

**Problem 6-18** (45 minutes)

## 1. High-low method:

	<i>Number of Ingots</i>	<i>Power Cost</i>
High activity level .....	130	\$6,000
Low activity level .....	<u>40</u>	<u>2,400</u>
Change .....	<u>90</u>	<u>\$3,600</u>

$$\begin{aligned}\text{Variable cost per unit} &= \frac{\text{Change in cost}}{\text{Change in activity}} \\ &= \frac{\$3,600}{90 \text{ ingots}} = \$40 \text{ per ingot}\end{aligned}$$

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

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

## 2. Scattergraph method (see the scattergraph on the following page):

(Note: Students' answers will vary due to the inherent imprecision and subjectivity of the scattergraph method of estimating fixed and variable costs.)

The line intersects the cost axis at about \$1,200. The variable cost can be estimated as follows:

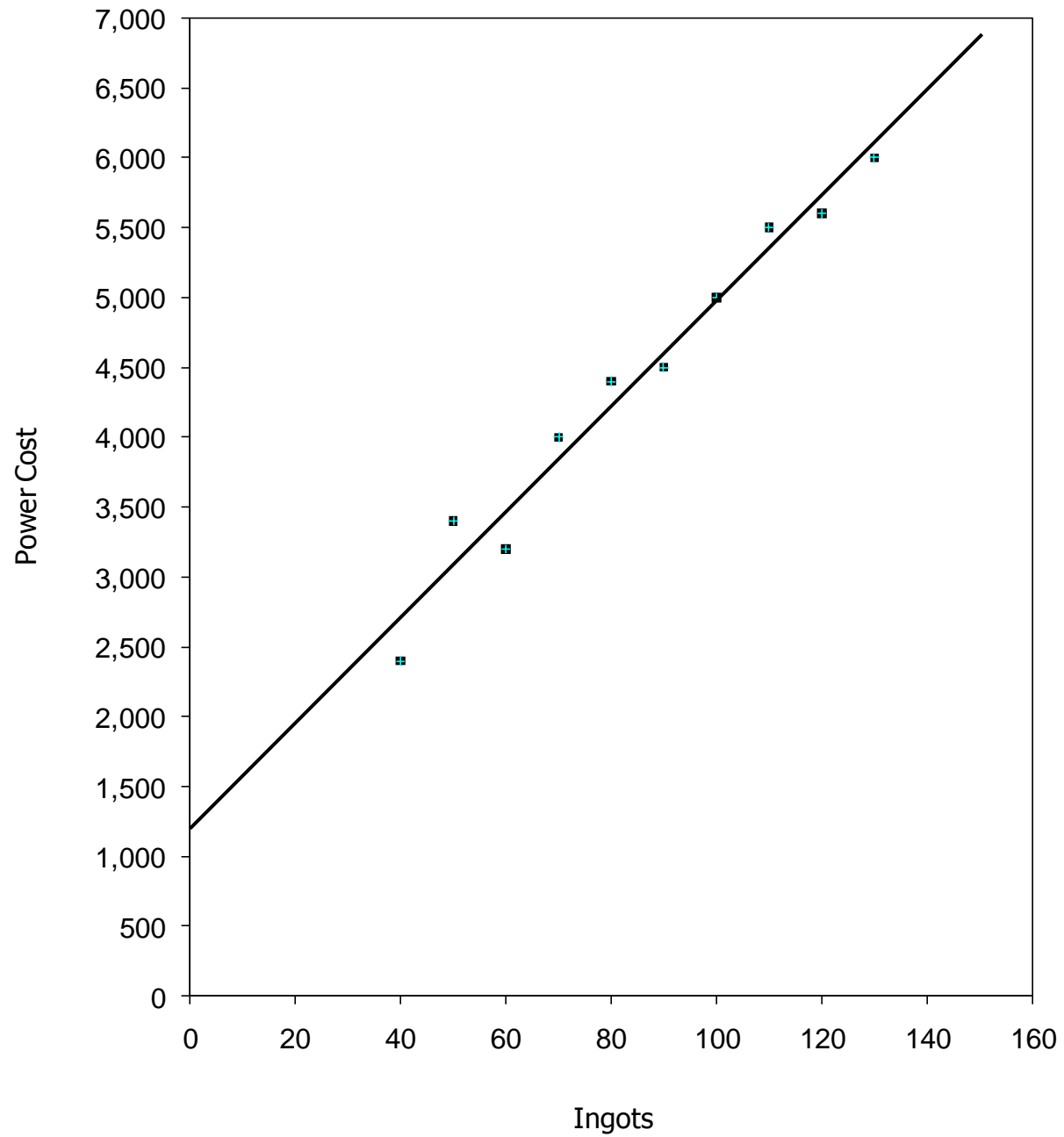
Total cost at 100 ingots (a point that falls on the line).	\$5,000
Less the fixed cost element (intersection of the Y axis on the graph) .....	<u>1,200</u>
Variable cost element at 100 ingots (total) .....	<u>\$3,800</u>

$$\$3,800 \div 100 \text{ ingots} = \$38 \text{ per ingot.}$$

Therefore, the cost formula is:  $Y = \$1,200 + \$38X$ .

### Problem 6-18 (continued)

The completed scattergraph follows:



**Problem 6-19** (30 minutes)

1. The least squares regression method:

<i>Number of Ingots (X)</i>	<i>Power Cost (Y)</i>
110	\$5,500
90	\$4,500
80	\$4,400
100	\$5,000
130	\$6,000
120	\$5,600
70	\$4,000
60	\$3,200
50	\$3,400
40	\$2,400

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost) .....	\$1,185
Slope (variable cost per unit) ....	\$37.82
$R^2$ .....	0.97

Therefore, the variable cost of power per ingot is \$37.82 and the fixed cost of power is \$1,185 per month and the cost formula is:

$$Y = \$1,185 + \$37.82X.$$

Note that the  $R^2$  is 0.97, which means that 97% of the variation in power cost is explained by the number of ingots. This is a very high  $R^2$  and indicates a very good fit.

**Problem 6-19** (continued)

2.

<i>Method</i>	<i>Total Fixed Cost</i>	<i>Variable Cost per Ingot</i>
High-low .....	\$800	\$40.00
Scattergraph method .....	\$1,200	\$38.00
Least squares.....	\$1,185	\$37.82

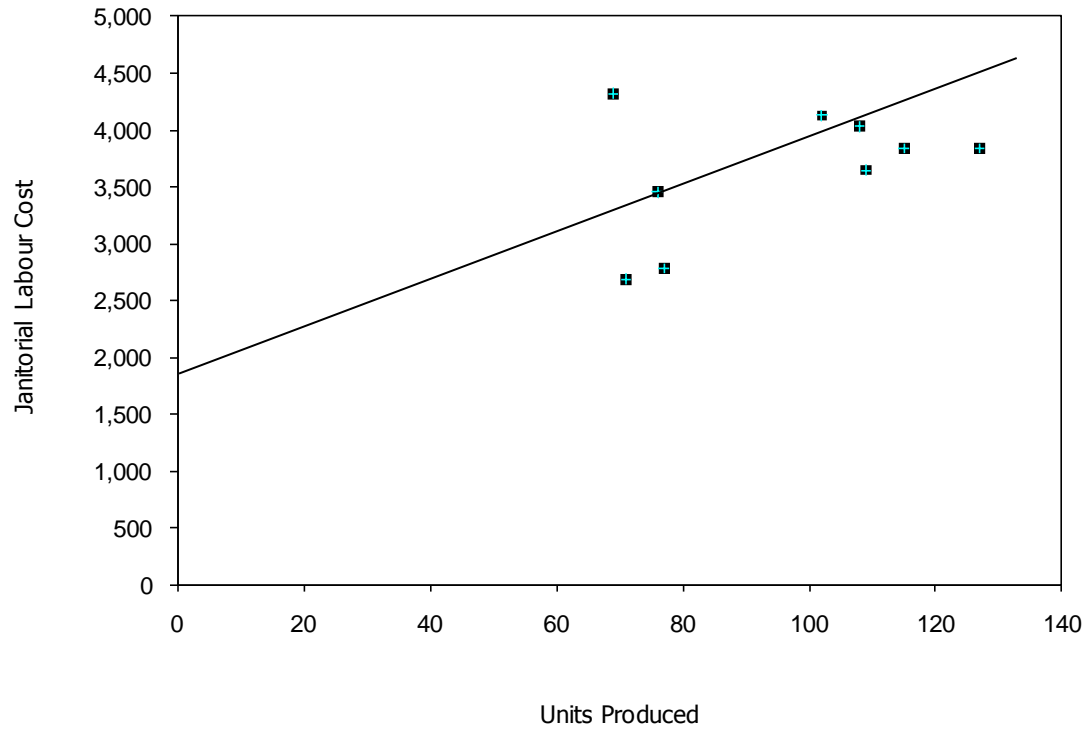
The high-low method is accurate only in those situations where the variable cost is truly constant, or where the high and the low points *happen* to fall on the correct regression line. Due to the high degree of potential inaccuracy, this method is less useful than the least-squares regression method.

The scattergraph method is imprecise and the results will depend on where the analyst chooses to place the line. However, the scattergraph plot can provide invaluable clues about nonlinearities and other problems with the data.

The least squares regression method is generally considered to be the most accurate method of cost analysis. However, it should always be used in conjunction with a scattergraph plot to ensure that the underlying relation really is linear.

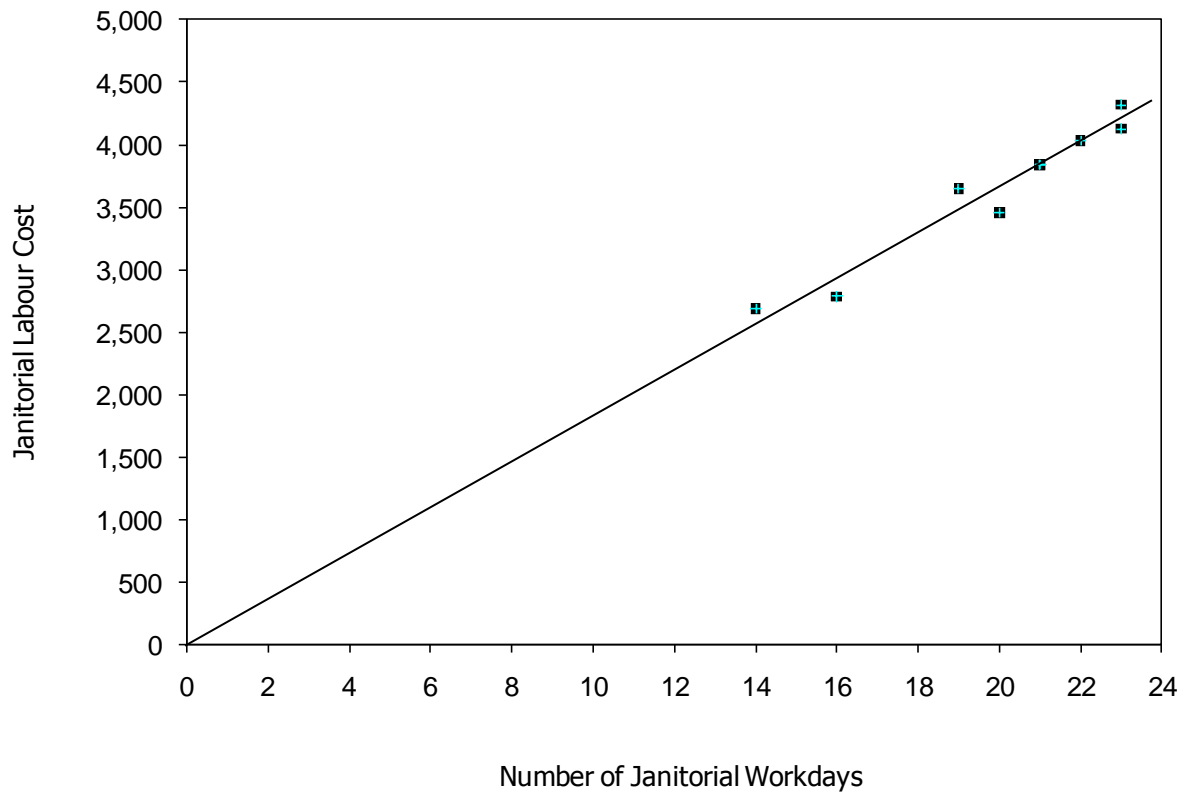
**Case 6-24** (30 minutes)

1. The completed scattergraph for the number of units produced as the activity base is presented below:



**Case 6-24** (continued)

2. The completed scattergraph for the number of workdays as the activity base is presented below:



### Case 6-24 (continued)

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

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