It currently uses the following three-part classification for its manufacturing costs: direct materials, direct manufacturing labor, and manufacturing overhead costs. Total manufacturing overhead costs of the plant in July 2017 are $150 million ($15 million of which are fixed). This total amount is allocated to each product line on the basis of the direct manufacturing labor costs of each line. Summary data (in millions) for July 2017 are as follows:

	Supreme	Deluxe	Regular
Direct material costs	$ 89	$ 57	$ 60
Direct manufacturing labor costs	$ 16	$ 26	$ 8
Manufacturing overhead costs	$ 48	$ 78	$ 24
Units produced	125	150	140

Required:

1. Compute the manufacturing cost per unit for each product produced in July 2017.

2. Suppose that, in August 2017, production was 150 million units of Supreme, 190 million units of Deluxe, and 220 million units of Regular. Why might the July 2017 information on manufacturing cost per unit be misleading when predicting total manufacturing costs in August 2017?

SOLUTION

(15 min.) **Computing and interpreting manufacturing unit costs**.

1.

			(in millions)	
	Supreme	**Deluxe**	**Regular**	**Total**
Direct material cost	$ 89.00	$ 57.00	$60.00	$206.00
Direct manuf. labor costs	16.00	26.00	8.00	50.00
Manufacturing overhead costs	48.00	78.00	24.00	150.00
Total manuf. costs	153.00	161.00	92.00	406.00
Fixed costs allocated at a rate of $15M ÷ $50M (direct mfg. labor) equal to $0.30 per dir. manuf. labor dollar (0.30 × $16; 26; 8)	4.80	7.80	2.40	15.00
Variable costs	$148.20	$153.20	$89.60	$391.00
Units produced (millions)	125	150	140	
Manuf. cost per unit (Total manuf. costs ÷ units produced)	$1.2240	$1.0733	$0.6571	
Variable manuf. cost per unit (Variable manuf. costs				

÷ Units produced)	$1.1856	$1.0213	$0.6400	

		(in millions)		
	Supreme	**Deluxe**	**Regular**	**Total**
2. Based on total manuf. cost per unit ($1.2240 × 150; $1.0733 × 190; $0.6571 × 220)	$183.60	$203.93	$144.56	$532.09
Correct total manuf. costs based on variable manuf. costs plus fixed costs equal				
Variable costs ($1.1856 × 150; $1.0213 × 190; $0.64 × 220)	$177.84	$194.05	$140.80	$512.69
Fixed costs				15.00
Total costs				$527.69

The total manufacturing cost per unit in requirement 1 includes $15 million of indirect manufacturing costs that are fixed irrespective of changes in the volume of output per month, while the remaining variable indirect manufacturing costs change with the production volume. Given the unit volume changes for August 2017, the use of total manufacturing cost per unit from the past month at a different unit volume level (both in aggregate and at the individual product level) will overestimate total costs of $532.09 million in August 2017 relative to the correct total manufacturing costs of $527.69 million calculated using variable manufacturing cost per unit times units produced plus the fixed costs of $15 million.

2-22 Direct, indirect, fixed, and variable costs. California Tires manufactures two types of tires that it sells as wholesale products to various specialty retail auto supply stores. Each tire requires a three-step process. The first step is mixing. The mixing department combines some of the necessary direct materials to create the material mix that will become part of the tire. The second step includes the forming of each tire where the materials are layered to form the tire. This is an entirely automated process. The final step is finishing, which is an entirely manual process. The finishing department includes curing and quality control.

Required:

1. Costs involved in the process are listed next. For each cost, indicate whether it is a direct variable, direct fixed, indirect variable, or indirect fixed cost, assuming "units of production of each kind of tire" is the cost object.

Costs:

Rubber	Mixing department manager
Reinforcement cables	Material handlers in each department
Other direct materials	Custodian in factory
Depreciation on formers	Night guard in factory
Depreciation on mixing machines	Machinist (running the mixing machine)
Rent on factory building	Machine maintenance personnel in each department

Fire insurance on factory building	Maintenance supplies for factory
Factory utilities	Cleaning supplies for factory
Finishing department hourly laborers	Machinist (running the forming machines)

2. If the cost object were the "mixing department" rather than units of production of each kind of tire, which preceding costs would now be direct instead of indirect costs?

SOLUTION

(15 min.) **Direct, indirect, fixed, and variable costs.**

1. Rubber—direct, variable
Reinforcement cables—direct, variable
Other direct materials—direct, variable
Depreciation on formers—indirect, fixed (unless "units of output" depreciation, which then would be variable)
Depreciation on mixing machines—indirect, fixed (unless "units of output" depreciation, which then would be variable)
Rent on factory building—indirect, fixed
Fire Insurance on factory building—indirect, fixed
Factory utilities—indirect, probably some variable and some fixed (e.g., electricity may be variable but heating costs may be fixed)
Finishing department hourly laborers—direct, variable (or fixed if the laborers are under a union contract)
Mixing department manager—indirect, fixed
Materials handlers—depends on how they are paid. If paid hourly and not under union contract, then indirect, variable. If salaried or under union contract, then indirect, fixed
Custodian in factory—indirect, fixed
Night guard in factory—indirect, fixed
Machinist (running the mixing machine)—depends on how they are paid. If paid hourly and not under union contract, then indirect, variable. If salaried or under union contract, then indirect, fixed
Machine maintenance personnel—indirect, probably fixed, if salaried, but may be variable if paid only for time worked and maintenance increases with increased production
Maintenance supplies—indirect, variable
Cleaning supplies—indirect, most likely fixed because the custodians probably do the same amount of cleaning every night
Machinist (running the forming machine)—depends on how they are paid. If paid hourly and not under union contract, then indirect, variable. If salaried or under union contract, then indirect, fixed

2. If the cost object is Mixing Department, then anything directly associated with the Mixing Department will be a direct cost. This will include:

- Depreciation on mixing machines

- Mixing Department manager
- Materials handlers (of the Mixing Department)
- Machinist (running the mixing machines)
- Machine Maintenance personnel (of the Mixing Department)
- Maintenance supplies (if separately identified for the Mixing Department)

Of course the rubber, reinforcement cables and other direct materials will also be a direct cost of the Mixing Department, but it is already a direct cost of each kind of tire produced.

2-23 Classification of costs, service sector. Market Focus is a marketing research firm that organizes focus groups for consumer-product companies. Each focus group has eight individuals who are paid $60 per session to provide comments on new products. These focus groups meet in hotels and are led by a trained, independent marketing specialist hired by Market Focus. Each specialist is paid a fixed retainer to conduct a minimum number of sessions and a per session fee of $2,200. A Market Focus staff member attends each session to ensure that all the logistical aspects run smoothly.

Required:

Classify each cost item **(A–H)** as follows:

a. Direct or indirect (D or I) costs of each individual focus group.
b. Variable or fixed (V or F) costs of how the total costs of Market Focus change as the number of focus groups conducted changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the number of groups conducted.)

You will have two answers (D or I; V or F) for each of the following items:

Cost Item	D or I	V or F
A. Payment to individuals in each focus group to provide comments on new products		
B. Annual subscription of Market Focus to *Consumer Reports* magazine		
C. Phone calls made by Market Focus staff member to confirm individuals will attend a focus group session (Records of individual calls are not kept.)		
D. Retainer paid to focus group leader to conduct 18 focus groups per year on new medical products		
E. Recruiting cost to hire marketing specialists		
F. Lease payment by Market Focus for corporate office		
G. Cost of tapes used to record comments made by individuals in a focus group session (These tapes are sent to the company whose products are being tested.)		
H. Gasoline costs of Market Focus staff for company-owned vehicles (Staff members submit monthly bills with no mileage breakdowns.)		
I. Costs incurred to improve the design of focus groups to make them more effective		

SOLUTION

(15–20 min.) **Classification of costs, service sector.**

Cost object: Each individual focus group
Cost variability: With respect to the number of focus groups

There may be some debate over classifications of individual items, especially with regard to cost variability.

Cost Item	D or I	V or F
A	D	V
B	I	F
C	I	F[a]
D	I	F
E	I	V
F	I	F
G	D	V
H	I	V[b]
I	I	F

[a]Some students will note that phone call costs are variable when each call has a separate charge. It is a fixed cost if Market Focus has a flat monthly charge for a line, irrespective of the amount of usage.
[b]Gasoline costs are likely to vary with the number of focus groups. However, vehicles likely serve multiple purposes, and detailed records may be required to examine how costs vary with changes in one of the many purposes served.

2-24 Classification of costs, merchandising sector. Band Box Entertainment (BBE) operates a large store in Atlanta, Georgia. The store has both a movie (DVD) section and a music (CD) section. BBE reports revenues for the movie section separately from the music section.

Required:

Classify each cost item **(A–H)** as follows:

a. Direct or indirect (D or I) costs of the total number of DVDs sold.
b. Variable or fixed (V or F) costs of how the total costs of the movie section change as the total number of DVDs sold changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the total number of DVDs sold.)

You will have two answers (D or I; V or F) for each of the following items:

Cost Item	D or I	V or F
A. Annual retainer paid to a video distributor		
B. Cost of store manager's salary		
C. Costs of DVDs purchased for sale to customers		
D. Subscription to *DVD Trends* magazine		
E. Leasing of computer software used for financial budgeting at		

the BBE store
F. Cost of popcorn provided free to all customers of the BBE store
G. Cost of cleaning the store every night after closing
H. Freight-in costs of DVDs purchased by BBE

SOLUTION
(15–20 min.) **Classification of costs, merchandising sector.**

Cost object: DVDs sold in movie section of store
Cost variability: With respect to changes in the number of DVDs sold

There may be some debate over classifications of individual items, especially with regard to cost variability.

Cost Item	D or I	V or F
A	D	F
B	I	F
C	D	V
D	D	F
E	I	F
F	I	V
G	I	F
H	D	V

2-25 Classification of costs, manufacturing sector. The Cooper Furniture Company of Potomac, Maryland, assembles two types of chairs (Recliners and Rockers). Separate assembly lines are used for each type of chair.

Required:

Classify each cost item **(A–I)** as follows:

a. Direct or indirect (D or I) cost for the total number of Recliners assembled.
b. Variable or fixed (V or F) cost depending on how total costs change as the total number of Recliners assembled changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the total number of Recliners assembled.)

You will have two answers (D or I; V or F) for each of the following items:

Cost Item	D or I V or F
A. Cost of fabric used on Recliners **B.** Salary of public relations manager for Cooper Furniture **C.** Annual convention for furniture manufacturers; generally Cooper Furniture attends **D.** Cost of lubricant used on the Recliner assembly line **E.** Freight costs of Recliner frames shipped from Durham to	

Cost Item	D or I V or F
Potomac, MD **F.** Electricity costs for Recliner assembly line (single bill covers entire plant) **G.** Wages paid to temporary assembly-line workers hired in periods of high Recliner production (paid on hourly basis) **H.** Annual fire-insurance policy cost for Potomac, MD plant **I.** Wages paid to plant manager who oversees the assembly lines for both chair types	

SOLUTION

(15–20 min.) **Classification of costs, manufacturing sector.**

Cost object: Type of chair assembled (Recliners or Rockers)
Cost variability: With respect to changes in the number of Recliners assembled
There may be some debate over classifications of individual items, especially with regard to cost variability.

Cost Item	D or I	V or F
A	D	V
B	I	F
C	I	F
D	D	V
E	D	V
F	I	V
G	D	V
H	I	F
I	I	F

2-26 Variable costs, fixed costs, total costs. Bridget Ashton is getting ready to open a small restaurant. She is on a tight budget and must choose between the following long-distance phone plans:

Plan A: Pay 10 cents per minute of long-distance calling.

Plan B: Pay a fixed monthly fee of $15 for up to 240 long-distance minutes and 8 cents per minute thereafter (if she uses fewer than 240 minutes in any month, she still pays $15 for the month).

Plan C: Pay a fixed monthly fee of $22 for up to 510 long-distance minutes and 5 cents per minute thereafter (if she uses fewer than 510 minutes, she still pays $22 for the month).

Required:

1. Draw a graph of the total monthly costs of the three plans for different levels of monthly long-distance calling.

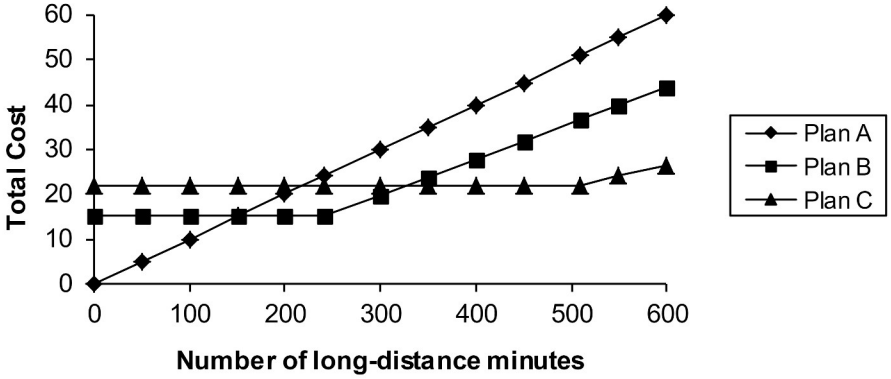
2. Which plan should Ashton choose if she expects to make 100 minutes of long-distance calls? 240 minutes? 540 minutes?

SOLUTION

(20 min.) **Variable costs, fixed costs, total costs.**

1.

Minutes/month	**0**	**50**	**100**	**150**	**200**	**240**	**300**	**327.5**	**350**	**400**	**450**	**510**	**540**	**600**	**650**
Plan A ($/month)	0	5	10	15	20	24	30	32.75	35	40	45	51	54	60	65
Plan B ($/month)	15	15	15	15	15	15	19.80	22	23.80	27.80	31.80	36.60	39	43.80	47.80
Plan C ($/month)	22	22	22	22	22	22	22	22	22	22	22	22	23.50	26.50	29



2. In each region, Ashton chooses the plan that has the lowest cost. From the graph (or from calculations)*, we can see that if Ashton expects to use 0–150 minutes of long-distance each month, she should buy Plan A; for 150–327.5 minutes, Plan B; and for more than 327.5 minutes, Plan C. If Ashton plans to make 100 minutes of long-distance calls each month, she should choose Plan A; for 240 minutes, choose Plan B; for 540 minutes, choose Plan C.

*Let x be the number of minutes when Plan A and Plan B have equal cost

$\$0.10x = \$15$

$x = \$15 \div \$0.10$ per minute $= 150$ minutes.

Let y be the number of minutes when Plan B and Plan C have equal cost

$\$15 + \$0.08\,(y - 240) = \$22$

$\$0.08\,(y - 240) = \$22 - \$15 = \$7$

$$y - 240 = \frac{\$7}{\$0.08} = 87.5$$

$y = 87.5 + 240 = 327.5$ minutes

2-27 Variable and Fixed Costs. Consolidated Motors specializes in producing one specialty vehicle. It is called Surfer and is styled to easily fit multiple surfboards in its back area and top-mounted storage racks. Consolidated has the following manufacturing costs:

Plant management costs, $1,992,000 per year

Cost of leasing equipment, $1,932,000 per year

Workers' wages, $800 per Surfer vehicle produced

Direct materials costs: Steel, $1,400 per Surfer; Tires, $150 per tire, each Surfer takes 5 tires (one spare).

City license, which is charged monthly based on the number of tires used in production:

0–500 tires	$ 40,040
501–1,000 tires	$ 65,000
more than 1,000 tires	$249,870

Consolidated currently produces 170 vehicles per month.

Required:

1. What is the variable manufacturing cost per vehicle? What is the fixed manufacturing cost per month?
2. Plot a graph for the variable manufacturing costs and a second for the fixed manufacturing costs per month. How does the concept of relevant range relate to your graphs? Explain.
3. What is the total manufacturing cost of each vehicle if 80 vehicles are produced each month? 205 vehicles? How do you explain the difference in the manufacturing cost per unit?

SOLUTION

(15–20 min.) **Variable costs and fixed costs.**

1. Variable manufacturing cost per vehicle

Steel	$1,400 per Surfer
Tires	750 per Surfer
Direct manufacturing labor	800 per Surfer
Total	$2,950 per Surfer

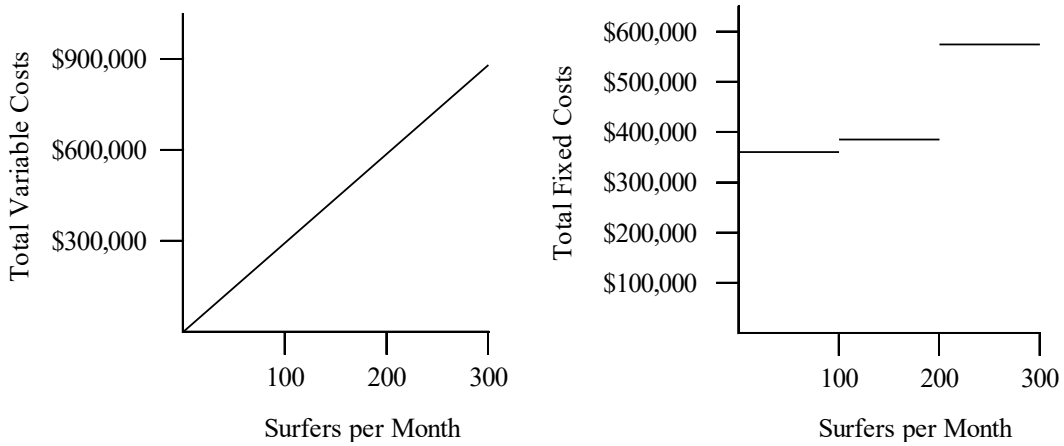
Fixed manufacturing costs per month

Plant management costs ($1,992,000 ÷ 12)	$ 166,000
Cost of leasing equipment ($1,932,000 ÷ 12)	161,000
City license (for 170 surfers or 850 tires)	65,000
Total fixed manufacturing costs	$392,000

Fixed costs per month (1 surfer takes 5 tires)

0 to 100 surfers per month	= $166,000 + $161,000 + $40,040 = $367,040
101 to 200 surfers per month	= $166,000 + $161,000 + $65,000 = $392,000
More than 200 surfers per month	= $166,000 + $161,000 + $249,870 = $576,870

2.



The concept of relevant range is potentially relevant for both graphs. However, the question does not place restrictions on the unit variable costs. The relevant range for the total fixed costs is from 0 to 100 surfers; 101 to 200 surfers; more than 200 surfers. Within these ranges, the total fixed costs do not change in total.

3.

	Vehicles Produced per Month (1)	Tires Produced per Month (2) = (1) × 5	Fixed Cost per Month (3)	Unit Fixed Cost per Vehicle (4) = FC ÷ (1)	Unit Variable Cost per Vehicle (5)	Unit Total Cost per Vehicle (6) = (4) + (5)
(a)	80	400	$367,040	$367,040 ÷ 80 = $4,588	$2,950	$7,538
(b)	205	1,025	$576,870	$576,870 ÷ 205 = $2,814	$2,950	$5,764

The unit cost for 80 vehicles produced per month is $7,538, while for 205 vehicles it is only $5,764. This difference is caused by the fixed cost increment of $209,830 (an increase of 50%, $209,830 ÷ $367,040 = 57%) being spread over an increment of 125 (205 – 80) vehicles (an increase of 156%, 125 ÷ 80). The fixed cost per unit is therefore lower.

2-28 Variable costs, fixed costs, relevant range. Gummy Land Candies manufactures jaw-breaker candies in a fully automated process. The machine that produces candies was purchased recently and can make 5,000 per month. The machine costs $6,500 and is depreciated using straight-line depreciation over 10 years assuming zero residual value. Rent for the factory space and warehouse and other fixed manufacturing overhead costs total $1,200 per month.

Gummy Land currently makes and sells 3,900 jaw-breakers per month. Gummy Land buys just enough materials each month to make the jaw-breakers it needs to sell. Materials cost 40¢ per jaw-breaker.

Next year Gummy Land expects demand to increase by 100%. At this volume of materials purchased, it will get a 10% discount on price. Rent and other fixed manufacturing overhead costs will remain the same.

Required:

1. What is Gummy Land's current annual relevant range of output?
2. What is Gummy Land's current annual fixed manufacturing cost within the relevant range? What is the annual variable manufacturing cost?
3. What will Gummy Land's relevant range of output be next year? How, if at all, will total annual fixed and variable manufacturing costs change next year? Assume that if it needs to Gummy Land could buy an identical machine at the same cost as the one it already has.

SOLUTION

(20 min.) **Variable costs, fixed costs, relevant range.**

1. The production capacity is 5,000 jaw breakers per month. Therefore, the current annual relevant range of output is 0 to 5,000 jaw breakers × 12 months = 0 to 60,000 jaw breakers.

2. Current annual fixed manufacturing costs within the relevant range are $1,200 × 12 = $14,400 for rent and other overhead costs, plus $6,500 ÷ 10 = $650 for depreciation, totaling $15,050.

The variable costs, the materials, are 40 cents per jaw breaker, or $18,720 ($0.40 per jaw breaker × 3,900 jaw breakers per month × 12 months) for the year.

3. If demand changes from 3,900 to 7,800 jaw breakers per month, or from 3,900 × 12 = 46,800 to 7,800 × 12 = 93,600 jaw breakers per year, Gummy Land will need a second machine. Assuming Gummy Land buys a second machine identical to the first machine, it will increase capacity from 5,000 jaw breakers per month to 10,000. The annual relevant range will be between 5,000 × 12 = 60,000 and 10,000 × 12 = 120,000 jaw breakers.

Assume the second machine costs $6,500 and is depreciated using straight-line depreciation over 10 years and zero residual value, just like the first machine. This will add $650 of depreciation per year.

Fixed costs for next year will increase to $15,700 from $15,050 for the current year + $650 (because rent and other fixed overhead costs will remain the same at $14,400). That is, total fixed costs for next year equal $650 (depreciation on first machine) + $650 (depreciation on second machine) + $14,400 (rent and other fixed overhead costs).

The variable cost per jaw breaker next year will be 90% × $0.40 = $0.36. Total variable costs equal $0.36 per jaw breaker × 93,600 jaw breakers = $33,696.

If Gummy Land decides not to increase capacity and meet only that amount of demand for which it has available capacity (5,000 jaw breakers per month or 5,000 × 12 = 60,000 jaw breakers per year), the variable cost per unit will be the same at $0.40 per jaw breaker. Annual total variable manufacturing costs will increase to $0.40 × 5,000 jaw breakers per month × 12 months = $24,000. Annual total fixed manufacturing costs will remain the same, $15,050.

2-29 Cost drivers and value chain. Torrance Technology Company (TTC) is developing a new touch-screen smartphone to compete in the cellular phone industry. The company will sell the phones at wholesale prices to cell phone companies, which will in turn sell them in retail stores to the final customer. TTC has undertaken the following activities in its value chain to bring its product to market:

A. Perform market research on competing brands
B. Design a prototype of the TTC smartphone
C. Market the new design to cell phone companies
D. Manufacture the TTC smartphone
E. Process orders from cell phone companies
F. Deliver the TTC smartphones to the cell phone companies
G. Provide online assistance to cell phone users for use of the TTC smartphone
H. Make design changes to the smartphone based on customer feedback

During the process of product development, production, marketing, distribution, and customer service, TTC has kept track of the following cost drivers:

Number of smartphones shipped by TTC

Number of design changes

Number of deliveries made to cell phone companies

Engineering hours spent on initial product design

Hours spent researching competing market brands

Customer-service hours

Number of smartphone orders processed

Machine hours required to run the production equipment

Required:

1. Identify each value-chain activity listed at the beginning of the exercise with one of the following value-chain categories:
   a. Design of products and processes
   b. Production
   c. Marketing
   d. Distribution
   e. Customer service
2. Use the list of preceding cost drivers to find one or more reasonable cost drivers for each of the activities in TTC's value chain.

SOLUTION

(20 min.) **Cost drivers and value chain.**

1. Perform market research on competing brands—Design of products and processes
   Design a prototype of the TTC smartphone—Design of products and processes
   Market the new design to cell phone companies—Marketing
   Manufacture the TTC smartphone—Production
   Process orders from cell phone companies—Distribution
   Deliver the TTC smartphones to the cell phone companies—Distribution
   Provide online assistance to cell phone users for use of the TTC smartphone—Customer service

Make design changes to the TTC smartphone based on customer feedback—Design of products and processes

2.

Value Chain Category	Activity	Cost Driver
Design of products and processes	Perform market research on competing brands	Hours spent researching competing market brands
	Design a prototype of the TTC smartphone	Engineering hours spent on initial product design
	Make design changes to the smartphone based on customer feedback	Number of design changes
Production	Manufacture the TTC smartphones	Machine hours required to run the production equipment
Marketing	Market the new design to cell phone companies	Number of smartphones shipped by TTC
Distribution	Process orders from cell phone companies	Number of smartphone orders processed
	Deliver the TTC smartphones to cell phone companies	Number of deliveries made to cell phone companies
Customer service	Provide on-line assistance to cell phone users for use of the TTC smartphone	Customer service hours

2-30 Cost drivers and functions. The representative cost drivers in the right column of this table are randomized so they do not match the list of functions in the left column.

Function	Representative Cost Driver
1. Accounts payable	**A.** Number of invoices sent
2. Recruiting	**B.** Number of purchase orders
3. Network Maintenance	**C.** Number of units manufactured
4. Production	**D.** Number of computers on the network
5. Purchasing	**E.** Number of employees hired
6. Warehousing	**F.** Number of bills received from vendors
7. Billing	**G.** Number of pallets moved

Required:

1. Match each function with its representative cost driver.

2. Give a second example of a cost driver for each function.

SOLUTION

(10–15 min.) **Cost drivers and functions.**

1.

Function	Representative Cost Driver
1. Accounts payable	Number of bills received from vendors
2. Recruiting	Number of employees hired
3. Network maintenance	Number of computers on the network
4. Production	Number of units manufactured
5. Purchasing	Number of purchase orders
6. Warehousing	Number of pallets moved
7. Billing	Number of invoices sent

2.

Function	Representative Cost Driver
1. Accounts payable	Number of checks written
2. Recruiting	Number of interviews conducted
3. Network Maintenance	Number of computer transactions
4. Production	Number of direct labor employees
5. Purchasing	Number of different types of materials purchased
6. Warehousing	Distance of deliveries made
7. Billing	Number of credit sales transactions

2-31 Total costs and unit costs, service setting. National Training recently started a business providing training events for corporations. In order to better understand the profitability of the business, the owners asked you for an analysis of costs—what costs are fixed, what costs are variable, and so on, for each training session. You have the following cost information:

Trainer: $11,000 per session

Materials: $2,500 per session and $35 per attendee

Catering Costs (subcontracted):

Food: $75 per attendee

Setup/cleanup: $25 per attendee

Fixed fee: $5,000 per training session

National Training is pleased with the service they use for the catering and have allowed them to place brochures on each dinner table as a form of advertising. In exchange, the caterer gives National Training a $1,000 discount per session.

Required:

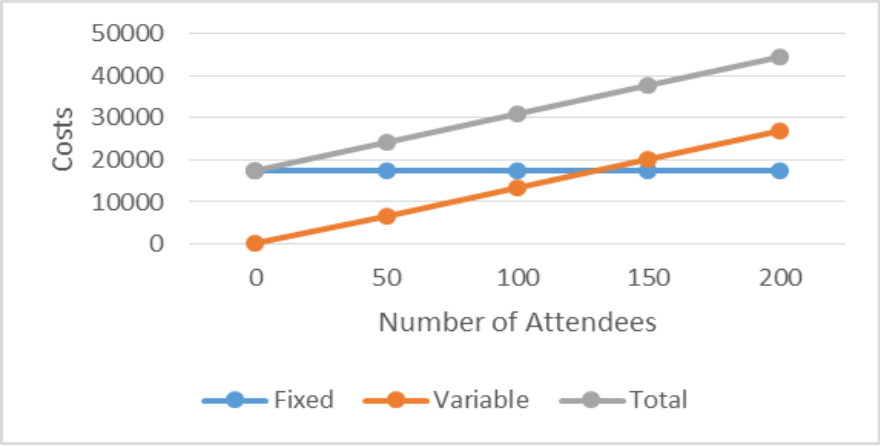
1. Draw a graph depicting fixed costs, variable costs, and total costs for each training session versus the number of guests.
2. Suppose 100 persons attend the next event. What is National Training's total net cost and the cost per attendee?
3. Suppose instead that 175 persons attend? What is National Training's total net cost and the cost per attendee?
4. How should National Training charge customers for their services? Explain briefly.

SOLUTION

(20 min.) **Total costs and unit costs**

Number of attendees	**0**	**50**	**100**	**175**	**200**
Variable cost per attendee (Materials $35 + Food, $75 + Setup/Cleanup, $25)	$135	$135	$135	$135	$135
Fixed Costs per session (Trainer, $11,000 + Materials, $2,500 + Catering, $5,000 − Offset for brochures, $1,000)	$17,500	$17,500	$17,500	$17,500	$17,500
Variable costs (number of attendees × variable cost per attendee)	0	6,750	13,500	23,625	27,000
Total costs (fixed + variable)	$17,500	$24,250	$31,000	$41,125	$44,500

1.



2.

Number of attendees	**0**	**50**	**100**	**175**	**200**
Total costs	$17,500	$24,250	$31,000	$41,125	$44,500

(fixed + variable)				
Costs per attendee (total costs ÷ number of attendees)	$355	$215	$168.33	$ 145

As shown in the table above, for 100 attendees the total cost will be $31,000, and the cost per attendee will be $310.00.

3. As shown in the table in requirement 2, for 175 attendees, the total cost will be $41,125, and the cost per attendee will be $235.

4. National Training should charge customers based on the number of attendees. As the number of attendees increase, national Training could offer price discounts because its fixed costs would be spread over a larger number of attendees. For 100 attendees, the fixed catering cost per attendee would be $40 ($4,000 ÷ 100 guests); for 200 attendees, it would be $20 ($4,000 ÷ 200 attendees). National Training's total cost per attendee would be $115 (variable cost per attendee of $75 + fixed catering cost per attendee of $40) for 100 attendees and $95 per attendee (variable cost per attendee of $75 + fixed catering cost per attendee of $20) for 200 attendees. The lower cost per attendee as the number of attendees increases allows National Training to offer price discounts and still earn a profit.

   Alternatively, National Training could charge a flat fee of $20,000 plus $150 per attendee. This would provide a margin of $15.00 per guest plus a $2,500 markup on the fixed costs. At 100 attendees, profit would be $4,000 ($2,500 on fixed costs + ($15.00 × 100 attendees)). At 175 attendees, profit would be $5,125 ($2,500 on fixed costs + ($15.00 × 175 attendees)).

2-32 Total and unit cost, decision making. Gayle's Glassworks makes glass flanges for scientific use. Materials cost $1 per flange, and the glass blowers are paid a wage rate of $28 per hour. A glass blower blows 10 flanges per hour. Fixed manufacturing costs for flanges are $28,000 per period. Period (nonmanufacturing) costs associated with flanges are $10,000 per period and are fixed.

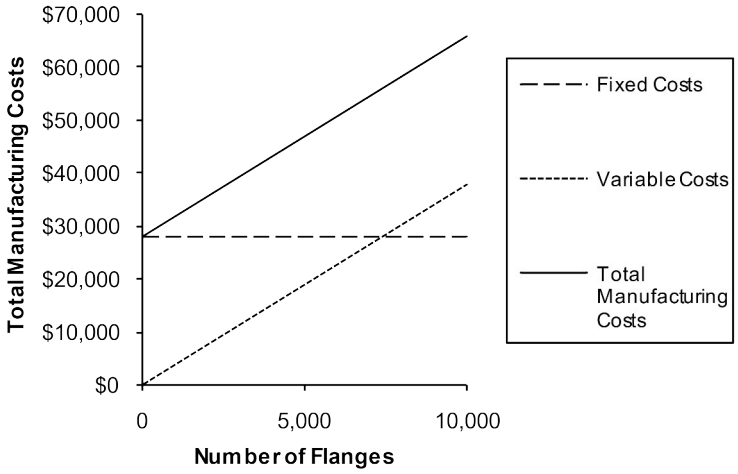
Required:

1. Graph the fixed, variable, and total manufacturing cost for flanges, using units (number of flanges) on the *x*-axis.
2. Assume Gayle's Glassworks manufactures and sells 5,000 flanges this period. Its competitor, Flora's Flasks, sells flanges for $10 each. Can Gayle sell below Flora's price and still make a profit on the flanges?
3. How would your answer to requirement 2 differ if Gayle's Glassworks made and sold 10,000 flanges this period? Why? What does this indicate about the use of unit cost in decision making?

SOLUTION

(25 min.) **Total and unit cost, decision making.**

1.



Note that the production costs include the $28,000 of fixed manufacturing costs but not the $10,000 of period costs. The variable cost is $1 per flange for materials, and $2.80 per flange ($28 per hour divided by 10 flanges per hour) for direct manufacturing labor for a total of $3.80 per flange.

2. The inventoriable (manufacturing) cost per unit for 5,000 flanges is
$3.80 × 5,000 + $28,000 = $47,000
Average (unit) cost = $47,000 ÷ 5,000 units = $9.40 per unit.

This is below Flora's selling price of $10 per flange. However, in order to make a profit, Gayle's Glassworks also needs to cover the period (non-manufacturing) costs of $10,000, or $10,000 ÷ 5,000 = $2 per unit.

Thus total costs, both inventoriable (manufacturing) and period (non-manufacturing), for the flanges is $9.40 + $2 = $11.40. Gayle's Glassworks cannot sell below Flora's price of $10 and still make a profit on the flanges.

Alternatively,

At Flora's price of $10 per flange:					
Revenue	$10	×	5,000	=	$50,000
Variable costs	$3.80	×	5,000	=	19,000
Fixed costs					38,000
Operating loss					$ (7,000)

Gayle's Glassworks cannot sell below $10 per flange and make a profit. At Flora's price of $10 per flange, the company has an operating loss of $7,000.

3. If Gayle's Glassworks produces 10,000 units, then total inventoriable cost will be:

Variable cost ($3.80 × 10,000) + fixed manufacturing costs, $28,000 = total manufacturing costs, $66,000.

Average (unit) inventoriable (manufacturing) cost will be $66,000 ÷ 10,000 units = $6.60 per flange
Unit total cost including both inventoriable and period costs will be
($66,000 + $10,000) ÷ 10,000 = $7.60 per flange, and Gayle's Glassworks will be able to sell the flanges for less than Flora's price of $10 per flange and still make a profit.

Alternatively,
At Flora's price of $10 per flange:

Revenue	$10	×	10,000	=	$100,000
Variable costs	$3.80	×	10,000	=	38,000
Fixed costs					38,000
Operating income					$ 24,000

Gayle's Glassworks can sell at a price below $10 per flange and still make a profit. The company earns operating income of $24,000 at a price of $10 per flange. The company will earn operating income as long as the price exceeds $7.60 per flange.

The reason the unit cost decreases significantly is that inventoriable (manufacturing) fixed costs and fixed period (non-manufacturing) costs remain the same regardless of the number of units produced. So, as Gayle's Glassworks produces more units, fixed costs are spread over more units, and cost per unit decreases. This means that if you use unit costs to make decisions about pricing, and which product to produce, you must be aware that the unit cost only applies to a particular level of output.

2-33 Inventoriable costs versus period costs. Each of the following cost items pertains to one of these companies: Best Buy (a merchandising-sector company), KitchenAid (a manufacturing-sector company), and HughesNet (a service-sector company):

a. Cost of phones and computers available for sale in Best Buy's electronics department
b. Electricity used to provide lighting for assembly-line workers at a KitchenAid manufacturing plant
c. Depreciation on HughesNet satellite equipment used to provide its services
d. Electricity used to provide lighting for Best Buy's store aisles
e. Wages for personnel responsible for quality testing of the KitchenAid products during the assembly process
f. Salaries of Best Buy's marketing personnel planning local-newspaper advertising campaigns
g. Perrier mineral water purchased by HughesNet for consumption by its software engineers
h. Salaries of HughesNet area sales managers
i. Depreciation on vehicles used to transport KitchenAid products to retail stores

Required:
1. Distinguish between manufacturing-, merchandising-, and service-sector companies.
2. Distinguish between inventoriable costs and period costs.
3. Classify each of the cost items (**a–i**) as an inventoriable cost or a period cost. Explain your

answers.

SOLUTION

(20–30 min.) **Inventoriable costs versus period costs.**

1. *Manufacturing-sector companies* purchase materials and components and convert them into different finished goods.

Merchandising-sector companies purchase and then sell tangible products without changing their basic form.

Service-sector companies provide services or intangible products to their customers—for example, legal advice or audits.

Only manufacturing and merchandising companies have inventories of goods for sale.

2. *Inventoriable costs* are all costs of a product that are regarded as an asset when they are incurred and then become cost of goods sold when the product is sold. These costs for a manufacturing company are included in work-in-process and finished goods inventory (they are "inventoried") to build up the costs of creating these assets.

Period costs are all costs in the income statement other than cost of goods sold. These costs are treated as expenses of the period in which they are incurred because they are presumed not to benefit future periods (or because there is not sufficient evidence to conclude that such benefit exists). Expensing these costs immediately best matches expenses to revenues.

3. (a) Phones and computers purchased for resale by Best Buy—inventoriable cost of a merchandising company. It becomes part of cost of goods sold when the phones and computers are sold.

(b) Electricity used for lighting at KitchenAid plant—inventoriable cost of a manufacturing company. It is part of the manufacturing overhead that is included in the manufacturing cost of a finished good.

(c) Depreciation on HughesNet satellite equipment used to provide its services—period cost of a service company. HughesNet has no inventory of goods for sale and, hence, no inventoriable cost.

(d) Electricity used to provide lighting for Best Buy's store aisles—period cost of a merchandising company. It is a cost that benefits the current period, and it is not traceable to goods purchased for resale.

(e) Wages for personnel responsible for quality testing of the KitchenAid products during the assembly process—inventoriable cost of a manufacturing company. It is usually part of the manufacturing overhead that is included in the manufacturing cost of a finished good (if quality testing is done for several products), but may be a direct cost, if quality testing is done by personnel who work on a specific KitchenAid product line such as the KitchenAid dishwasher.

(f) Salaries of Best Buy's marketing personnel—period cost of a merchandising company. It is not cost of goods purchased for resale. It is presumed not to benefit future periods (or at least not to have sufficiently reliable evidence to estimate such future benefits).

(g) Perrier mineral water consumed by HughesNet's software engineers—period cost of a service company. HughesNet has no inventory of goods for sale and, hence, no inventoriable cost.

(h) Salaries of HughesNet's marketing personnel—period cost of a service company. HughesNet has no inventory of goods for sale and, hence, no inventoriable cost.

(i) Depreciation on vehicles used to transport KitchenAid products to retail stores—period cost of a manufacturing company. This is a distribution cost, not an inventoriable cost.

2-34 Computing cost of goods purchased and cost of goods sold. The following data are for Marvin Department Store. The account balances (in thousands) are for 2017.

Marketing, distribution, and customer-service costs	$ 37,000
Merchandise inventory, January 1, 2017	27,000
Utilities	17,000
General and administrative costs	43,000
Merchandise inventory, December 31, 2017	34,000
Purchases	155,000
Miscellaneous costs	4,000
Transportation-in	7,000
Purchase returns and allowances	4,000
Purchase discounts	6,000
Revenues	280,000

Required:

1. Compute **(a)** the cost of goods purchased and **(b)** the cost of goods sold.

2. Prepare the income statement for 2017.

SOLUTION

(20 min.) **Computing cost of goods purchased and cost of goods sold.**

1a.

Marvin Department Store
Schedule of Cost of Goods Purchased
For the Year Ended December 31, 2017
(in thousands)

Purchases		$155,000
Add transportation-in		7,000
		162,000
Deduct:		
Purchase returns and allowances	$4,000	
Purchase discounts	6,000	10,000
Cost of goods purchased		$152,000

1b.

Marvin Department Store
Schedule of Cost of Goods Sold
For the Year Ended December 31, 2017
(in thousands)

Beginning merchandise inventory 1/1/2017	$ 27,000
Cost of goods purchased (see above)	152,000
Cost of goods available for sale	179,000
Ending merchandise inventory 12/31/2017	34,000
Cost of goods sold	$145,000

2.

Marvin Department Store
Income Statement
Year Ended December 31, 2017
(in thousands)

Revenues		$280,000
Cost of goods sold (see above)		145,000
Gross margin		135,000
Operating costs		
Marketing, distribution, and customer service costs	$37,000	
Utilities	17,000	
General and administrative costs	43,000	
Miscellaneous costs	4,000	
Total operating costs		101,000
Operating income		$ 34,000

2-35 Cost of goods purchased, cost of goods sold, and income statement. The following data are for Arizona Retail Outlet Stores. The account balances (in thousands) are for 2017.

Marketing and advertising costs	$ 55,200
Merchandise inventory, January 1, 2017	103,500
Shipping of merchandise to customers	4,600
Depreciation on store fixtures	9,660
Purchases	598,000
General and administrative costs	73,600
Merchandise inventory, December 31, 2017	119,600
Merchandise freight-in	23,000
Purchase returns and allowances	25,300
Purchase discounts	20,700
Revenues	736,000

Required:

1. Compute **(a)** the cost of goods purchased and **(b)** the cost of goods sold.

2. Prepare the income statement for 2017.

SOLUTION

(20 min.) **Cost of goods purchased, cost of goods sold, and income statement.**

1a.

Arizona Retail Outlet Stores
Schedule of Cost of Goods Purchased
For the Year Ended December 31, 2017
(in thousands)

Purchases		$598,000
Add freight—in		23,000
		621,000
Deduct:		
Purchase returns and allowances	$25,300	
Purchase discounts	20,700	46,000
Cost of goods purchased		$575,000

1b.

Arizona Retail Outlet Stores
Schedule of Cost of Goods Sold
For the Year Ended December 31, 2017
(in thousands)

Beginning merchandise inventory 1/1/2017	$103,500
Cost of goods purchased (see above)	575,000
Cost of goods available for sale	678,500
Ending merchandise inventory 12/31/2017	119,600
Cost of goods sold	$558,900

2.

Arizona Retail Outlet Stores
Income Statement
Year Ended December 31, 2017
(in thousands)

Revenues		$736,000
Cost of goods sold (see above)		558,900
Gross margin		177,100
Operating costs		
Marketing and advertising costs	$55,200	
Depreciation on store fixtures	9,660	
Shipping of merchandise to customers	4,600	
General and administrative costs	73,600	
Total operating costs		143,060
Operating income		$ 34,040

2-36 Flow of Inventoriable Costs. Renka's Heaters selected data for October 2017 are presented here (in millions):

Direct materials inventory 10/1/2017	$ 105
Direct materials purchased	365
Direct materials used	385
Total manufacturing overhead costs	450
Variable manufacturing overhead costs	265
Total manufacturing costs incurred during October 2017	1,610
Work-in-process inventory 10/1/2017	230
Cost of goods manufactured	1,660
Finished-goods inventory 10/1/2017	130
Cost of goods sold	1,770

Required:

Calculate the following costs:

1. Direct materials inventory 10/31/2017
2. Fixed manufacturing overhead costs for October 2017
3. Direct manufacturing labor costs for October 2017
4. Work-in-process inventory 10/31/2017
5. Cost of finished goods available for sale in October 2017
6. Finished goods inventory 10/31/2017

SOLUTION

(20 min.) **Flow of Inventoriable Costs.**

(All numbers below are in millions).

1.

Direct materials inventory 10/1/2017	$ 105
Direct materials purchased	365
Direct materials available for production	470
Direct materials used	(385)
Direct materials inventory 10/31/2017	$ 85

2.

Total manufacturing overhead costs	$ 450
Subtract: Variable manufacturing overhead costs	(265)
Fixed manufacturing overhead costs for October 2017	$ 185

3.

Total manufacturing costs incurred during October 2017	$ 1,610
Subtract: Direct materials used (from requirement 1)	(385)
Total manufacturing overhead costs	(450)
Direct manufacturing labor costs for October 2017	$ 775

4.

Work-in-process inventory 10/1/2017	$ 230
Total manufacturing costs incurred during October 2017	1,610
Work-in-process available for production	1,840
Subtract: Cost of goods manufactured (moved into finished goods)	(1,660)
Work-in-process inventory 10/31/2017	$ 180

5.

Finished goods inventory 10/1/2017	$ 130
Cost of goods manufactured (moved from work in process)	1,660
Cost of finished goods available for sale in October 2017	$ 1,790

6.

Cost of finished goods available for sale in October 2017 (from requirement 5)	$ 1,790
Subtract: Cost of goods sold	(1,770)
Finished goods inventory 10/31/2017	$ 20

2-37 Cost of goods manufactured, income statement, manufacturing company. Consider the following account balances (in thousands) for the Peterson Company:

Peterson Company	Beginning of 2017	End of 2017
Direct materials inventory	21,000	23,000
Work-in-process inventory	26,000	25,000
Finished-goods inventory	13,000	20,000
Purchases of direct materials		74,000
Direct manufacturing labor		22,000
Indirect manufacturing labor		17,000
Plant insurance		7,000
Depreciation—plant, building, and equipment		11,000
Repairs and maintenance—plant		3,000
Marketing, distribution, and customer-		91,000

service costs

General and administrative costs 24,000

Required:

1. Prepare a schedule for the cost of goods manufactured for 2017.

2. Revenues for 2017 were $310 million. Prepare the income statement for 2017.

SOLUTION

(30–40 min.) **Cost of goods manufactured, income statement, manufacturing company.**

1.

Peterson Company
Schedule of Cost of Goods Manufactured
Year Ended December 31, 2017
(in thousands)

Direct materials cost		
Beginning inventory, January 1, 2017	$ 21,000	
Purchases of direct materials	74,000	
Cost of direct materials available for use	95,000	
Ending inventory, December 31, 2017	23,000	
Direct materials used		$ 72,000
Direct manufacturing labor costs		22,000
Indirect manufacturing costs		
Indirect manufacturing labor	17,000	
Plant insurance	7,000	
Depreciation—plant building & equipment	11,000	
Repairs and maintenance—plant	3,000	
Total indirect manufacturing costs		38,000
Manufacturing costs incurred during 2017		132,000
Add beginning work-in-process inventory, January 1, 2017		26,000
Total manufacturing costs to account for		158,000
Deduct ending work-in-process inventory, December 31, 2017		25,000
Cost of goods manufactured (to Income Statement)		$133,000

2.

Peterson Company
Income Statement
Year Ended December 31, 2017
(in thousands)

Revenues		$310,000
Cost of goods sold:		
Beginning finished goods, January 1, 2017	$ 13,000	
Cost of goods manufactured	133,000	
Cost of goods available for sale	146,000	
Ending finished goods, December 31, 2017	20,000	
Cost of goods sold		126,000
Gross margin		184,000

Operating costs:		
Marketing, distribution, and customer-service costs	91,000	
General and administrative costs	24,000	
Total operating costs		115,000
Operating income		$ 69,000

2-38 Cost of goods manufactured, income statement, manufacturing company. Consider the following account balances (in thousands) for the Carolina Corporation:

Carolina Corporation	Beginning of 2017	End of 2017
Direct materials inventory	124,000	73,000
Work-in-process inventory	173,000	145,000
Finished-goods inventory	240,000	206,000
Purchases of direct materials		262,000
Direct manufacturing labor		217,000
Indirect manufacturing labor		97,000
Plant insurance		9,000
Depreciation—plant, building, and equipment		45,000
Plant utilities		26,000
Repairs and maintenance—plant		12,000
Equipment leasing costs		65,000
Marketing, distribution, and customer-service costs		125,000
General and administrative costs		71,000

Required:

1. Prepare a schedule for the cost of goods manufactured for 2017.

2. Revenues (in thousands) for 2017 were $1,300,000. Prepare the income statement for 2017.

SOLUTION

(30–40 min.) **Cost of goods manufactured, income statement, manufacturing company.**

Carolina Corporation
Schedule of Cost of Goods Manufactured
Year Ended December 31, 2017

(in thousands)

Direct materials costs		
Beginning inventory, January 1, 2017	$124,000	
Purchases of direct materials	262,000	
Cost of direct materials available for use	386,000	
Ending inventory, December 31, 2014	73,000	
Direct materials used		$313,000
Direct manufacturing labor costs		217,000
Indirect manufacturing costs		
Indirect manufacturing labor	97,000	
Plant insurance	9,000	
Depreciation—plant building & equipment	45,000	
Plant utilities	26,000	
Repairs and maintenance—plant	12,000	
Equipment lease costs	65,000	
Total indirect manufacturing costs		254,000
Manufacturing costs incurred during 2017		784,000
Add beginning work-in-process inventory, January 1, 2017		173,000
Total manufacturing costs to account for		957,000
Deduct ending work-in-process inventory, December 31, 2017		145,000
Cost of goods manufactured (to Income Statement)		$812,000

Carolina Corporation
Income Statement
Year Ended December 31, 2017
(in thousands)

Revenues		$1,300,000
Cost of goods sold:		
Beginning finished goods, January 1, 2017	$ 240,000	
Cost of goods manufactured	812,000	
Cost of goods available for sale	1,052,000	
Ending finished goods, December 31, 2017	206,000	
Cost of goods sold		846,000
Gross margin		454,000
Operating costs:		
Marketing, distribution, and customer-service costs	125,000	
General and administrative costs	71,000	
Total operating costs		196,000
Operating income		$ 258,000

2-39 Income statement and schedule of cost of goods manufactured. The Howell Corporation has the following account balances (in millions):

For Specific Date		For Year 2017	
Direct materials inventory, Jan. 1, 2017	$15	Purchases of direct materials	$325
Work-in-process inventory, Jan. 1, 2017	10	Direct manufacturing labor	100
Finished goods inventory, Jan. 1, 2017	70	Depreciation—plant and equipment	80
Direct materials inventory, Dec. 31, 2017	20	Plant supervisory salaries	5
Work-in-process inventory, Dec. 31, 2017	5	Miscellaneous plant overhead	35
Finished goods inventory, Dec. 31, 2017	55	Revenues	950
		Marketing, distribution, and customer-service costs	240
		Plant supplies used	10
		Plant utilities	30
		Indirect manufacturing labor	60

Required:

Prepare an income statement and a supporting schedule of cost of goods manufactured for the year ended December 31, 2017. (For additional questions regarding these facts, see the next problem.)

SOLUTION

(25–30 min.) **Income statement and schedule of cost of goods manufactured.**

Howell Corporation
Income Statement for the Year Ended December 31, 2017
(in millions)

Revenues		$950
Cost of goods sold		
Beginning finished goods, Jan. 1, 2017	$ 70	
Cost of goods manufactured (below)	645	
Cost of goods available for sale	715	
Ending finished goods, Dec. 31, 2017	55	660
Gross margin		290
Marketing, distribution, and customer-service costs		240
Operating income		$ 50

Howell Corporation
Schedule of Cost of Goods Manufactured
for the Year Ended December 31, 2017
(in millions)

Direct materials costs		
Beginning inventory, Jan. 1, 2017	$ 15	
Purchases of direct materials	325	
Cost of direct materials available for use	340	
Ending inventory, Dec. 31, 2017	20	
Direct materials used		$320
Direct manufacturing labor costs		100
Indirect manufacturing costs		
Indirect manufacturing labor	60	
Plant supplies used	10	
Plant utilities	30	
Depreciation—plant and equipment	80	
Plant supervisory salaries	5	
Miscellaneous plant overhead	35	220
Manufacturing costs incurred during 2017		640
Add beginning work-in-process inventory, Jan. 1, 2017		10
Total manufacturing costs to account for		650
Deduct ending work-in-process, Dec. 31, 2017		5
Cost of goods manufactured		$645

2-40 Interpretation of statements (continuation of 2-39).

Required:

1. How would the answer to Problem 2-39 be modified if you were asked for a schedule of cost of goods manufactured and sold instead of a schedule of cost of goods manufactured? Be specific.
2. Would the sales manager's salary (included in marketing, distribution, and customer-service costs) be accounted for any differently if the Howell Corporation were a merchandising-sector company instead of a manufacturing-sector company?
3. Using the flow of manufacturing costs outlined in Exhibit 2-9 (page 44), describe how the wages of an assembler in the plant would be accounted for in this manufacturing company.
4. Plant supervisory salaries are usually regarded as manufacturing overhead costs. When might some of these costs be regarded as direct manufacturing costs? Give an example.
5. Suppose that both the direct materials used and the plant and equipment depreciation are related to the manufacture of 1 million units of product. What is the unit cost for the direct materials assigned to those units? What is the unit cost for plant and equipment depreciation? Assume that yearly plant and equipment depreciation is computed on a straight-line basis.
6. Assume that the implied cost-behavior patterns in requirement 5 persist. That is, direct material costs behave as a variable cost and plant and equipment depreciation behaves as a fixed cost. Repeat the computations in requirement 5, assuming that the costs are being predicted for the manufacture of 1.2 million units of product. How would the total costs be affected?
7. As a management accountant, explain concisely to the president why the unit costs differed in requirements 5 and 6.

SOLUTION

(15–20 min.) **Interpretation of statements (continuation of 2-39).**

1. The schedule in 2-39 can become a Schedule of Cost of Goods Manufactured and Sold simply by including the beginning and ending finished goods inventory figures in the supporting schedule, rather than directly in the body of the income statement. Note that the term *cost of goods manufactured* refers to the cost of goods brought to completion (finished) during the accounting period, whether they were started before or during the current accounting period. Some of the manufacturing costs incurred are held back as costs of the ending work in process; similarly, the costs of the beginning work in process inventory become a part of the cost of goods manufactured for 2017.

2. The sales manager's salary would be charged as a marketing cost as incurred by both manufacturing and merchandising companies. It is basically a period (operating) cost that appears below the gross margin line on an income statement.

3. An assembler's wages would be assigned to the products worked on. Thus, the wages cost would be charged to Work-in-Process and would not be expensed until the product is transferred through Finished Goods Inventory to Cost of Goods Sold as the product is sold.

4. The direct-indirect distinction can be resolved only with respect to a particular cost object. For example, in defense contracting, the cost object may be defined as a contract. Then, a plant supervisor working only on that contract will have his or her salary charged directly and wholly to that single contract.

5. Direct materials used = $320,000,000 ÷ 1,000,000 units = $320 per unit
Depreciation on plant equipment = $80,000,000 ÷ 1,000,000 units = $80 per unit

6. Direct materials unit cost would be unchanged at $320 per unit. Depreciation cost per unit would be $80,000,000 ÷ 1,200,000 = $66.67 per unit. Total direct materials costs would rise by 20% to $384,000,000 ($320 per unit × 1,200,000 units), whereas total depreciation would be unaffected at $80,000,000.

7. Unit costs are averages, and they must be interpreted with caution. The $320 direct materials unit cost is valid for predicting total costs because direct materials is a variable cost; total direct materials costs indeed change as output levels change. However, fixed costs like depreciation must be interpreted quite differently from variable costs. A common error in cost analysis is to regard all unit costs as one—as if all the total costs to which they are related are variable costs. Changes in output levels (the denominator) will affect *total variable costs*, but not *total fixed costs*. Graphs of the two costs may clarify this point; it is safer to think in terms of total costs rather than in terms of unit costs.

2-41 Income statement and schedule of cost of goods manufactured. The following items (in millions) pertain to Schaeffer Corporation:

Schaeffer's manufacturing costing system uses a three-part classification of direct materials, direct manufacturing labor, and manufacturing overhead costs.

For Specific Date		For Year 2017	
Work-in-process inventory, Jan. 1, 2017	$10	Plant utilities	$ 8
Direct materials inventory, Dec. 31, 2017	4	Indirect manufacturing labor	21
Finished-goods inventory, Dec. 31, 2017	16	Depreciation—plant and equipment	6
Accounts payable, Dec. 31, 2017	24	Revenues	359
Accounts receivable, Jan. 1, 2017	53	Miscellaneous manufacturing overhead	15
Work-in-process inventory, Dec. 31, 2017	5	Marketing, distribution, and customer-service costs	90
Finished-goods inventory, Jan 1, 2017	46	Direct materials purchased	88
Accounts receivable, Dec. 31, 2017	32	Direct manufacturing labor	40
Accounts payable, Jan. 1, 2017	45	Plant supplies used	9
Direct materials inventory, Jan. 1, 2017	34	Property taxes on plant	2

Required:

Prepare an income statement and a supporting schedule of cost of goods manufactured. (For additional questions regarding these facts, see the next problem.)

SOLUTION

(25–30 min.) **Income statement and schedule of cost of goods manufactured.**

Schaeffer Corporation
Income Statement
for the Year Ended December 31, 2017
(in millions)

Revenues		$359
Cost of goods sold		
Beginning finished goods, Jan. 1, 2017	$ 46	
Cost of goods manufactured (below)	224	
Cost of goods available for sale	270	
Ending finished goods, Dec. 31, 2014	16	254
Gross margin		105
Marketing, distribution, and customer-service costs		90
Operating income (loss)		$ 15

Schaeffer Corporation
Schedule of Cost of Goods Manufactured
for the Year Ended December 31, 2017
(in millions)

Direct material costs		
Beginning inventory, Jan. 1, 2017	$ 34	
Direct materials purchased	88	
Cost of direct materials available for use	122	
Ending inventory, Dec. 31, 2017	4	
Direct materials used		$118
Direct manufacturing labor costs		40
Indirect manufacturing costs		
Plant supplies used	9	
Property taxes on plant	2	
Plant utilities	8	
Indirect manufacturing labor costs	21	
Depreciation—plant and equipment	6	
Miscellaneous manufacturing overhead costs	15	61
Manufacturing costs incurred during 2017		219
Add beginning work-in-process inventory, Jan. 1, 2017		10
Total manufacturing costs to account for		229
Deduct ending work-in-process inventory, Dec. 31, 2017		5
Cost of goods manufactured (to income statement)		$224

2-42 Terminology, interpretation of statements (continuation of 2-41).

Required:

1. Calculate total prime costs and total conversion costs.
2. Calculate total inventoriable costs and period costs.
3. Design costs and R&D costs are not considered product costs for financial statement purposes. When might some of these costs be regarded as product costs? Give an example.
4. Suppose that both the direct materials used and the depreciation on plant and equipment are related to the manufacture of 2 million units of product. Determine the unit cost for the direct materials assigned to those units and the unit cost for depreciation on plant and equipment. Assume that yearly depreciation is computed on a straight-line basis.
5. Assume that the implied cost-behavior patterns in requirement 4 persist. That is, direct material costs behave as a variable cost and depreciation on plant and equipment behaves as a fixed cost. Repeat the computations in requirement 4, assuming that the costs are being predicted for the manufacture of 3 million units of product. Determine the effect on total costs.
6. Assume that depreciation on the equipment (but not the plant) is computed based on the number of units produced because the equipment deteriorates with units produced. The depreciation rate on equipment is $1.50 per unit. Calculate the depreciation on equipment assuming (a) 2 million units of product are produced and (b) 3 million units of product are produced.

SOLUTION

(15–20 min.) **Terminology, interpretation of statements (continuation of 2-36)**.

1.

Direct materials used	$118 million
Direct manufacturing labor costs	40 million
Prime costs	$158 million
Direct manufacturing labor costs	$ 40 million
Indirect manufacturing costs	61 million
Conversion costs	$101 million

2. Inventoriable costs (in millions) for Year 2017

Plant utilities	$ 8
Indirect manufacturing labor	21
Depreciation—plant and equipment	6
Miscellaneous manufacturing overhead	15
Direct materials used	118
Direct manufacturing labor	40
Plant supplies used	9
Property taxes on plant	2
Total inventoriable costs	$219

Period costs (in millions) for Year 2017

Marketing, distribution, and customer-service costs	$ 90

3. Design costs and R&D costs may be regarded as product costs in case of contracting with a governmental agency. For example, if the Air Force negotiated to contract with Lockheed to build a new type of supersonic fighter plane, design costs and R&D costs may be included in the contract as product costs.

4. Direct materials used = $118,000,000 ÷ 2,000,000 units = $59 per unit
Depreciation on plant and equipment = $6,000,000 ÷ 2,000,000 units = $3 per unit

5. Direct materials unit cost would be unchanged at $59. Depreciation unit cost would be $6,000,000 ÷ 3,000,000 = $2 per unit. Total direct materials costs would increase by 50% to $177,000,000 ($59 per unit × 3,000,000 units). Total depreciation cost of $6,000,000 would remain unchanged.

6. In this case, equipment depreciation is a variable cost in relation to the unit output. The amount of equipment depreciation will change in direct proportion to the number of units produced.
(a) Depreciation will be $3 million ($1.50 × 2 million) when 2 million units are produced.
(b) Depreciation will be $4.5 million ($1.50 × 3 million) when 3 million units are produced.

2-43 Labor cost, overtime, and idle time. David Letterman works in the production department of Northeast Plastics (NEP) as a machine operator. David, a long-time employee of NEP, is paid on an hourly basis at a rate of $24 per hour. David works five 8-hour shifts per week Monday–Friday (40 hours). Any time David works over and above these 40 hours is considered overtime for which he is paid at a rate of time and a half ($36 per hour). If the overtime falls on weekends, David is paid at a rate of double time ($48 per hour). David is also paid an additional $24 per hour for any holidays worked, even if it is part of his regular 40 hours. David is paid his regular wages even if the machines are down (not operating) due to regular machine maintenance, slow order periods, or unexpected mechanical problems. These hours are considered "idle time."

During December David worked the following hours:

	Hours worked including machine downtime	**Machine downtime**
Week 1	50	6.0
Week 2	44	2.0
Week 3	46	4.0
Week 4	45	3.5

Included in the total hours worked are two company holidays (Christmas Eve and Christmas Day) during Week 4. All overtime worked by David was Monday–Friday, except for the hours worked in Week 3; all of the Week 3 overtime hours were worked on a Saturday.

Required:

1. Calculate (a) direct manufacturing labor, (b) idle time, (c) overtime and holiday premium, and (d) total earnings for David in December.
2. Is idle time and overtime premium a direct or indirect cost of the products that David worked on in December? Explain.

SOLUTION

(20 min.) **Labor cost, overtime and idle time.**

1.(a) Total cost of hours worked at regular rates	
50 hours × $24 per hour	$1,200
44 hours × $24 per hour	1,056
46 hours × $24 per hour	1,104
45 hours × $24 per hour	1,080
	4,440
Minus idle time	
(6.0 hours × $24 per hour)	144
(2.0 hours × $24 per hour)	48
(4.0 hours × $24 per hour)	96
(3.5 hours × $24 per hour)	84
Total idle time	372
Direct manufacturing labor costs	$4,068
(b) Idle time = 15.5 hours × $24 per hour =	$ 372
(c) Overtime and holiday premium.	
Week 1: Overtime (50 – 40) hours × Premium, $12 per hour	$ 120
Week 2: Overtime (44 – 40) hours × Premium, $12 per hour	48
Week 3: Overtime (46 – 40) hours × Premium, $24 per hour	144
Week 4: Overtime (45 – 40) hours × Premium, $12 per hour	60
Week 4: Holiday 8 hours × 2 days × Premium, $24 per hour	384
Total overtime and holiday premium	$ 756
(d) Total earnings in December	
Direct manufacturing labor costs	$4,068
Idle time	372
Overtime and holiday premium	756
Total earnings	$5,196

2. Idle time caused by regular machine maintenance, slow order periods, or unexpected mechanical problems is an indirect cost of the product because it is not related to a specific product.

Overtime premium caused by the heavy overall volume of work is also an indirect cost because it is not related to a particular job that happened to be worked on during the overtime

hours. If, however, the overtime is the result of a demanding "rush job," the overtime premium is a direct cost of that job.

2-44 Missing records, computing inventory costs. Ron Howard recently took over as the controller of Johnson Brothers Manufacturing. Last month, the previous controller left the company with little notice and left the accounting records in disarray. Ron needs the ending inventory balances to report first-quarter numbers.

For the previous month (March 2017) Ron was able to piece together the following information:

Direct materials purchased	$120,000
Work-in-process inventory, 3/1/2017	$ 35,000
Direct materials inventory, 3/1/2017	$ 12,500
Finished-goods inventory, 3/1/2017	$160,000
Conversion costs	$330,000
Total manufacturing costs added during the period	$420,000
Cost of goods manufactured	4 times direct materials used
Gross margin as a percentage of revenues	20%
Revenues	$518,750

Calculate the cost of:

Required:
1. Finished-goods inventory, 3/31/2017
2. Work-in-process inventory, 3/31/2017
3. Direct materials inventory, 3/31/2017

SOLUTION
(30–40 min.) **Missing records, computing inventory costs.**

1. Finished goods inventory, 3/31/2017 = $105,000
2. Work-in-process inventory, 3/31/2017 = $95,000
3. Direct materials inventory, 3/31/2017 = $42,500

This problem is not as easy as it first appears. These answers are obtained by working from the known figures to the unknowns in the schedule below. The basic relationships between categories of costs are:

Manufacturing costs added during the period (given)	$420,000
Conversion costs (given)	$330,000
Direct materials used = Manufacturing costs added – Conversion costs	

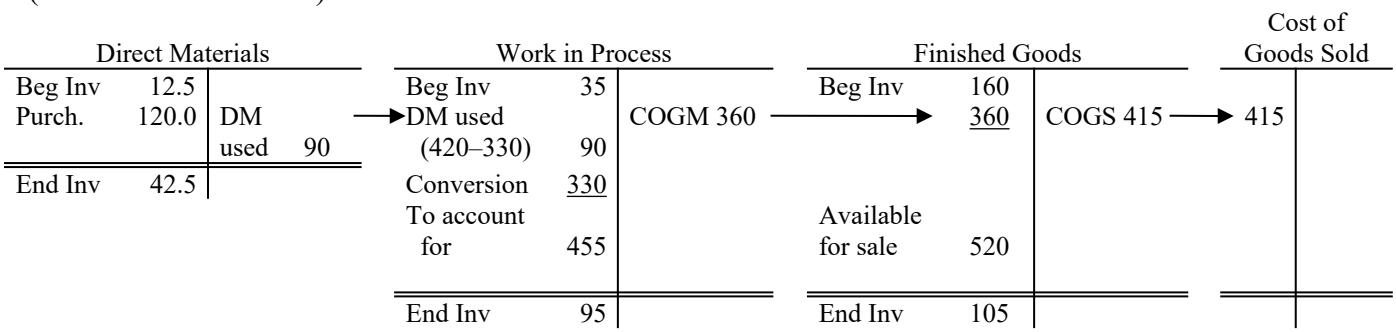
$= \$420{,}000 - \$330{,}000 = \$90{,}000$

Cost of goods manufactured = Direct Materials Used × 4
$= \$90{,}000 \times 4 = \$360{,}000$

Schedule of Computations

Direct materials inventory, 3/1/2017 (given)		$ 12,500
Direct materials purchased (given)		120,000
Direct materials available for use		132,500
Direct materials inventory, 3/31/2017	3 =	42,500
Direct materials used		90,000
Conversion costs (given)		330,000
Manufacturing costs added during the period (given)		420,000
Add work in process inventory, 3/1/2017 (given)		35,000
Manufacturing costs to account for		455,000
Deduct work in process inventory, 3/31/2017	2 =	95,000
Cost of goods manufactured (4 × $90,000)		360,000
Add finished goods inventory, 3/1/2017		160,000
Cost of goods available for sale		520,000
Deduct finished goods inventory, 3/31/2017	1 =	105,000
Cost of goods sold (80% × $518,750)		$415,000

Some instructors may wish to place the key amounts in a Work in Process T-account. This problem can be used to introduce students to the flow of costs through the general ledger (amounts in thousands):



2-45 Comprehensive problem on unit costs, product costs. Atlanta Office Equipment manufactures and sells metal shelving. It began operations on January 1, 2017. Costs incurred for 2017 are as follows (V stands for variable; F stands for fixed):

Direct materials used	$140,000 V
Direct manufacturing labor costs	22,000 V
Plant energy costs	5,000 V
Indirect manufacturing labor costs	18,000 V
Indirect manufacturing labor costs	14,000 F
Other indirect manufacturing costs	8,000 V

Other indirect manufacturing costs	26,000 F
Marketing, distribution, and customer-service costs	120,000 V
Marketing, distribution, and customer-service costs	43,000 F
Administrative costs	54,000 F

Variable manufacturing costs are variable with respect to units produced. Variable marketing, distribution, and customer-service costs are variable with respect to units sold.

Inventory data are as follows:

	Beginning: January 1, 2017	Ending: December 31, 2017
Direct materials	0 lb	2,300 lbs
Work in process	0 units	0 units
Finished goods	0 units	? units

Production in 2017 was 100,000 units. Two pounds of direct materials are used to make one unit of finished product.

Revenues in 2017 were $473,200. The selling price per unit and the purchase price per pound of direct materials were stable throughout the year. The company's ending inventory of finished goods is carried at the average unit manufacturing cost for 2017. Finished-goods inventory at December 31, 2017, was $20,970.

Required:

1. Calculate direct materials inventory, total cost, December 31, 2017.
2. Calculate finished-goods inventory, total units, December 31, 2017.
3. Calculate selling price in 2017.
4. Calculate operating income for 2017.

SOLUTION

(30 min.) **Comprehensive problem on unit costs, product costs.**

1. If 2 pounds of direct materials are used to make each unit of finished product, 100,000 units × 2 lbs., or 200,000 lbs. were used at $0.70 per pound of direct materials ($140,000 ÷ 200,000 lbs.). (The direct material costs of $140,000 are direct materials used, not purchased.) Therefore, the ending inventory of direct materials is 2,300 lbs. × $0.70 = $1,610.

2.

	Manufacturing Costs for 100,000 units		
	Variable	Fixed	Total
Direct materials costs	$140,000	$ –	$140,000

Direct manufacturing labor costs	22,000	–	22,000
Plant energy costs	5,000	–	5,000
Indirect manufacturing labor costs	18,000	14,000	32,000
Other indirect manufacturing costs	8,000	26,000	34,000
Cost of goods manufactured	$193,000	$40,000	$233,000

Average unit manufacturing cost: $233,000 ÷ 100,000 units = $2.33 per unit

Finished goods inventory in units: $= \frac{\$20{,}970 \text{ (given)}}{\$2.33 \text{ per unit}}$ = 9,000 units

3. Units sold in 2017 = Beginning inventory + Production – Ending inventory
= 0 + 100,000 –9,000 = 91,000 units
Selling price in 2017 = $473,200 ÷ 91,000
= $5.20 per unit

4.

Atlanta Office Equipment
Income Statement
Year Ended December 31, 2017
(in thousands)

Revenues (91,000 units sold × $5.20)		$473,200
Cost of units sold:		
Beginning finished goods, Jan. 1, 2017	$ 0	
Cost of goods manufactured	233,000	
Cost of goods available for sale	233,000	
Ending finished goods, Dec. 31, 2017	20,970	212,030
Gross margin		261,170
Operating costs:		
Marketing, distribution, and customer-service costs ($120,000 + $43,000)	163,000	
Administrative costs	54,000	217,000
Operating income		$ 44,170

Note: Although not required, the full set of unit variable costs is:

Direct materials cost ($0.70 × 2 lbs.)	$1.40	
Direct manufacturing labor cost ($22,000 ÷ 100,000)	0.22	
Plant energy cost ($5,000 ÷ 100,000)	0.05	= $1.93 per unit manufactured
Indirect manufacturing labor cost ($18,000 ÷ 100,000)	0.18	
Other indirect manufacturing cost ($8,000 ÷ 100,000)	0.08	
Marketing, distribution, and customer-service costs ($120,000 ÷ 91,000)	$1.32	per unit sold

2-46 Different meanings of product costs. There are at least 3 different purposes for which we measure product costs. They are (1) pricing and product mix decisions, (2) determining the appropriate charge for a government contract, and (3) for preparing financial statements for external reporting following Generally Accepted Accounting Principles. On the following table, indicate whether the indicated cost would be included or excluded for the particular purpose. If your answer is not definitive (include or exclude), provide a short explanation of why.

Type of Cost	Purpose: Pricing/Product Mix	Purpose: Government Contract	Purpose: Financial Statement (using GAAP)
Direct Material			
Direct Manufacturing Labor			
Manufacturing Overhead			
Marketing Costs			
Distribution Expense			
Customer Service			

SOLUTION

(15 min.) **Different meanings of product costs**

Type of Cost	Purpose: Pricing/Product Mix	Purpose: Government Contract	Purpose: Financial Statement (using GAAP)
Direct materials	Include	Include	Include

Direct manufacturing labor	Include	Include	Include
Manufacturing overhead	Include	Include	Include
Marketing costs	Include	Exclude*	Exclude
Distribution expense	Include	Exclude*	Exclude
Customer service	Include	Exclude*	Exclude

* – These costs are generally excluded but may be included if specifically required for a specific contract.

2-47 Cost classification; ethics. Paul Howard, the new plant manager of Garden Scapes Manufacturing Plant Number 7, has just reviewed a draft of his year-end financial statements. Howard receives a year-end bonus of 11.5% of the plant's operating income before tax. The year-end income statement provided by the plant's controller was disappointing to say the least. After reviewing the numbers, Howard demanded that his controller go back and "work the numbers" again. Howard insisted that if he didn't see a better operating income number the next time around he would be forced to look for a new controller.

Garden Scapes Manufacturing classifies all costs directly related to the manufacturing of its product as product costs. These costs are inventoried and later expensed as costs of goods sold when the product is sold. All other expenses, including finished-goods warehousing costs of $3,640,000, are classified as period expenses. Howard had suggested that warehousing costs be included as product costs because they are "definitely related to our product." The company produced 260,000 units during the period and sold 240,000 units.

As the controller reworked the numbers, he discovered that if he included warehousing costs as product costs, he could improve operating income by $280,000. He was also sure these new numbers would make Howard happy.

Required:

1. **S**how numerically how operating income would improve by $280,000 just by classifying the preceding costs as product costs instead of period expenses.
2. Is Howard correct in his justification that these costs are "definitely related to our product"?
3. By how much will Howard profit personally if the controller makes the adjustments in requirement 1?
4. What should the plant controller do?

SOLUTION

(20-25 min.) **Classification of costs; ethics.**

1. $$\text{Warehousing costs per unit} = \frac{\text{Warehousing costs}}{\text{Units produced}}$$
$$= \frac{\$3,640,000}{260,000 \text{ units}} = \$14 \text{ per unit.}$$

If the $3,640,000 is treated as period costs, the entire amount would be expensed during the year as incurred. If it is treated as a product cost, it would be "unitized" at $14 per unit and expensed as each unit of the product is sold. Therefore, if only 240,000 of the 260,000 units are sold, only $3,360,000 ($14 per unit × 240,000 units) of the $3,640,000 would be expensed in the current period. The remaining $3,640,000 – $3,360,000 = $280,000 would be inventoried on the balance sheet until a later period when the units are sold. The value of finished goods inventory can also be calculated directly to be $280,000 ($14 per unit × 20,000 units).

2. No. With respect to classifying costs as product or period costs, this determination is made by GAAP. It is not something that can be justified by the plant manager or plant controller. Even though these costs are in fact related to the product, they are not direct costs of manufacturing the product. GAAP requires that research and development, as well as all costs related to warehousing and distribution of goods, be classified as period costs and expensed in the period they are incurred.

3. Paul Howard would improve his personal bonus and take-home pay by
11.5% × $280,000 = $32,200

4. The controller should not reclassify costs as product costs just so the plant can reap short-term benefits, including the increase in Howard's personal year-end bonus. Research and development costs, costs related to the shipping of finished goods, and costs related to warehousing finished goods are all period costs under GAAP and must be treated as such. Changing this classification on Garden Scapes Manufacturing's financial statements would violate GAAP and would likely be considered fraudulent. The idea of costs being classified as product costs versus period costs is to properly reflect on the income statement those costs that are directly related to manufacturing (costs incurred to transform one asset, direct materials into another asset, finished goods) and to properly reflect on the balance sheet those costs that will provide a future benefit (inventory). The controller should not be intimidated by Howard. Howard stands to personally benefit from the reclassification of costs. The controller should insist that he must adhere to GAAP so as not to submit fraudulent financial statements to corporate headquarters. If Howard insists on the reclassification, the controller should raise the issue with the chief financial officer after informing Howard that he is doing so. If, after taking all these steps, there is continued pressure to modify the numbers, the controller should consider resigning from the company rather than engage in unethical behavior.

2-48 Finding unknown amounts. An auditor for the Internal Revenue Service is trying to reconstruct some partially destroyed records of two taxpayers. For each of the cases in the accompanying list, find the unknowns designated by the letters A and B for Case 1 and C and D for Case 2.

	Case 1	Case 2
	(in thousands)	
Accounts receivable, 12/31	$ 8,000	$ 3,150
Cost of goods sold	A	31,800
Accounts payable, 1/1	4,500	2,550
Accounts payable, 12/31	2,700	2,250
Finished-goods inventory, 12/31	B	7,000
Gross margin	18,000	C
Work-in-process inventory, 1/1	3,000	1,500
Work-in-process inventory, 12/31	0	4,700
Finished-goods inventory, 1/1	5,000	7,000
Direct materials used	13,000	19,000
Direct manufacturing labor	4,500	8,500
Manufacturing overhead costs	9,500	D
Purchases of direct materials	13,500	10,500
Revenues	52,000	52,300
Accounts receivable, 1/1	3,000	2,100

SOLUTION

(20–25 min.) **Finding unknown amounts.**

Let G = given, I = inferred

Step 1: Use gross margin formula	Case 1		Case 2	
Revenues	$52,000	G	$52,300	G
Cost of goods sold	**A** 34,000	I	31,800	G
Gross margin	$18,000	G	**C** $20,500	I

Step 2: Use schedule of cost of goods manufactured formula				
Direct materials used	$13,000	G	$19,000	G
Direct manufacturing labor costs	4,500	G	8,500	G
Indirect manufacturing costs	9,500	G	**D** 7,500	I
Manufacturing costs incurred	27,000	I	35,000	I
Add beginning work in process, 1/1	3,000	G	1,500	G
Total manufacturing costs to account for	30,000	I	36,500	I
Deduct ending work in process, 12/31	0	G	4,700	G
Cost of goods manufactured	$30,000	I	$31,800	I

Step 3: Use cost of goods sold formula

Beginning finished goods inventory, 1/1		$ 5,000	G	$ 7,000 G
Cost of goods manufactured		30,000	I	31,800 I
Cost of goods available for sale		35,000	I	38,800 I
Ending finished goods inventory, 12/31	**B**	1,000	I	7,000 G
Cost of goods sold		$34,000	I	$31,800 G

For case 1, do steps 1, 2, and 3 in order.
For case 2, do steps 1, 3, and then 2.

Try It 2-1 Solution

The following table shows the total costs of gasoline and insurance and the cost per mile if the truck is driven (a) 20,000 miles and (b) 30,000 miles.

Number of Miles Driven	**Variable Gasoline Costs**	**Fixed Insurance Costs**	**Total Costs**	**Cost per Mile**
(1)	**(2) = $0.15 × (1)**	**(3)**	**(4) = (2) + (3)**	**(5) = (4) ÷ (1)**
20,000	$3,000	$6,000	$ 9,000	$0.45
30,000	4,500	6,000	10,500	0.35

Try It 2-2 Solution

We first calculate the cost of direct materials used and then total manufacturing costs incurred in 2017.

The cost of direct materials used is:

Beginning inventory of direct materials, January 1, 2017	$12,000
+ Purchases of direct materials in 2017	85,000
− Ending inventory of direct materials, December 31, 2017	7,000
= Direct materials used in 2017	$90,000

Total manufacturing costs incurred refers to all direct manufacturing costs and manufacturing overhead costs incurred during 2017 for all goods worked on during the year. Diana Corporation classifies its manufacturing costs into the three categories described earlier.

(i) Direct materials used in 2017	$ 90,000
(ii) Direct manufacturing labor costs in 2017	30,000
(iii) Manufacturing overhead costs in 2017	40,000
Total manufacturing costs incurred in 2017	$160,000

Try It 2-3 Solution

(a) *Cost of goods manufactured* refers to the cost of goods brought to completion, whether they were started before or during the current accounting period. Some of the manufacturing costs incurred during 2017 are held back as the cost of the ending work-in-process inventory.

The cost of goods manufactured in 2017 for Diana Corporation is calculated as follows:

Beginning work-in-process inventory, January 1, 2017	$ 9,000
+ Total manufacturing costs incurred in 2017	160,000
= Total manufacturing costs to account for	169,000
– Ending work-in-process inventory, December 31, 2017	8,000
= Cost of goods manufactured in 2017	$161,000

(b) The *cost of goods sold* is the cost of finished goods inventory sold to customers during the current accounting period. Cost of goods sold is an expense that is matched against revenues. The cost of goods sold in 2017 for Diana Corporation is calculated as follows:

Beginning inventory of finished goods, January 1, 2017	$ 15,000
+ Cost of goods manufactured in 2017	161,000
– Ending inventory of finished goods, December 31, 2017	21,000
= Cost of goods sold in 2017	$155,000