

## Linear Functions and Relations

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

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

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**Instructions:** Answer all questions to the best of your ability. Show all your work in the space provided for full credit.

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1. Compute  $\frac{x}{y}$  if  $x + \frac{1}{y} = 4$  and  $y + \frac{1}{x} = \frac{1}{4}$ . (8)

2. Two lines with nonzero slope and the same  $y$ -intercept have the property that the sum of their slopes is 0. What is the sum of the  $x$ -coordinates of their  $x$ -intercepts? (10)

*Hint:* Turn the words into math. Let the common  $y$ -intercept be  $(0, b)$  and the two  $x$ -intercepts be  $(c, 0)$  and  $(d, 0)$ .

3. A line passing through the points  $(2a + 1, 3a^2)$  and  $(3a + 1, 5a^2)$  has slope  $a + 3$ , where  $a$  is nonzero. Find the value of  $a$ . (12)

4. Find  $A$  if the graph of the equation  $Ax + 3y = 5$  is parallel to the graph of  $5x - 2y = 4$ . (12)

5. Find  $B$  if the graph of the equation  $3x - By + 2$  is perpendicular to the graph of  $3y = -2x + 4$ . (12)

6. Find  $A$  and  $B$  if the graph of the equation  $Ax + 3y = B$  produces the same line as the graph of the equation  $2x + 6y = 7$ . (12)

7. Consider the points  $(1, -2)$  and  $(-5, 6)$ . (10)

(a) Find the distance between the two points.

(b) What are the coordinates of the midpoint of the segment connecting these points?

(c) Find the slope of the line through both points.

(d) Find the standard form of the equation whose graph is the line through both points.

8. If  $f(x) = 3x - 2$  and  $g(x) = x^2 + 1$ , find: (10)
- (a)  $f(g(2))$

(b)  $g(f(-1))$

9. Graph the relation  $\{(-3, 1), (-1, 2), (0, -2), (2, 0), (3, 3)\}$ . (8)

On your coordinate plane, plot each point. Then answer: Is this relation a function?

10. Give the domain of each relation. (12)

(a)  $\{(x, y) : y = \frac{2x+1}{x-4}\}$

(b)  $\{(x, y) : y \leq \frac{3}{x^2-1}\}$

(c)  $\{(x, y) : y = \frac{x}{|x|+5}\}$

(d)  $\{(x, y) : |2x - 3| + |y - 1| = 2\}$

11. True or False?

(8)

(a) All relations are functions.

(b) All functions are relations.

12. Find the range of each function with domain  $D$ .

(10)

(a)  $h : x \mapsto -2x + 5, D = \{1, 3, 5\}$

(b)  $j : x \mapsto x^2 - 1, D = \{-2, 0, 2\}$

(c)  $k : x \mapsto |x + 2|, D = \{-4, -2, 1\}$

(d)  $m : x \mapsto 4x - 3, D = \{0, 2, 4\}$