

## Section 16-1: Collecting Data

### Techniques of Sampling

1. 010815b, P.I. A.S.3  
Which method of collecting data would most likely result in an unbiased random sample?  
[A] placing a survey in a local newspaper to determine how people voted in the 2004 presidential election  
[B] surveying honor students taking Mathematics B to determine the average amount of time students in a school spend doing homework each night  
[C] selecting every third teenager leaving a movie theater to answer a survey about entertainment  
[D] selecting students by the last digit of their school ID number to participate in a survey about cafeteria food

## Section 16-2: Organizing Data

### Grouped Data

2. 060401a, P.I. A.S.9  
The test scores for 10 students in Ms. Sampson's homeroom were 61, 67, 81, 83, 87, 88, 89, 90, 98, and 100. Which frequency table is accurate for this set of data?

[A]

Interval	Frequency
61–70	2
71–80	2
81–90	8
91–100	10

[B]

Interval	Frequency
61–70	2
71–80	2
81–90	7
91–100	10

[C]

Interval	Frequency
61–70	2
71–80	0
81–90	8
91–100	10

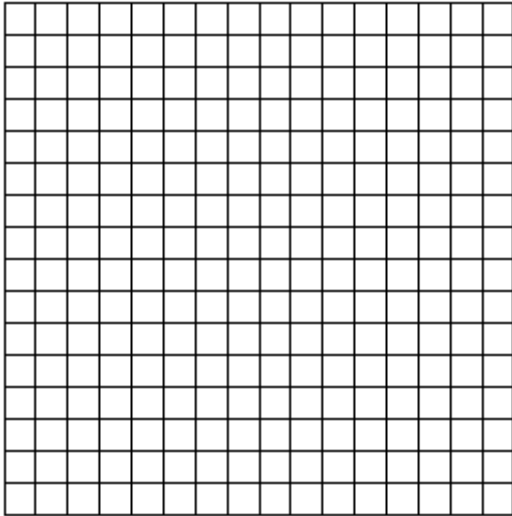
[D]

Interval	Frequency
61–70	2
71–80	0
81–90	6
91–100	2

Constructing a Stem-and-Leaf Diagram

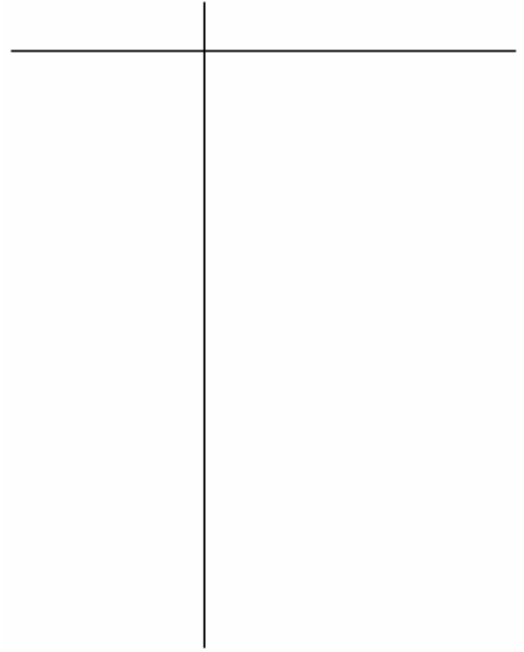
3. 010132a, P.I. A.S.5

On a science quiz, 20 students received the following scores: 100, 95, 95, 90, 85, 85, 85, 80, 80, 80, 80, 75, 75, 75, 70, 70, 65, 65, 60, 55. Construct a statistical graph, such as a histogram or a stem-and-leaf plot, to display this data. [*Be sure to title the graph and label all axes or parts used.*]



4. 010535a

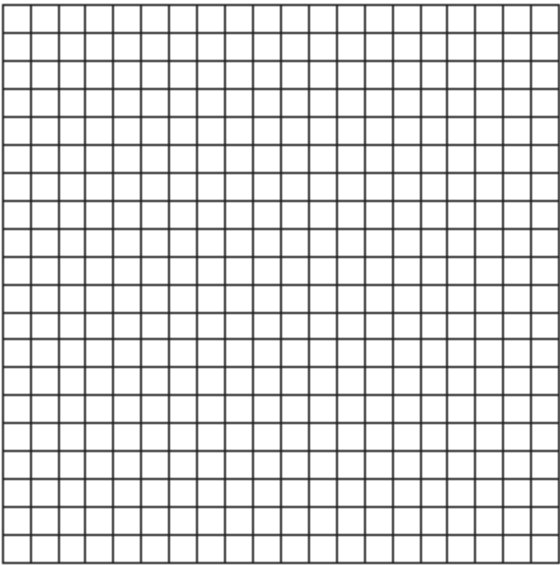
Construct a stem-and-leaf plot listing the scores below in order from lowest to highest.  
15, 25, 28, 32, 39, 40, 43, 26, 50, 75, 65, 19,  
55, 72, 50



Section 16-3: The Histogram

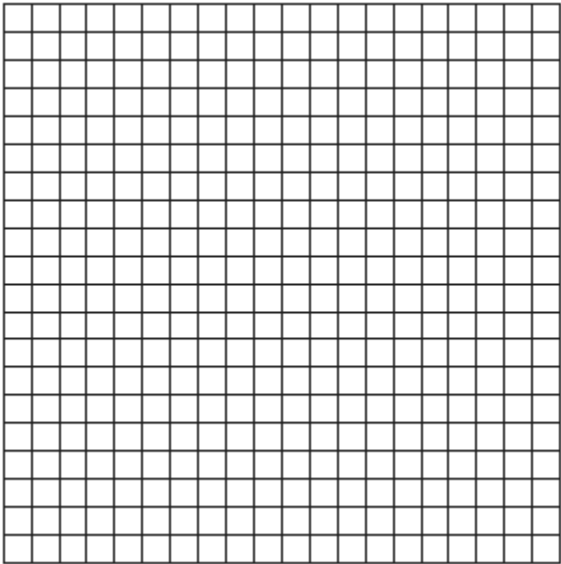
5. 080437a, P.I. A.S.5
- The following set of data represents the scores on a mathematics quiz:  
58, 79, 81, 99, 68, 92, 76, 84, 53, 57, 81, 91,  
77, 50, 65, 57, 51, 72, 84, 89
- Complete the frequency table below and, on the accompanying grid, draw and label a frequency histogram of these scores.

Mathematics Quiz Scores		
Interval	Tally	Frequency
50–59		
60–69		
70–79		
80–89		
90–99		



6. 060033a, P.I. A.S.5
- The scores on a mathematics test were 70, 55, 61, 80, 85, 72, 65, 40, 74, 68, and 84.
- Complete the accompanying table, and use the table to construct a frequency histogram for these scores.

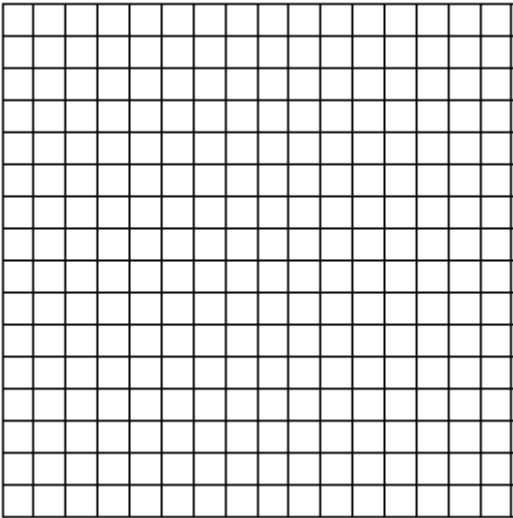
Score	Tally	Frequency
40–49		
50–59		
60–69		
70–79		
80–89		



7. 010032a, P.I. A.S.5
- In the time trials for the 400-meter run at the state sectionals, the 15 runners recorded the times shown in the table below.

400-Meter Run	
Time (sec)	Frequency
50.0–50.9	
51.0–51.9	II
52.0–52.9	
53.0–53.9	III
54.0–54.9	IIII

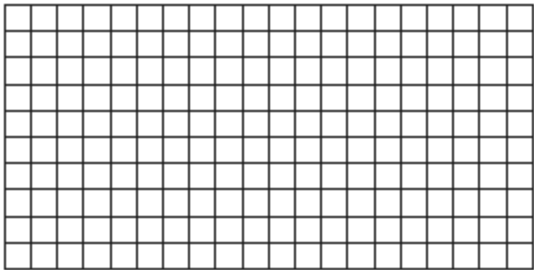
a Using the data from the frequency column, draw a frequency histogram on the grid provided below.



b What percent of the runners completed the time trial between 52.0 and 53.9 seconds?

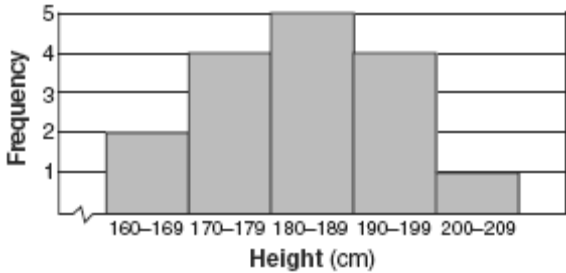
8. 010334a, P.I. A.S.5
- Sarah's mathematics grades for one marking period were 85, 72, 97, 81, 77, 93, 100, 75, 86, 70, 96, and 80.
- a Complete the tally sheet and frequency table below, and construct and label a frequency histogram for Sarah's grades using the accompanying grid.

Interval (grades)	Tally	Frequency
61–70		
71–80		
81–90		
91–100		



b Which interval contains the 75th percentile (upper quartile)?

9. 010504a, P.I. A.S.9
- The accompanying histogram shows the heights of the students in Kyra's health class.



What is the total number of students in the class?

- [A] 209    [B] 15    [C] 16    [D] 5

## Section 16-4: The Mean, the Median, and the Mode

### The Mean

10. 080402a, P.I. 6.S.5  
Rosario and Enrique are in the same mathematics class. On the first five tests, Rosario received scores of 78, 77, 64, 86, and 70. Enrique received scores of 90, 61, 79, 73, and 87. How much higher was Enrique's average than Rosario's average?

[A] 2 points [B] 3 points  
[C] 4 points [D] 15 points

11. 080535a, P.I. 6.S.5  
Seth bought a used car that had been driven 20,000 miles. After he owned the car for 2 years, the total mileage of the car was 49,400. Find the average number of miles he drove *each month* during those 2 years.

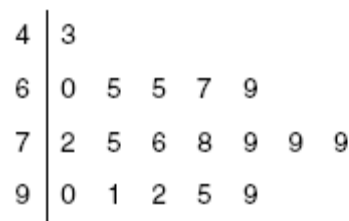
### The Median

12. 010005a, P.I. 6.S.5  
What was the median high temperature in Middletown during the 7-day period shown in the table below?

Daily High Temperature in Middletown	
Day	Temperature (°F)
Sunday	68
Monday	73
Tuesday	73
Wednesday	75
Thursday	69
Friday	67
Saturday	63

[A] 69 [B] 75 [C] 73 [D] 70

13. 060321a, P.I. 6.S.5  
The student scores on Mrs. Frederick's mathematics test are shown on the stem-and-leaf plot below.



Key: 4 | 3 = 43 points

Find the median of these scores.

14. 080714a, P.I. 6.S.5  
The accompanying stem-and-leaf plot represents Ben's test scores this year.



Key: 7 | 2 = 72

What is the median score for this set of data?

[A] 80 [B] 79 [C] 73 [D] 81

15. 010321b, P.I. A.S.4  
Two social studies classes took the same current events examination that was scored on the basis of 100 points. Mr. Wong's class had a median score of 78 and a range of 4 points, while Ms. Rizzo's class had a median score of 78 and a range of 22 points. Explain how these classes could have the same median score while having very different ranges.

# The Mode

16. 060509a, P.I. 6.S.5

Jorge made the accompanying stem-and-leaf plot of the weights, in pounds, of each member of the wrestling team he was coaching.

Stem	Leaf
10	9
11	
12	3 8
13	2 4 4 6 8
14	1 3 5 5 9
15	2 3 7 7 9
16	1 3 7 8 8 8 9
17	3 8

Key: 16 | 1 = 161

What is the mode of the weights?

- [A] 168 [B] 152 [C] 145 [D] 150

17. 060637a, P.I. 6.S.5

Sara's test scores in mathematics were 64, 80, 88, 78, 60, 92, 84, 76, 86, 78, 72, and 90. Determine the mean, the median, and the mode of Sara's test scores.

18. 080501a, P.I. A.S.4

The weights of all the students in grade 9 are arranged from least to greatest. Which statistical measure separates the top half of this set of data from the bottom half?

- [A] mean [B] average  
[C] median [D] mode

19. 010118a, P.I. A.S.4

From January 3 to January 7, Buffalo recorded the following daily high temperatures: 5°, 7°, 6°, 5°, and 7°. Which statement about the temperatures is true?

- [A] mean < median [B] mean = mode  
[C] median = mode [D] mean = median

20. 010315a, P.I. A.S.4

The ages of five children in a family are 3, 3, 5, 8, and 18. Which statement is true for this group of data?

- [A] median > mean [B] mean > median  
[C] mode > mean [D] median = mode

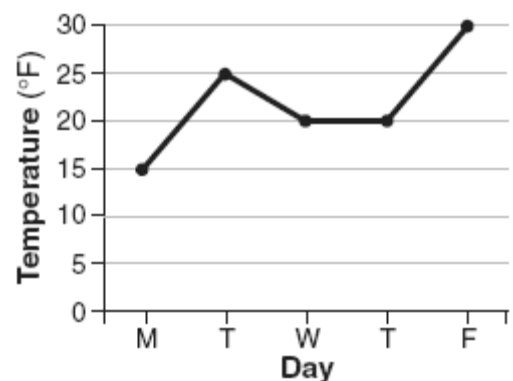
21. 010618a, P.I. A.S.4

Melissa's test scores are 75, 83, and 75. Which statement is true about this set of data?

- [A] mean = median [B] mode < median  
[C] mean < mode [D] mode = median

22. 080608a, P.I. 6.S.5

The accompanying graph shows the high temperatures in Elmira, New York, for a 5-day period in January.



Which statement describes the data?

- [A] median = mean [B] median = mode  
[C] mean = mode [D] mean < mode

23. 069929a, P.I. A.A.6

The mean (average) weight of three dogs is 38 pounds. One of the dogs, Sparky, weighs 46 pounds. The other two dogs, Eddie and Sandy, have the same weight. Find Eddie's weight.

24. 089913a, P.I. A.A.6  
If 6 and  $x$  have the same mean (average) as 2, 4, and 24, what is the value of  $x$ ?  
[A] 5      [B] 14      [C] 10      [D] 36
25. 060204a, P.I. A.A.6  
During each marking period, there are five tests. If Vanita needs a 65 average to pass this marking period and her first four grades are 60, 72, 55, and 80, what is the *lowest* score she can earn on the last test to have a passing average?  
[A] 80      [B] 100      [C] 58      [D] 65
26. 080110a, P.I. A.A.6  
The exact average of a set of six test scores is 92. Five of these scores are 90, 98, 96, 94, and 85. What is the other test score?  
[A] 91      [B] 86      [C] 92      [D] 89
27. 010432a, P.I. A.A.6  
TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is \$360. If the weekly salaries of four of the employees are \$340, \$340, \$345, and \$425, what is the salary of the fifth employee?
28. 010230a, P.I. A.A.6  
The students in Woodland High School's meteorology class measured the noon temperature every schoolday for a week. Their readings for the first 4 days were Monday,  $56^{\circ}$ ; Tuesday,  $72^{\circ}$ ; Wednesday,  $67^{\circ}$ ; and Thursday,  $61^{\circ}$ . If the mean (average) temperature for the 5 days was exactly  $63^{\circ}$ , what was the temperature on Friday?
29. 060017a, P.I. A.A.6  
For five algebra examinations, Maria has an average of 88. What must she score on the sixth test to bring her average up to exactly 90?  
[A] 92      [B] 94      [C] 98      [D] 100
30. 010026a, P.I. A.A.6  
Judy needs a mean (average) score of 86 on four tests to earn a midterm grade of B. If the mean of her scores for the first three tests was 83, what is the *lowest* score on a 100-point scale that she can receive on the fourth test to have a midterm grade of B?
31. 060703a, P.I. A.A.6  
In his first three years coaching baseball at High Ridge High School, Coach Batty's team won 7 games the first year, 16 games the second year, and 4 games the third year. How many games does the team need to win in the fourth year so that the coach's average will be 10 wins per year?  
[A] 13      [B] 9      [C] 3      [D] 10
32. 080227a, P.I. A.A.6  
Tamika could not remember her scores from five mathematics tests. She did remember that the mean (average) was exactly 80, the median was 81, and the mode was 88. If all her scores were integers with 100 the highest score possible and 0 the lowest score possible, what was the *lowest* score she could have received on any one test?
33. 060738a, P.I. A.A.6  
Angelo, Brandon, and Carl work in the same office. Angelo's age is 4 years more than twice Carl's age. Brandon is 5 years younger than Carl. The average of the three ages is 41. Find the age of *each* of the men.

34. 060438a, P.I. A.A.6  
On the first six tests in her social studies course, Jerelyn's scores were 92, 78, 86, 92, 95, and 91. Determine the median and the mode of her scores. If Jerelyn took a seventh test and raised the mean of her scores exactly 1 point, what was her score on the seventh test?

### Section 16-5: Measures of Central Tendency and Grouped Data

35. 080008a, P.I. A2.S.3  
On an English examination, two students received scores of 90, five students received 85, seven students received 75, and one student received 55. The average score on this examination was  
[A] 75 [B] 77 [C] 79 [D] 76

36. fall0737ia, P.I. A.S.4  
The values of 11 houses on Washington St. are shown in the table below.

Value per House	Number of Houses
\$100,000	1
\$175,000	5
\$200,000	4
\$700,000	1

Find the mean value of these houses in dollars. Find the median value of these houses in dollars. State which measure of central tendency, the mean or the median, *best* represents the values of these 11 houses. Justify your answer.

37. 060507b, P.I. A2.S.3  
What is the mean of the data in the accompanying table?

Scores ( $x_i$ )	Frequency ( $f_i$ )
25	3
20	2
11	5
10	4

- [A] 14.5 [B] 16 [C] 11 [D] 15

38. 010807b, P.I. A2.S.3  
Mayken collected data about the size of the honors classes in her school building. This set of data is shown in the accompanying table.

Class Size	Frequency
8	1
10	3
14	2

Which statement about the range of this sample is true?

- [A] range > mean [B] range < mean  
[C] range = mean  
[D] range < standard deviation

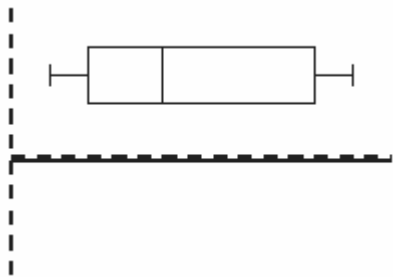


## Section 16-6: Quartiles, Percentiles, and Cumulative Frequency

### Constructing a Box-and-Whisker Plot

39. 060220a

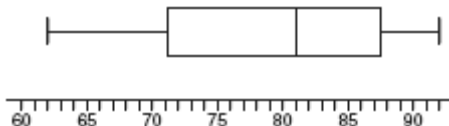
The accompanying diagram is an example of which type of graph?



- [A] box-and-whisker plot      [B] bar graph  
[C] stem-and-leaf plot      [D] histogram

40. 010301a, P.I. A.S.9

The accompanying diagram shows a box-and-whisker plot of student test scores on last year's Mathematics A midterm examination.

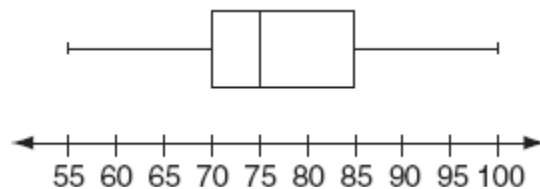


What is the median score?

- [A] 71      [B] 92      [C] 62      [D] 81

41. 060610a, P.I. A.S.9

The accompanying box-and-whisker plot represents the scores earned on a science test.

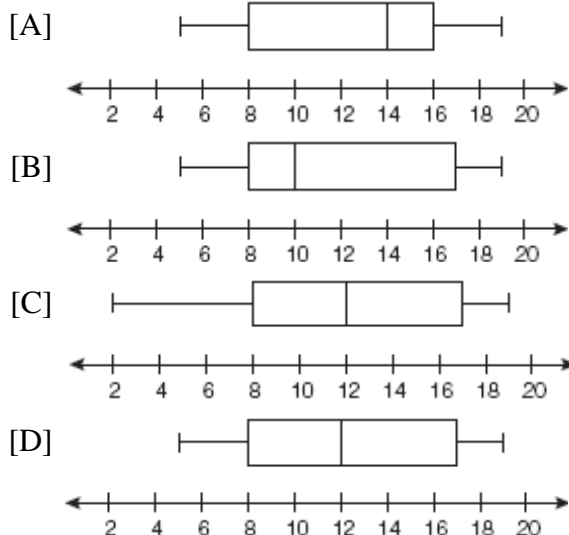


What is the median score?

- [A] 85      [B] 75      [C] 77      [D] 70

42. fall0709ia, P.I. A.S.5

The data set 5, 6, 7, 8, 9, 9, 9, 10, 12, 14, 17, 17, 18, 19, 19 represents the number of hours spent on the Internet in a week by students in a mathematics class. Which box-and-whisker plot represents the data?

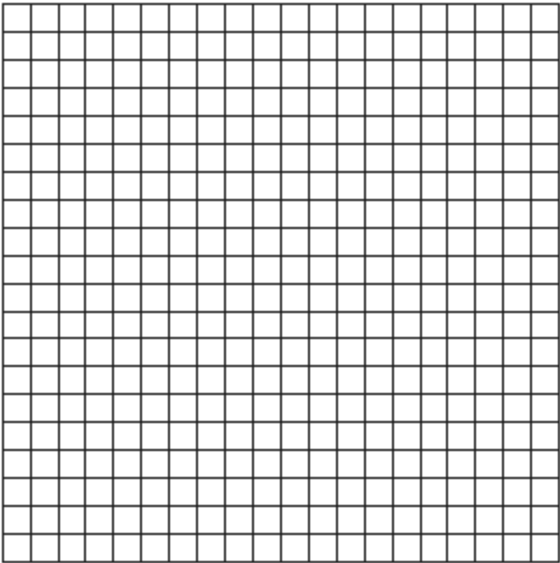


Constructing a Cumulative Frequency Histogram

43. 080134a, P.I. A.S.5
- The following data consists of the weights, in pounds, of 30 adults:  
195, 206, 100, 98, 150, 210, 195, 106, 195, 168, 180, 212, 104, 195, 100, 216, 195, 209, 112, 99, 206, 116, 195, 100, 142, 100, 135, 98, 160, 155

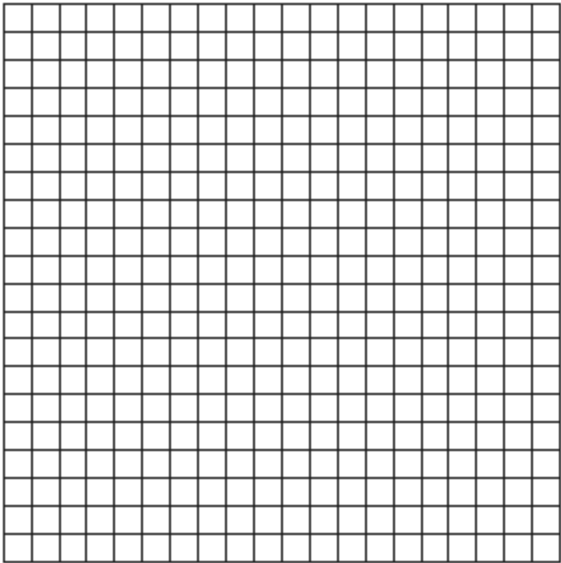
Using the data, complete the accompanying cumulative frequency table and construct a cumulative frequency histogram on the grid below.

Interval	Frequency	Cumulative Frequency
51–100		
101–150		
151–200		
201–250		



44. 010739a, P.I. A.S.5
- The accompanying table shows the weights, in pounds, for the students in an algebra class. Using the data, complete the cumulative frequency table and construct a cumulative frequency histogram on the grid below.

Interval	Frequency	Cumulative Frequency
91–100	6	
101–110	3	
111–120	0	
121–130	3	
131–140	0	
141–150	2	
151–160	2	



## Section 16-7: Bivariate Statistics

45. fall0714ia, P.I. A.S.2

Which situation should be analyzed using bivariate data?

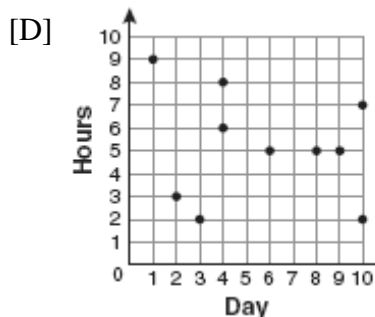
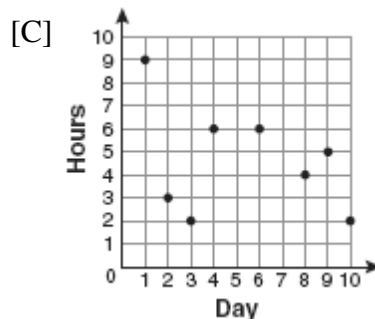
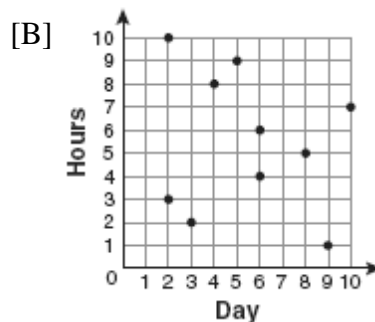
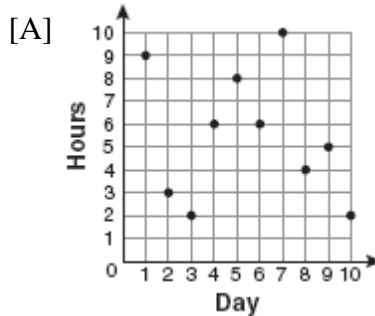
- [A] Mr. Chan keeps track of his daughter's algebra grades for the quarter.
- [B] Mr. Benjamin tries to see if his students' shoe sizes are directly related to their heights.
- [C] Ms. Saleem keeps a list of the amount of time her daughter spends on her social studies homework.
- [D] Mr. DeStefan records his customers' best video game scores during the summer.

46. fall0701ia, P.I. A.S.7

For 10 days, Romero kept a record of the number of hours he spent listening to music. The information is shown in the table below.

Day	1	2	3	4	5	6	7	8	9	10
Hours	9	3	2	6	8	6	10	4	5	2

Which scatter plot shows Romero's data graphically?



### Correlation

47. fall0707ia, P.I. A.S.14

Which situation describes a correlation that is *not* a causal relationship?

- [A] The faster the pace of a runner, the quicker the runner finishes.
- [B] The rooster crows, and the Sun rises.
- [C] The more powerful the microwave, the faster the food cooks.
- [D] The more miles driven, the more gasoline needed.

### Line of Best Fit

48. 060722b, P.I. A2.S.7

The accompanying table shows the enrollment of a preschool from 1980 through 2000. Write a linear regression equation to model the data in the table.

Year ( $x$ )	Enrollment ( $y$ )
1980	14
1985	20
1990	22
1995	28
2000	37

49. 060134b, P.I. A2.S.7

The 1999 win-loss statistics for the American League East baseball teams on a particular date is shown in the accompanying chart.

	W	L
New York	52	34
Boston	49	39
Toronto	47	43
Tampa Bay	39	49
Baltimore	36	51

Find the mean for the number of wins,  $\bar{W}$ , and the mean for the number of losses,  $\bar{L}$ , and determine if the point  $(\bar{W}, \bar{L})$  is a point on the line of best fit. Justify your answer.

50. 010530b, P.I. A2.S.7

A real estate agent plans to compare the price of a cottage,  $y$ , in a town on the seashore to the number of blocks,  $x$ , the cottage is from the beach. The accompanying table shows a random sample of sales and location data. Write a linear regression equation that relates the price of a cottage to its distance from the beach. Use the equation to predict the price of a cottage, to the *nearest dollar*, located three blocks from the beach.

Number of Blocks from the Beach ( $x$ )	Price of a Cottage ( $y$ )
5	\$132,000
0	\$310,000
4	\$204,000
2	\$238,000
1	\$275,000
7	\$60,800

51. 080728b, P.I. A2.S.7

The accompanying table shows the percent of the adult population that married before age 25 in several different years. Using the year as the independent variable, find the linear regression equation. Round the regression coefficients to the *nearest hundredth*. Using the equation found above, estimate the percent of the adult population in the year 2009 that will marry before age 25, and round to the *nearest tenth of a percent*.

Year ( $x$ )	Percent ( $y$ )
1971	42.4
1976	37.4
1980	37.1
1984	34.1
1989	32.1
1993	28.8
1997	25.7
2000	25.5

52. 080133b, P.I. A2.S.7

The availability of leaded gasoline in New York State is decreasing, as shown in the accompanying table.

Year	1984	1988	1992	1996	2000
Gallons Available (in thousands)	150	124	104	76	50

Determine a linear relationship for  $x$  (years) versus  $y$  (gallons available), based on the data given. The data should be entered using the year and gallons available (in thousands), such as (1984,150). If this relationship continues, determine the number of gallons of leaded gasoline available in New York State in the year 2005. If this relationship continues, during what year will leaded gasoline first become unavailable in New York State?

53. 010328b, P.I. A2.S.7

In a mathematics class of ten students, the teacher wanted to determine how a homework grade influenced a student's performance on the subsequent test. The homework grade and subsequent test grade for each student are given in the accompanying table.

Homework Grade ( $x$ )	Test Grade ( $y$ )
94	98
95	94
92	95
87	89
82	85
80	78
75	73
65	67
50	45
20	40

a Give the equation of the linear regression line for this set of data.

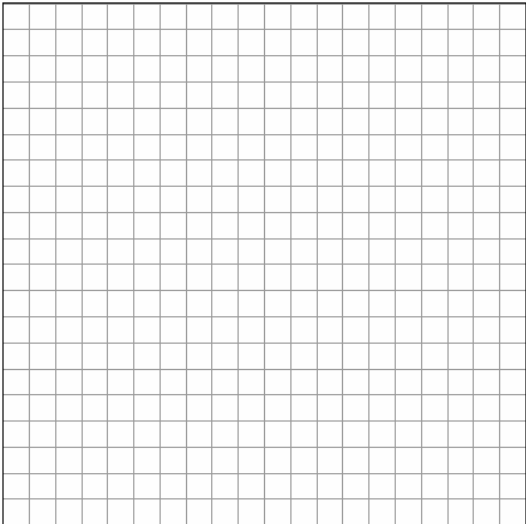
b A new student comes to the class and earns a homework grade of 78. Based on the equation in part a, what grade would the teacher predict the student would receive on the subsequent test, to the *nearest integer*?

54. 080331b, P.I. A2.S.7

The table below shows the results of an experiment that relates the height at which a ball is dropped,  $x$ , to the height of its first bounce,  $y$ .

Drop Height ( $x$ ) (cm)	Bounce Height ( $y$ ) (cm)
100	26
90	23
80	21
70	18
60	16

Find  $\bar{x}$ , the mean of the drop heights. Find  $\bar{y}$ , the mean of the bounce heights. Find the linear regression equation that best fits the data. Show that  $(\bar{x}, \bar{y})$  is a point on the line of regression. [The use of the grid is optional.]

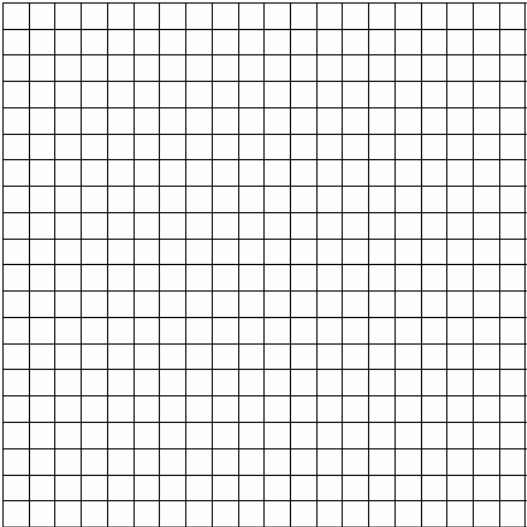


55. 010234b, P.I. A2.S.7

Two different tests were designed to measure understanding of a topic. The two tests were given to ten students with the following results:

Test $x$	75	78	88	92	95	67	55	72	74	81
Test $y$	81	73	85	88	89	73	66	75	70	78

Construct a scatter plot for these scores, and then write an equation for the line of best fit (round slope and intercept to the *nearest hundredth*).



Find the correlation coefficient.  
Predict the score, to the *nearest integer*, on test  $y$  for a student who scored 87 on test  $x$ .

56. 080533b, P.I. A2.S.7

The accompanying table illustrates the number of movie theaters showing a popular film and the film's weekly gross earnings, in millions of dollars.

Number of Theaters ( $x$ )	Gross Earnings ( $y$ ) (millions of dollars)
443	2.57
455	2.65
493	3.73
530	4.05
569	4.76
657	4.76
723	5.15
1,064	9.35

Write the linear regression equation for this set of data, rounding values to *five decimal places*. Using this linear regression equation, find the approximate gross earnings, in millions of dollars, generated by 610 theaters. Round your answer to *two decimal places*. Find the minimum number of theaters that would generate at least 7.65 million dollars in gross earnings in one week.

57. 010633b, P.I. A2.S.7

Since 1990, fireworks usage nationwide has grown, as shown in the accompanying table, where  $t$  represents the number of years since 1990, and  $p$  represents the fireworks usage per year, in millions of pounds.

Number of Years Since 1990 ( $t$ )	Fireworks Usage per Year, In Millions of Pounds ( $p$ )
0	67.6
2	88.8
4	119.0
6	120.1
7	132.5
8	118.3
9	159.2
11	161.6

Find the equation of the linear regression model for this set of data, where  $t$  is the independent variable. Round values to *four decimal places*. Using this equation, determine in what year fireworks usage would have reached 99 million pounds. Based on this linear model, how many millions of pounds of fireworks would be used in the year 2008? Round your answer to the *nearest tenth*.

58. 060631b, P.I. A2.S.7

A factory is producing and stockpiling metal sheets to be shipped to an automobile manufacturing plant. The factory ships only when there is a minimum of 2,050 sheets in stock. The accompanying table shows the day,  $x$ , and the number of sheets in stock,  $f(x)$ .

Day ( $x$ )	Sheets in Stock ( $f(x)$ )
1	860
2	930
3	1000
4	1150
5	1200
6	1360

Write the linear regression equation for this set of data, rounding the coefficients to *four decimal places*. Use this equation to determine the day the sheets will be shipped.



[1] D

[2] D

[4] The student draws a histogram, a stem-and-leaf plot, or any other acceptable statistical graph, with proper labels and a title.

[3] The student makes one or two minor errors, such as a lack of label, title, or connected dots.

[2] The student makes several minor errors or one major error, such as not accounting for all 20 scores.

[1] The student draws just the beginning of a graph.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[3] incorrect procedure.

[2] A correct stem-and-leaf plot is drawn, including a key.

[1] The data are arranged correctly, but incorrect labels are written on the stem-and-leaf columns. [Columns do not need to be labeled for a full-credit response, but full credit may not be awarded if the columns are labeled incorrectly.]

or [1] The data are listed in the stem-and-leaf plot, but not in ascending order.

or [1] One or two of the scores are left out of the stem-and-leaf plot.

or [1] Duplicate values are left out of the stem-and-leaf plot.

[0] Incorrect labels are written on the stem-and-leaf columns, and scores are left out of the plot.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[4] obviously incorrect procedure.

[3] The frequency table is completed correctly, showing frequencies of 6, 2, 4, 5, and 3, and a frequency histogram is drawn and labeled correctly.

[2] The frequency table is completed correctly, but one graphing error is made, such as not labeling the axes, having nonequal intervals, or starting the  $x$ -axis at 50.

or [2] The frequency table is completed incorrectly, but an appropriate frequency histogram is drawn.

or [2] The frequency histogram is drawn and labeled correctly, but the frequency table is not completed.

[1] The frequency table is completed correctly, but two or more graphing errors are made.

or [1] The frequency table is completed correctly, but no frequency histogram is drawn or a bar graph is drawn.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[5] incorrect procedure.

[4] A correct table and histogram with appropriate labels and scales are shown, such as the table below.

SCORE	TALLY	FREQUENCY
40-49	/	1
50-59	/	1
60-69	///	3
70-79	///	3
80-89	///	3

[3] An incorrect table is shown, but the histogram is appropriate, based on this table.  
or [3] A correct table is shown, but one error is made on the histogram, such as using incorrect labels or no labels.

or [3] An incomplete table is shown, but the histogram is correct.

[2] An incomplete table is shown, and the histogram is partially correct.

or [2] A correct table is shown, and a correct bar graph is made.

[1] A correct table is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[6] incorrect procedure.

---

*a* [2] An appropriate histogram is drawn with both axes labeled with a correct numerical scale.

[1] A correct bar graph is drawn.

or [1] The parts of the histogram are not labeled.

or [1] Equal interval scales are not shown.

or [1] One error on frequency calculation is made.

[0] Two or more mistakes on frequency calculation are made.

*b* [2] 60% and an appropriate explanation is given.

[1] An appropriate method to find percent is shown, but a mistake is made in reading the

chart, such as  $\frac{6}{15} = 40\%$  or  $\frac{9}{15}$  is shown but

not given as a percent answer.

or [1] 60% and no explanation is given.

*a* and *b*

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[7] incorrect procedure.

---

*a* [3] The frequency table is completed correctly, and a histogram is drawn with a correct scale and is labeled correctly.

[2] One or two errors are made in the frequency table, but an appropriate histogram is drawn.

or [2] The frequency table is completed correctly, but one error is made in drawing the histogram.

[1] A correct histogram is drawn, but the frequency table is not completed.

*b* [1] The interval 91-100 is identified as containing the 75th percentile.

or [1] The appropriate interval is identified, based on an incorrect frequency table in part *a*.

*a* and *b*

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[8] incorrect procedure.

---

[9] C

[10] B

[2] 1,225, and appropriate work is shown, such as solving an equation or writing an explanation.

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] Appropriate work is shown, but the conversion from years to months is incorrect, but an appropriate solution is found.

or [1] 1,225, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[11] incorrect procedure.

[12] A

[2] 77, and appropriate work is shown, such as  $(76 + 78) \div 2$ .

[1] 76 and 78 are identified.

or [1] 77, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[13] incorrect procedure.

[14] A

[2] An appropriate explanation is given, such as:

One very high or very low score in either class would have a great effect on the range for that class, but might not affect the median at all. The range is the difference between the two most extreme values, the lowest and the highest. The median, being the middle value, is not very sensitive to outliers or to extreme values.

or [2] Specific examples are shown to illustrate the situation.

[1] An understanding of median and range is demonstrated, but the specific situation is not explained.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[15] incorrect procedure.

[16] A

[3] Mean = 79, median = 79, and mode = 78, and appropriate work is shown.

[2] Appropriate work is shown, but only two of the three measures of central tendency are determined and identified correctly.

or [2] Appropriate work is shown and all three measures of central tendency are determined correctly, but the measures are not identified or are identified incorrectly.

[1] Appropriate work is shown, but only one of the three measures of central tendency is determined and identified correctly.

or [1] Mean = 79, median = 79, and mode = 78, but no work is shown.

[0] 79, 79, and 78, but no work is shown, and the answers are not identified or are identified incorrectly.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[17] obviously incorrect procedure.

[18] C

[19] D

[20] B

[21] D

[22] B

[3] 34 and an appropriate explanation is given, such as  $38 = \frac{46 + 2x}{3}$ .

[2] An appropriate method or equation is shown, but one computational mistake is made.

or [2] The student does not take into consideration two dogs of equal weight and gives an answer of 68.

[1] The student understands weighted average in that three dogs averaging 38 pounds must have a total weight of 114 pounds but does not subtract the known weight.

or [1] 34 and no explanation is given.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[23] incorrect procedure.

[24] B

[25] C

[26] D

[2] \$350, and appropriate work is shown, such as  $\frac{1450 + x}{5} = 360$  or trial and error with

at least three trials and appropriate checks.

[1] Appropriate work is shown, but one computational error is made.

or [1] The total of the five salaries is shown to be  $5 \times 360 = 1800$ , but no further correct work is shown.

or [1] \$350, but no work is shown or fewer than three trials with appropriate checks are shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[27] incorrect procedure.

[3] 59 or 59°, and appropriate work is shown, such as  $63 = \frac{256 + x}{5}$  or

$56 + 72 + 67 + 61 = 256$ ,  $63 \times 5 = 315$ , and  $315 - 256 = 59$ .

[2] Appropriate work is shown, but one computational error is made.

or [2] A value is chosen for Friday's temperature that rounds to 63, such as 57 or 61,

but whose mean is not exactly 63, and appropriate work is shown.

[1] A limited understanding of the concept of the mean is shown, such as the sum of the temperatures must be 315, but the given temperatures are not subtracted.

or [1] The correct mean of the four given temperatures is calculated.

or [1] 59 or 59°, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[28] incorrect procedure.

[29] D

[3] 95 and an appropriate method is shown that obtains an answer, such as  $344 - 249$  or a similar equation or method.

or [3] Four scores are tried that round off to an average of 86, such as 93 or 94. Round off to 86 must be shown.

[2] An appropriate method is shown, but one computational mistake is made.

[1] The student understands weighted average and shows that the average of 83 for 3 tests is a total of 249 points.

or [1] 95 and no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[30] incorrect procedure.

[31] A

[3] 63, and appropriate work is shown, such as  $400 - (81 + 88 + 88)$  and determining the highest and lowest possible scores remaining that total 143.

[2] Appropriate work is shown, but one computational error is made.

[1] A total of 400 is shown, but one conceptual error is made, such as 257 is subtracted, and then 143 is split into 72 and 71, resulting in an answer of 71.

or [1] Appropriate work is shown, but more than one computational error is made.

or [1] No answer or an incorrect answer is found, but a list such as \_\_\_\_, \_\_\_\_, 81, 88, 88 is shown.

or [1] 63, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[32] incorrect procedure.

[4] Angelo is 66, Brandon is 26, and Carl is 31, and appropriate work is shown, such as solving an equation or trial and error with at least three trials and appropriate checks.

[3] Appropriate work is shown, but one computational error is made.

or [3] 66, 26, and 31, and appropriate work is shown, but the solutions are not labeled or are labeled incorrectly.

[2] Appropriate work is shown, but two or more computational errors are made.

or [2] Appropriate work is shown, but one conceptual error is made.

or [2] The trial-and-error method is used to find a correct solution, but only two trials and appropriate checks are shown.

or [2] The trial-and-error method is attempted and at least six systematic trials and appropriate checks are shown, but no solution is found.

or [2] Carl is 31, and appropriate work is shown, but the ages of the other men are not found.

or [2] An incorrect equation of equal difficulty is solved appropriately.

[1] Appropriate work is shown, but one conceptual error and one computational error are made.

or [1] A correct equation is written, but no further correct work is shown.

or [1] Angelo is 66, Brandon is 26, and Carl is 31, but no work or only one trial with an appropriate check is shown.

[0] Angelo is 66 *or* Brandon is 26 *or* Carl is 31, but no work is shown.

or [0] 66, 26, and 31, but no work is shown, and the answers are not labeled or are labeled incorrectly.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[33] obviously incorrect procedure.

[4] Median = 91.5, mode = 92, and seventh test score = 96, and appropriate work is shown.

[3] Appropriate work is shown, but one computational error is made.

or [3] Seventh test score = 96, but only the median or the mode is found correctly, but appropriate work is shown.

or [3] 91.5, 92, and 96, and appropriate work is shown, but the median and mode are not labeled or are labeled incorrectly.

[2] Appropriate work is shown, but two or more computational errors are made.

or [2] Appropriate work is shown, but one conceptual error is made.

or [2] Both the median and the mode are found and labeled correctly, and appropriate work is shown, but the seventh test score is not found or is found incorrectly.

or [2] Seventh test score = 96, and appropriate work is shown, but the median and the mode are not found or are found incorrectly.

[1] Either the median or the mode is found and labeled correctly, and appropriate work is shown, but no further correct work is shown.

or [1] Median = 91.5, mode = 92, and seventh test score = 96, but no work is shown.

[0] Median = 91.5 or mode = 92 or seventh test score = 96, but no work is shown.

or [0] 91.5, 92, and 96, but no work is shown and the answers are not labeled.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[34] obviously incorrect procedure.

[35] C

[4] Mean = 225,000, median = 175,000, and the median is stated to be the best measure of central tendency, an appropriate justification is given, and appropriate work is shown.

[3] Appropriate work is shown, but one computational error is made, but an appropriate measure of central tendency is stated, and an appropriate justification is given.

or [3] Mean = 225,000, median = 175,000, and the median is stated to be the best measure of central tendency, but no justification is given.

[2] Appropriate work is shown, but two or more computational errors are made, but an appropriate measure of central tendency is stated, and an appropriate justification is given.

or [2] Appropriate work is shown, but one conceptual error is made.

or [2] Appropriate work is shown to find mean = 225,000 and median = 175,000, but no further correct work is shown.

[1] Appropriate work is shown, but one computational error and one conceptual error are made.

or [1] Mean = 225,000 and median = 175,000, but no further work is shown.

[0] Mean = 225,000 or median = 175,000, but no further work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[36] obviously incorrect procedure.

[37] D

[38] B

[39] A

[40] D

[41] B

[42] B

[4] Correct cumulative frequencies of 7, 14, 24, and 30 and a fully labeled correct histogram are shown.

[3] Incorrect cumulative frequencies are shown, but the histogram is appropriate for the data.

or [3] Correct cumulative frequencies are shown, but a partially incorrect histogram is shown, such as the axes not being labeled, having nonequal intervals, or the x-axis starting at 50.

[2] Only a frequency histogram is completed correctly.

or [2] Only a correct cumulative frequency table and a correct bar graph are shown.

[1] An appropriate bar graph is shown, but it is based on frequencies, not the cumulative frequency.

or [1] Only a correct cumulative frequency table is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[43] incorrect procedure.

---

[4] The table is completed correctly, and an appropriate cumulative frequency histogram is drawn and labeled.

[3] The table is completed correctly, but one error is made in drawing the cumulative frequency histogram or one or more labeling errors are made.

or [3] The table is not completed correctly, but an appropriate cumulative frequency histogram is drawn, based on the table.

[2] One error is made in completing the table, and one graphing error is made in drawing the cumulative frequency histogram.

or [2] The table is completed correctly, but one conceptual error is made, such as drawing a frequency histogram or a cumulative frequency bar graph.

[1] The table is completed correctly, but no histogram is drawn.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[44] incorrect procedure.

---

[45] B

---

[46] A

---

[47] B

---

[2]  $y = 1.08x - 2125$  or an equivalent equation is written.

[1] One conceptual error is made, such as writing a regression equation that is not linear.

or [1] The expression  $1.08x - 2125$  is written, but no equation is written.

or [1] The correct values are identified for  $a$  and  $b$ , but no equation is written.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[48] incorrect procedure.

---

- [6]  $\bar{W} = 44.6$  and  $\bar{L} = 43.2$ , the line of best-fit equation ( $y = -1.007559x + 88.137149$ ) is shown, and an appropriate justification of point  $(\bar{W}, \bar{L})$  fitting or not fitting, depending on the rounding of the equation, is given.
- [5]  $\bar{W}$  or  $\bar{L}$  is incorrect, but the rest of the work is appropriate.
- or [5] All conditions of the problem are met, except it is not stated whether  $(\bar{W}, \bar{L})$  lies or does not lie on the line of best fit.
- or [5]  $\bar{W}$  and  $\bar{L}$  and the equation of the line of best fit are correct, but one error results in an incorrect conclusion, such as the calculation or interchanging of  $\bar{W}$  and  $\bar{L}$ .
- [4] Both  $\bar{W}$  and  $\bar{L}$  are incorrect, but the rest of the work is appropriate.
- or [4]  $\bar{W}$  and  $\bar{L}$  are correct, but the equation of the line of best fit is incorrect, but the justification is appropriate, based on the incorrect equation.
- or [4]  $\bar{W}$  and  $\bar{L}$  are correct, a correct scatter plot is drawn, a correct line of best fit is drawn,  $(\bar{W}, \bar{L})$  is plotted correctly, and a statement indicating that the point does or does not fit the line is given, with an appropriate explanation, but no equation is used.
- or [4] All conditions of the problem are met, except for the justification of whether  $(\bar{W}, \bar{L})$  lies on the line.
- [3]  $\bar{W}$  and  $\bar{L}$  are correct, but the equation of the line of best fit is stated incorrectly, and no further work is shown.
- [2] Only  $\bar{W}$  and  $\bar{L}$  are found correctly.
- [1] Only one mean is found correctly.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [49]

- [4]  $y = -34739.71292x + 313309.0909$  and 209,090, and appropriate work is shown.
- [3] Appropriate work is shown, but one computational or rounding error is made.
- or [3] An incorrect linear equation with a negative slope is written, but an appropriate price is found for three blocks from the beach.
- [2] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [2] Appropriate work is shown, but one conceptual error is made.
- or [2] A correct linear function is written, but no further correct work is shown.
- or [2] An incorrect linear equation with a positive slope is written, but an appropriate price is found for three blocks from the beach.
- [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or [1] 209,090, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [50]
- [4]  $y = -0.58x + 1185.09$  and 19.9, and appropriate work is shown.
- [3] Appropriate work is shown, but one computational or rounding error is made.
- [2] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [2] Appropriate work is shown, but one conceptual error is made.
- or [2] A correct linear equation is written, but no further correct work is shown.
- or [2] An incorrect linear equation is written, but an appropriate percentage is found.
- [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or [1] 19.9, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [51]



- [6]  $y = -6.2x + 12,451.2$ ; 20.2 thousand; and 2008; and appropriate work is shown.
- [5] The correct equation is shown, but only the number of gallons or the year is correct.
- [4] The slope and  $y$ -intercept are incorrect, but the slope is negative and the number of gallons and the year are appropriate, based on the incorrect equation.
- [3] The slope and  $y$ -intercept are incorrect, but the slope is negative, but only the number of gallons or the year is appropriate, based on the incorrect equation.
- [2] The correct equation is shown, but the number of gallons and the year are not determined or are determined incorrectly.
- or [2] The incorrect equation  $y = 6.2x + 12,451.2$  is shown, but appropriate work is shown for the number of gallons and the year.
- [1] An incorrect equation is shown with a negative slope, and the number of gallons and the year are not determined.
- or [1] 20.2 thousand and 2008, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [52]

- [4] a  $y = 0.8344648562x + 14.64960064$  or an equivalent answer expressed to three significant digits
- and b 80, and appropriate work is shown.
- [3] One computational error is made or one rounding error is made with one of the numbers in the equation, such as truncating or not giving at least three significant digits.
- [2] Only the correct answer for either part a or part b is found.
- or [2] Appropriate work is shown, but more than one computational or rounding error is made.
- [1] 78 is substituted into an incorrect linear equation, but it is evaluated appropriately.
- or [1]  $y = 0.8344648562x + 14.64960064$  and 80, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [53]
- [4]  $\bar{x} = 80$ ,  $\bar{y} = 20.8$ , and  $y = 0.25x + 0.8$ , and appropriate work is shown to prove that  $(\bar{x}, \bar{y})$  is a point on the line of regression.
- [3] Appropriate work is shown, but one computational error is made.
- [2] Appropriate work is shown, but two or more computational errors are made.
- or [2] Appropriate work is shown, but one conceptual error is made.
- [1]  $\bar{x} = 80$ ,  $\bar{y} = 20.8$ , and  $y = 0.25x + 0.8$ , but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [54]

- [6] A correct scatter plot,  $y = 0.62x + 29.18$ ,  $r = 0.92$ , and 83; and appropriate work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
- or [5] A correct scatter plot, equation, and score are shown, but no  $r$ -value is found.
- [4] A correct scatter plot and equation are shown, but the  $r$ -value and score are missing or incorrect.
- or [4] An incorrect equation is shown, but all further work is appropriate.
- or [4] The scatter plot is missing or incorrect, but all further work is appropriate.
- [3] The scatter plot is incorrect, but a correct equation and either a correct  $r$ -value or score are found.
- or [3] The scatter plot is correct, but an incorrect equation and either an appropriate  $r$ -value or score based on the incorrect equation are found.
- [2] Only a correct scatter plot is shown, and all further work is missing or incorrect.
- or [2] Only a correct equation is shown, and all further work is missing or incorrect.
- [1] An incorrect equation is shown, but an appropriate score is found.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 

- [6]  $y = 0.01021x - 1.66787$ , 4.56, and 913, and appropriate work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
- or [5] The expression  $0.01021x - 1.66787$  is written and 4.56 and 913 are found, and appropriate work is shown.
- [4] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [4] A correct equation is written, but either the gross earnings or the number of theaters is not found, but appropriate work is shown.
- or [4] An incorrect equation of equal difficulty is written, but appropriate answers are found, and appropriate work is shown.
- [3] Appropriate work is shown, but one conceptual error is made.
- or [3]  $y = 0.01021x - 1.66787$ , 4.56, and 913, but no work is shown.
- or [3] The expression  $0.01021x - 1.66787$  is written and either 4.56 or 913 is found, and appropriate work is shown.
- [2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or [2] A correct equation is written, but no further correct work is shown.
- [1] 4.56 and 913, but no work is shown.
- or [1] The expression  $0.01021x - 1.66787$  is written, but no further correct work is shown.
- [0] Either 4.56 or 913, but no work is shown.
- or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-

- [6]  $p = 8.1875t + 72.7860$ , 1993, and 220.2, and appropriate work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
- or [5] The expression  $8.1875t + 72.7860$  is written and 1993 and 220.2 are found, and appropriate work is shown.
- [4] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [4] A correct equation is written, but either the year or the predicted value for 2008 is not found, but appropriate work is shown.
- or [4] An incorrect equation is solved appropriately.
- [3] Appropriate work is shown, but one conceptual error is made.
- or [3]  $p = 8.1875t + 72.7860$ , 1993, and 220.2, but no work is shown.
- or [3] The expression  $8.1875t + 72.7860$  is written and either 1993 or 220.2 is found, and appropriate work is shown.
- [2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or [2] A correct equation is written, but no further correct work is shown.
- or [2] 1993 and 220.2, but no work is shown.
- [1] The expression  $8.1875t + 72.7860$  is written, but no further correct work is shown.
- or [1] 1993 or 220.2, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [57]
- [4]  $f(x) = 98.8571x + 737.3333$  or  $y = 98.8571x + 737.3333$  and day 14, and appropriate substitution is made, such as  $2050 = 98.8571x + 737.3333$ .
- [3] Appropriate work is shown, but one computational or rounding error is made.
- or [3] A correct linear regression equation is written and day 14, but no substitution is made.
- or [3] The expression  $98.8571x + 737.3333$  is written and day 14, and appropriate substitution is made, but no equation is written.
- [2] Appropriate work is shown, but two or more computational or rounding errors are made.
- or [2] Appropriate work is shown, but one conceptual error is made.
- or [2] A correct linear regression equation is written, but no further correct work is shown.
- or [2] An incorrect equation of equal difficulty is solved appropriately.
- [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or [1] The expression  $98.8571x + 737.3333$  is written, but no further correct work is shown.
- or [1] Day 14, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
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- [58]