Pearson

Chapter 2

Different costs for different purposes

Assignment material

Questions

2.1 Define a cost object and give three examples.

Solution:
A *cost object* is anything for which a 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.

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

2.3 Why do managers consider direct costs to be more accurate than indirect costs?

Solution:
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.

Solution:
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.

Solution:
A *variable cost* changes in total in proportion to changes in the related level of total activity or volume. An example is a sales commission that is 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.

Solution:
A *cost driver* is a variable, such as the level of activity or volume, that causally affects 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?

Solution:
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.

Solution:
Unit costs are 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, retail and service sector companies differ from each other.

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

Retail-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?

Solution:
Manufacturing companies typically 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 Define the following: direct materials costs, direct manufacturing labour costs, manufacturing overhead costs, prime costs and conversion costs.

Solution:
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 labour costs include the compensation of all manufacturing labour 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. Also called *indirect manufacturing costs* and *factory overhead costs*.

Prime costs are all direct manufacturing costs (direct materials cost and direct manufacturing labour costs).

Conversion costs are all manufacturing costs other than direct material costs. It represents the cost of converting raw into finished goods.

2.12 Distinguish between inventoriable costs and period costs. Do service sector companies have inventoriable costs? Explain.

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

No. Service sector companies have no inventories of tangible products for sale and, hence, no inventoriable costs.

2.13 Describe the overtime premium and idle time categories of indirect labour.

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

Idle time is a subclassification of indirect labour 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 two different purposes for calculating product costs.

Solution:

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,
- preparing financial statements for external reporting under Australian Accounting Standards.

2.15 What are three common features of cost accounting and activity management?

Solution:
Three common features of cost accounting and activity management are:

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

Exercises

2.16 Calculating and interpreting manufacturing unit costs

Green Office Products (GOP) produces three different paper products at its manufacturing 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 labour and manufacturing overhead costs. Total manufacturing overhead costs of the plant in July 2018 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 labour costs of each line. Summary data (in millions) for July 2018 are as follows:

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

Required

1. Calculate the manufacturing cost per unit for each product produced in July 2018.
2. Suppose that, in August 2018, production was 150 million units of Supreme, 190 million units of Deluxe and 220 million units of Regular. Why might the July 2018 information on manufacturing cost per unit be misleading when predicting total manufacturing costs in August 2018?

Solution: (15 min.)

Calculating and interpreting manufacturing unit costs

1.

	(in millions)			
	Supreme	**Deluxe**	**Regular**	**Total**
Direct materials costs	$89.00	$57.00	$60.00	$206.00
Direct manufacturing labour costs	$16.00	$26.00	$8.00	$50.00
Manufacturing overhead costs	$48.00	$78.00	$24.00	$150.00
Total manufacturing costs	$125.00	$150.00	$140.00	$406.00

Fixed costs allocated at a rate of \$15M ÷ \$50M (direct mfg. labour costs) equal to \$0.30 per direct manufacturing labour 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	125	150	140	
Cost per unit (total mfg. costs ÷ units produced)	\$1.2240	\$1.0733	\$0.6571	
Variable mfg. cost per unit (variable mfg. costs ÷ units produced)	\$1.1856	\$1.0213	\$0.6400	

2.

	(in millions)			
	Supreme	**Deluxe**	**Regular**	**Total**
Based on total mfg. cost per unit: (\$1.2240×150; \$1.0733×190; \$0.6571×220)	\$183.60	\$203.90	\$144.56	\$532.09
Correct total mfg. costs based on variable mfg. costs plus fixed costs equal:				
Variable costs (\$1.1856×150; \$1.0213×190; \$0.64 × 220)	\$177.84	\$194.05	\$140.80	\$152.69
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 2018 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 yield incorrect estimates of total costs of \$532.09 million in August 2018 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.

2.17 Direct, indirect, fixed and variable costs

Best Tyres manufactures two types of tyre which it sells as wholesale products to various specialty retail auto supply stores. Each tyre 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 tyre. The second step involves the forming of each tyre, where the materials are layered and shaped to form the tyre. 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 below. For each cost below, indicate whether it is a direct variable, direct fixed, indirect variable or indirect fixed cost, assuming that 'units of production of each kind of tyre' 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 labourers	Machinist (running the forming machines)

2. If the cost object were 'Mixing Department' rather than units of production of each kind of tyre, which costs above would now be direct instead of indirect costs?

Solution: (15 min.)

Direct, indirect, fixed and variable costs

1.

Costs:	
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 labourers	direct, variable (or fixed if the labourers are under a union contract)
Mixing department manager	indirect, fixed
Material handlers in each department	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 in each department	indirect, probably fixed, if salaried, but may be variable if paid only for time worked and maintenance increases with increased production

Maintenance supplies for factory	indirect, variable
Cleaning supplies for factory	indirect, most likely fixed because the custodians probably do the same amount of cleaning every night
Machinist (running the forming machines)	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.

2.18 Classification of costs, service sector

People Points is a marketing research firm that organises 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 People Points. Each specialist is paid a fixed fee to conduct a minimum number of sessions and a per-session fee of $2200. A People Points staff member attends each session to ensure that all the logistical aspects run smoothly.

Required

Classify each of the following cost items (**A–H**) as:

a. direct or indirect (D or I) costs with respect to each individual focus group

b. variable or fixed (V or F) costs with respect to how the total costs of People Points 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 People Points to *Consumer Reports* magazine		
C	Telephone calls made by People Points staff member to confirm that individuals will attend a focus group session (records of individual calls are not kept)		
D	Meals provided to participants in each focus group		
E	Lease payment by People Points for corporate office		
F	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)		
G	Fuel costs of People Points staff for company-owned vehicles (staff members submit monthly bills)		
H	Fee paid to focus group leader to conduct 20 focus groups per year on new products		

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	Payment to individuals in each focus group to provide comments on new products	D	V
B	Annual subscription of People Points to *Consumer Reports* magazine	I	F
C	Telephone calls made by People Points staff member to confirm that individuals will attend a focus group session (records of individual calls are not kept)	I	V[a]
D	Meals provided to participants in each focus group	D	V
E	Lease payment by People Points for corporate office	I	F
F	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)	D	F
G	Fuel costs of People Points staff for company-owned vehicles (staff members submit monthly bills)	I	V[b]
H	Fee paid to focus group leader to conduct 20 focus groups per year on new products	I	F

[a]Some students will note that phone call costs are variable when each call has a separate charge. It may be a fixed cost if People Points has a flat monthly charge for a line, irrespective of the amount of usage.
[b]Fuel 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.

2.19 Classification of costs, retail sector

Home Entertainment Online (HEO) operates an online streaming service. The company offers both a movie and a music subscription service. HEO reports revenues for the movie service separately from the music service.

Required

Classify each of the following cost items (**A–G**) as:

a. direct or indirect (D or I) costs with respect to the total number of movie subscriptions sold

b. variable or fixed (V or F) costs with respect to how the total costs of the movie service change as the total number of subscriptions 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 subscriptions 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	Electricity costs of HEO office (bill covers entire office)		
B	Costs of licence fees paid to filmmakers for access to their films for five years		
C	Subscription to *Movie Trends* website for all staff for one year		
D	Leasing of computer software used for financial budgeting at HEO office		
E	Cost of popcorn voucher to be redeemed at a supermarket, provided free to all customers of HEO		
F	Insurance policy for HEO office		
G	Costs of royalty fees paid to a filmmaker who wishes to be paid per subscriber		

Solution: (15–20 min.)

Classification of costs, retail sector

Cost object: Videos sold in video section of store
Cost variability: With respect to changes in the number of videos 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	Electricity costs of HEO office (bill covers entire office)	I	F
B	Costs of licence fees paid to filmmakers for access to their films for five years	D	V
C	Subscription to *Movie Trends* website for all staff for one year	D	F
D	Leasing of computer software used for financial budgeting at HEO office	I	F
E	Cost of popcorn voucher to be redeemed at a supermarket, provided free to all customers of HEO	I	V
F	Insurance policy for HEO office	I	F
G	Costs of royalty fees paid to a filmmaker who wishes to be paid per subscriber	D	V

2.20 Classification of costs, manufacturing sector

A vehicle assembly plant assembles two types of vehicle (dirt bikes and motorised buggies). Separate assembly lines are used for each type of vehicle.

Required

Classify each of the following cost items (**A–G**) as:

- **a.** direct or indirect (D or I) costs with respect to the total number of vehicles assembled (dirt bikes and motorised buggies)
- **b.** variable or fixed (V or F) costs with respect to how the total costs of the plant change as the total number of vehicles of each type 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 vehicles of each type 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 tyres used on motorised buggies		
B	Salary of public relations manager for the plant		
C	Salary of engineer who monitors design changes on the motorised buggies		
D	Freight costs of dirt bike engines shipped from overseas		
E	Electricity costs for the whole plant (single bill covers entire plant)		
F	Wages paid to temporary assembly-line workers hired in periods of high production (paid on hourly basis)		
G	Annual building insurance policy cost for the whole plant		

Solution: (15–20 min.)

Classification of costs, manufacturing sector

Cost object: Type of vehicle assembled (dirt bikes or motorised buggies)
Cost variability: With respect to changes in the number of vehicles 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	Cost of tyres used on motorised buggies	D	V
B	Salary of public relations manager for the plant	I	F
C	Salary of engineer who monitors design changes on the motorised buggies	D	F
D	Freight costs of dirt bike engines shipped from overseas	D	V
E	Electricity costs for the whole plant (single bill covers entire plant)	I	V
F	Wages paid to temporary assembly-line workers hired in periods of high production (paid on hourly basis)	D	V
G	Annual building insurance policy cost for the whole plant	I	F

2.21 Variable costs, fixed costs, total costs

Anna Leigh is getting ready to open a small restaurant. She is on a tight budget and must choose between the following long-distance telephone 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 480 minutes, she still pays $22 for the month).

Required

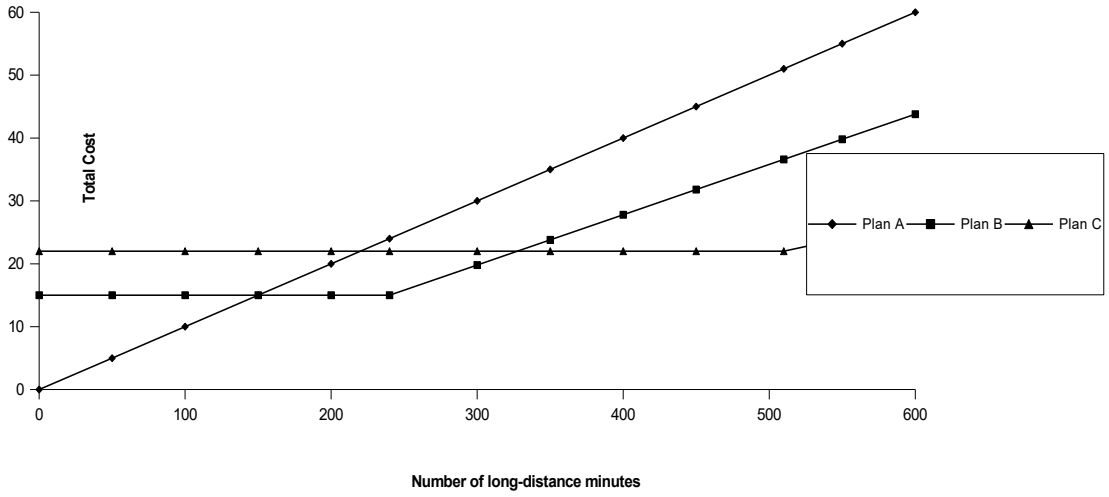
1. Draw a graph of the total monthly costs of the three plans for different levels of monthly long-distance calling.
2. Which plan should Leigh choose if she expects to make 100 minutes of long-distance calls? 240 minutes? 540 minutes?

Solution: (20 min.)

Variable costs, fixed costs, total costs

1.

Minutes per 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	19.8	22	23.8	27.8	31.8	36.6	39	43.8	47.8
Plan C ($/month)	22	22	22	22	22	22	22	22	22	22	22	22	23.5	26.5	29



2. In each region, Leigh chooses the plan that has the lowest cost. From the graph (or from calculations)[c], we can see that if Leigh 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 over 327.5 minutes, Plan C. If Leigh 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.

[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

2.22 Variable costs and fixed costs

Consolidated Motors (CM) specialises 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	\$1400 per Surfer
Tyres; each Surfer takes 5 tyres (one spare)	\$150 per tyre
Environmental license, which is charged monthly based on the number of tyres used in production:	
0–500 tyres	\$40 040
501–1000 tyres	\$65 000
More than 1000 tyres	\$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 of 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	\$1400 per Surfer
Tires	750 per Surfer
Direct manufacturing labour	800 per Surfer
Total	\$2950 per Surfer

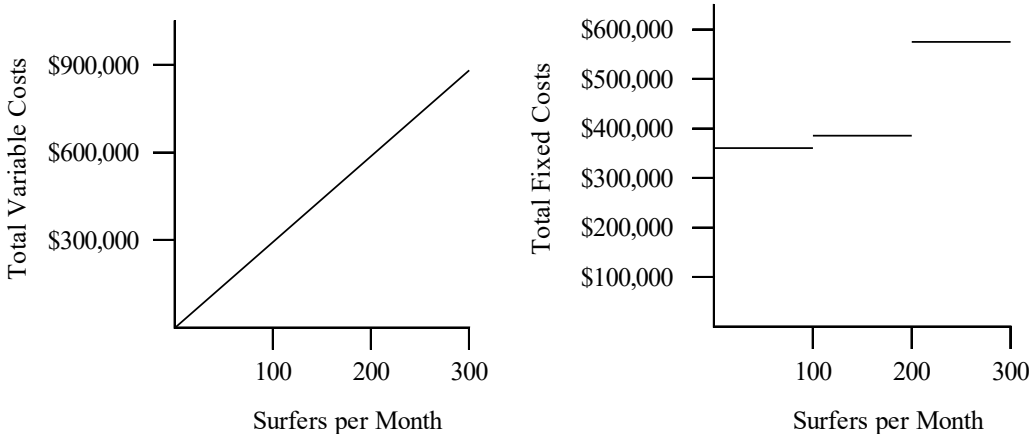
Fixed manufacturing costs per month

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 = $4588	$2 950	$7538
(b)	205	1 025	$576 870	$576 870 ÷ 205 = $2814	$2 950	$5764

The unit cost for 80 vehicles produced per month is $7538, while for 205 vehicles it is only $5764. 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.

2.23 Variable costs, fixed costs, relevant range

Lolliland manufactures rock lollies in a fully automated process. The machine that produces lollies was purchased recently and can make 5000 per month. The machine costs $6500 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 $1200 per month.

Lolliland currently makes and sells 3900 rock lollies per month. Lolliland buys just enough materials each month to make the rock lollies it needs to sell. Materials cost $0.40 per rock lolly.

Next year Lolliland 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 Lolliland's current annual relevant range of output?
2. What is Lolliland's current annual fixed manufacturing cost within the relevant range? What is the variable manufacturing cost?
3. What will Lolliland's relevant range of output be next year? How, if at all, will total fixed and variable manufacturing costs change next year? Assume that, if it needs to, Lolliland 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 5000 rock lollies per month. Therefore, the current annual relevant range of output is 0 to 5000 rock lollies × 12 months = 0 to 60 000 rock lollies.

2. Current annual fixed manufacturing costs within the relevant range are $1200 × 12 = $14 400 for rent and other overhead costs, plus $6500 ÷ 10 = $650 for depreciation, totalling $15 050.

   The variable costs, the materials, are 40 cents per rock lolly, or $18 720 ($0.40 per rock lollies × 3900 rock lolly per month × 12 months) for the year.

3. If demand changes from 3900 to 7800 rock lollies per month, or from 3900 × 12 = 46 800 to 7800 × 12 = 93 600 rock lollies per year, Lolliland will need a second machine. Assuming Lolliland buys a second machine identical to the first machine, it will increase capacity from 5000 rock lollies per month to 10 000. The annual relevant range will be between 5000 × 12 = 60 000 and 10 000 × 12 = 120 000 rock lollies.

   Assume the second machine costs $6500 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 rock lollies next year will be 90% × $0.40 = $0.36. Total variable costs equal $0.36 per rock lollies × 93 600 rock lollies = $33 696.

If Lolliland decides not to increase capacity and meet only that amount of demand for which it has available capacity (5000 rock lollies per month or 5,000 × 12 = 60 000 rock lollies per year), the variable cost per unit will be the same at $0.40 per rock lollies. Annual total variable manufacturing costs will increase to $0.40 × 5000 rock lollies per month × 12 months = $24 000. Annual total fixed manufacturing costs will remain the same, $15 050.

2.24 Cost drivers and value chain

Beyond Mobile Phones (BMP) is developing a new touch-screen smartphone to compete in the mobile phone industry. The phones will be sold at wholesale prices to phone companies, which will in turn sell them in retail stores to the final customer. BMP has undertaken the following activities in its value chain to bring its product to market. Identify the customer need. (What do smartphone users want?)

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

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

Number of smartphones shipped by BMP
Number of design changes
Number of deliveries made to mobile phone companies
Engineering hours spent on initial product design
Hours spent researching competing market brands
Customer-service hours
Number of smartphone orders processed
Number of mobile phone companies purchasing the BMP smartphone
Machine hours required to run the production equipment
Number of surveys returned and processed from competing smartphone users

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 cost drivers above to find one or more reasonable cost drivers for each of the activities in BMP's value chain.

Solution: (20 min.)

Cost drivers and value chain

1.

Identify the customer need. (What do smartphone users want?)	a. Design of products and processes
Perform market research on competing brands	a. Design of products and processes
Design a prototype of the BMP smartphone	a. Design of products and processes
Market the new design to mobile phone companies	c. Marketing
Manufacture the BMP smartphone	b. Production
Process orders from mobile phone companies	d. Distribution
Package the BMP smartphones	b. Production
Deliver the BMP smartphones to the mobile phone companies	d. Distribution
Provide online assistance to mobile phone users for use of the BMP smartphone	e. Customer service
Make design changes to the smartphone based on customer feedback	a. Design of products and processes

2.

Value Chain Category	Activity	Cost driver
Design of products and processes	Identify customer needs	Number of surveys returned and processed from competing smartphone users

	Perform market research on competing brands	Hours spent researching competing market brands
		Number of surveys returned and processed from competing smartphone users
	Design a prototype of the BMP 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 BMP smartphone	Machine hours required to run the production equipment
	Package the BMP smartphones	Number of smartphones shipped by BMP
Marketing	Market the new design to mobile phone companies	Number of mobile phone companies purchasing the BMP smartphone
Distribution	Process orders from mobile phone companies	Number of smartphone orders processed
		Number of deliveries made to mobile phone companies
	Deliver the BMP smartphones to mobile phone companies	Number of deliveries made to mobile phone companies
Customer Service	Provide online assistance to mobile phone users for use of the BMP smartphone	Number of smartphones shipped by BMP
		Customer Service hours

2.25 Cost drivers and functions

The list of representative cost drivers in the right column of the table overleaf are randomised with respect to the list of functions in the left column. That is, they do not match.

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

2.

	Function	Representative cost driver
1	Accounts payable	Number of checks written
2	Recruitment	Number of interviews conducted
3	Network maintenance	Number of computer transactions
4	Production	Number of direct labour employees
5	Purchasing	Number of different types of materials purchased
6	Warehousing	Distance of deliveries made
7	Billing	Number of credit sales transactions

2.26 Total costs and unit costs

A student association has hired a band and a caterer for a graduation party. The band will charge a fixed fee of $1000 for an evening of music, and the caterer will charge a fixed fee of $600 for the party set-up and an additional $9 per person who attends. Snacks and soft drinks will be provided by the caterer for the duration of the party. Students attending the party will pay $5 each at the door.

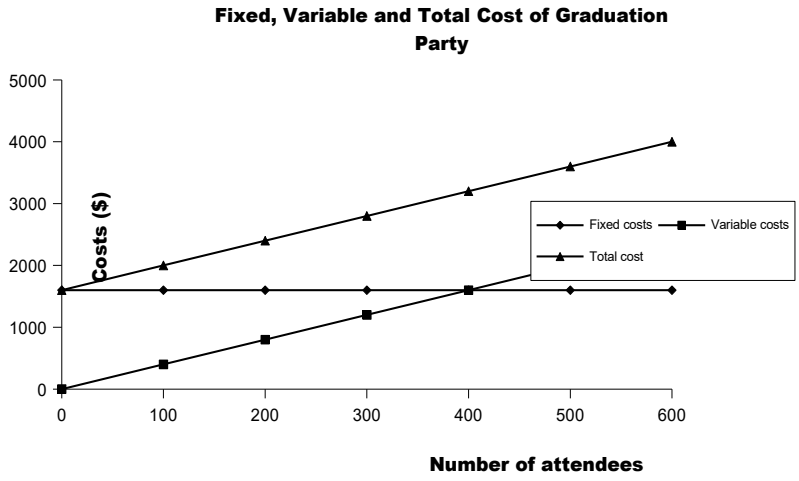
Required

1. Draw a graph depicting the fixed cost, the variable cost and the total cost to the student association for different attendance levels.
2. Suppose 100 people attend the party. What will be the total cost to the student association? What will be the cost per person?
3. Suppose 500 people attend the party. What will be the total cost to the student association and the cost per attendee?
4. Draw a graph depicting the cost per attendee for different attendance levels. As president of the student association, you want to request a grant to cover some of the party costs. Will you use the per attendee cost numbers to make your case? Why or why not?

Solution: (20 min.)

Total costs and unit costs

1.



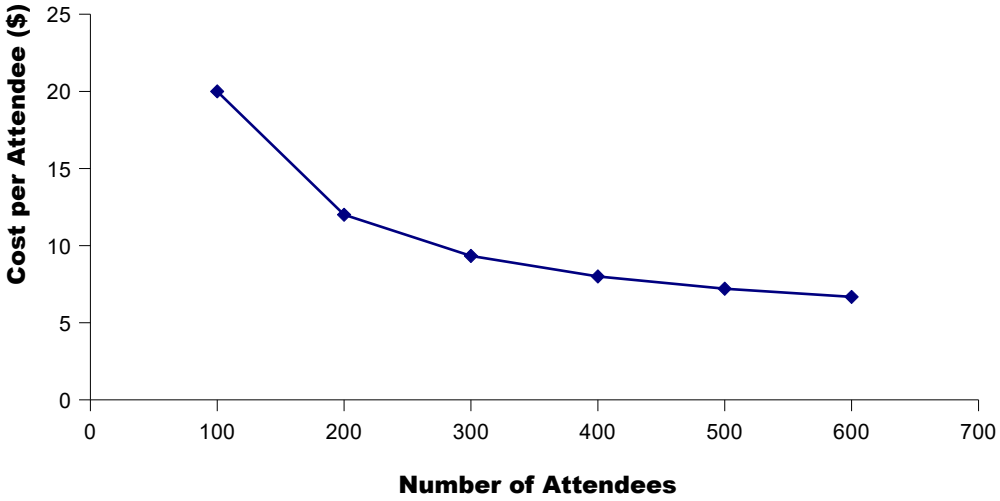
2.

Number of attendees	0	100	200	300	400	500	600
Total costs (fixed + variable)	$1600	$2000	$2400	$2800	$3200	$3600	$4000
Costs per attendee (total costs ÷ number of attendees)		$20.00	$12.00	$9.33	$8.00	$7.20	$6.67

As shown in the table above, for 100 attendees the total cost will be $2000 and the cost per attendee will be $20.

3. As shown in the table in requirement 2, for 500 attendees the total cost will be $3600 and the cost per attendee will be $7.20.

4. Using the calculations shown in the table in requirement 2, we can construct the cost-per-attendee graph shown below:



As president of the student association requesting a grant for the party, you should not use the per unit calculations to make your case. The person making the grant may assume an attendance of 500 students and use a low number like $7.20 per attendee to calculate the size of your grant. Instead, you should emphasise the fixed cost of $1600 that you will incur even if no students or very few students attend the party, and try to get a grant to cover as much of the fixed costs as possible as well as a variable portion to cover as much of the $4 net variable cost to the student association for each person attending the party.

2.27 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: $2500 per session and $35 per attendee
Catering costs (sub-contracted):
  Food: $75 per attendee
  Set-up/clean-up: $25 per attendee
  Fixed fee: $5000 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 $1000 discount per session.

Required

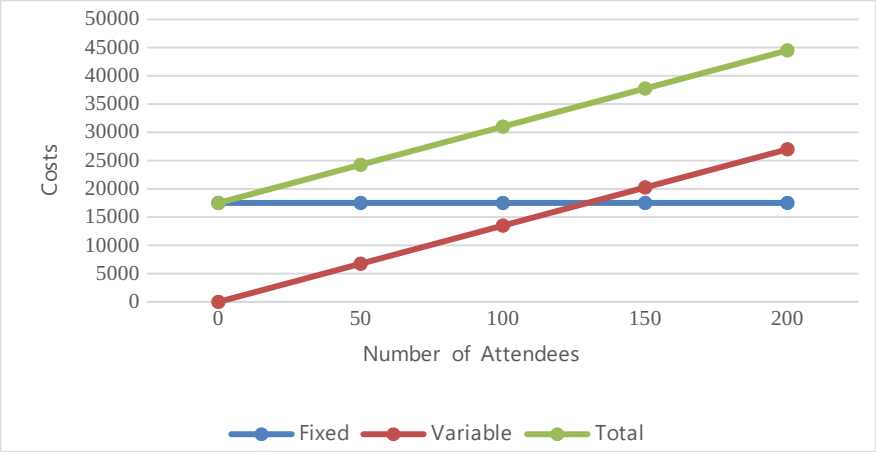
1. Draw a graph depicting fixed costs, variable costs and total costs for each training session versus the number of attendees.
2. Suppose that 100 people attend the next event. What is National Training's total net cost and the cost per attendee?
3. Suppose instead that 175 people attend. What is National 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, service setting

Number of attendees	0	50	100	175	200
Variable cost per attendee (Materials, $35 + Food, $75 + Set-up/clean-up, $25)	$135	$135	$135	$135	$135
Fixed cost per session (Trainer, $11 000 + Materials, $2500 + Fixed fee, $5000 − Offset for brochures, $1000)	17 500	17 500	17 500	17 500	17 500
Variable costs (number of attendees × variable cost per attendee)	0	6750	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 (fixed + variable)	$17 500	$24 250	$31 000	$41 125	$44 500
Cost per attendee (total costs ÷ number of attendees)		$485	$310	$235	$222.50

As shown in the table above, for 100 attendees the total cost will be $31 000, and the cost per attendee will be $310.

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 ($4000 ÷ 100 guests); for 200 attendees, it would be $20 ($4000 ÷ 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 per guest plus a $2500 mark-up on the fixed costs. At 100 attendees, profit would be $4000 {$2500 on fixed costs + ($15 × 100 attendees)}. At 175 attendees, profit would be $5125 {$2500 on fixed costs + ($15 × 175 attendees)}.

2.28 Total and unit cost, decision making

Gail'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 (non-manufacturing) costs associated with flanges are $10 000 per period and are fixed.

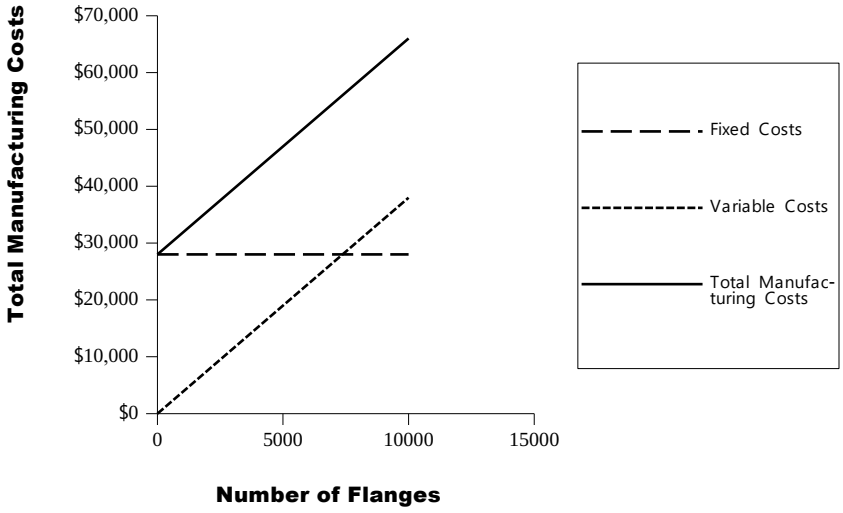
Required

1. Graph the fixed, variable and total manufacturing cost for flanges, using units (number of flanges) on the x-axis.
2. Assume that Gail's Glassworks manufactures and sells 5000 flanges this period. Their competitor, Fred's Flasks, sells flanges for $10 each. Can Gail's sell below Fred's price and still make a profit on the flanges?
3. How would your answer to requirement 2 differ if Gail'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. Graph:



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 labour for a total of $3.80 per flange.

2. The inventoriable (manufacturing) cost per unit for 5000 flanges is:
$3.80 × 5000 + $28 000 = $47 000
Average (unit) cost = $47 000 ÷ 5000 units = $9.40 per unit.

This is below Fred's selling price of $10 per flange. However, in order to make a profit, Gail's Glassworks also needs to cover the period (non-manufacturing) costs of $10 000, or $10 000 ÷ 5000 = $2 per unit.

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

Alternatively,
At Fred'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				$(7000)

Gail's Glassworks cannot sell below $10 per flange and make a profit. At Fred's price of $10 per flange, the company has an operating loss of $7000.

3. If Graham'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.

$$\text{Average (unit) inventoriable (manufacturing) cost} = \frac{\$66\,000}{10\,000 \text{ units}}$$

= $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 Graham's Glassworks will be able to sell the flanges for less than Fred and still make a profit.

Alternatively,
At Fred'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

Graham'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 (nonmanufacturing) costs remain the same regardless of the number of units produced. So, as Graham'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.

2.29 Inventoriable costs versus period costs

Each of the following cost items pertains to one of these companies: Westinghouse (a manufacturing sector company), Kmart (a retail sector company) and Google (a service sector company):

a. Cost of electronic items purchased by Kmart for sale to its customers
b. Electricity used to provide lighting for assembly-line workers at a Westinghouse refrigerator assembly plant
c. Depreciation on Google's computer equipment used to update directories of websites
d. Electricity used to provide lighting for Kmart's store aisles
e. Wages of personnel responsible for quality testing of components for Westinghouse refrigerators during the assembly process
f. Salaries of Kmart's marketing personnel planning local newspaper advertising campaigns
g. Mineral water purchased by Google for consumption by its software engineers
h. Salaries of Google's marketing personnel selling banner advertising
i. Depreciation on vehicles used to transport Westinghouse products to retail stores

Required

1. Distinguish between manufacturing sector, retail sector 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.

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

Service sector companies provide services or intangible products to their customers.

Only manufacturing and retail 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 the expenses to revenues.

3.

a. *Cost of electronic items purchased by Kmart for resale to its customers* Inventoriable cost of a retail company. It becomes part of cost of goods sold when the items are sold.

b. *Electricity used at Westinghouse assembly 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 Google's computer equipment* Period cost of a service company. Google has no inventory of goods for sale and, hence, no inventoriable cost.

d. *Electricity for Kmart's store aisles* Period cost of a retail company. It is a cost that benefits the current period and it is not traceable to goods purchased for resale.

e. *Wages of personnel responsible for quality testing of components for Westinghouse refrigerators during the assembly process* Inventoriable cost of a manufacturing company. It is part of the direct labour that is included in the manufacturing cost of a finished good.

f. *Salaries of Kmart's marketing personnel* Period cost of a retail company. It is a cost that is not traceable to 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. *Mineral water consumed by Google's engineers* Period cost of a service company. Google has no inventory of goods for sale and hence no inventoriable cost.

h. *Salaries of Google's marketing personnel* Period cost of a service company. Google has no inventory of goods for sale and, hence, no inventoriable cost.

i. *Depreciation on vehicles used to transport Westinghouse products to retail stores* It is a period cost of a manufacturing company, as these are considered distribution costs benefiting the current period and are not traceable to the manufacture of the goods.

Problems

2.30 Flow of inventoriable costs

Bio Bags' selected data (in millions) for October 2018 are presented here:

Direct materials inventory, 1 October 2018	$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 2018	1610
Work-in-process inventory, 1 October 2018	230
Cost of goods manufactured	1660
Finished goods inventory, 1 October 2018	130
Cost of goods sold	1770

Required

Calculate the following costs:

1. Direct materials inventory, 31 October 2018
2. Fixed manufacturing overhead costs for October
3. Direct manufacturing labour costs for October
4. Work-in-process inventory, 31 October 2018
5. Cost of goods available for sale in October
6. Finished goods inventory, 31 October 2018

Solution: (20 min.)

Flow of inventoriable costs

(All numbers below are in millions).

1.

Direct materials inventory 1/10/2018	$105
Direct materials purchased	365
Direct materials available for production	470
Direct materials used	385
Direct materials inventory 31/10/2018	$85

2.

Total manufacturing overhead costs	$450
Subtract: Variable manufacturing overhead costs	265
Fixed manufacturing overhead costs for October 2018	$185

3.

Total manufacturing costs	$1610
Subtract: Direct materials used (from requirement 1)	385
Total manufacturing overhead costs	450
Direct manufacturing labour costs for October 2018	$775

4.

Work-in-process inventory 1/10/2018	$230
Total manufacturing costs	1610
Work-in-process available for production	1840
Subtract: Cost of goods manufactured (moved into Finished Goods)	1660
Work-in-process inventory 31/10/2018	$180

5.

Finished goods inventory 1/10/2018	$130
Cost of goods manufactured (moved from WIP)	1660

Cost of finished goods available for sale in October 2018	$1790

6.

Finished goods available for sale in October 2018 (from requirement 5)	$1790
Subtract: Cost of goods sold	1770
Finished goods inventory 31/10/2018	$20

2.31 Calculating cost of goods purchased, cost of goods sold and income statement

The following data are for Rose Retail Outlet Store. The account balances (in thousands) are for 2018.

Marketing and advertising costs	$37 000
Retail inventory, 1 January 2018	27 000
Retail inventory, 31 December 2018	34 000
Utilities	17 000
General and administrative costs	43 000
Purchases	155 000
Miscellaneous costs	4 000
Retail freight-in	7 000
Purchase returns and allowances	6 000
Purchase discounts	6 000
Revenues	280 000

Required

1. Calculate: (a) the cost of goods purchased and (b) the cost of goods sold.
2. Prepare the income statement for 2018.

Solution: (20 min.)

Calculating cost of goods purchased, cost of goods sold and income statement

1. Calculation of cost of goods purchased and costs of goods sold is as follows:

(a) Cost of goods purchased:

Rose Retail Outlet Stores
Schedule of Cost of Goods Purchased
For the Year Ended 31 December 2018
(in thousands)

Purchases		$155 000
Add freight—in		7 000
		162 000
Deduct:		
Purchase returns and allowances	$6 000	
Purchase discounts	6 000	12 000
Cost of goods purchased		$150 000

(b) Cost of goods sold:

Rose Retail Outlet Stores
Schedule of Cost of Goods Sold
For the Year Ended 31 December 2018
(in thousands)

Beginning retail inventory 1/1/2018	$27 000
Cost of goods purchased (see above)	150 000
Cost of goods available for sale	177 000
Ending retail inventory 31/12/2018	34 000
Cost of goods sold	$143 000

2. Income statement:

Rose Retail Outlet Stores
Income Statement
Year Ended 31 December 2018
(in thousands)

Revenues		$280 000
Cost of goods sold (see above)		143 000
Gross margin		37 000
Operating costs		
Marketing and advertising costs	$37 000	
Utilities	17 000	
General and administrative costs	43 000	
Miscellaneous costs	4000	
Total operating costs		101 000
Operating income		$36 000

2.32 Cost of goods manufactured

Consider the following account balances (in thousands) for Kavanagh Ltd:

Kavanagh Ltd	Beginning of 2018	End of 2018
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 labour		22 000
Indirect manufacturing labour		17 000
Plant insurance		7 000
Depreciation—plant, building and equipment		11 000
Repairs and maintenance—plant		3 000
Marketing, distribution and customer service costs		91 000
General and administrative costs		24 000

Required

1. Prepare a schedule for the cost of goods manufactured for 2018.
2. Revenues for 2018 were $310 million. Prepare the income statement for 2018.

Solution: (30–40 min.)

Cost of goods manufactured

1.

Kavanagh Ltd
Schedule of Cost of Goods Manufactured
Year Ended 31 December 2018
(in thousands)

Direct materials costs:		
Beginning inventory, 1 January 2017	$21 000	
Purchases of direct materials	74 000	
Cost of direct materials available for use	95 000	
Ending inventory, 31 December 2017	23 000	
Direct materials used		$72 000
Direct manufacturing labour costs		22 000
Indirect manufacturing costs:		
Indirect manufacturing labour	17 000	
Plant insurance	7000	
Depreciation—plant building & equipment	11 000	

Repairs and maintenance—plant	3000	
Total indirect manufacturing costs		38 000
Manufacturing costs incurred during 2018		132 000
Add beginning work-in-process inventory, 1 January 2018		26 000
Total manufacturing costs to account for		158 000
Deduct ending work-in-process inventory, 31 December 2018		25 000
Cost of goods manufactured (to Income Statement)		$133 000

2.

Kavanagh Ltd
Income Statement
Year Ended 31 December 2018
(in thousands)

Revenues		$310 000
Cost of goods sold:		
Beginning finished goods, 1 January 2018	$13 000	
Cost of goods manufactured	133 000	
Cost of goods available for sale	146 000	
Ending finished goods, 31 December 2018	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

2.33 Income statement and schedule of cost of goods manufactured

Hancock Ltd has the following account balances (in millions):

For specific date		For year 2018	
Direct materials inventory, 1 January 2018	$15	Purchases of direct materials	$325
Work-in-process inventory, 1 January 2018	10	Direct manufacturing labour	100
Finished goods inventory, 1 January 2018	70	Depreciation—plant and equipment	80
Direct materials inventory, 31 December 2018	20	Plant supervisory salaries	5
Work-in-process inventory, 31 December 2018	5	Miscellaneous plant overhead	35
Finished goods inventory, 31 December 2018	55	Revenues	950
		Marketing, distribution and customer service costs	240
		Plant supplies used	10
		Plant utilities	30
		Indirect manufacturing labour	60

Required

Prepare an income statement and a supporting schedule of cost of goods manufactured for the financial year ended 31 December 2018. (For additional questions regarding these facts, see the next problem.)

Solution: (25–30 min.)

Income statement and schedule of cost of goods manufactured

Income statement:

Hancock Ltd
Income Statement for the Year Ended 31 December 2018
(in millions)

Revenues		$950
Cost of goods sold:		
Beginning finished goods, 1 Jan. 2018	$70	
Cost of goods manufactured (below)	645	
Cost of goods available for sale	715	
Ending finished goods, 31 Dec. 2018	55	660
Gross margin		290
Marketing, distribution, and customer-service costs		240
Operating income		$50

Cost of goods manufactured:

Hancock Ltd
Schedule of Cost of Goods Manufactured
for the Year Ended 31 December 2018
(in millions)

Direct materials costs:		
Beginning inventory, 1 Jan. 2018	$15	
Purchases of direct materials	325	
Cost of direct materials available for use	340	
Ending inventory, 31 Dec. 2018	20	
Direct materials used		$320
Direct manufacturing labour costs		100
Indirect manufacturing costs:		
Indirect manufacturing labour	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 2018		640
Add beginning work-in-process inventory, 1 Jan. 2018		10
Total manufacturing costs to account for		650
Deduct ending work-in-process, 31 Dec. 2018		5
Cost of goods manufactured		$645

2.34 Interpretation of statements (continuation of 2.33)

Required

1. How would the answer to problem 2.33 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 Hancock Ltd were a retail sector company instead of a manufacturing sector company? Using the flow of manufacturing costs outlined in Figure 2.9, describe how the wages of an assembly worker in the plant would be accounted for in this manufacturing company.
3. 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.
4. 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 calculated on a straight-line basis.
5. Assume that the implied cost behaviour patterns in requirement 4 persist. That is, direct materials costs behave as a variable cost, and plant and equipment depreciation behaves as a fixed cost. Repeat the calculations in requirement 4, assuming that the costs are being predicted for the manufacture of 1.2 million units of product. How would the total costs be affected?
6. As a management accountant, explain concisely to the chief executive officer why the unit costs differ in requirements 4 and 5.

Solution: (15–20 min.)

Interpretation of statements (continuation of 2.33)

1. The schedule in 2.33 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 2018.

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

3. The direct-indirect distinction can be resolved only with respect to a particular cost object. For example, in defence 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.

4. 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

5. 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.

6. 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.

2.35 Income statement and schedule of cost of goods manufactured

The following items (in millions) pertain to Chan Ltd:

For specific date		For year 2019	
Work-in-process inventory, 1 January 2019	\$10	Plant utilities	\$8
Direct materials inventory, 31 December 2019	4	Indirect manufacturing labour	21
Finished goods inventory, 31 December 2019	16	Depreciation—plant and equipment	6
Accounts payable, 31 December 2019	24	Revenues	359
Accounts receivable, 1 January 2019	53	Miscellaneous manufacturing overhead	15
Work-in-process inventory, 31 December 2019	5	Marketing, distribution and customer	90

		service costs	
Finished goods inventory, 1 January 2019	46	Direct materials purchased	88
Accounts receivable, 31 December 2019	32	Direct manufacturing labour	40
Accounts payable, 1 January 2019	45	Plant supplies used	9
Direct materials inventory, 1 January 2019	34	Property taxes on plant	2

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

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

Chan Ltd

Income Statement for the Year Ended 31 December 2019

(in millions)

Revenues		$359
Cost of goods sold		
Beginning finished goods, 1 Jan. 2019	$46	
Cost of goods manufactured (below)	224	
Cost of goods available for sale	270	
Ending finished goods, 31 Dec. 2019	16	254
Gross margin		105
Marketing, distribution, and customer-service costs		90
Operating income (loss)		$15

Chan Ltd

Schedule of Cost of Goods Manufactured

for the Year Ended 31 December 2019

(in millions)

Direct material costs		
Beginning inventory, 1 Jan. 2019	$34	
Direct materials purchased	88	
Cost of direct materials available for use	122	
Ending inventory, 31 Dec. 2019	4	
Direct materials used		$118
Direct manufacturing labour costs		40
Indirect manufacturing costs		
Plant supplies used	9	
Property taxes on plant	2	
Plant utilities	8	
Indirect manufacturing labour costs	21	
Depreciation—plant and equipment	6	
Miscellaneous manufacturing overhead costs	15	61
Manufacturing costs incurred during 2019		219
Add beginning work-in-process inventory, 1 Jan. 2019		10
Total manufacturing costs to account for		229
Deduct ending work-in-process inventory, 31 Dec. 2019		5
Cost of goods manufactured (to income statement)		$224

2.36 Terminology, interpretation of statements (continuation of 2.35)

For Chan Ltd (see problem 2.35):

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 calculated on a straight-line basis.
5. Assume that the implied cost behaviour patterns in requirement 4 persist. That is, direct materials costs behave as a variable cost and depreciation on plant and equipment behaves as a fixed cost. Repeat the calculations 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 calculated 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 that: (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 2.35)

1. Prime costs (in millions)

Direct materials used	$118
Direct manufacturing labour costs	40
Total prime costs	$158

Conversion costs (in millions)

Direct manufacturing labour costs	$40
Indirect manufacturing costs	61
Total conversion costs	$101

2. Inventoriable costs (in millions)

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

Period costs (in millions)

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.

2.37 Missing records, calculating inventory costs

Steve Williams recently took over as the management accountant of Johnson Brothers Manufacturing. Last month, the previous management accountant left the company with little notice and left the accounting records in disarray. Steve needs the ending inventory balances to report first-quarter numbers.

For the previous month (March 2019), Steve was able to piece together the following information:

Direct materials purchased	$120 000
Work-in-process inventory, 1 March 2019	$35 000
Direct materials inventory, 1 March 2019	$12 500
Finished goods inventory, 1 March 2019	$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

Required

Calculate the cost of:

1. Finished goods inventory, 31 March 2019
2. Work-in-process inventory, 31 March 2019
3. Direct materials inventory, 31 March 2019

Solution: (30–40 min.)

Missing records, calculating inventory costs

1. Finished goods inventory, 31 March 2019 = $150 000
2. Work-in-process inventory, 31 March 2019 = $95 000
3. Direct materials inventory, 31 March 2019 = $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 × 4 = $360 000	

Schedule of Computations

Direct materials inventory, 1 March 2019 (given)	$12 500	
Direct materials purchased (given)	120 000	
Direct materials available for use		132 500
Direct materials inventory, 31 March 2019	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, 1 March 2019 (given)		35 000
Manufacturing costs to account for		455 000
Deduct work in process inventory, 31 March 2019	2 =	95 000
Cost of goods manufactured (4 × $90,000)		360 000
Add finished goods inventory, 1 March 2019		160 000
Cost of goods available for sale		520 000
Deduct finished goods inventory, 31 March 2019	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):

Direct Materials				Work in Process				Finished Goods				Cost of Goods Sold
Beg Inv	12.5			Beg Inv	35			Beg Inv	160			
Purch.	120.0	DM used	90 →	DM used (420–330)	90	COGM	360 →		360	COGS	415 →	415
End Inv	42.5			Conversion	330							
				To account for	455			Available for sale	520			
				End Inv	95			End Inv	105			

2.38 Comprehensive problem on unit costs, product costs

Eco Office Equipment manufactures and sells metal shelving. It began operations on 1 January 2019. Costs incurred for 2019 are as follows (V stands for variable; F stands for fixed):

Direct materials used	$140 000 V
Direct manufacturing labour costs	22 000 V
Plant energy costs	5 000 V
Indirect manufacturing labour costs	18 000 V
Indirect manufacturing labour 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:

	Beginning: 1 January 2019	Ending: 31 December 2019
Direct materials	0 kg	2300 kg
Work in progress	0 units	0 units
Finished goods	0 units	? units

Production in 2019 was 100 000 units. Two kilograms of direct materials are used to make one unit of finished product.

Revenues in 2019 were $473 200. The selling price per unit and the purchase price per kilogram 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 2019. Finished goods inventory at 31 December 2019 was $20 970.

Required

1. Calculate direct materials inventory, total cost, 31 December 2019.
2. Calculate finished goods inventory, total units, 31 December 2019.
3. Calculate selling price in 2019.
4. Calculate operating profit for 2019.

Solution: (30 min.)

Comprehensive problem on unit costs, product costs

1. If 2 kg of direct materials are used to make each unit of finished product, 100 000 units × 2 kg, or 200 000 kg were used at $0.60 per kg of direct materials ($140 000 ÷ 200 000 kg). (The direct material costs of $120 000 are direct materials used, not purchased.) Therefore, the ending inventory of direct materials is 2300 kg × $0.70 = $1610.

Manufacturing costs for 100 000 units

	Variable	Fixed	Total	
Direct materials costs	$140000	$ –	$140 000	
Direct manufacturing labour costs	22000	–	22,000	
Plant energy costs	5 000	–	5 000	
Indirect manufacturing labour 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

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

2. Units sold in 2019 = Beginning inventory + Production – Ending inventory

	= 0 + 100 000 − 9000
	= 91 000 units
Selling price in 2019	= $473 200 ÷ 91 000
	= $5.20 per unit

3.

Eco Office Equipment
Income Statement
Year Ended 31 December 2019
(in thousands)

Revenues (91 000 units sold × $5.20)		$473 200
Cost of units sold:		
Beginning finished goods, 1 Jan. 2019	$0	
Cost of goods manufactured	233 000	
Cost of goods available for sale	233 000	
Ending finished goods, 31 Dec. 2019	20 970	212 030
Gross margin		261 170
Operating costs:		
Marketing, distribution, and customer-service costs	163 000	
Administrative costs	54 000	217 000
Operating profit		$44 170

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

Direct materials cost ($0.70 × 2 kg)	$1.40	
Direct manufacturing labour cost ($22 000 ÷ 100 000)	0.22	
Plant energy cost ($5000 ÷ 100 000)	0.05	
Indirect manufacturing labour cost ($18 000 ÷ 100 000)	0.18	
Other indirect manufacturing cost ($8000 ÷ 100 000)	0.0	
	$1.93	per unit manufactured
Marketing, distribution, and customer-service costs ($120 000 ÷ 91 000)	$1.32	per unit sold

2.39 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 that these new numbers would make Howard happy.

Required

1. Show 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.)

Cost classification; 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 'unitised' at $14 per unit and expensed as each unit of the product is sold. Hence, 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. AAS 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 behaviour.

Collaborative learning problem

2.40 Finding unknown amounts

An auditor for the Australian Taxation Office 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–D**.

	Case 1 (in thousands)	Case 2
Accounts receivable, 30 June	$8 000	$3 150
Cost of goods sold	**A**	31 800
Accounts payable, 1 July	4 500	2 550
Accounts payable, 30 June	2 700	2 250
Finished goods inventory, 30 June	**B**	7 000
Gross margin	18 000	**C**
Work-in-process inventory, 1 July	3 000	1 500
Work-in-process inventory, 30 June	0	4 700
Finished goods inventory, 1 July	5 000	7 000
Direct materials used	13 000	19 000
Direct manufacturing labour	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 July	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
Cost of goods sold	**A**	34 000	I		31 800
Gross margin		$18 000	G	**C**	$20 500

Step 2: Use schedule of cost of goods manufactured formula				
Direct materials used	$13 000	G		$19 000
Direct manufacturing labour costs	4 500	G		8 500
Indirect manufacturing costs	9 500	G	**D**	7 500
Manufacturing costs incurred	27 000	I		35 000

Add beginning work in process, 1 July			3 000	G		1 500 G
Total manufacturing costs to account for			30 000	I		36 500 I
Deduct ending work in process, 30 June			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 July			$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, 30 June		**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.