

Student: \_\_\_\_\_  
Date: \_\_\_\_\_

Instructor: Andreas Lazari  
Course: Math2620 F - Fall 2018

Assignment: Chapter 4.1, 4.2, and 4.3-  
Homework

1. What does it mean to say that two variables are positively associated? Negatively associated?

What does it mean to say that two variables are positively associated?

- A. There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable decreases.
- B. There is a linear relationship between the variables.
- C. There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable increases.
- D. There is a relationship between the variables that is not linear.

What does it mean to say that two variables are negatively associated?

- A. There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable decreases.
- B. There is a relationship between the variables that is not linear.
- C. There is a linear relationship between the variables.
- D. There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable increases.

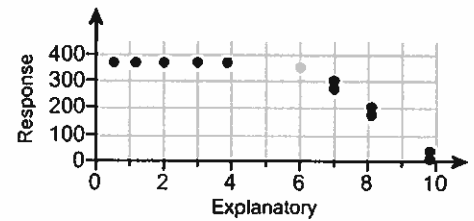
2. Fill in the blank below.

If  $r = -1$ , then a perfect negative linear relation exists between the two quantitative variables.

If  $r = (1) \underline{1}$  then a perfect negative linear relation exists between the two quantitative variables.

- (1)  -2,  1,  
 2,  
 -1,  
 0,

3. Determine whether the scatter diagram indicates that a linear relation may exist between the two variables. If the relation is linear, determine whether it indicates a positive or negative association between the variables. Use this information to answer the following.



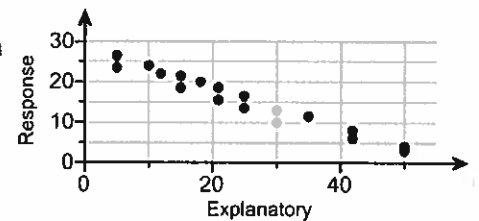
Do the two variables have a linear relationship?

- A. The data points do not have a linear relationship because they lie mainly in a straight line.  
 B. The data points do not have a linear relationship because they do not lie mainly in a straight line.  
 C. The data points have a linear relationship because they do not lie mainly in a straight line.  
 D. The data points have a linear relationship because they lie mainly in a straight line.

If the relationship is linear do the variables have a positive or negative association?

- A. The variables have a positive association.  
 B. The variables have a negative association.  
 C. The relationship is not linear.

4. Determine whether the scatter diagram indicates that a linear relation may exist between the two variables. If the relation is linear, determine whether it indicates a positive or negative association between the variables. Use this information to answer the following.



Do the two variables have a linear relationship?

- A. The data points have a linear relationship because they do not lie mainly in a straight line.  
 B. The data points do not have a linear relationship because they lie mainly in a straight line.  
 C. The data points have a linear relationship because they lie mainly in a straight line.  
 D. The data points do not have a linear relationship because they do not lie mainly in a straight line.

Do the two variables have a positive or a negative association?

- A. The two variables have a negative association.  
 B. The two variables have a positive association.  
 C. None of the above

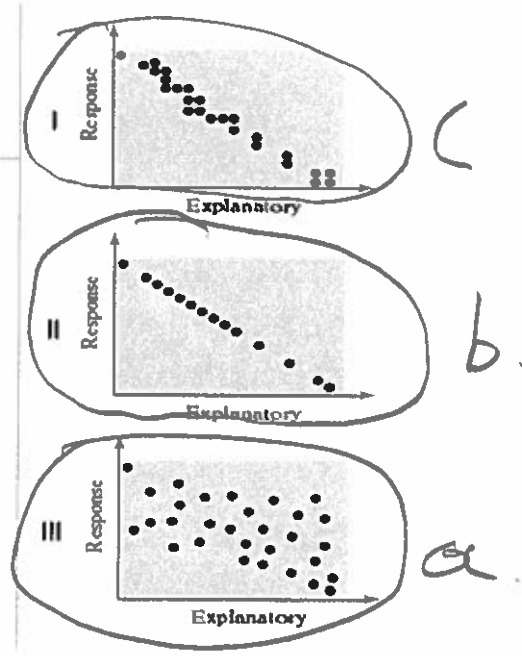
5. Match the linear correlation coefficient to the scatter diagram. The scales on the x- and y-axis are the same for each scatter diagram.

(a)  $r = -0.049$ , (b)  $r = -1$ , (c)  $r = -0.992$

(a) Scatter diagram (1) III

(b) Scatter diagram (2) II

(c) Scatter diagram (3) I



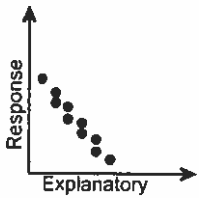
- (1)  III  
 I  
 II
- (2)  I  
 II  
 III
- (3)  I  
 II  
 III

6. Match the linear correlation coefficient to the scatter diagram.

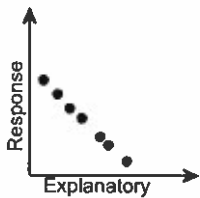
$r = -0.038$

Choose the correct graph below.

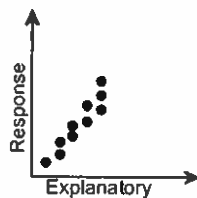
A.



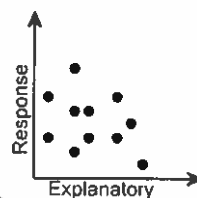
B.



C.



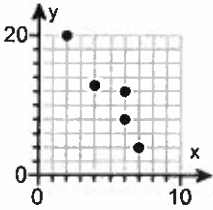
D.



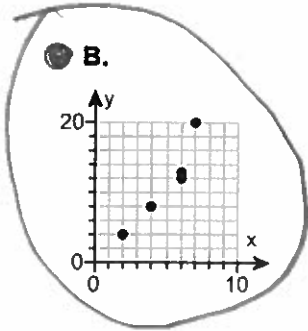
7. For the accompanying data set, (a) draw a scatter diagram of the data, (b) compute the correlation coefficient.  
[Click here to view the data set.](#)<sup>1</sup> [Click here to view the critical values table.](#)<sup>2</sup>

(a) Draw a scatter diagram of the data. Choose the correct graph below.

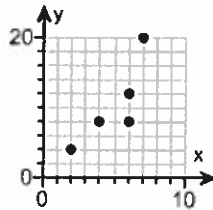
A.



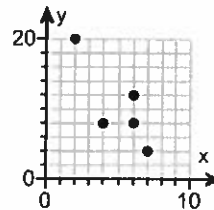
B.



C.



D.



(b) By hand, compute the correlation coefficient.

The correlation coefficient is  $r = \underline{0.940}$ . (Round to three decimal places as needed.)

1: Data set

x	2	4	6	6	7
y	4	8	12	13	20

~~2: Critical values for the correlation coefficient~~

~~Critical Values for Correlation Coefficient~~

use TI 83/84

LinReg (ax+by)

b)  $r = 0.94011506 \approx 0.940$

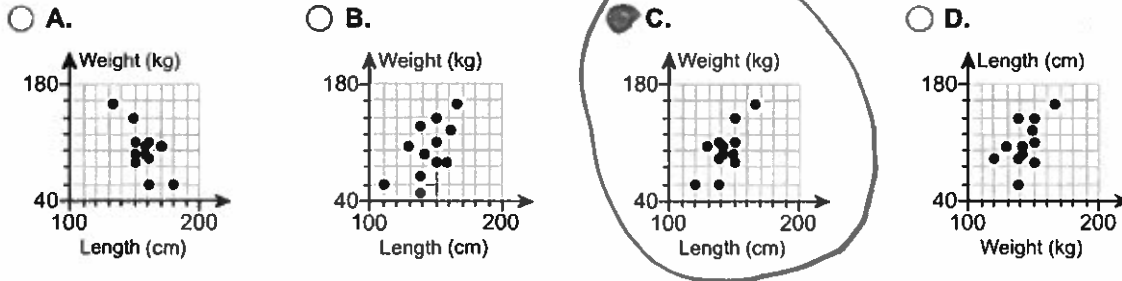


9. Researchers initiated a long-term study of the population of American black bears. One aspect of the study was to develop a model that could be used to predict a bear's weight (since it is not practical to weigh bears in the field). One variable thought to be related to weight is the length of the bear. The accompanying data represent the lengths and weights of 12 American black bears. Complete parts (a) through (c).  
<sup>5</sup> Click the icon to view the data table.

(a) Which variable is the explanatory variable based on the goals of the research?

- A. The number of bears  
 B. The length of the bear  
 C. The weight of the bear

(b) Draw a scatter diagram of the data. Choose the correct graph below.



(c) Determine the linear correlation coefficient between weight and length.

The linear correlation coefficient between weight and length is  $r = \underline{0.726}$ .  
 (Round to three decimal places as needed.)

5: Data table

Total Length (cm)	Weight (kg)
139.0	110
138.0	60
139.0	90
120.5	60
149.0	95
141.0	105
141.0	95
150.0	85
166.0	155
151.5	140
129.5	105
150.0	110

LinReg(ax+b)

b)  $r = 0.72605366$   
 $r \approx 0.726$

10. What does it mean to say that the linear correlation coefficient between two variables equals 1? What would the scatter diagram look like?

Choose the correct answer below.

- A. When the linear correlation coefficient is 1, there is a perfect positive linear relation between the two variables. The scatter diagram would contain points that all lie on a line with a positive slope.
- B. When the linear correlation coefficient is 1, there is a perfect horizontal linear relation between the two variables. The scatter diagram would contain points that all lie on a horizontal line.
- C. When the linear correlation coefficient is 1, there is a perfect negative linear relation between the two variables. The scatter diagram would contain points that all lie on a line with a negative slope.
- D. When the linear correlation coefficient is 1, there is no linear relation between the variables. The scatter diagram would contain points that show no discernable relationship.

11. What does it mean if  $r = 0$ ?

Choose the correct answer below.

- ~~A. No relationship exists between the variables.~~
- B. No linear relationship exists between the variables.
- C. A relationship does exist between the variables.
- D. A linear relationship does exist between the variables.

12. A pediatrician wants to determine the relation that exists between a child's height,  $x$ , and head circumference,  $y$ . She randomly selects 11 children from her practice, measures their heights and head circumferences, and obtains the accompanying data. Complete parts (a) and (b) below.

<sup>6</sup> Click the icon to view the children's data.

(a) Find the least-squares regression line treating height as the explanatory variable and head circumference as the response variable.

$$\hat{y} = 0.181x + (12.442)$$

(Round to three decimal places as needed.)

(b) Use the regression equation to predict the head circumference of a child who is 24.25 inches tall.

$$\hat{y} = 16.84 \text{ in.}$$

(Round to two decimal places as needed.)

6: Data Table

Height (inches), $x$	Head Circumference (inches), $y$
28	17.4
24.75	17.0
25.5	17.0
26.25	17.4
24.25	16.7
27.75	17.5
26.5	17.2
27	17.4
26.5	17.2
26.5	17.4
27.75	17.4

LinReg(ax + b)

a)  $a = 0.18137028 \approx 0.181$   
 $b = 12.44241724 \approx 12.442$

$r = 0.895547$

b) use TI83/84  
 $Y(24.25) = 16.84064665$   
 $\approx 16.84$



13. An engineer wants to determine how the weight of a car,  $x$ , affects gas mileage,  $y$ . The following data represent the weights of various cars and their miles per gallon.

Car	A	B	C	D	E
Weight (pounds), $x$	2520	3100	3440	3755	4045
Miles per Gallon, $y$	27.3	21	22.1	19	17.6

- (a) Find the least-squares regression line treating weight as the explanatory variable and miles per gallon as the response variable.

Write the equation for the least-squares regression line.

$$\hat{y} = -0.0059x + 41.4452 \quad (\text{Round to four decimal places as needed.})$$

- (b) Predict the miles per gallon of car C and compute the residual. Is the miles per gallon of this car above average or below average for cars of this weight?

The predicted value is 21.00 miles per gallon.

(Round to two decimal places as needed.)

Is the value above or below average?

It is above average.

It is below average.

use LinReg(ax+b)

$$a = -0.0059446 \approx -0.0059$$

$$b = 41.445212 \approx 41.4452$$

$$Y(3440) = 20.99576 \approx 21.00$$

$$\text{Residual} = e_c = y_c - \hat{y}_c = 22.1 - 21.00 = 1.1$$

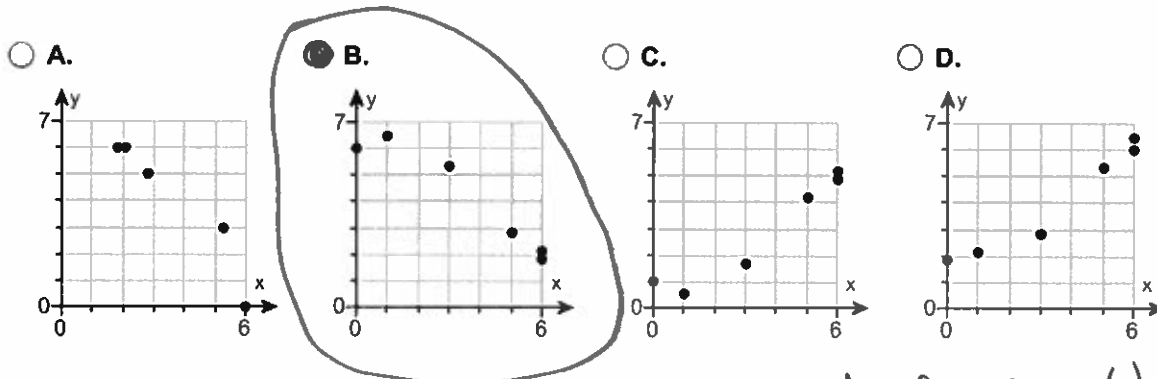
$\Rightarrow$  Above average

14. A data set is given below.

- (a) Draw a scatter diagram. Comment on the type of relation that appears to exist between  $x$  and  $y$ .  
 (b) Find the least-squares regression line.  
 (c) Graph the least-squares regression line on the scatter diagram drawn in part (a).

$x$	0	1	3	5	6	6
$y$	6.0	6.5	5.3	2.8	1.8	2.1

(a) Choose the correct graph below.



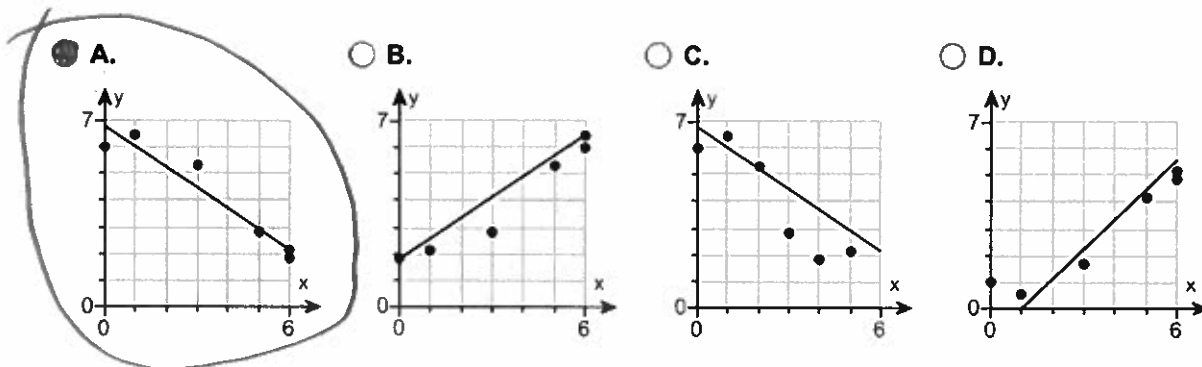
There appears to be (1) linear, negative relationship.

(b)  $\hat{y} = -0.775x + 6.795$   
 (Round to three decimal places as needed.)

Lin Reg ( $ax+b$ )

$a = -0.77462686 \approx -0.775$   
 $b = 6.79452736 \approx 6.795$

(c) Choose the correct graph below.



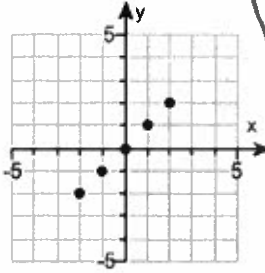
- (1)  no  a nonlinear
- a linear, negative  
 a linear, positive  
 a constant

15. Complete parts (a) through (c) for the data below.

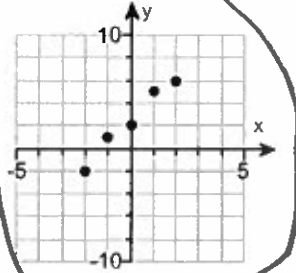
x	-2	-1	0	1	2
y	-2	1	2	5	6

(a) Draw a scatter diagram treating x as the explanatory variable and y as the response variable. Choose the correct scatter diagram below.

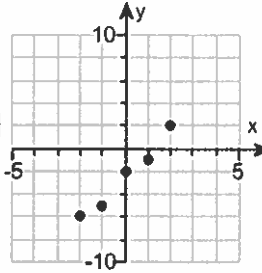
A.



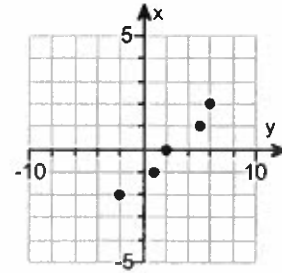
B.



C.



D.



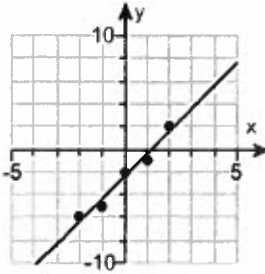
(b) Find the least-squares regression line.

$\hat{y} = \underline{2}x + (\underline{2.4})$   
 (Round to three decimal places as needed.)

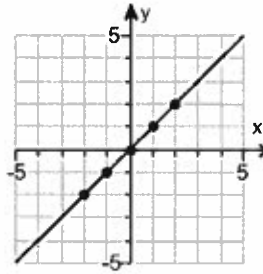
Lin Reg(ax+b)  
 $a = 2$   
 $b = 2.4$

(c) Graph the least-squares regression line on the scatter diagram. Choose the correct graph below.

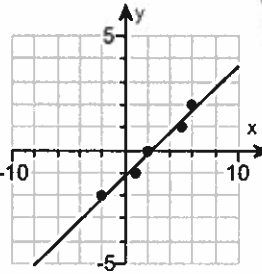
A.



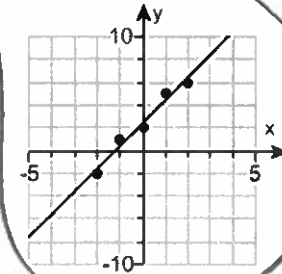
B.



C.



D.



16. A data set is given below.

(a) Draw a scatter diagram. Comment on the type of relation that appears to exist between  $x$  and  $y$ .

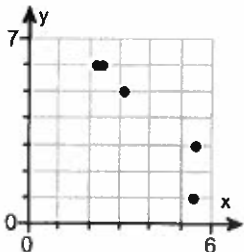
(b) Find the least-squares regression line.

(c) Graph the least-squares regression line on the scatter diagram drawn in part (a).

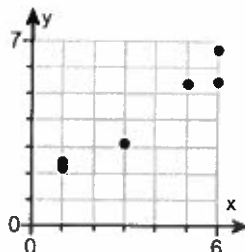
$x$	1	1	3	5	6	6
$y$	5.4	6.7	5.5	3.1	2.2	2.4

(a) Choose the correct graph below.

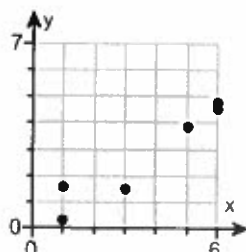
A.



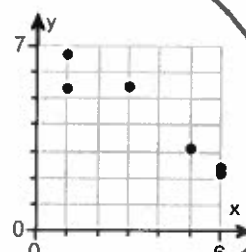
B.



C.



D.



There appears to be a ~~linear~~ linear negative relationship.

(b)  $\hat{y} = -0.771x + (7.043)$   
(Round to three decimal places as needed.)

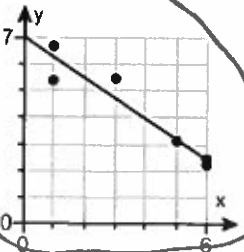
LinRep(ax+b)

$$a = -0.7707317 \approx -0.771$$

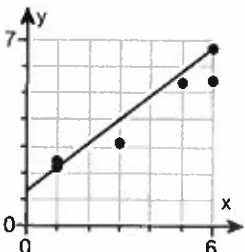
$$b = 7.0426829 \approx 7.043$$

(c) Choose the correct graph below.

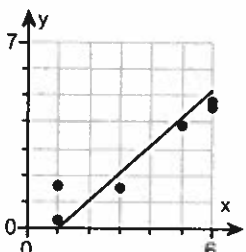
A.



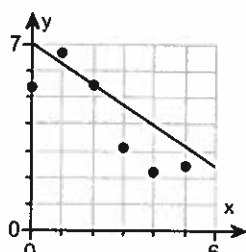
B.



C.



D.



(1)  a linear, negative  a linear, positive

a nonlinear

a constant

no

17. Suppose a doctor measures the height,  $x$ , and head circumference,  $y$ , of 8 children and obtains the data below. The correlation coefficient is  $0.833$  and the least squares regression line is  $\hat{y} = 0.143x + 13.457$ . Complete parts (a) and (b) below.

$r$

Height, $x$	27.5	24.5	26.5	25	27.25	26.75	25.75	27.25	26.75	26.75	27.25
Head Circumference, $y$	17.3	17.1	17.2	16.9	17.5	17.3	17.1	17.4	17.4	17.3	17.3

(a) Compute the coefficient of determination,  $R^2$ .

$R^2 = 69.3$  % (Round to one decimal place as needed.)

(b) Based on the coefficient of determination ( $R^2$ ) is the linear model giving good predictions?

- A. Yes
- B. Maybe
- C. None of these
- D. No

$R^2 = 100(r)^2 = 100(0.833)^2 = 69.3889 \approx 69.3$

1. C.

There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable increases.

A.

There is a linear relationship between the variables, and whenever the value of one variable increases, the value of the other variable decreases.

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2. (1) -1,

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3. C. The data points do not have a linear relationship because they do not lie mainly in a straight line.

C. The relationship is not linear.

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4. C. The data points have a linear relationship because they lie mainly in a straight line.

A. The two variables have a negative association.

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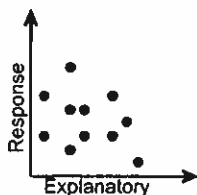
5. (1) III

(2) II

(3) I

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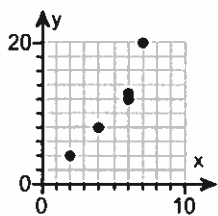
6.



D.

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7.

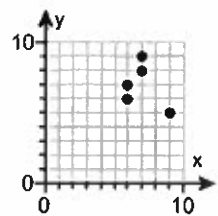


B.

0.940

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8.

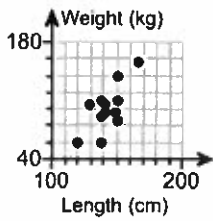


D.

-0.387

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9. B. The length of the bear



C. Length (cm)

0.726

10. A.

When the linear correlation coefficient is 1, there is a perfect positive linear relation between the two variables. The scatter diagram would contain points that all lie on a line with a positive slope.

11. B. No linear relationship exists between the variables.

12. 0.181

12.442

16.84

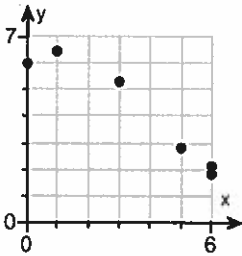
13. -0.0059

~~41.4452~~ → 41.4452.

~~20.9957~~ → 20.9957 ≈ 21.00

It is above average.

14.

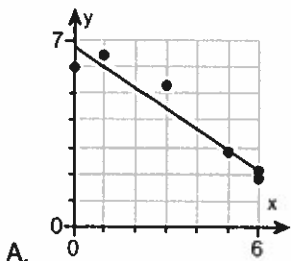


B.

(1) a linear, negative

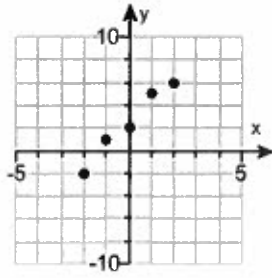
-0.775

6.795



A.

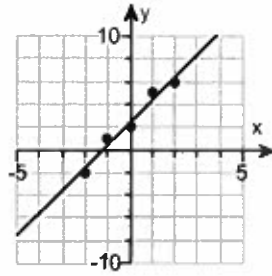
15.



B.

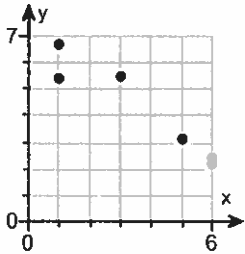
2.000

2.400



D.

16.

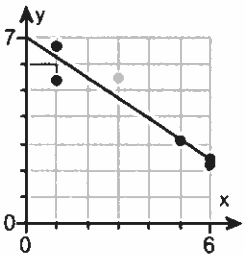


D.

(1) a linear, negative

-0.771

7.043



A.

17. 69.3

A. Yes