CHAPTER 3
COST BEHAVIOUR

DISCUSSION QUESTIONS

1. Knowledge of cost behaviour allows a manager to assess changes in costs that result from changes in activity. This allows a manager to examine the effects of choices that change activity. For example, if excess capacity exists, bids that at least cover variable costs may be totally appropriate. Knowing what costs are variable and what costs are fixed can help a manager make better bids and, ultimately, better business decisions.

2. A driver is a factor that causes or leads to a change in a cost or activity; it is an output measure. The driver for general machine maintenance cost in a factory could be machine hours. The driver for raw materials used is the number of units produced.

3. The cost formula for monthly shipping cost is:

Monthly shipping cost = $3,560 + $6.70 (Packages shipped)

The independent variable is packages shipped. The dependent variable is monthly shipping cost. The fixed cost per month is $3,560. The variable rate is $6.70.

4. Some account categories are primarily fixed or variable. Even if the cost is mixed, either the fixed component or the variable component is relatively small. As a result, assigning all of the cost to either a fixed or variable category is unlikely to result in large errors. For example, depreciation on property, plant, and equipment is largely fixed. The cost of telephone expense for the sales office, if it consisted primarily of long-distance calls, could be seen as largely variable (variable with respect to the number of customers).

5. Committed fixed costs are those incurred for the acquisition of long-term activity capacity and are not subject to change in the short run. Annual resource expenditure is independent of actual activity usage. For example, the cost of a factory building is a committed fixed cost. Discretionary fixed costs are those incurred for the acquisition of short-term activity capacity, the levels of which can be altered quickly. In the short run, resource expenditure is also independent of actual activity usage. Salaries of engineers is an example of such an expenditure.

6. The concept of relevant range is important in dealing with step costs because if the relevant range is contained completely within one step, the cost behaves as a fixed cost. However, if the relevant range spans two or more steps, the accountant must be aware of the cost increase as output goes up within the relevant range.

7. Mixed costs are usually reported in total in the accounting records. How much of the cost is fixed and how much is variable is unknown and must be estimated.

8. The cost formula for a strictly fixed cost has only a fixed cost amount. There is no variable rate and no independent variable. For the depreciation example, the cost formula looks like this:

Depreciation per year = $15,000

9. The cost formula for a strictly variable cost has only the variable rate and independent variable. There is no fixed component. For the electrical power example, the cost formula looks like this:

Electrical power = $1.15 x (Machine hours)

10. A scattergraph allows a visual portrayal of the relationship between cost and activity. It reveals to the investigator whether a relationship may exist and, if so, whether a linear function can be used to approximate the relationship.

11. Managers can use their knowledge of the cost relationships to estimate the fixed and variable components. A scattergraph can be used as an aid in this process. From a scattergraph, a manager can select two points that best represent the relationship. These two points can then be used to derive a linear cost formula. The high-low method tells the manager which two points to select to compute the linear cost formula. The selection of the two points is not left to judgment.

12. Because the scattergraph method is not restricted to the high and low points, it is possible to select two points that better represent the relationship between activity and costs, producing a better estimate of fixed and variable costs. The main advantage of the high-low method is that it removes subjectivity from the choice process. The same line will be produced by two different people.

13. Assuming that the scattergraph reveals that a linear cost function is suitable, then the method of least squares selects a line that best fits the data points. The method also provides a measure of goodness of fit so that the strength of the relationship between cost and activity can be assessed.

14. The best-fitting line is the one that is “closest” to the data points. This is usually measured by the line that has the smallest sum of squared deviations.

15. The coefficient of determination is the percentage of total variability in costs explained by activity. As such, it is a measure of goodness of fit, the strength of the relationship between cost and activity.

MULTIPLE-CHOICE EXERCISES

3–1	**a**	
3–2	**e**	
3–3	**c**	
3–4	**b**	
3–5	**a**	
3–6	**d**	
3–7	**c**	
3–8	**b**	**Total cost = \$123,800 + (\$15 × 2,000) = \$153,800**
3–9	**a**	
3–10	**b**	
3–11	**a**	
3–12	**e**	
3–13	**b**	
3–14	**d**	

CORNERSTONE EXERCISES

Cornerstone Exercise 3–15

1. **The cost formula takes the following form:**

   Total cost = Fixed cost + (Variable rate × Number of flash drives)

   The monthly fixed cost is $18,000 (the combined $15,000 cost of equipment depreciation and $3,000 cost of advertising), as it does not vary according to the number of flash drives manufactured. The variable costs are materials and manufacturing overhead, as both do vary with the number of flash drives produced.

   Cost of materials per flash drive is $\frac{\text{280,000 grams}}{\text{5,000 flash drives}}$ **= 56 grams per flash drive. The material cost per drive = $0.10 × 56 grams per drive = $5.60 per drive.**

   Cost of manufacturing overhead per flash drive is $\frac{\$22{,}500}{5{,}000}$ **= $4.50 per drive.**

   Therefore, the variable rate per flash drive is $5.60 + $4.50 = $10.10.

   The cost formula is:

   Total cost of flash drives = $18,000 + ($10.10 × Number of flash drives)

2. **Expected fixed cost for next month is $18,000.**

   Expected variable cost for next month is $10.10 × 6,000 flash drives = $60,600.

   Expected total manufacturing cost for next month is $18,000 + $60,600 = $78,600.

Cornerstone Exercise 3–16

***Step 1—Find the high and low points*: The high number of employee hours is in April, and the low number of employee hours is in August.**

Cornerstone Exercise 3–16 (Concluded)

Step 2—Calculate the variable rate:

$$\text{Variable rate} = \frac{\text{High point cost - Low point cost}}{\text{High employee hours - Low employee hours}}$$

$$= \frac{\$9{,}787 - \$7{,}531}{610 - 310} = \frac{\$2{,}256}{300}$$

= $7.52 per employee hour

Step 3—Calculate the fixed cost:

Fixed cost = Total cost – (Variable rate × Employee hours)

Let's choose the low point with total cost of $7,531 and employee hours of 310.

Fixed cost = $7,531 – ($7.52 × 310) = $7,531 – $2,331 = $5,200

(*Hint:* Check your work by computing fixed cost using the high point.)

***Step 4—Construct a cost formula*: If the variable rate is $7.52 per employee hour and fixed cost is $5,200 per month, then the formula for total monthly labour cost is:**

Total labour cost = $5,200 + ($7.52 × Employee hours)

Cornerstone Exercise 3–17

1. Total variable labour cost = Variable rate × Employee hours
= $7.52* × 675
= $5,076

2. Total labour cost = Fixed cost + (Variable rate × Employee hours)
= $5,200* + ($7.52 × 675)
= $5,200 + $5,076
= $10,276

***Refer to the solution for Cornerstone Exercise 3–16 for detailed explanation of the computations for variable cost per unit ($7.52) and total fixed cost ($5,200).**

Cornerstone Exercise 3–18

1. **Total variable labour cost = Variable rate × Employee hours**

   = $7.52* × 4,000

   = $30,080

2. **There's a trick here; the cost formula is for the month, but we are being asked to budget labour cost for the year. So, we will need to multiply the fixed cost for the month by 12 (the number of months in a year).**

   Total fixed labour cost = Fixed cost × 12 months in a year

   = $5,200* × 12

   = $62,400

3. **Total labour cost = 12($5,200) + ($7.52 × 4,000)**

   = $62,400 + $30,080

   = $92,480

   ***Refer to the solution for Cornerstone Exercise 3–16 for detailed explanation of the computations for variable cost per unit ($7.52) and total fixed cost ($5,200).**

Cornerstone Exercise 3–19

1. **The fixed cost and the variable rate are given directly by regression.**

   Fixed cost = $ 1,145

   Variable rate = $13.82

2. **The cost formula is:**

   Total labour cost = $1,145 + ($13.82 × employee hours)

3. **Budgeted labour cost = $1,145 + ($13.82 × 675) = $10,474**

EXERCISES

Exercise 3–20

a. Power to operate a drill (to drill holes in the wooden frames of the futons)—Variable cost

b. Cloth to cover the futon mattress—Variable cost

c. Salary of the factory receptionist—Fixed cost

d. Cost of food and decorations for the annual Canada Day party for all factory employees—Fixed cost

e. Fuel for a forklift used to move materials in a factory—Variable cost

f. Depreciation on the factory—Fixed cost

g. Depreciation on a forklift used to move partially completed goods—Fixed cost

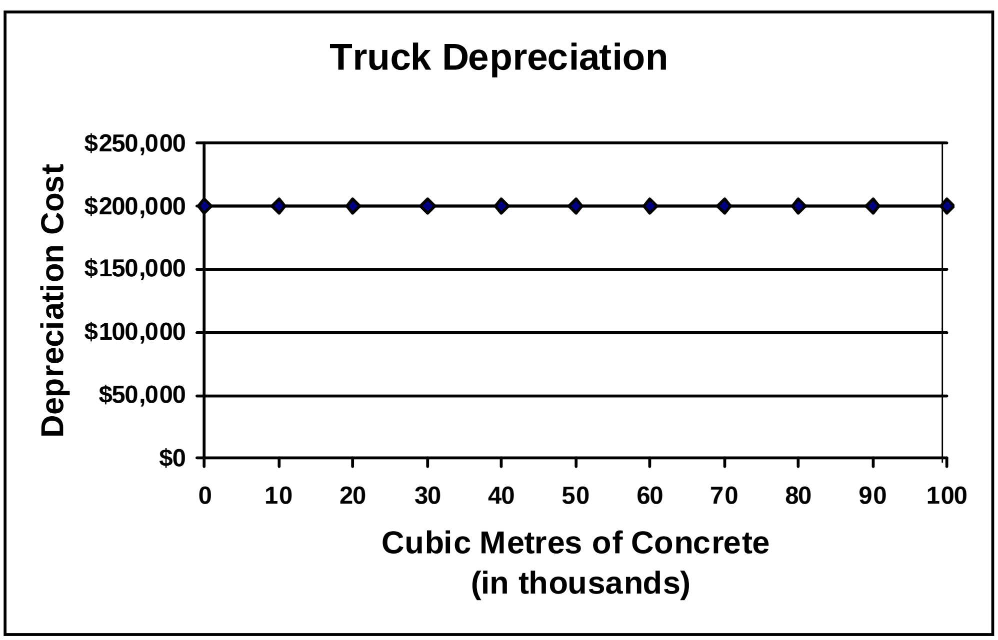
h. Wages paid to workers who assemble the futon frame—Variable cost

i. Wages paid to workers who maintain the factory equipment—Fixed cost

j. Cloth rags used to wipe the excess stain off the wooden frames—Variable cost

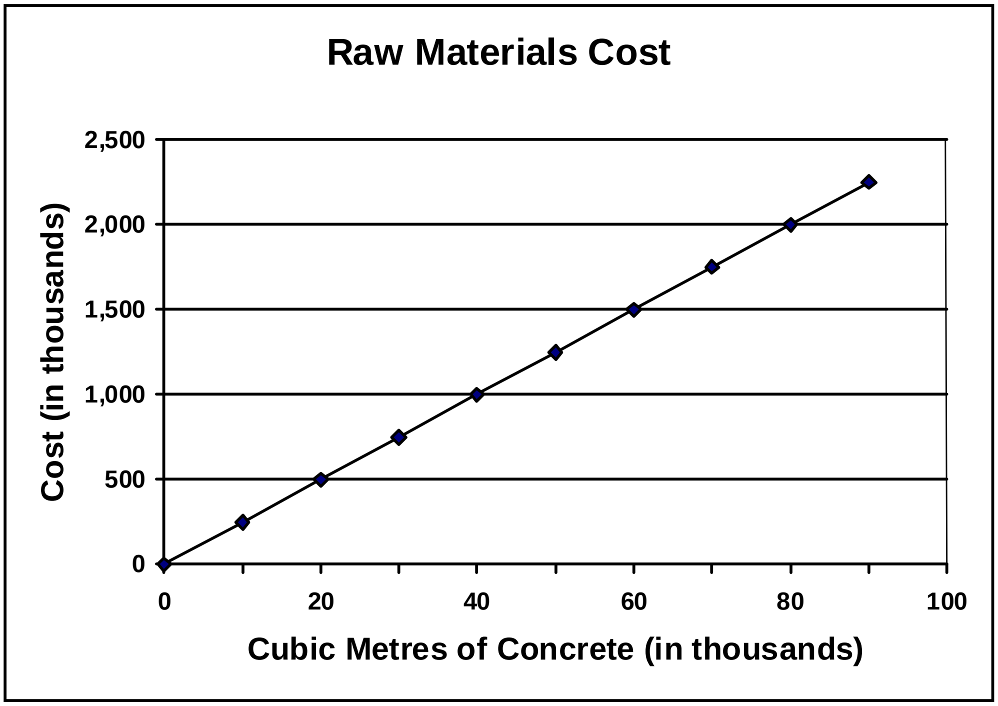
Exercise 3–21

1.



Exercise 3–21 (Concluded)

2.



3. **Truck depreciation—Fixed cost**

Raw materials cost—Variable cost

Exercise 3–22

Cost Category	Variable Cost	Discretionary Fixed Cost	Committed Fixed Cost
Technician salaries		X	
Laboratory facility			X
Laboratory equipment			X
Chemicals and other supplies	X		

Exercise 3–23

1. Total maintenance cost = $310,000 + ($18.50 × 150,000) = $3,085,000
2. Total fixed maintenance cost = $310,000
3. Total variable maintenance cost = $18.50(150,000) = $2,775,000
4. Total maintenance cost per unit $= \dfrac{\$310{,}000 + (\$18.50 \times 150{,}000)}{150{,}000}$

   $= \dfrac{\$3{,}085{,}000}{150{,}000}$

   $= \$20.57$
5. Fixed maintenance cost per unit $= \dfrac{\$310{,}000}{150{,}000} = \$2.07$
6. Variable maintenance cost per unit = $18.50

Exercise 3–24

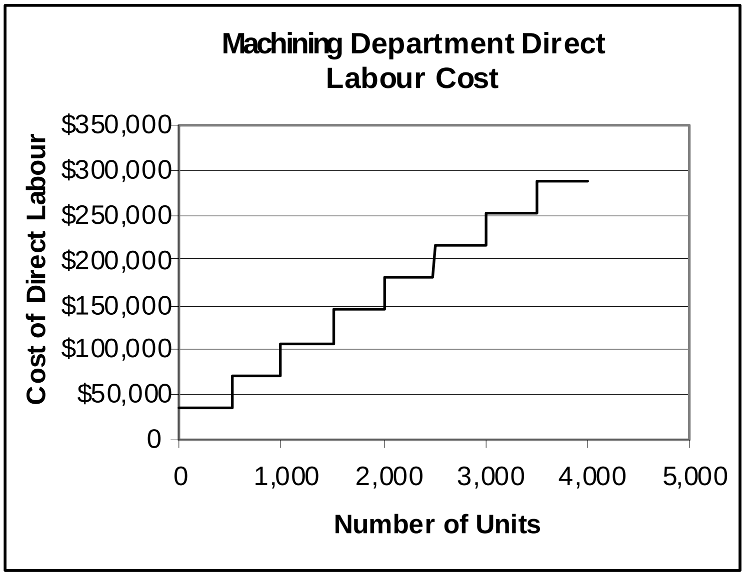
1. Total maintenance cost = $310,000 + ($18.50 × 80,000) = $1,790,000
2. Total fixed maintenance cost = $310,000
3. Total variable maintenance cost = $18.50(80,000) = $1,480,000
4. Total maintenance cost per unit $= \dfrac{\$310{,}000 + (\$18.50 \times 80{,}000)}{80{,}000}$

   $= \dfrac{\$1{,}790{,}000}{80{,}000}$

   $= \$22.38$
5. Fixed maintenance cost per unit $= \dfrac{\$310{,}000}{80{,}000} = \$3.88$
6. Variable maintenance cost per unit = $18.50

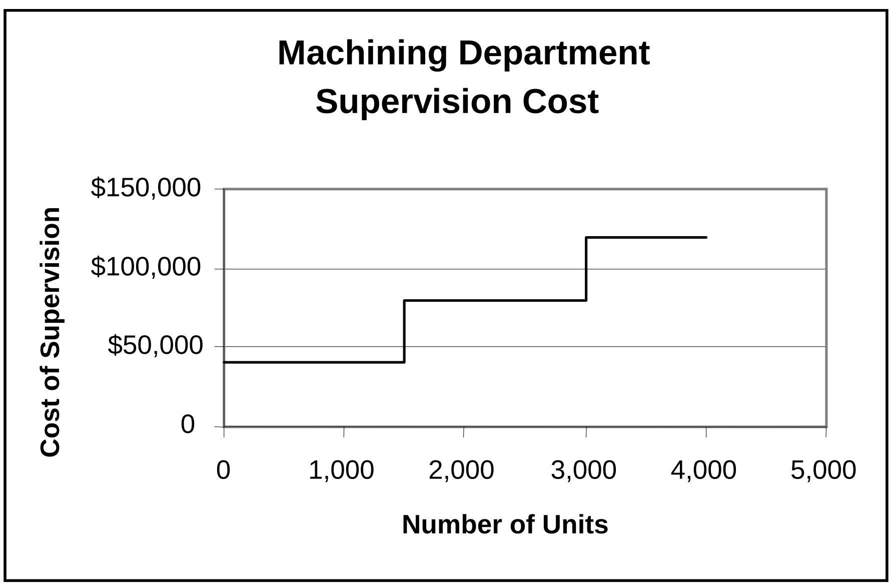
Exercise 3–25

1.



The direct labour cost in the machining department is a step cost (with narrow steps).

2.



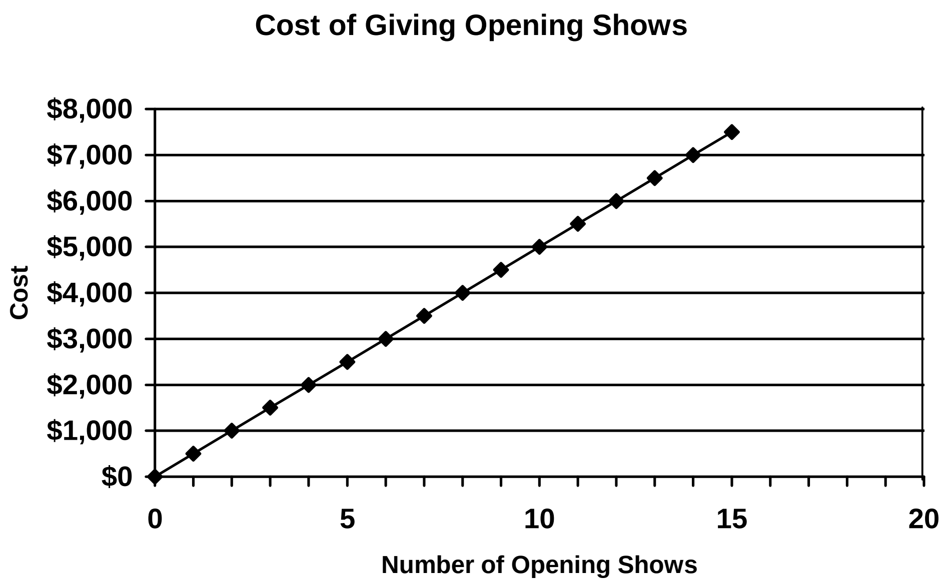
The cost of supervision for the machining department is a step cost (with wide steps).

3. **Direct labour cost increase = $144,000 – $108,000 = $36,000**

   Supervision increase = $80,000 – $40,000 = $40,000

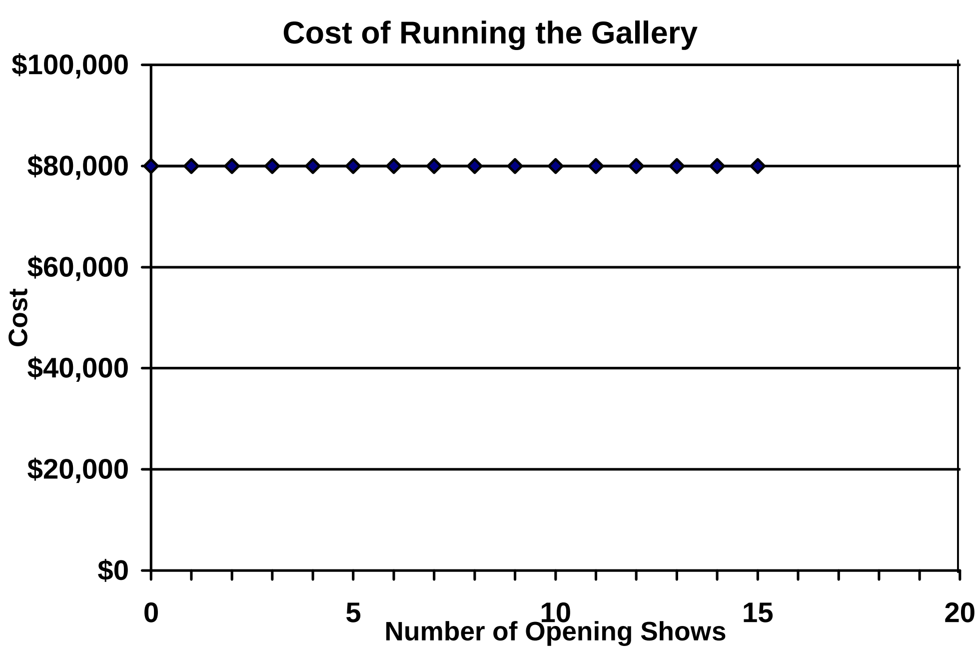
Exercise 3–26

1.



This is a strictly variable cost.

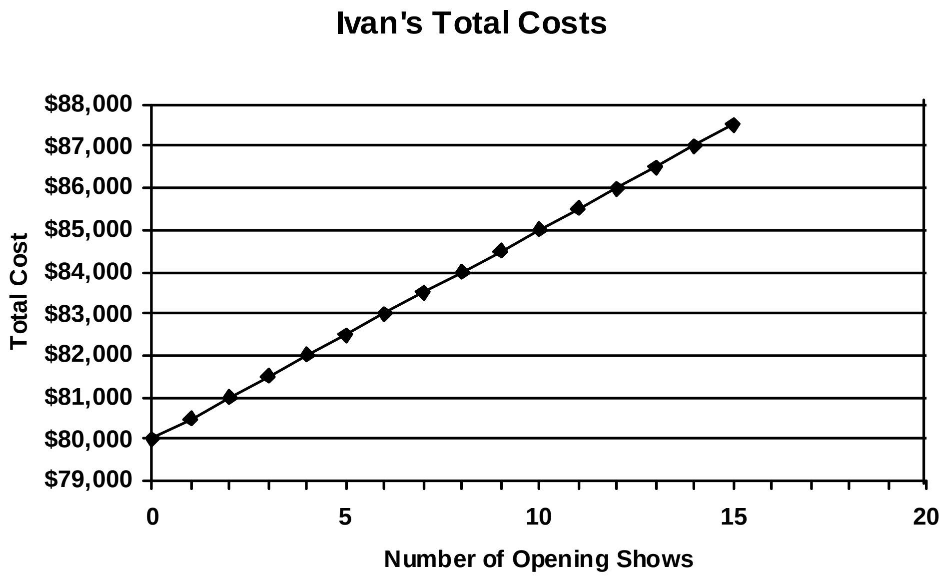
2.



This is a strictly fixed cost.

Exercise 3–26 (Concluded)

3.



This is a mixed cost.

Exercise 3–27

1. **Total cost = $80,000 + ($500 × Number of opening shows)**

2. **Total cost = $80,000 + ($500 × 12) = $86,000**
   Total cost = $80,000 + ($500 × 14) = $87,000

Exercise 3–28

1. **The high point is March with 3,100 appointments. The low point is January with 700 appointments.**

2. **Variable rate** $= \dfrac{\$2,790 - \$1,758}{3,100 - 700}$

$$= \frac{\$1,032}{2,400}$$

= $0.43 per tanning appointment

Using the high point:

Fixed cost = $2,790 – ($0.43 × 3,100) = $1,457

OR

Using the low point:

Fixed cost = $1,758 – ($0.43 × 700) = $1,457

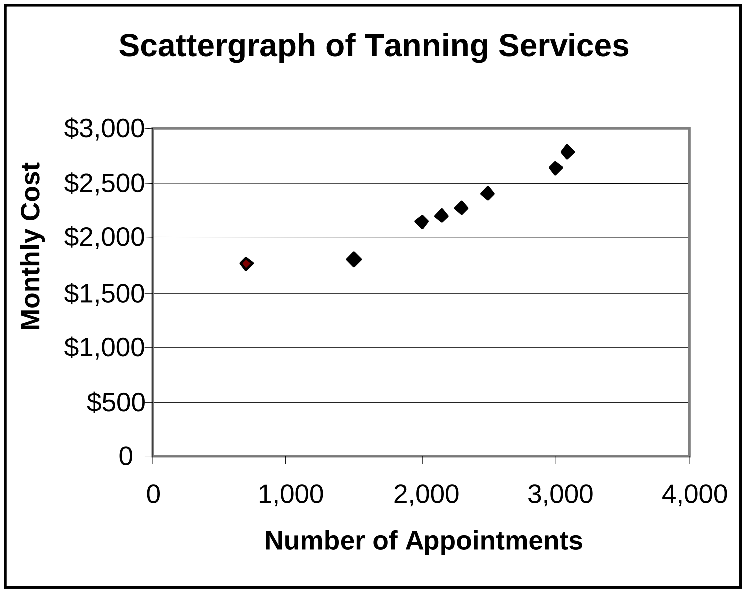
3. **Total tanning service cost = $1,457 + ($0.43 × Number of appointments)**

4. **Total predicted cost for September = $1,457 + ($0.43 × 2,500) = $2,532**

   Total fixed cost for September = $1,457

   Total predicted variable cost = $0.43(2,500) = $1,075

Exercise 3–29



Yes, it appears that there is a linear relationship between tanning cost and number of appointments.

Exercise 3–30

1. **Total cost of tanning services = $1,290 + ($0.45 × Number of appointments)**

2. **Total predicted cost for September = $1,290 + ($0.45 × 2,500) = $2,415**

Exercise 3–31

1. **Airplane depreciation:**

   $$\text{Variable rate} = \frac{\$18{,}000{,}000 - \$18{,}000{,}000}{44{,}000 - 28{,}000} = \$0$$

   Fixed cost = $18,000,000 – ($0 × 44,000) = $18,000,000

2. **Total cost of airplane depreciation = $18,000,000**

   Airplane depreciation is a strictly fixed cost.

Exercise 3–31 (Concluded)

3. **Fuel:**

$$\text{Variable rate} = \frac{\$445{,}896{,}000 - \$283{,}752{,}000}{44{,}000 - 28{,}000} = \$10{,}134$$

Fixed cost = $445,896,000 – ($10,134 × 44,000) = $0

4. **Total cost of fuel = $10,134 × Number of airplane flight hours**

   Fuel is a strictly variable cost.

5. **Airplane maintenance:**

$$\text{Variable rate} = \frac{\$15{,}792{,}000 - \$11{,}504{,}000}{44{,}000 - 28{,}000} = \$268$$

Fixed cost = $15,792,000 – ($268 × 44,000) = $4,000,000

6. **Total cost of airplane maintenance = $4,000,000 + ($268 × Number of airplane flight hours)**

   Airplane maintenance is a mixed cost.

7. **Total cost of each resource at 36,000 machine hours:**

   Total cost of airplane depreciation = $18,000,000

   Total cost of fuel = $10,134(36,000) = $364,824,000

   Total cost of airplane maintenance = $4,000,000 + ($268 × 36,000) = $13,648,000

Exercise 3–32

1. **Total annual cost of airplane depreciation = 12($18,000,000)**
   = $216,000,000

   Total annual cost of fuel = $10,134 × Annual number of airplane flight hours

   Total annual cost of airplane maintenance = 12($4,000,000) + ($268 × Annual number of airplane flight hours)

   NOTE: Fixed and variable costs, based on monthly data, are computed in Exercise 3–31.

2. **Total annual cost of airplane depreciation = 12($18,000,000)**
   = $216,000,000

   Total annual cost of fuel = $10,134(480,000) = $4,864,320,000

   Total annual cost of airplane maintenance = 12($4,000,000) + ($268 × 480,000) = $176,640,000

Exercise 3–33

1. Total cost of receiving = $23,100 + ($316 × Number of parts inspected)

2. Independent variable—number of parts inspected

   Dependent variable—total cost of receiving

   Variable rate—$316 per part inspected

   Fixed cost per month—$23,100

3. Total cost of receiving = $23,100 + ($316 × 2,500) = $813,100

Exercise 3–34

1. Total annual cost of receiving

   = 12($23,100) + ($316 × Number of parts inspected in a year)
   = $277,200 + ($316 × Number of parts inspected in a year)

   NOTE: Fixed and variable costs, based on monthly data, are computed in Exercise 3–33.

2. Total annual cost of receiving = $277,200 + ($316 × 29,000) = $9,441,200

Exercise 3–35

1.

Overhead cost	Dependent variable
$109,743	Fixed cost (intercept)
$80.75	Variable rate (slope)
Direct labour hours	Independent variable

2. Next month's budgeted overhead cost = $109,743 + ($80.75 × 5,000)
   = $513,493

3. Next quarter's budgeted overhead cost = (3 × $109,743) + ($80.75 × 18,000)
   = $329,229 + $1,453,500
   = $1,782,729

4. Next year's budgeted overhead cost = (12 × $109,743) + ($80.75 × 58,000)
   = $1,316,916 + $4,683,500
   = $6,000,416

Exercise 3–36

1.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.956577
R Square	0.91504
Adjusted R Square	0.900879
Standard Error	27.97953
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	50588.88	50588.88	64.62108	0.000198
Residual	6	4697.124	782.854		
Total	7	55286			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4315.593	158.0348	27.30787	1.59E-07	3928.896	4702.291	3928.896	4702.291
X Variable 1	1.846242	0.229669	8.038724	0.000198	1.284263	2.408221	1.284263	2.408221

2. **Overhead cost = $4,316 + ($1.85 × Number of direct labour hours)**

3. **The R^2 is 0.915, or 91.5 percent. Direct labour hours account for slightly more than 91 percent of overhead cost. Thus, direct labour hours is a good predictor of overhead cost. Another factor (or factors) accounts for the remaining 8.5 percent of overhead cost.**

4. **Overhead cost = $4,316 + ($1.85 × 700) = $5,611**

Exercise 3–37

1.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.917226**
R Square	**0.841304**
Adjusted R Square	**0.825435**
Standard Error	**164.5461**
Observations	**12**

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	**1**	**1435369**	**1435369**	**53.01371**	**2.66E-05**
Residual	**10**	**270754.2**	**27075.42**		
Total	**11**	**1706123**			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	**942.103**	**88.16653**	**10.68549**	**8.63E-07**	**745.6557**	**1138.55**	**745.6557**	**1138.55**
X Variable 1	**1.787814**	**0.245543**	**7.281052**	**2.66E-05**	**1.240709**	**2.334919**	**1.240709**	**2.334919**

2. Delivery cost = $942 + ($1.79 × Number of deliveries)

3. The R^2 is 0.841, or 84.1 percent. Number of deliveries accounts for slightly more than 84 percent of delivery cost. This is not bad. Another factor (or factors) accounts for just under 16 percent of delivery cost.

4. Delivery cost = $942 + ($1.79 × 300) = $1,479

PROBLEMS

Problem 3–38

1. a. Mixed cost
   b. Variable cost
   c. Variable cost
   d. Step cost with narrow steps
   e. Fixed cost
   f. Fixed cost
   g. Variable cost (assumes counter help can be called in or sent back home as the need arises)
   h. Step cost
   i. Mixed cost

2. a. While the contract stays the same ($150 per month plus $15 per hour of technical time), the company's need for computer technical help is so stable that the same number of hours are required each month. Now, the cost is essentially fixed.
   b. The company drives the vehicles on identical trips each month. Thus, the mileage and type of trip (highway versus in town) never vary. Now, the cost is essentially fixed.
   c. If beer is purchased in advance each day, in barrels to be tapped at night, and the leftover beer is poured down the drain at the close of business each day, the cost would be a step cost.
   d. The university may use so much paper that it considers the cost as essentially variable.
   e. Suppose that the dental office is located in a large shopping mall that charges rent based on the level of sales. Rent would be variable.
   f. If the law office expanded and an additional, temporary receptionist was hired on days with a heavy volume of appointments, the cost would be variable.
   g. If the individuals working behind the counter are assured that their complete shift would be worked once they arrive, the cost would be a step cost (assumes more counter help could be called in if demand rose).

Problem 3–38 (Concluded)

h. If the hygienists were paid based on number of patients seen, the cost would be variable.

i. If a company decided that the fixed amount of $15 per month was very small relative to the total electrical bill (e.g., $500 per month), then the cost could be viewed as variable.

Problem 3–39

a. This must be the high-low method because she has only two data points (one for each year).

b. This is the method of least squares done on a personal computer. While it is possible to use a personal computer to do the other methods, it is unlikely that Francis would have gone to all the trouble of entering 60 months of data simply to use the high-low method.

c. Ron is making a scattergraph.

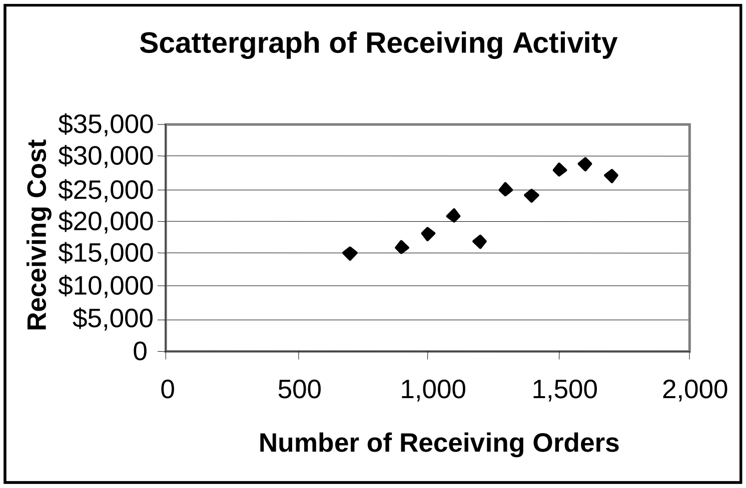
d. In all probability, Lois is using the high-low method. She can do this quickly and get some rough results in time for her meeting.

Problem 3–40

a. Variable cost
b. Committed fixed cost
c. Discretionary fixed cost
d. Discretionary fixed cost
e. Discretionary fixed cost
f. Variable cost
g. Variable cost
h. Discretionary fixed cost
i. Discretionary fixed cost
j. Variable cost

Problem 3–41

1.



Yes, the relationship appears to be reasonably linear.

2. Using the high-low method:

Variable receiving cost $= \dfrac{\$27,000 - \$15,000}{1,700 - 700} = \$12$

Fixed receiving cost = $15,000 – $12(700) = $6,600

Predicted cost for 1,450 receiving orders:

Receiving cost = $6,600 + $12(1,450) = $24,000

3. Receiving cost for the quarter = 3($6,600) + $12(4,650)
= $19,800 + $55,800
= $75,600

Receiving cost for the year = 12($6,600) + $12(18,000)
= $79,200 + $216,000
= $295,200

Problem 3–42

1. Receiving cost = $3,212 + ($15.15 × Number of receiving orders)

2. Receiving cost = $3,212 + ($15.15 × 1,450) = $25,180

Problem 3–42 (Concluded)

3. Receiving cost for the quarter = 3($3,212) + $15.15(4,650)
= $9,636 + $70,448
= $80,084

Receiving cost for the year = 12($3,212) + $15.15(18,000)
= $38,544 + $272,700
= $311,244

Problem 3–43

1. Salaries:

Senior accountant—fixed

Office assistant—fixed

Internet and software subscriptions—mixed

Consulting by senior partner—variable

Depreciation (equipment)—fixed

Supplies—mixed

Administration—fixed

Rent (offices)—fixed

Utilities—mixed

2. Internet and software subscriptions:

$$\text{Variable rate} = \frac{\$850 - \$700}{150 - 120} = \$5$$

Fixed amount = $850 – ($5 × 150) = $100

Supplies:

$$\text{Variable rate} = \frac{\$1,100 - \$905}{150 - 120} = \$6.50$$

Fixed amount = $1,100 – ($6.50 × 150) = $125

Utilities:

$$\text{Variable rate} = \frac{\$365 - \$332}{150 - 120} = \$1.10$$

Fixed amount = $365 – ($1.10 × 150) = $200

Problem 3–43 (Concluded)

3.

	Unit Fixed	Variable Cost
Salaries:		
Senior accountant	$2,500	—
Office assistant	1,200	—
Internet and software subscriptions	100	$ 5.00
Consulting by senior partner	—	10.00
Depreciation (equipment)	2,400	—
Supplies	125	6.50
Administration	500	—
Rent (offices)	2,000	—
Utilities	200	1.10
Total cost	$9,025	$22.60

Total clinic cost = $9,025 + ($22.60 × Professional hours)

For 140 professional hours:

Clinic cost = $9,025 + ($22.60 × 140) = $12,189

Charge per hour = $\frac{\$12,189}{140}$ = $87.06

Fixed charge per hour = $\frac{\$9,025}{140}$ = $64.46

Variable charge per hour = $22.60

4. For 170 professional hours:

Charge per hour = $\frac{\$9,025}{170}$ + $22.60 = $53.09 + $22.60 = $75.69

The charge drops because the fixed costs are spread over more professional hours.

Problem 3–44

1. Committed resource charges: monthly fee, activation fee, cancellation fee (if triggered by contract cancellation prior to one year)

   Flexible resource charges: all additional charges for airtime, long distance, and roaming

Problem 3–44 (Concluded)

2. **Plan 1:**

Minutes available	=	Minutes used	+	Unused minutes
60 minutes	=	45 minutes	+	15 minutes

Plan 2:

Minutes available	=	Minutes used	+	Unused minutes
120 minutes	=	45 minutes	+	75 minutes

Plan 1 is more cost effective. Jana will have some unused capacity (on average, 15 minutes a month), and the overall cost will be lower by $10 per month.

3. **Plan 1:***

Minutes available	=	Minutes used	+	Unused minutes
60 minutes	=	90 minutes	+	(–30) minutes

Plan 1:*

Monthly minutes available	=	Minutes used	+	Unused minutes
60 minutes	=	60 minutes	+	0 minutes

Additional minutes = 30 minutes

***There are a number of ways to illustrate the use of minutes with Plan 1. Here are two possibilities. The problem, of course, is that all included monthly minutes are used and Jana must purchase additional minutes.**

Plan 2:

Minutes available	=	Minutes used	+	Unused minutes
120 minutes	=	90 minutes	+	30 minutes

Plan 2 is now more cost effective, as the monthly cost is $30. Under Plan 1, Jana will pay $20 plus $30 (30 minutes × $1.00) per month. (The $1.00 additional charge includes the airtime and regional roaming charge.)

4. **Results of students' analyses will vary.**

Problem 3–45

1. **Variable costs—salary of the two paralegals times the percentage of time spent in processing uncontested claims; salary of the accountant times the percentage of time spent in this activity; cost of claims forms, cheques, envelopes, and postage**

   Fixed costs—salaries of the two paralegals times the percentage of time spent in handling contested claims, depreciation on office equipment used in claims processing activity

2. **The independent variable is number of claims; the dependent variable is cost of claims processing.**

3. **The low point is March with $31,260 cost and 4,900 claims; the high point is June with $44,895 cost and 7,930 claims.**

   $$\text{Variable rate} = \frac{\$44,895 - \$31,260}{7,930 - 4,900}$$

   $$= \frac{\$13,635}{3,030}$$

   $$= \$4.50 \text{ per claim}$$

   Using the high point:

   Fixed cost = $44,895 – ($4.50 × 7,930) = $9,210

   Total cost of claims processing = $9,210 + ($4.50 × Claims)

4. **Cost of outsourcing = $4.60(75,600) = $347,760**

   Cost of processing in house = 12($9,210) + $4.50(75,600)
   = $110,520 + $340,200
   = $450,720

   Tiffany should outsource the claims processing for a savings of $102,960 ($450,720 – $347,760).

Problem 3–46

1. **The state unemployment insurance premiums and the average cost per injury are fixed with respect to the number of speakers sold. The state unemployment insurance premiums are variable (to an extent) with respect to the number of injury claims. That is, over a certain base premium, the premium increases as the number of injuries increases. The average cost per injury is variable with respect to the number of serious versus nonserious injuries incurred. However, Kicker's experience was that serious injuries could be reduced through education and changes in dangerous practices. The number of speakers sold was not relevant.**

2. **Yes, the safety program paid for itself. There was a $50,000 reduction in annual cost of state unemployment insurance premiums and a $22,000 reduction in the total cost of injuries per year [$22,500 ($1,500 × 15) – $500 ($50 × 10)]. This is a monetary reduction of $72,000 per year versus the $60,000 salary of the safety director. In addition, the number of workdays lost went from 30 to 0, and the number of serious injuries went from 4 to 0. While these reductions were not quantified (outside the average injury cost), they are important and are considered a benefit of the safety program.**

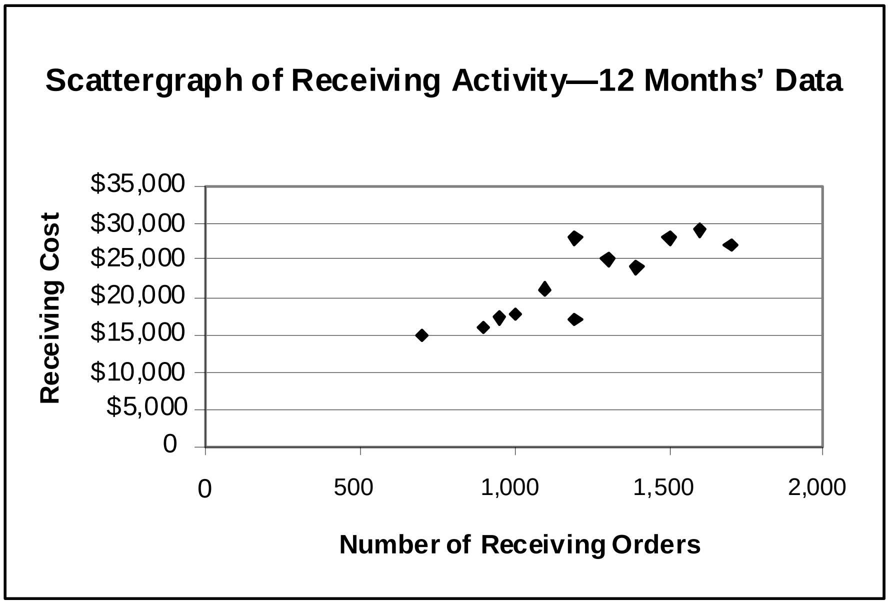
Problem 3–47

1. **Results of regressions:**

	10 Months' Data	*12 Months' Data*
Intercept..........................	3,212	3,820
Slope................................	15.15	15.10
R^2.....................................	0.8485	0.7451

Problem 3–47 (Continued)

2.



The point for the 11th month (1,200 receiving orders and $28,000 total receiving cost) appears to be an outlier. Since the cost was so much higher in this month due to an event that is not expected to happen again, this data point could easily be dropped. Then, data from the 11 remaining months could be used to develop a cost formula for receiving cost.

Problem 3–47 (Concluded)

3. Results for the method of least squares after dropping month 11.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.926737
R Square	0.858841
Adjusted R Square	0.843157
Standard Error	2051.781
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.31E+08	2.31E+08	54.7581	4.1E-05
Residual	9	37888233	4209804		
Total	10	2.68E+08			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3168.56	2565.262	1.23518	0.248035	–2634.47	8971.589	–2634.47	8971.589
X Variable 1	15.17946	2.051314	7.399872	4.1E-05	10.53906	19.81986	10.53906	19.81986

Receiving cost

= $3,169 + ($15.18 × Number of receiving orders)

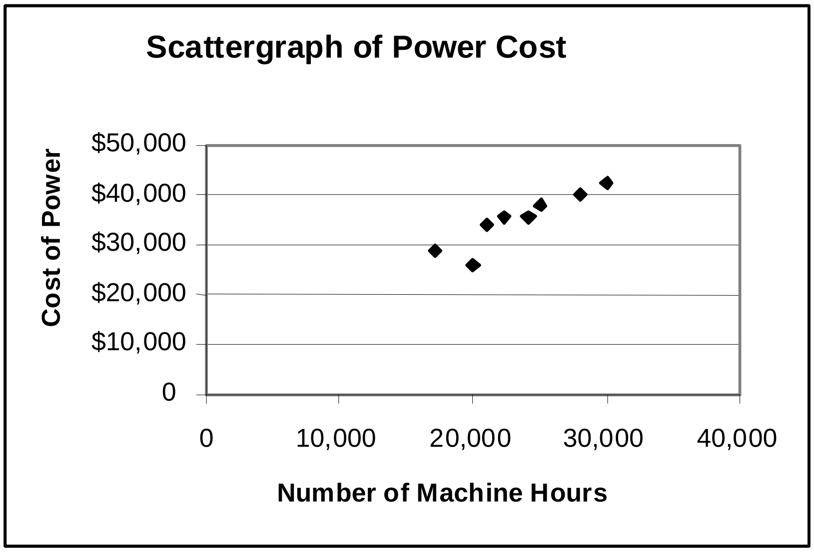
Predicted receiving cost for a month

= $3,169 + ($15.18 × 1,450) = $25,180

The regression run on the 11 months of data from “typical” months appears to be better than the one for all 12 months. R^2 is higher for the regression without the outlier (85.88 percent versus 74.51 percent), and the scattergraph gives Tracy confidence that the data without the outlier describe a relatively linear relationship. Since the storm damage is not expected to recur, month 11 can safely be dropped from a regression meant to help predict future receiving cost.

Problem 3–48

1.



The overall relationship looks reasonably linear—although the data point for the first quarter may be an outlier.

2. Using the high-low method:

Variable power cost = $\frac{\$42{,}500 - \$29{,}000}{30{,}000 - 18{,}000}$ **= $1.13 (rounded)**

Fixed power cost = $42,500 – ($1.13 × 30,000) = $8,600

Total power cost = $8,600 + ($1.13 × Number of machine hours)

Problem 3–48 (Continued)

3. Output of regression program:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.89336
R Square	0.798092
Adjusted R Square	0.76444
Standard Error	2673.925
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.7E+08	1.7E+08	23.71643	0.002795
Residual	6	42899246	7149874		
Total	7	2.12E+08			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	6899.784	5910.388	1.1674	0.287339	–7562.42	21361.99	–7562.42	21361.99
X Variable 1	1.209052	0.248268	4.869952	0.002795	0.601562	1.816541	0.601562	1.816541

Total power cost = $6,900 + ($1.21 × Machine hours)

R^2 is 0.798, or 79.8 percent. This is not bad; however, a little more than 20 percent of the variance in the dependent variable (power cost) is *not* explained by the independent variable (machine hours).

Problem 3–48 (Concluded)

4. **The output of a regression program after quarter 1 (20,000, $26,000) has been dropped.**

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.957884
R Square	0.917541
Adjusted R Square	0.901049
Standard Error	1367.285
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.04E+08	1.04E+08	55.63605	0.000683
Residual	5	9347339	1869468		
Total	6	1.13E+08			

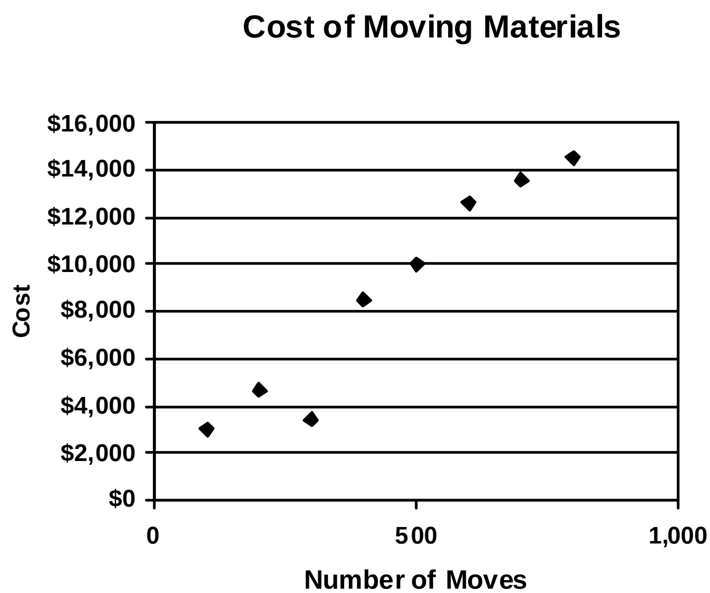
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	12407.56	3289.994	3.771302	0.013006	3950.378	20864.75	3950.378	20864.75
X Variable 1	1.009804	0.135381	7.458958	0.000683	0.661796	1.357812	0.661796	1.357812

Total power cost = $12,408 + ($1.01 × Number of machine hours)

This regression looks better in terms of R^2. The R^2 for this regression is 0.918, or 91.8 percent. By dropping the outlier, the explanatory power of machine hours is much improved. However, the controller should first carefully examine quarter 1 to see what the reason was for the lower than expected power cost. If the explanation is that something occurred that is not expected to reoccur, then the point can be dropped. If the reason is one that is expected to reoccur, then that needs to be factored into the controller's judgment about power costs.

Problem 3–49

1. **The scattergraph provides evidence for a linear relationship, but the observation for 300 moves may be an outlier.**



2. **High (800, $14,560); Low (100, $3,000)**

Variable rate $= \dfrac{\$14{,}560 - \$3{,}000}{800 - 100}$

$= \dfrac{\$11{,}560}{700} = \$16.51$

Fixed rate $= \$3{,}000 - (\$16.51 \times 100)$

$= \$3{,}000 - \$1{,}651 = \$1{,}349$

Total cost = $1,349 + ($16.51 × Number of moves)

Total cost = $1,349 + ($16.51 × 550) = $10,430 (rounded)

Problem 3–49 (Continued)

3. Output of the regression routine calculated by a spreadsheet:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.967858
R Square	0.93675
Adjusted R Square	0.926208
Standard Error	1266.703
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.43E+08	1.43E+08	88.86166	8.1E-05
Residual	6	9627225	1604538		
Total	7	1.52E+08			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	497.5	987.0073	0.504049	0.632196	–1917.62	2912.622	–1917.62	2912.622
X Variable 1	18.425	1.954566	9.426646	8.1E-05	13.64235	23.20765	13.64235	23.20765

Rounding the coefficients:

Variable rate = $18.43 per move

Fixed rate = $498

Total cost = $498 + ($18.43 × Number of moves)

= $498 + ($18.43 × 550) = $10,635 (rounded)

R^2 = 0.94 (rounded)

This says that 94 percent of the variability in the cost of moving materials is explained by the number of moves.

4. Normally, we would prefer the least squares method since the data appear to be linear. However, the third observation may be an outlier. If the third observation (300 moves and $3,400 of cost) is dropped, the R^2 rises to 99 percent. The new cost formula would be:

Total cost = $1,411 + ($17.28 × Number of moves)

The higher fixed cost is much more in keeping with what we observed with the scattergraph in Requirement 1.

CASES

Case 3–50

1. The order should cover the variable costs described in the cost formulas. These variable costs represent flexible resources.

Materials ($94 × 20,000)	$1,880,000
Labour ($16 × 20,000)	320,000
Variable overhead ($80 × 20,000)	1,600,000
Variable selling ($7 × 20,000)	140,000
Total additional resource spending	$3,940,000
Divided by units produced	÷ 20,000
Total unit variable cost	$ 197

Garner should accept the order because it would cover total variable costs and increase income by $15 per unit ($212 – $197), for a total increase of $300,000.

2. The coefficients of determination indicate the reliability of the cost formulas. Of the four formulas, overhead activity may be a problem. A coefficient of determination of 0.56 means that only about 56 percent of the variability on overhead cost is explained by direct labour hours. This should have a bearing on the answer to Requirement 1 because if the percentage is low, there are activity drivers other than direct labour hours that are affecting variability in overhead cost. What these drivers are and how resource spending would change need to be known before a sound decision can be made.

Case 3–50 (Concluded)

3. **Resource spending attributable to order:**

Materials ($94 × 20,000)	$ 1,880,000
Labour ($16 × 20,000)	320,000
Variable overhead:	
($85 × 20,000)	1,700,000
($5,000 × 12)	60,000
($300 × 600)	180,000
Variable selling ($7 × 20,000)	140,000
Total additional resource spending	$ 4,280,000
Divided by units produced	÷ 20,000
Total unit variable cost	$ 214

The order would not be accepted now because it does not cover the variable activity costs. Each unit would lose $2 ($212 – $214).

It would also be useful to know the step-cost functions for any activities that have resources acquired in advance of usage on a short-term basis. It is possible that there may not be enough unused activity capacity to handle the special order, and resource spending may also be affected by a need (which, in this case, would be unexpected) to expand activity capacity.

Case 3–51

1. **Andrew's behaviour is definitely unethical. He is stealing confidential information from Kilborn and using it for unethical advantages. Kilborn would not approve of Andrew's actions and would have a potential lawsuit against him for theft of information.**

2. **Assuming that the data were acquired illicitly, Bill's instincts were on target. To hire Andrew in implicit exchange for the confidential information would be a violation of integrity. As soon as Andrew joined Brindon's staff, Kilborn could have legal standing to include Thomas Electronics in any suit against Andrew. Not only are Andrew's actions in violation of Kilborn's code of conduct, they should also be against Thomas Electronics' code of conduct. Finally, Bill should remember that Andrew is basically a disloyal employee. If he is willing to act against the best interests of his former employer, he will certainly be willing to act against the best interests of his current and future employers.**

CMA PROBLEM*

CMA Problem 3–1 COST CLASSIFICATION AND BEHAVIOUR—SPARTA COMPANY

a.

	Machine-Hours	Overhead Costs
High	**25,000**	**99,000**
Low	**<u>10,000</u>**	**<u>64,500</u>**
Change	**15,000**	**34,500**

Variable cost = \$34,500 / 15,000 = \$2.30
Fixed cost = \$99,000 – (25,000 × \$2.30) = \$41,500

b. **Economic plausibility criteria – is it reasonable to expect overhead costs would vary with machine hours? Yes.**

Goodness of fit criteria – the r^2 = 91%. This means 91% of the variation in overhead costs is explained by the variation in machine hours.

Significance of slope coefficient – the t-value of 15 is greater than 2, making the slope coefficient significantly different from zero.

Conclusion: the regression is acceptable.

c. **Using the high-low method, the overhead equation is:**
Overhead = \$41,500 + 2.30*MH
The estimate of overhead costs at 22,000 machine hours is:
\$41,500 + 2.30(22,000) = \$92,100

Using regression analysis, the overhead equation is:
Overhead = \$39,859 + 2.15*MH
The estimate of overhead costs at 22,000 machine hours is:
\$39,859 + 2.15(22,000) = \$87,159