



# MATH110: Regression Correlation

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Name: \_\_\_\_\_

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

Score: / 30

## Learning Objectives

- Interpret the correlation coefficient  $r$
- Compute the slope and intercept of the least-squares line
- Write and use a regression equation for prediction

*Simplify each expression completely. Show all steps and circle your final answer.*

## Correlation Coefficient Interpretation

1. A study yields a correlation coefficient of  $r = 0.78$ . Describe the direction and strength of the linear relationship.

$$r = 0.78$$

Answer: \_\_\_\_\_

2. A study yields a correlation coefficient of  $r = 0.54$ . Describe the direction and strength of the linear relationship.

$$r = 0.54$$

Answer: \_\_\_\_\_

3. A study yields a correlation coefficient of  $r = -0.65$ . Describe the direction and strength of the linear relationship.

$$r = -0.65$$

Answer: \_\_\_\_\_

4. A study yields a correlation coefficient of  $r = -0.28$ . Describe the direction and strength of the linear relationship.

$$r = -0.28$$

Answer: \_\_\_\_\_

5. A study yields a correlation coefficient of  $r = -0.92$ . Describe the direction and strength of the linear relationship.

$$r = -0.92$$

Answer: \_\_\_\_\_

## Least-squares regression line from summary statistics

6. For a bivariate data set:  $r = 0.5$ ,  $s_x = 4$ ,  $s_y = 8$ , mean of  $x = 24$ , mean of  $y = 43$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 4, \quad s_y = 8, \quad \bar{x} = 24, \quad \bar{y} = 43$$

Answer: \_\_\_\_\_

7. For a bivariate data set:  $r = 0.5$ ,  $s_x = 4$ ,  $s_y = 12$ , mean of  $x = 13$ , mean of  $y = 40$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 4, \quad s_y = 12, \quad \bar{x} = 13, \quad \bar{y} = 40$$

Answer: \_\_\_\_\_

8. For a bivariate data set:  $r = 0.5$ ,  $s_x = 2$ ,  $s_y = 8$ , mean of  $x = 19$ , mean of  $y = 25$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 2, \quad s_y = 8, \quad \bar{x} = 19, \quad \bar{y} = 25$$

Answer: \_\_\_\_\_

9. For a bivariate data set:  $r = 0.8$ ,  $s_x = 2$ ,  $s_y = 8$ , mean of  $x = 20$ , mean of  $y = 38$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.8, \quad s_x = 2, \quad s_y = 8, \quad \bar{x} = 20, \quad \bar{y} = 38$$

Answer: \_\_\_\_\_

10. For a bivariate data set:  $r = 0.5$ ,  $s_x = 2$ ,  $s_y = 12$ , mean of  $x = 24$ , mean of  $y = 46$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 2, \quad s_y = 12, \quad \bar{x} = 24, \quad \bar{y} = 46$$

Answer: \_\_\_\_\_

### Prediction from a Regression Equation

---

11. A regression equation is  $\hat{y} = 15 + 9x$ . Predict  $y$  when  $x = 22$ .

$$\hat{y} = 15 + 9x, \quad x = 22$$

Answer: \_\_\_\_\_

12. A regression equation is  $\hat{y} = 17 + 5x$ . Predict  $y$  when  $x = 16$ .

$$\hat{y} = 17 + 5x, \quad x = 16$$

Answer: \_\_\_\_\_

13. A regression equation is  $\hat{y} = 19 + 1x$ . Predict  $y$  when  $x = 20$ .

$$\hat{y} = 19 + 1x, \quad x = 20$$

Answer: \_\_\_\_\_

---

14. A regression equation is  $\hat{y} = 20 + 3x$ . Predict  $y$  when  $x = 7$ .

$$\hat{y} = 20 + 3x, \quad x = 7$$

Answer: \_\_\_\_\_

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15. A regression equation is  $\hat{y} = 16 + 9x$ . Predict  $y$  when  $x = 8$ .

$$\hat{y} = 16 + 9x, \quad x = 8$$

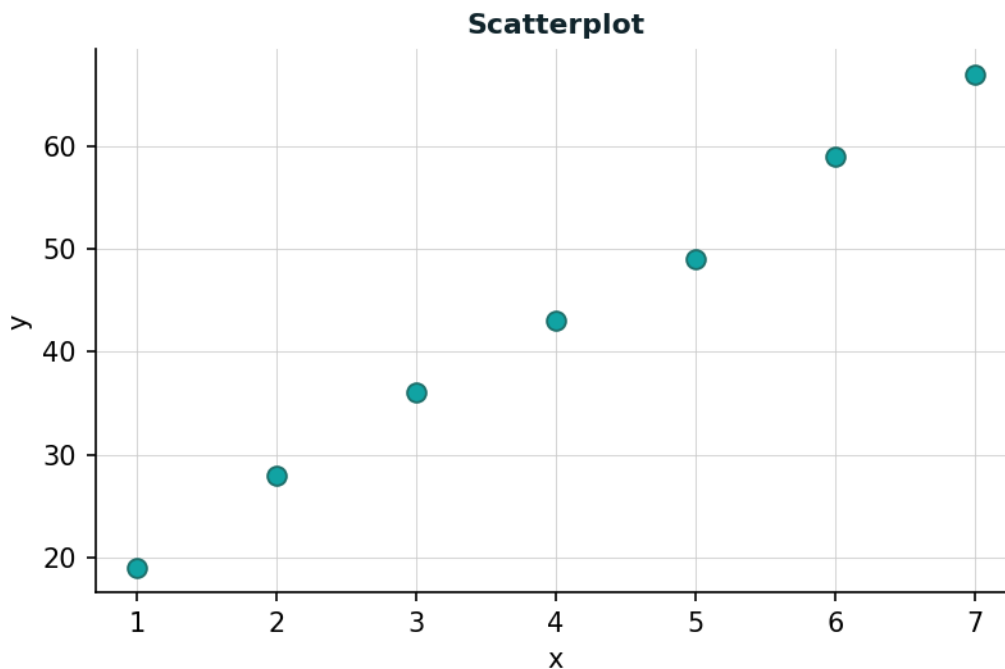
Answer: \_\_\_\_\_

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### Describing a Scatterplot

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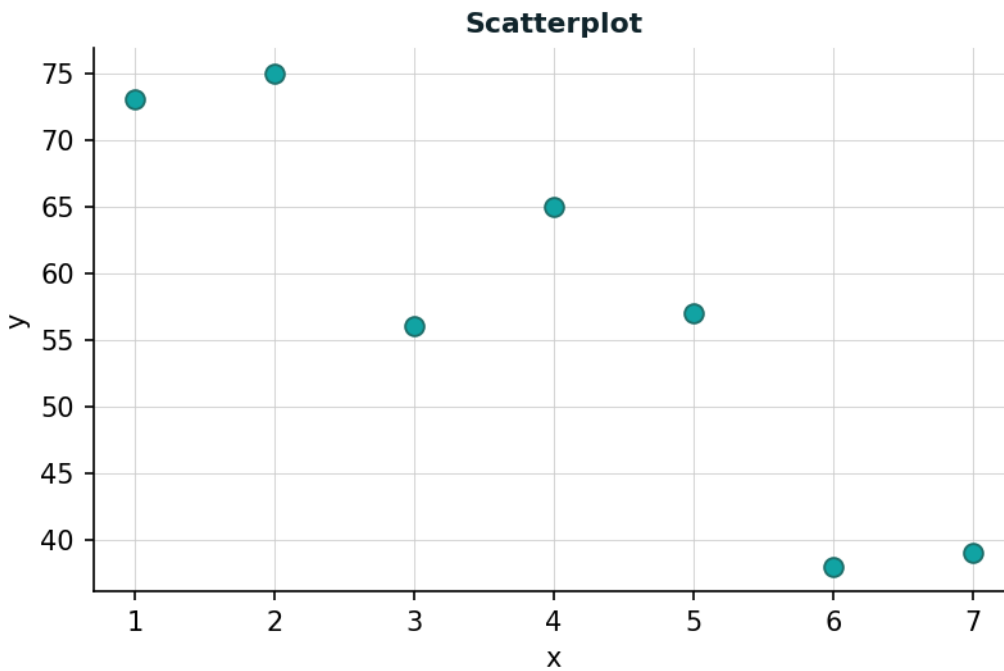
16. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



Answer: \_\_\_\_\_

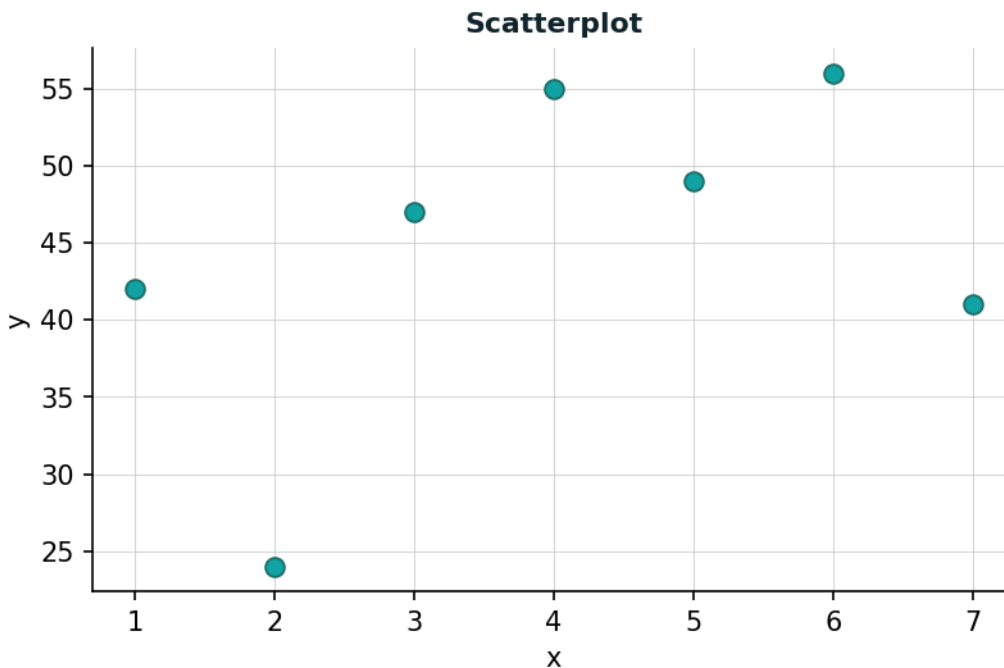
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17. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



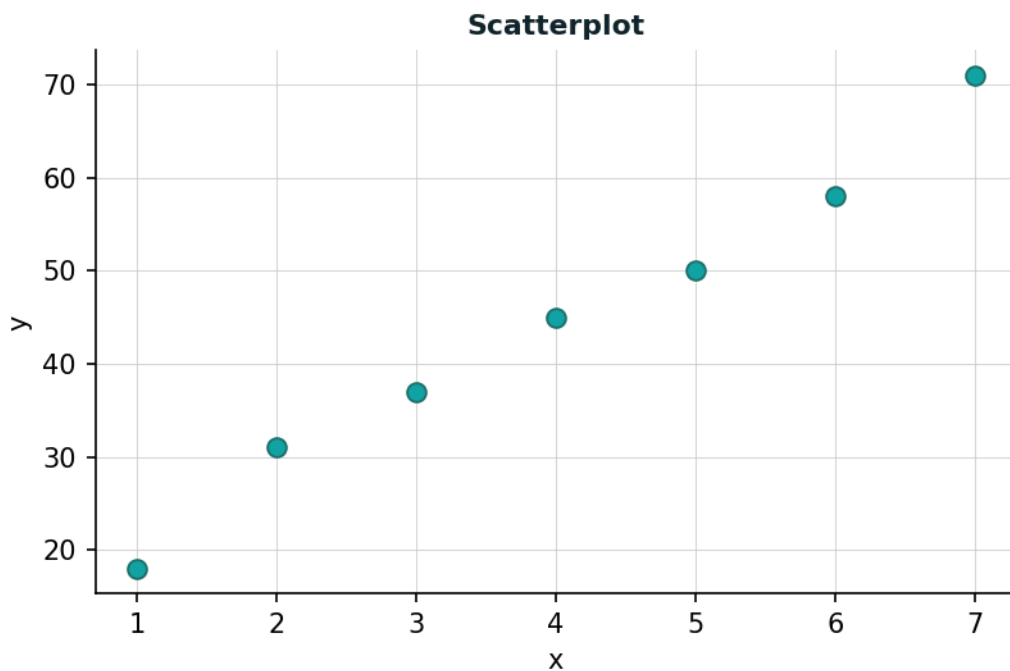
Answer: \_\_\_\_\_

18. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



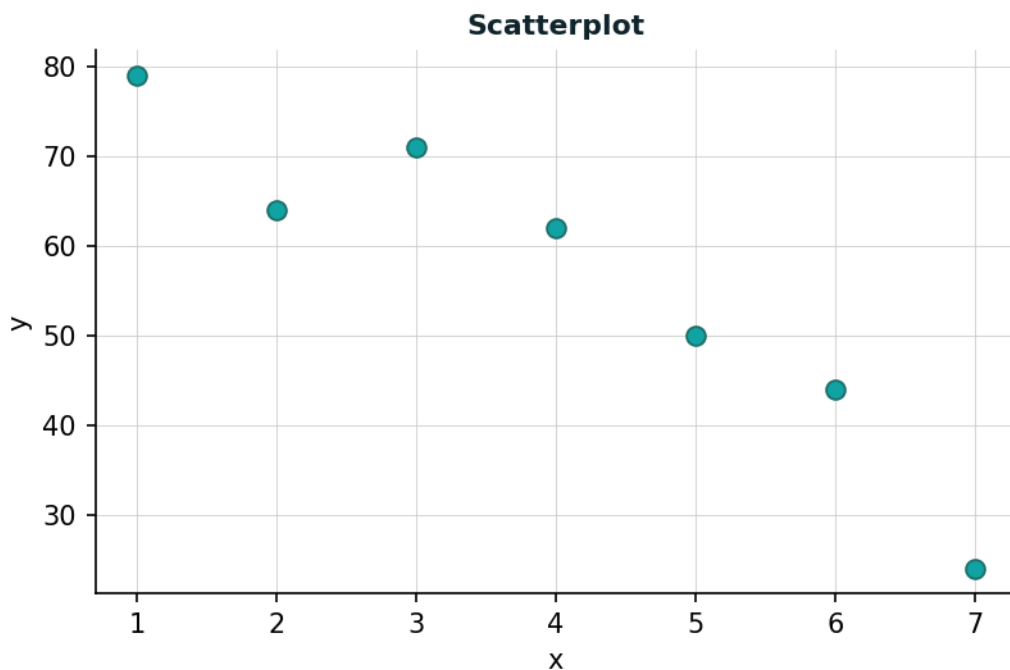
Answer: \_\_\_\_\_

19. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



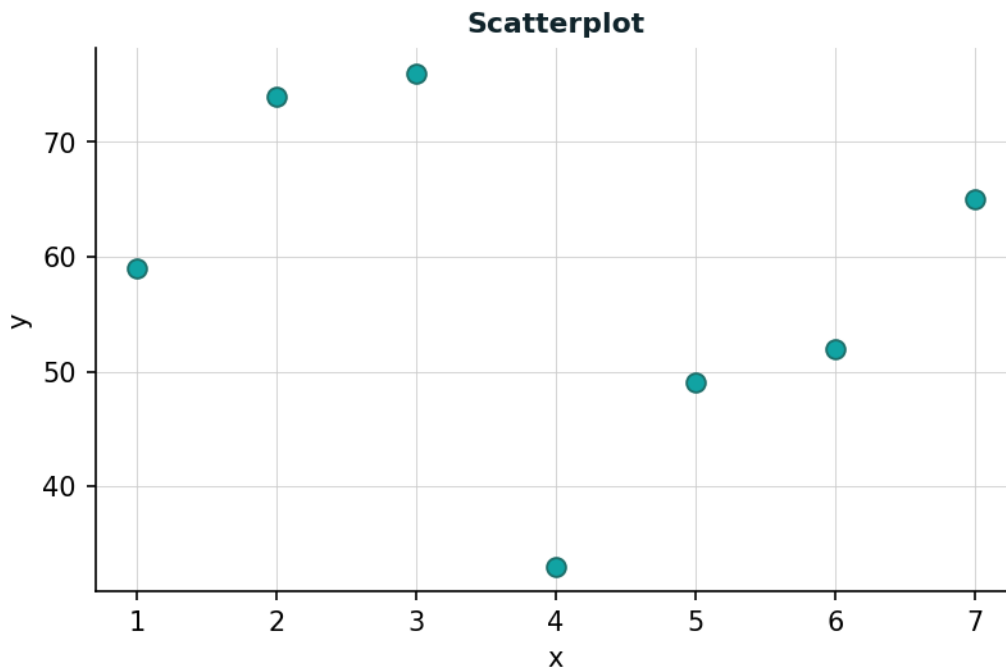
Answer: \_\_\_\_\_

20. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



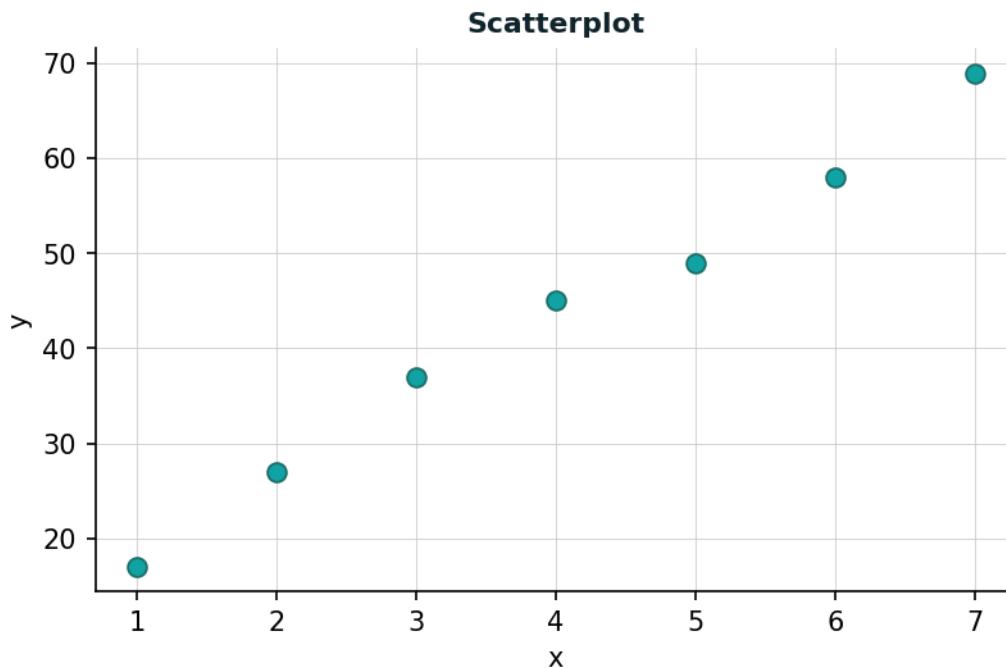
Answer: \_\_\_\_\_

21. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



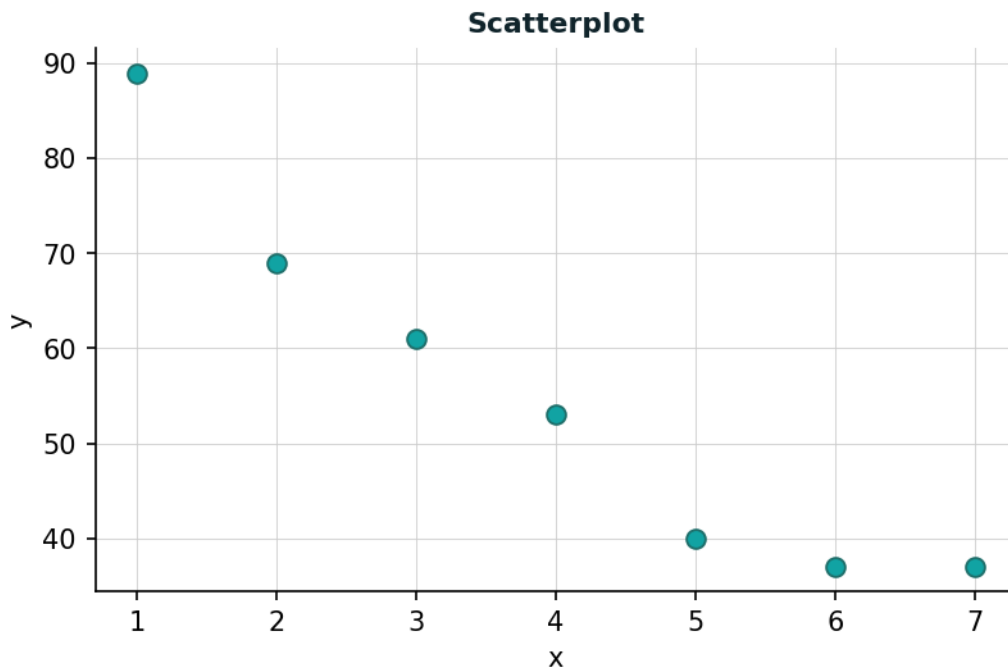
Answer: \_\_\_\_\_

22. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



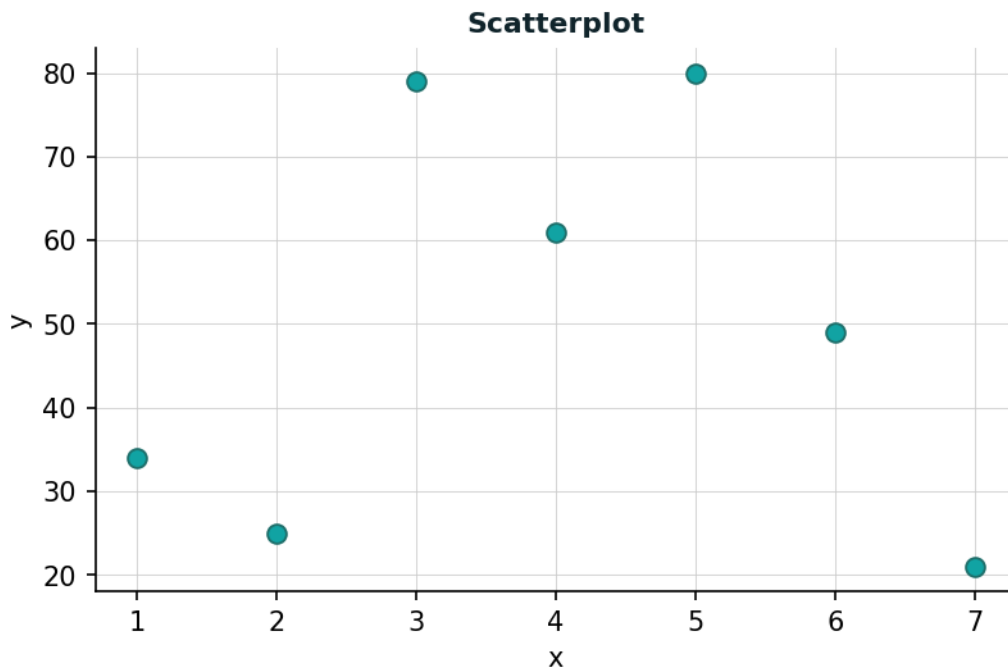
Answer: \_\_\_\_\_

23. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



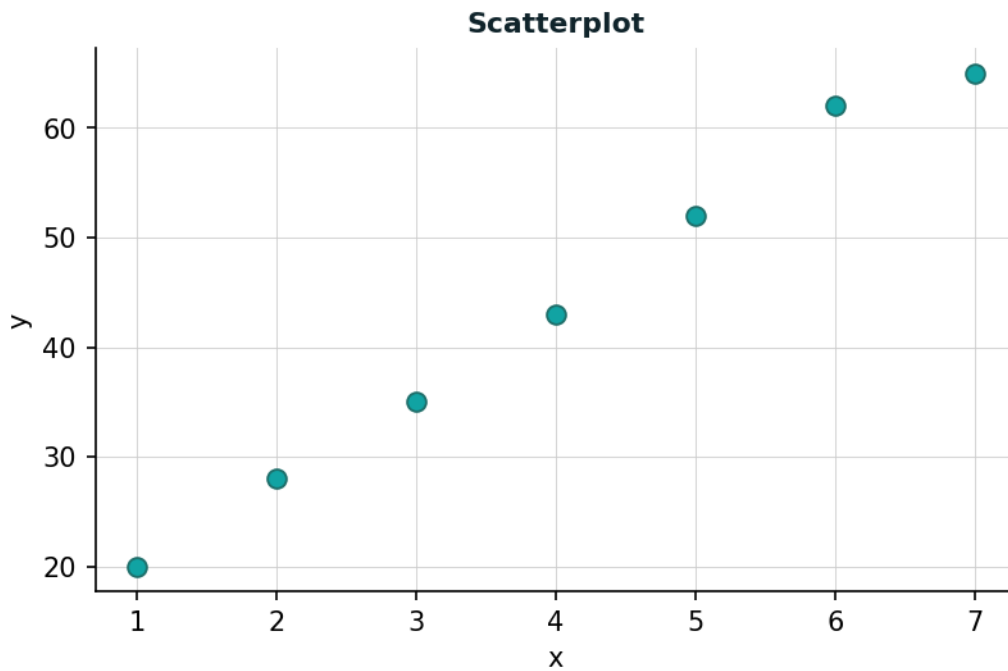
Answer: \_\_\_\_\_

24. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



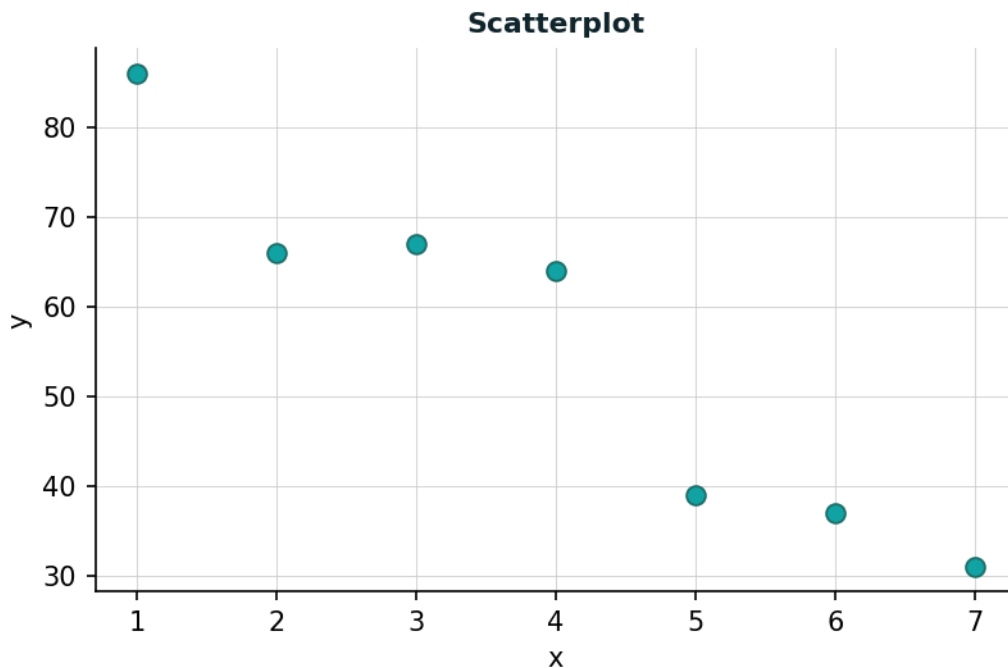
Answer: \_\_\_\_\_

25. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



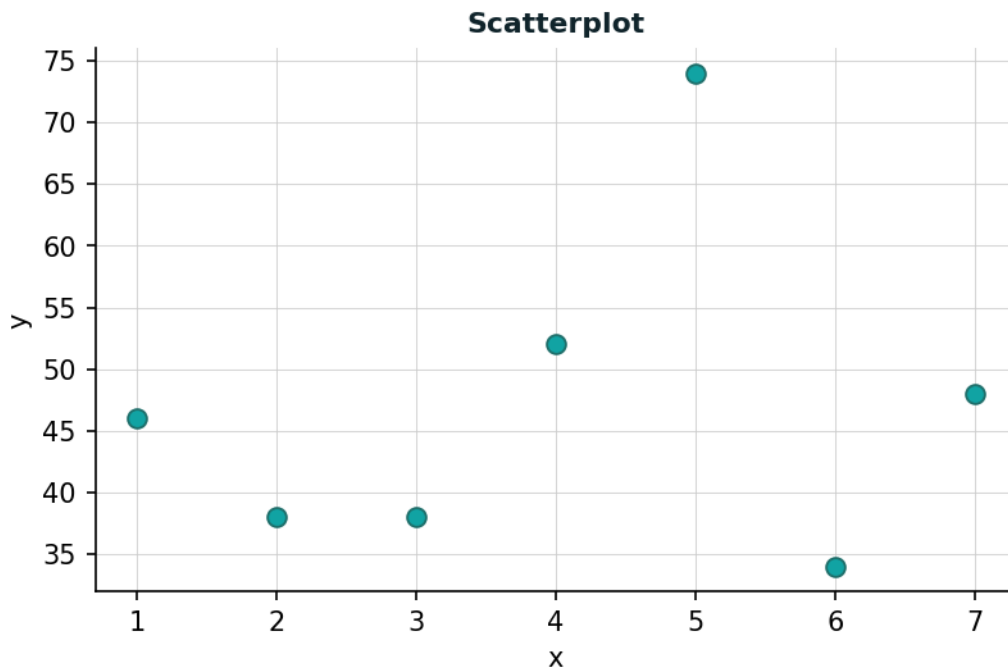
Answer: \_\_\_\_\_

26. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



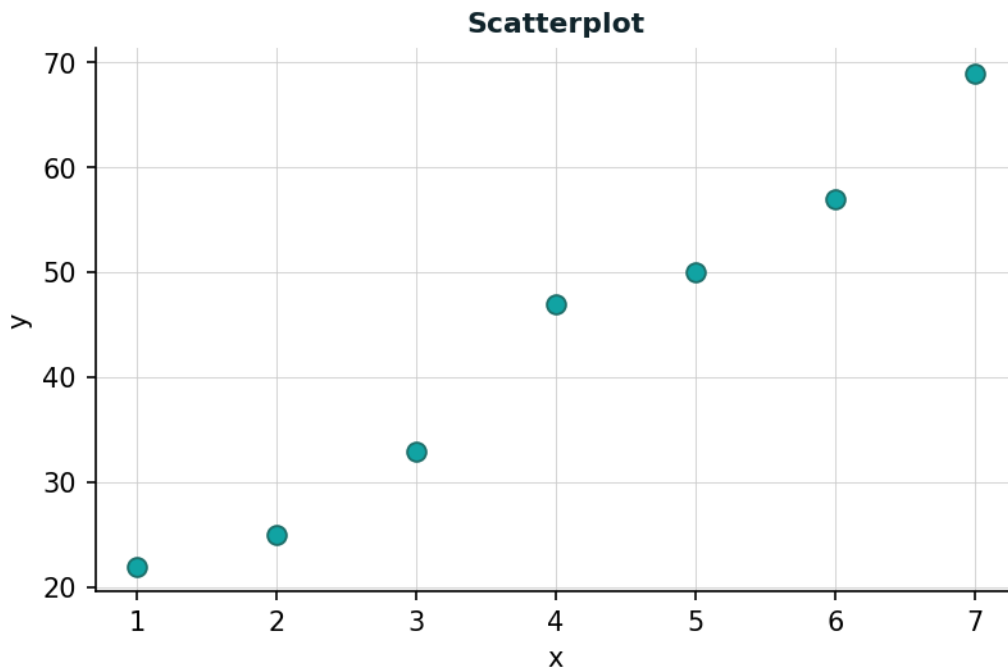
Answer: \_\_\_\_\_

27. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



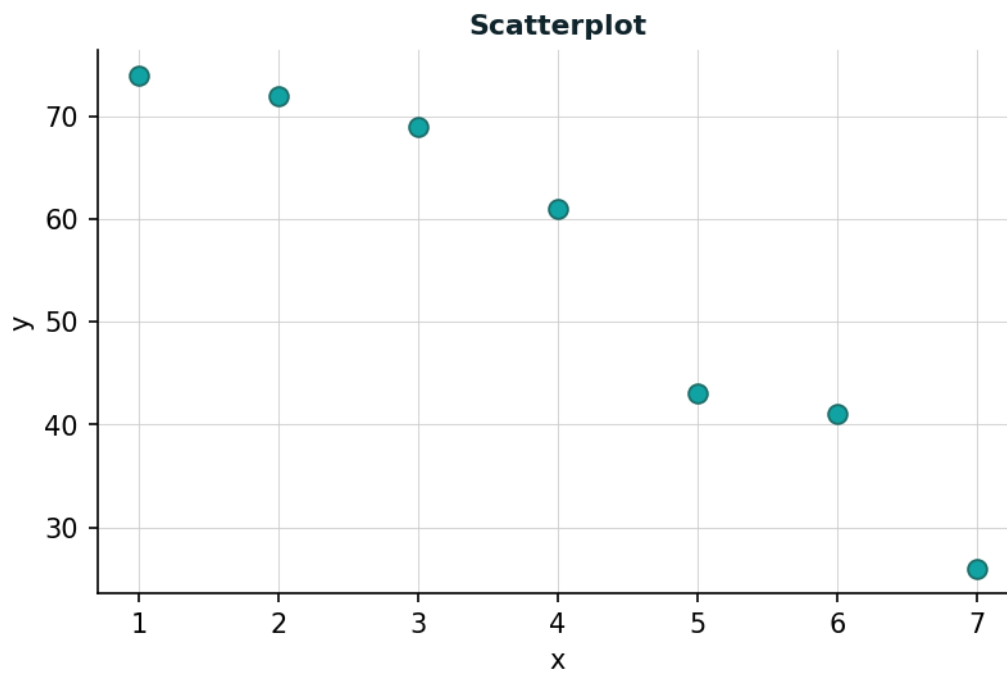
Answer: \_\_\_\_\_

28. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



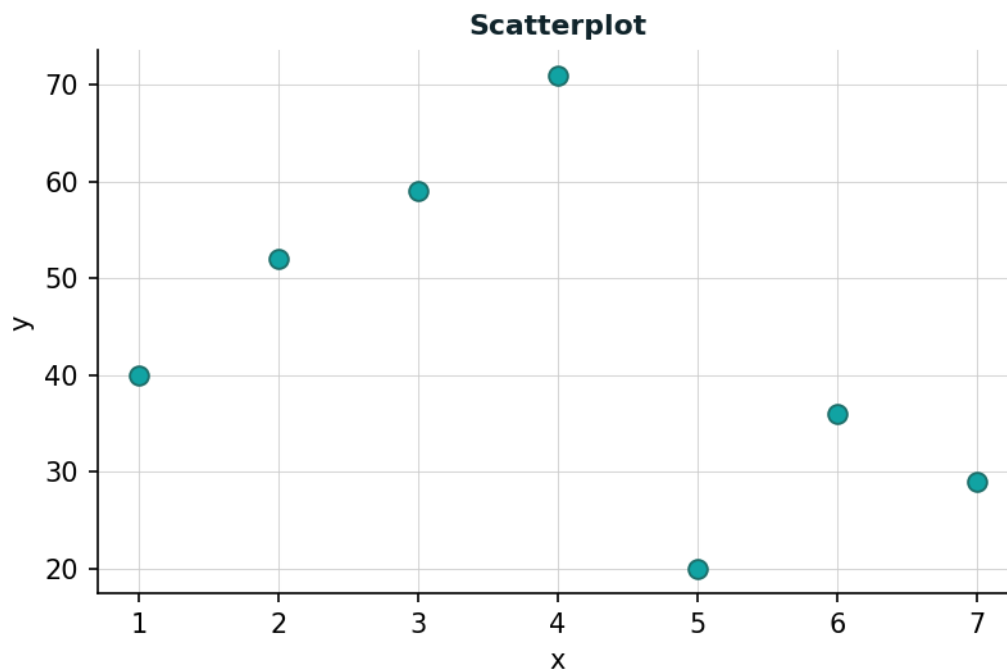
Answer: \_\_\_\_\_

29. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



Answer: \_\_\_\_\_

30. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



Answer: \_\_\_\_\_



# MATH110: Regression Correlation

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ANSWER KEY & SOLUTIONS

*Topics: Describing a Scatterplot, Least-squares regression line from summary statistics, Correlation Coefficient Interpretation, Prediction from a Regression Equation. All answers verified by independent computation.*

## Solutions

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## Correlation Coefficient Interpretation

---

1. A study yields a correlation coefficient of  $r = 0.78$ . Describe the direction and strength of the linear relationship.

$$r = 0.78$$

→ Sign of  $r$ :  $r=0.78$  is positive (positive  $r$  means positive association, negative means negative).

→  $|r| = 0.78$ . Strength:  $|r| < 0.3$  is weak,  $0.3$  to  $0.7$  is moderate,  $> 0.7$  is strong.

→ This is a strong positive linear relationship.

**Answer:**  $r = 0.78$  : positive, strong relationship

---

2. A study yields a correlation coefficient of  $r = 0.54$ . Describe the direction and strength of the linear relationship.

$$r = 0.54$$

→ Sign of  $r$ :  $r=0.54$  is positive (positive  $r$  means positive association, negative means negative).

→  $|r| = 0.54$ . Strength:  $|r| < 0.3$  is weak,  $0.3$  to  $0.7$  is moderate,  $> 0.7$  is strong.

→ This is a moderate positive linear relationship.

**Answer:**  $r = 0.54$  : positive, moderate relationship

---

3. A study yields a correlation coefficient of  $r = -0.65$ . Describe the direction and strength of the linear relationship.

$$r = -0.65$$

→ Sign of  $r$ :  $r=-0.65$  is negative (positive  $r$  means positive association, negative means negative).

→  $|r| = 0.65$ . Strength:  $|r| < 0.3$  is weak,  $0.3$  to  $0.7$  is moderate,  $> 0.7$  is strong.

→ This is a moderate negative linear relationship.

**Answer:**  $r = -0.65$  : negative, moderate relationship

---

4. A study yields a correlation coefficient of  $r = -0.28$ . Describe the direction and strength of the linear relationship.

$$r = -0.28$$

→ Sign of  $r$ :  $r=-0.28$  is negative (positive  $r$  means positive association, negative means negative).

→  $|r| = 0.28$ . Strength:  $|r| < 0.3$  is weak,  $0.3$  to  $0.7$  is moderate,  $> 0.7$  is strong.

→ This is a weak negative linear relationship.

**Answer:**  $r = -0.28$  : negative, weak relationship

---

5. A study yields a correlation coefficient of  $r = -0.92$ . Describe the direction and strength of the linear relationship.

$$r = -0.92$$

→ Sign of  $r$ :  $r=-0.92$  is negative (positive  $r$  means positive association, negative means negative).

→  $|r| = 0.92$ . Strength:  $|r| < 0.3$  is weak,  $0.3$  to  $0.7$  is moderate,  $> 0.7$  is strong.

→ This is a strong negative linear relationship.

**Answer:**  $r = -0.92$  : negative, strong relationship

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## Least-squares regression line from summary statistics

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6. For a bivariate data set:  $r = 0.5$ ,  $s_x = 4$ ,  $s_y = 8$ , mean of  $x = 24$ , mean of  $y = 43$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 4, \quad s_y = 8, \quad \bar{x} = 24, \quad \bar{y} = 43$$

$$\rightarrow \text{Slope } b = r \times (s_y/s_x) = 0.5 \times (8/4) = 1.0.$$

$$\rightarrow \text{Intercept } a = (\text{mean } y) - b \times (\text{mean } x) = 43 - (1.0)(24) = 19.0.$$

$$\rightarrow \text{Regression line: } \hat{y} = 19.0 + 1.0x \text{ (r-squared} = 0.25).$$

**Answer:**  $b = r \frac{S_y}{S_x} = 1.0, \quad a = \bar{y} - b\bar{x} = 19.0 \Rightarrow \hat{y} = 19.0 + 1.0x$

---

7. For a bivariate data set:  $r = 0.5$ ,  $s_x = 4$ ,  $s_y = 12$ , mean of  $x = 13$ , mean of  $y = 40$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 4, \quad s_y = 12, \quad \bar{x} = 13, \quad \bar{y} = 40$$

$$\rightarrow \text{Slope } b = r \times (s_y/s_x) = 0.5 \times (12/4) = 1.5.$$

$$\rightarrow \text{Intercept } a = (\text{mean } y) - b \times (\text{mean } x) = 40 - (1.5)(13) = 20.5.$$

$$\rightarrow \text{Regression line: } \hat{y} = 20.5 + 1.5x \text{ (r-squared} = 0.25).$$

**Answer:**  $b = r \frac{S_y}{S_x} = 1.5, \quad a = \bar{y} - b\bar{x} = 20.5 \Rightarrow \hat{y} = 20.5 + 1.5x$

---

8. For a bivariate data set:  $r = 0.5$ ,  $s_x = 2$ ,  $s_y = 8$ , mean of  $x = 19$ , mean of  $y = 25$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 2, \quad s_y = 8, \quad \bar{x} = 19, \quad \bar{y} = 25$$

$$\rightarrow \text{Slope } b = r \times (s_y/s_x) = 0.5 \times (8/2) = 2.0.$$

$$\rightarrow \text{Intercept } a = (\text{mean } y) - b \times (\text{mean } x) = 25 - (2.0)(19) = -13.0.$$

$$\rightarrow \text{Regression line: } \hat{y} = -13.0 + 2.0x \text{ (r-squared} = 0.25).$$

**Answer:**  $b = r \frac{S_y}{S_x} = 2.0, \quad a = \bar{y} - b\bar{x} = -13.0 \Rightarrow \hat{y} = -13.0 + 2.0x$

---

9. For a bivariate data set:  $r = 0.8$ ,  $s_x = 2$ ,  $s_y = 8$ , mean of  $x = 20$ , mean of  $y = 38$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.8, \quad s_x = 2, \quad s_y = 8, \quad \bar{x} = 20, \quad \bar{y} = 38$$

$$\rightarrow \text{Slope } b = r \times (s_y/s_x) = 0.8 \times (8/2) = 3.2.$$

$$\rightarrow \text{Intercept } a = (\text{mean } y) - b \times (\text{mean } x) = 38 - (3.2)(20) = -26.0.$$

$$\rightarrow \text{Regression line: } \hat{y} = -26.0 + 3.2x \text{ (r-squared} = 0.64).$$

**Answer:**  $b = r \frac{S_y}{S_x} = 3.2, \quad a = \bar{y} - b\bar{x} = -26.0 \Rightarrow \hat{y} = -26.0 + 3.2x$

---

10. For a bivariate data set:  $r = 0.5$ ,  $s_x = 2$ ,  $s_y = 12$ , mean of  $x = 24$ , mean of  $y = 46$ . Find the least-squares regression line  $\hat{y} = a + bx$ .

$$r = 0.5, \quad s_x = 2, \quad s_y = 12, \quad \bar{x} = 24, \quad \bar{y} = 46$$

$$\rightarrow \text{Slope } b = r \times (s_y/s_x) = 0.5 \times (12/2) = 3.0.$$

$$\rightarrow \text{Intercept } a = (\text{mean } y) - b \times (\text{mean } x) = 46 - (3.0)(24) = -26.0.$$

$$\rightarrow \text{Regression line: } \hat{y} = -26.0 + 3.0x \text{ (r-squared} = 0.25).$$

**Answer:**  $b = r \frac{s_y}{s_x} = 3.0, \quad a = \bar{y} - b\bar{x} = -26.0 \Rightarrow \hat{y} = -26.0 + 3.0x$

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## Prediction from a Regression Equation

---

11. A regression equation is  $\hat{y} = 15 + 9x$ . Predict  $y$  when  $x = 22$ .

$$\hat{y} = 15 + 9x, \quad x = 22$$

→ Substitute  $x = 22$  into  $\hat{y} = 15 + 9x$ .

$$\rightarrow \hat{y} = 15 + 9(22) = 213.$$

**Answer:**  $\hat{y} = 15 + 9(22) = 213$

---

12. A regression equation is  $\hat{y} = 17 + 5x$ . Predict  $y$  when  $x = 16$ .

$$\hat{y} = 17 + 5x, \quad x = 16$$

→ Substitute  $x = 16$  into  $\hat{y} = 17 + 5x$ .

$$\rightarrow \hat{y} = 17 + 5(16) = 97.$$

**Answer:**  $\hat{y} = 17 + 5(16) = 97$

---

13. A regression equation is  $\hat{y} = 19 + 1x$ . Predict  $y$  when  $x = 20$ .

$$\hat{y} = 19 + 1x, \quad x = 20$$

→ Substitute  $x = 20$  into  $\hat{y} = 19 + 1x$ .

$$\rightarrow \hat{y} = 19 + 1(20) = 39.$$

**Answer:**  $\hat{y} = 19 + 1(20) = 39$

---

14. A regression equation is  $\hat{y} = 20 + 3x$ . Predict  $y$  when  $x = 7$ .

$$\hat{y} = 20 + 3x, \quad x = 7$$

→ Substitute  $x = 7$  into  $\hat{y} = 20 + 3x$ .

$$\rightarrow \hat{y} = 20 + 3(7) = 41.$$

**Answer:**  $\hat{y} = 20 + 3(7) = 41$

---

15. A regression equation is  $\hat{y} = 16 + 9x$ . Predict  $y$  when  $x = 8$ .

$$\hat{y} = 16 + 9x, \quad x = 8$$

→ Substitute  $x = 8$  into  $\hat{y} = 16 + 9x$ .

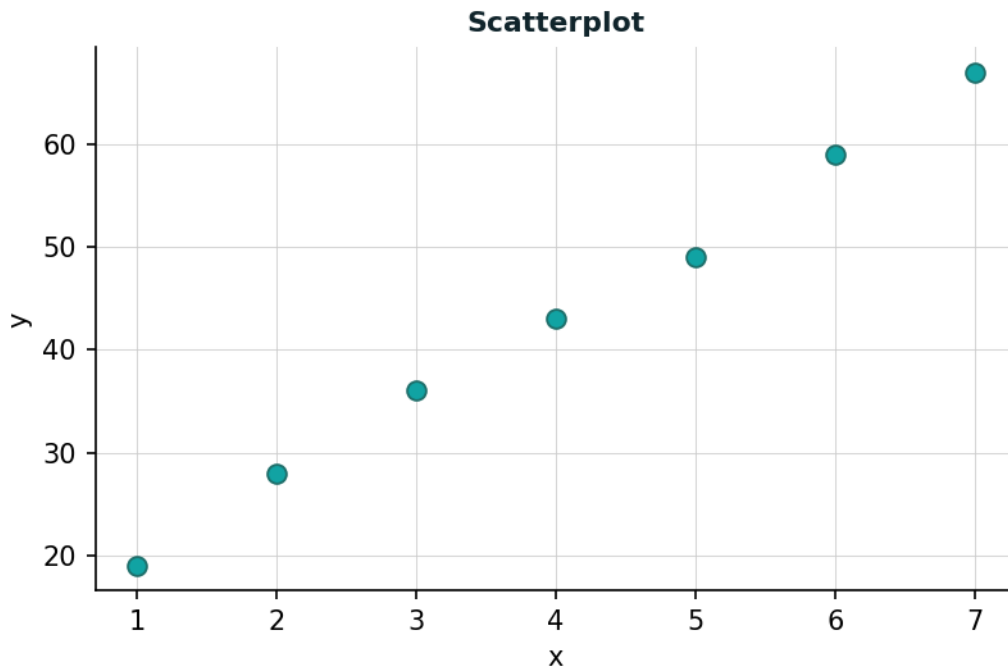
$$\rightarrow \hat{y} = 16 + 9(8) = 88.$$

**Answer:**  $\hat{y} = 16 + 9(8) = 88$

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## Describing a Scatterplot

16. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points rise left to right -> positive.

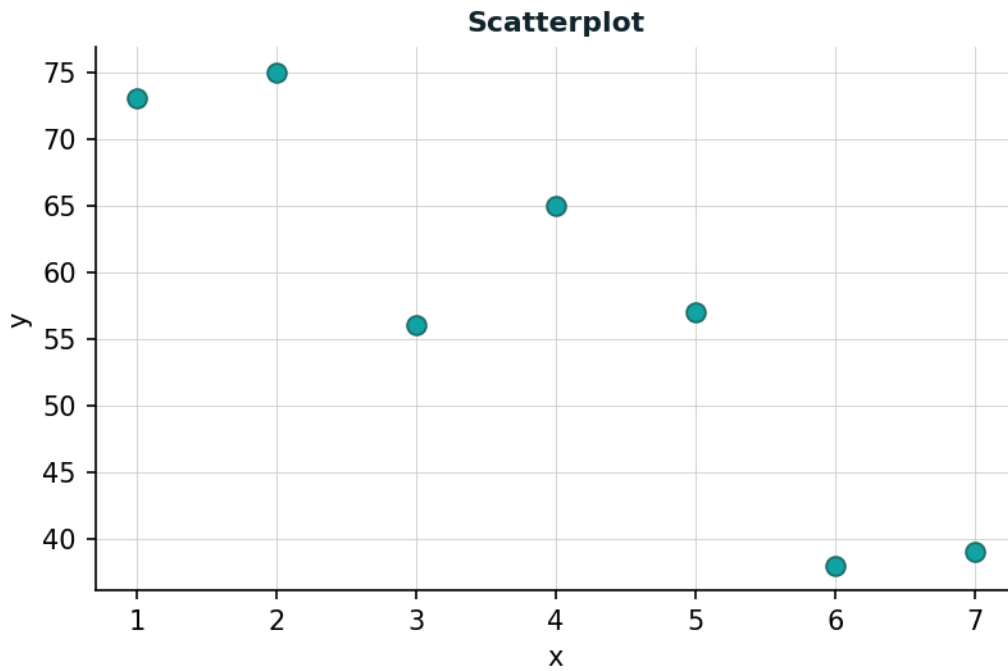
→ Form: points cluster around a line -> linear.

→ Strength: tight clustering -> strong.

→ Answer: A) positive, linear, strong.

**Answer:** A) positive, linear, strong

17. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association

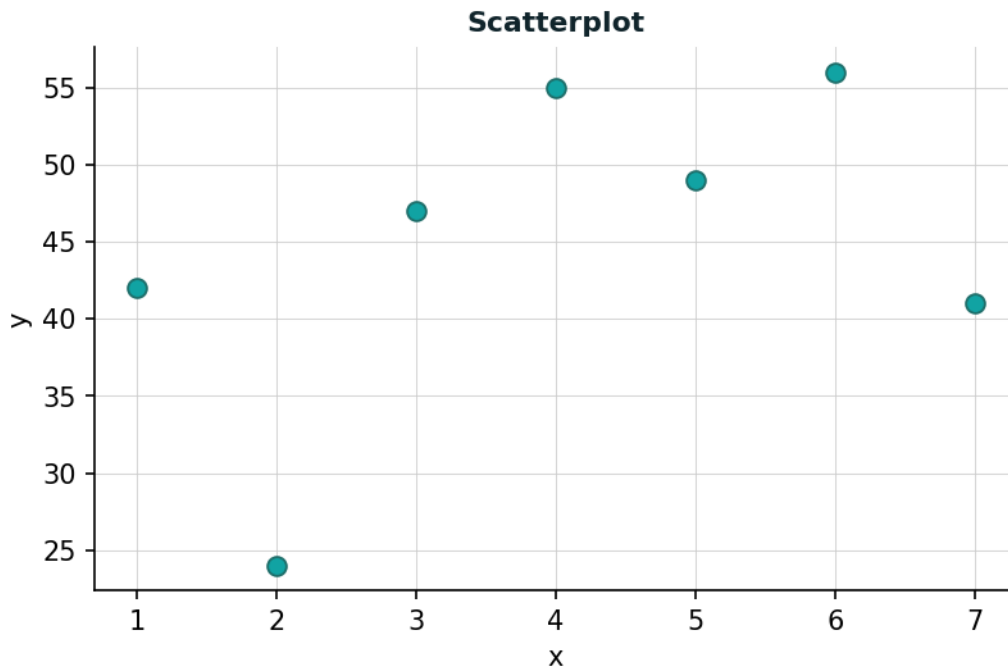


- Direction: points decline left to right -> negative.
- Form: points loosely follow a line -> linear.
- Strength: moderate scatter -> moderate.
- Answer: B) negative, linear, moderate.

**Answer:** B) negative, linear, moderate

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18. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



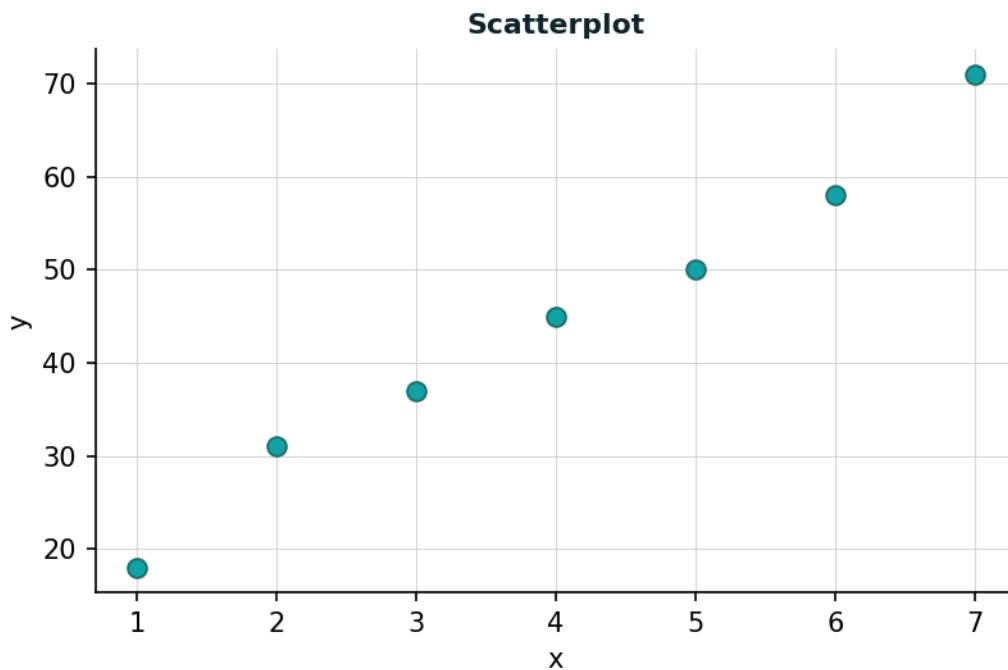
→ No pattern is visible in the scatterplot -> no association.

→ Answer: C) no association.

**Answer:** C)noassociation

---

19. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points rise left to right -> positive.

→ Form: points cluster around a line -> linear.

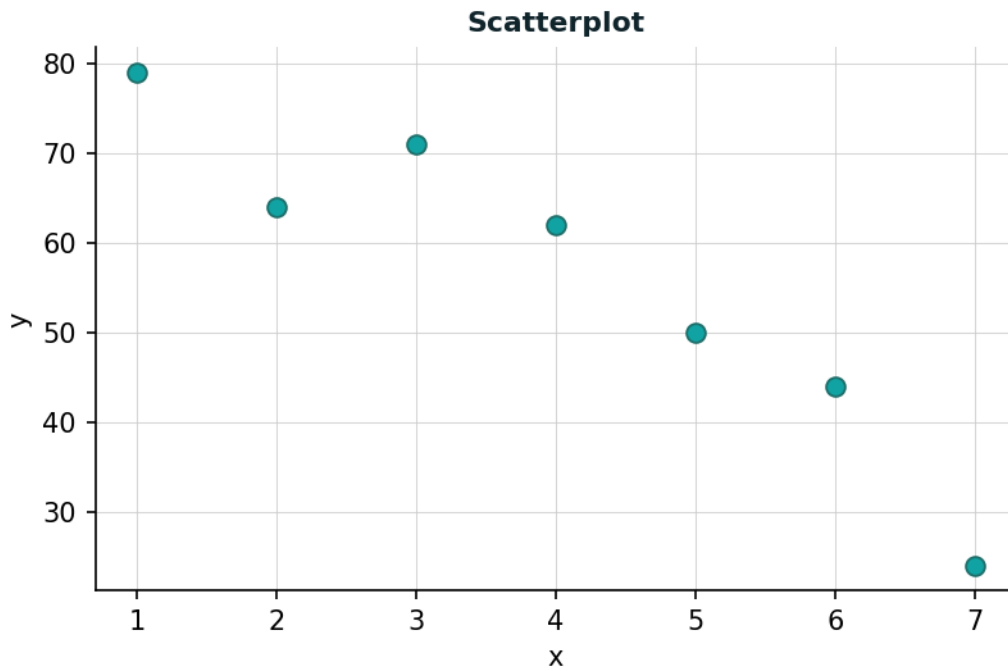
→ Strength: tight clustering -> strong.

→ Answer: A) positive, linear, strong.

**Answer:** A) positive, linear, strong

---

20. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points decline left to right -> negative.

→ Form: points loosely follow a line -> linear.

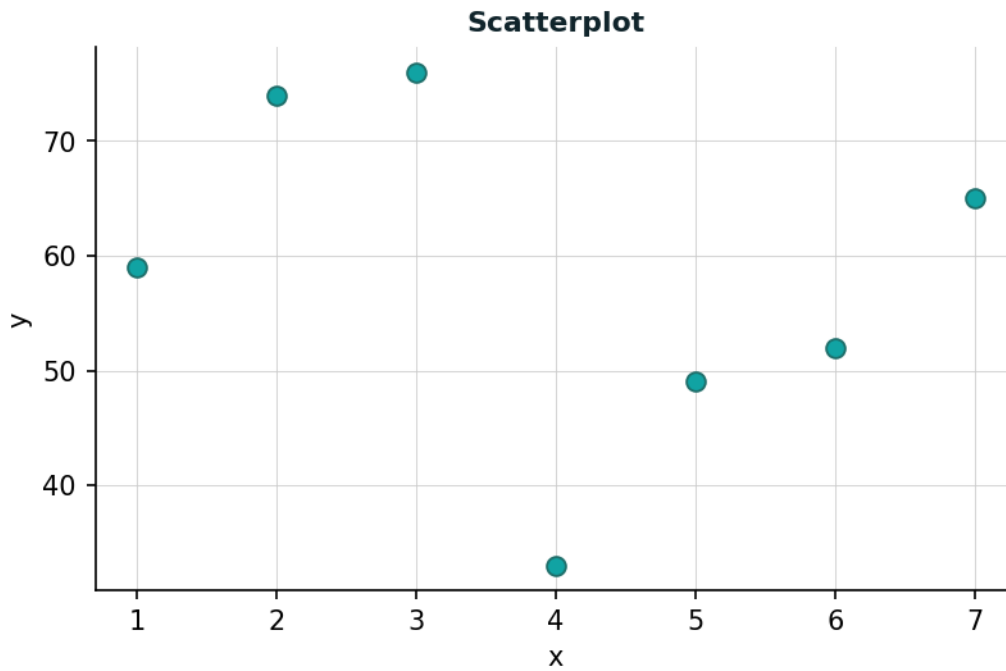
→ Strength: moderate scatter -> moderate.

→ Answer: B) negative, linear, moderate.

**Answer:** B) negative, linear, moderate

---

21. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



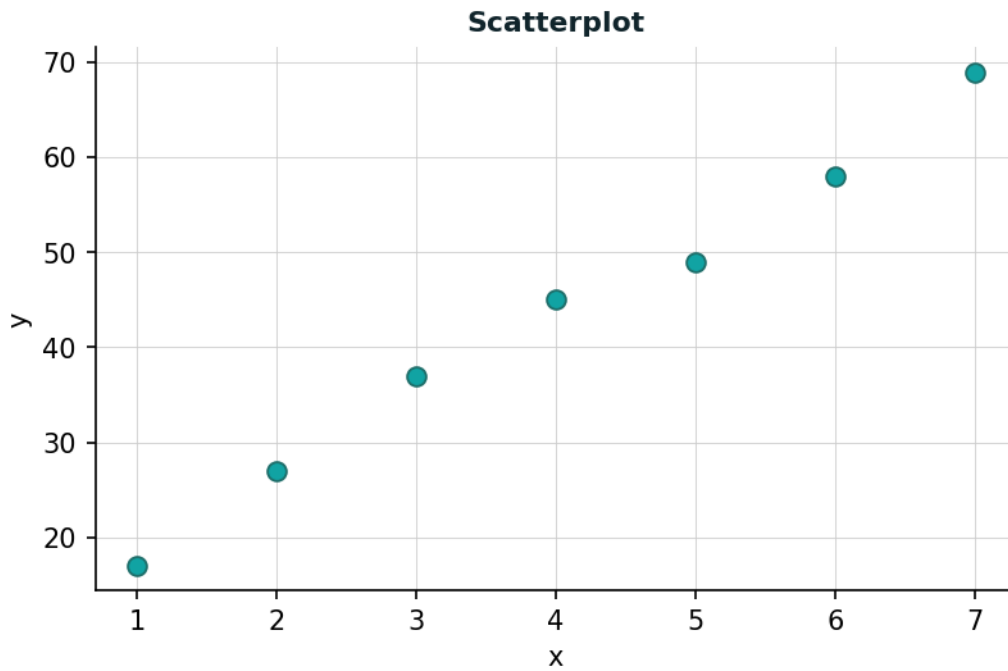
→ No pattern is visible in the scatterplot -> no association.

→ Answer: C) no association.

**Answer:** C)noassociation

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22. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association

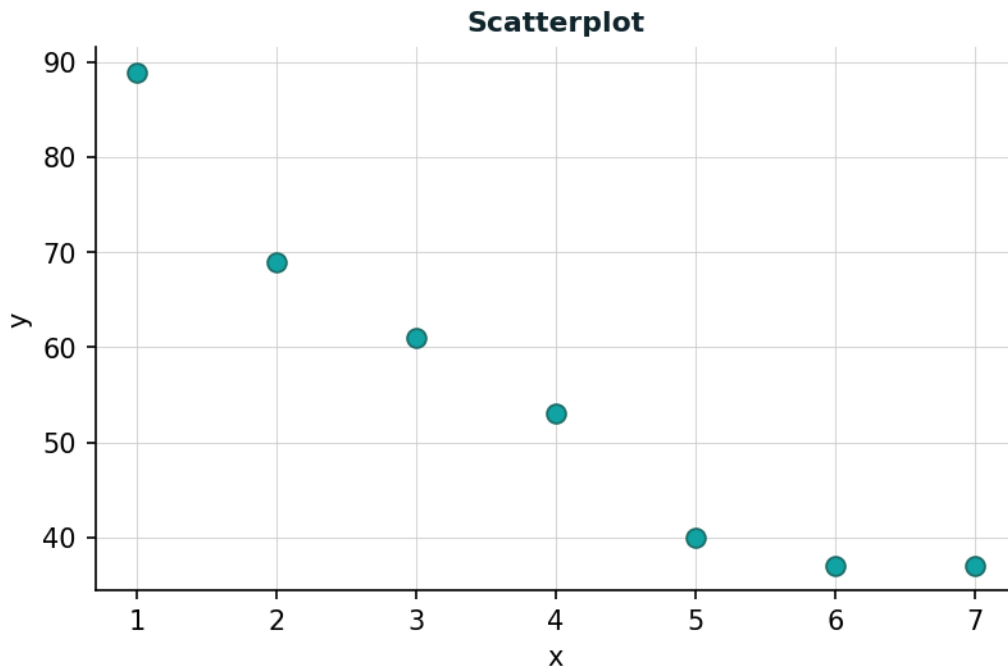


- Direction: points rise left to right -> positive.
- Form: points cluster around a line -> linear.
- Strength: tight clustering -> strong.
- Answer: A) positive, linear, strong.

**Answer:** A) positive, linear, strong

---

23. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points decline left to right -> negative.

→ Form: points loosely follow a line -> linear.

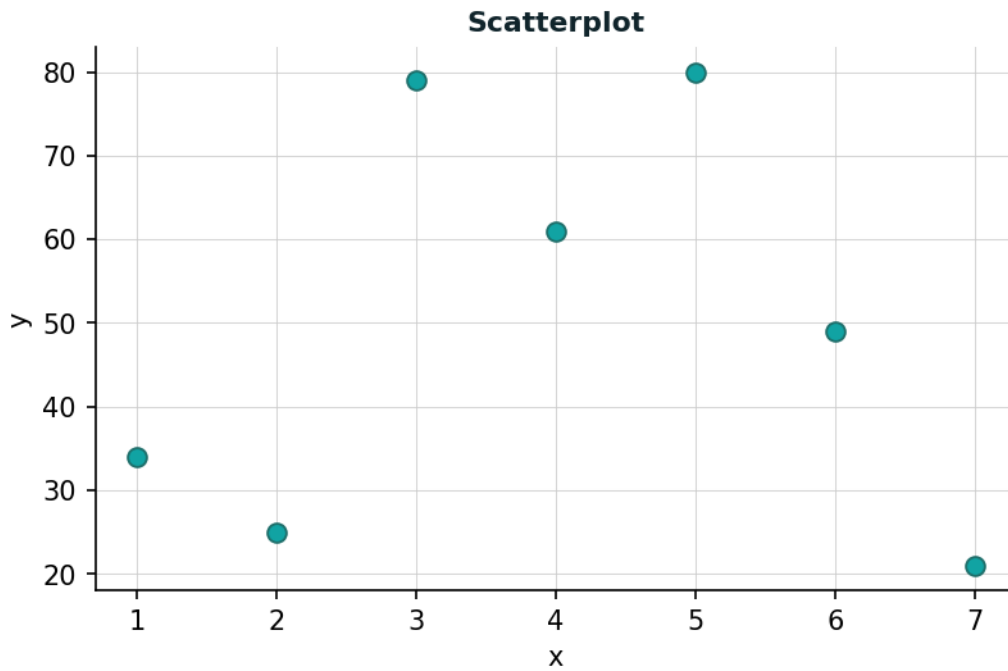
→ Strength: moderate scatter -> moderate.

→ Answer: B) negative, linear, moderate.

**Answer:** B) negative, linear, moderate

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24. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



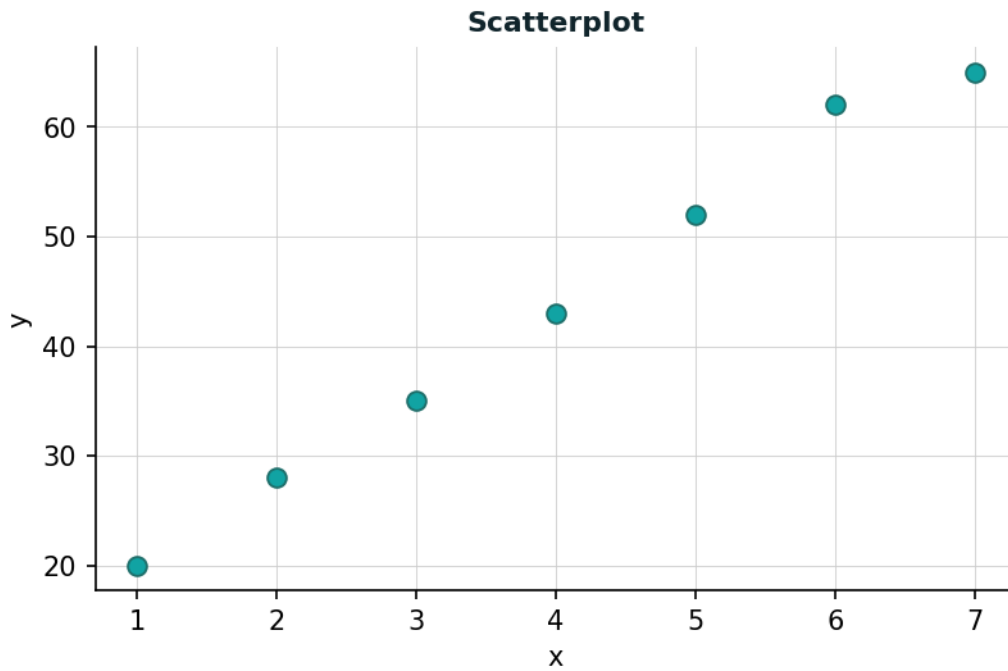
→ No pattern is visible in the scatterplot -> no association.

→ Answer: C) no association.

**Answer:** C)noassociation

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25. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association

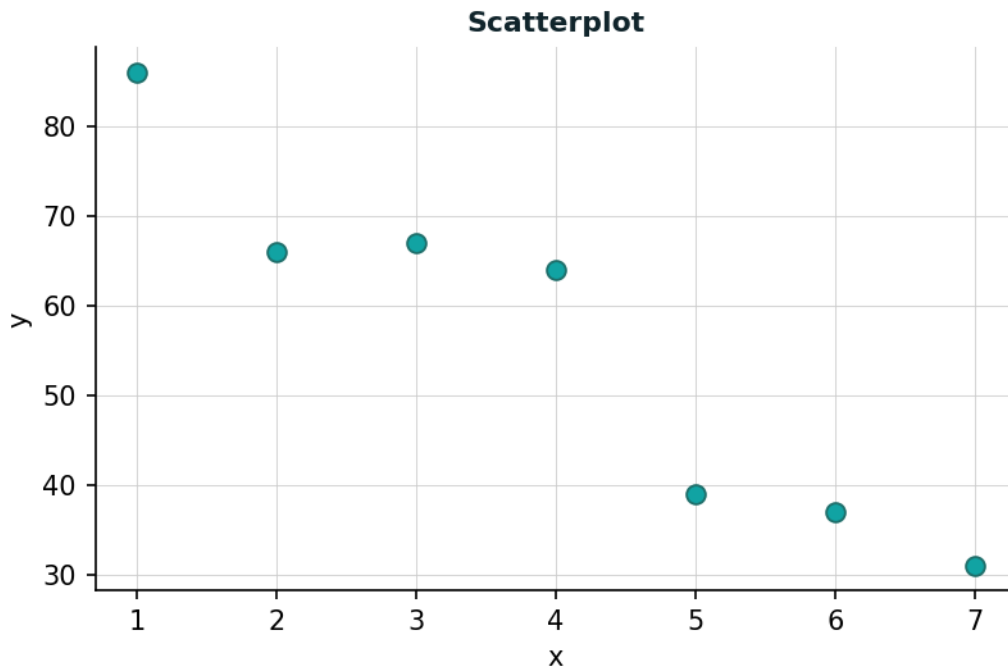


- Direction: points rise left to right -> positive.
- Form: points cluster around a line -> linear.
- Strength: tight clustering -> strong.
- Answer: A) positive, linear, strong.

**Answer:** A) positive, linear, strong

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26. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points decline left to right -> negative.

→ Form: points loosely follow a line -> linear.

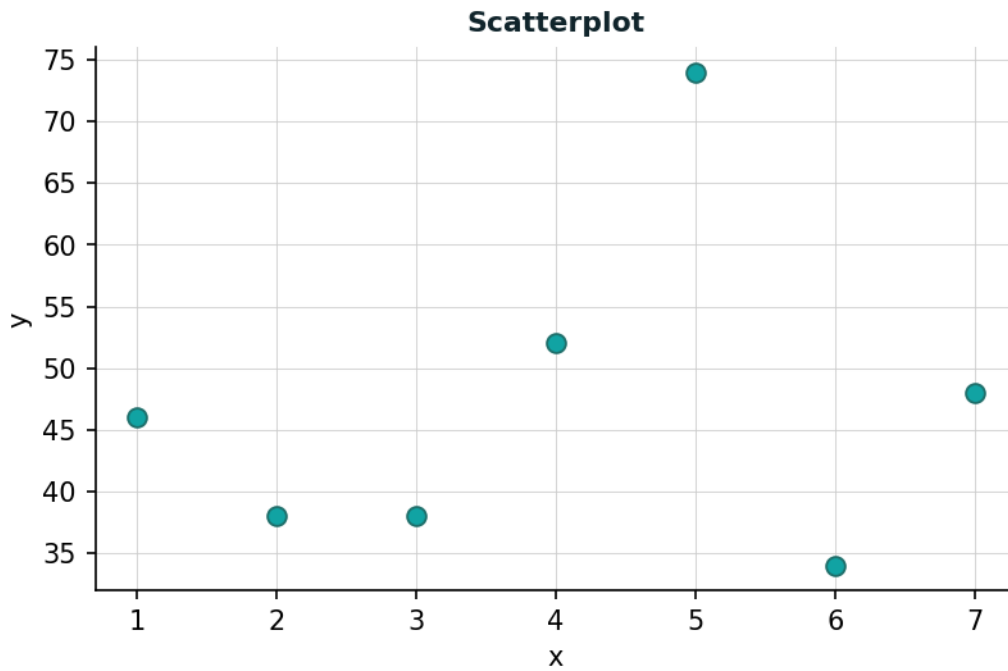
→ Strength: moderate scatter -> moderate.

→ Answer: B) negative, linear, moderate.

**Answer:** B) negative, linear, moderate

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27. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



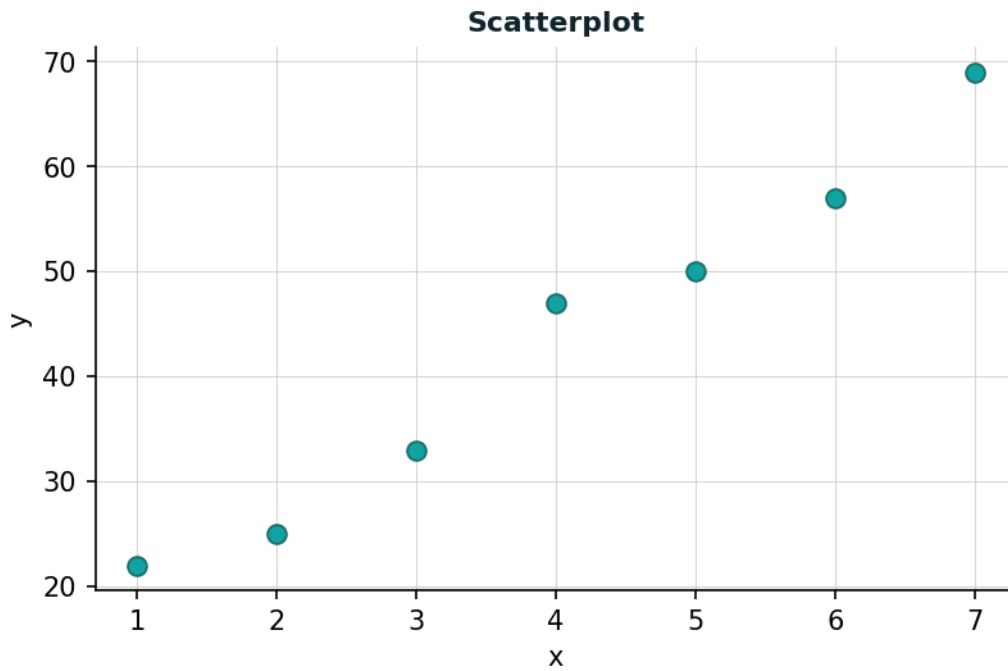
→ No pattern is visible in the scatterplot -> no association.

→ Answer: C) no association.

**Answer:** C)noassociation

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28. A scatterplot shows: points clustered tightly around a line rising from left to right, with no unusual values. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association

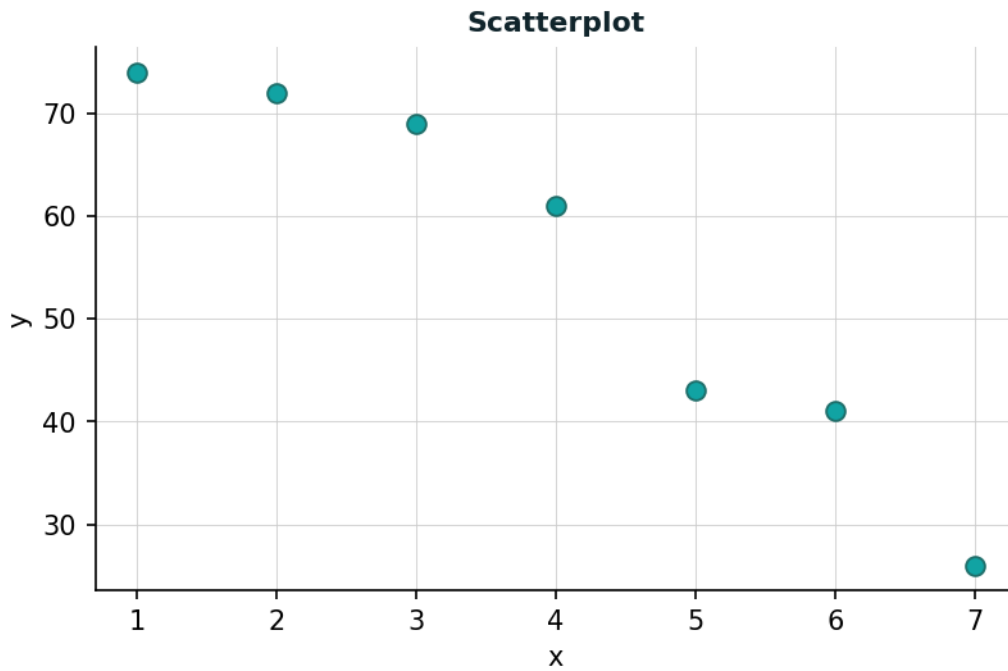


- Direction: points rise left to right -> positive.
- Form: points cluster around a line -> linear.
- Strength: tight clustering -> strong.
- Answer: A) positive, linear, strong.

**Answer:** A) positive, linear, strong

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29. A scatterplot shows: points that fall loosely along a line declining from left to right, with moderate scatter. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ Direction: points decline left to right -> negative.

→ Form: points loosely follow a line -> linear.

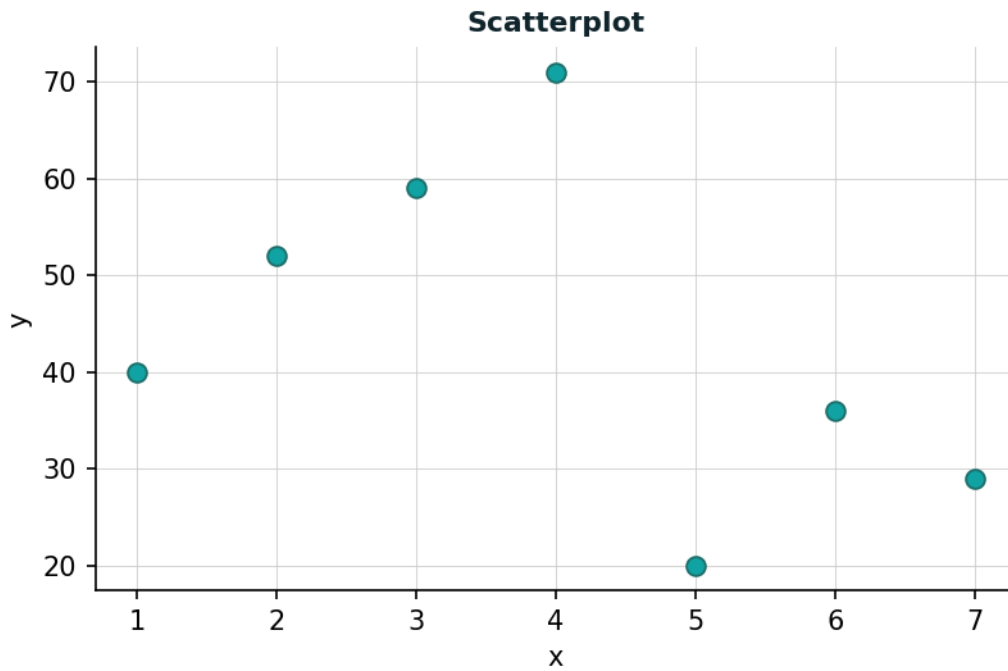
→ Strength: moderate scatter -> moderate.

→ Answer: B) negative, linear, moderate.

**Answer:** B) negative, linear, moderate

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30. A scatterplot shows: points scattered randomly with no discernible pattern or trend. What are the direction, form, and strength of the association? Options: A) positive, linear, strong B) negative, linear, moderate C) no association



→ No pattern is visible in the scatterplot -> no association.

→ Answer: C) no association.

**Answer:** C)noassociation

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