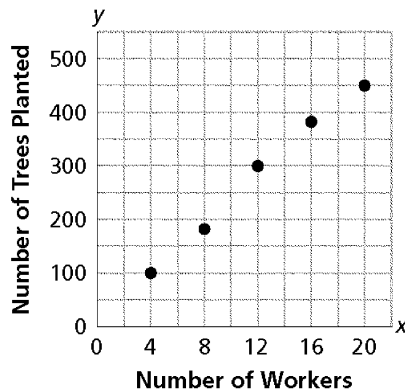


**Mathematical Models Test 2****Short Answer**

The Grant Center for Outdoor Education gives student groups experience in studying nature and helping to restore the environment for fish, birds, and animals.

1. The number of seeding trees that can be planted in one day depends on the number of students in the work group. Data from several different work groups is shown in the next graph.



- a. Draw a line that estimates the pattern in (*workers*, *trees*) data.
- b. Write an equation for your graph model relating trees planted to number of workers.
- c. Use your linear model to estimate how many trees will be planted by a work crew of 14. Explain how you find your answer.
- d. Use your linear model to estimate how many workers will be required to plant 270 trees. Explain how you find your answer.
- e. What is the slope of your linear model? What does that slope tell about the relationship between the variables?

2. Use the table to answer parts (a) and (b).

<b>x</b>	2	3	7	14	21
<b>y</b>	42	28	12	6	4

a. Are  $x$  and  $y$  linearly or inversely related? How do you know?

b. Write an equation to describe the relationship between  $x$  and  $y$ .

3. Diane started working at an ice cream shop and earned \$6 for an hour. She will receive a \$2 raise for every year she works at the shop.

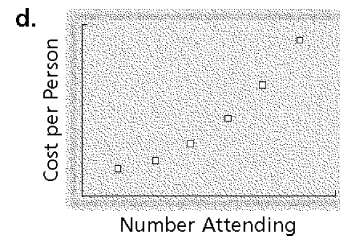
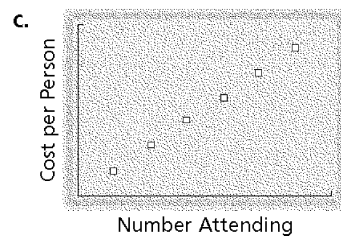
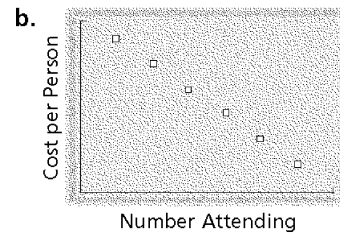
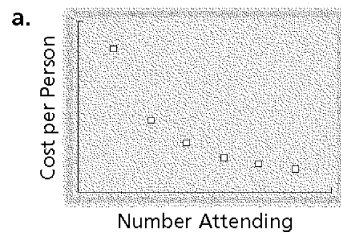
a. Write an equation that expresses her salary in terms of years spent working at the ice cream shop.

b. Use this equation to find Diane’s salary after five years of working at the ice cream shop.

4. The Frederick Douglass Middle School chorus always has a party after their first concert. The cost per person for this party depends on the number of team members who attend. The following table shows some sample (*number attending, cost per person*) values.

<b>Number attending</b>	5	10	15	20	25	30
<b>Cost per person</b>	\$24	\$12	\$8	\$6	\$4.80	\$4

Which of the following graphs shows best the relationship between number attending the party and cost per person, and how do you know?



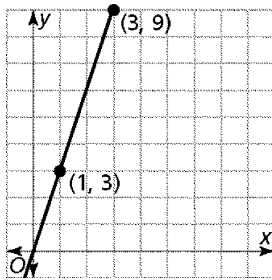
Write an equation to represent the relationship?

Write an equation and sketch a graph for the line that meets the given conditions.

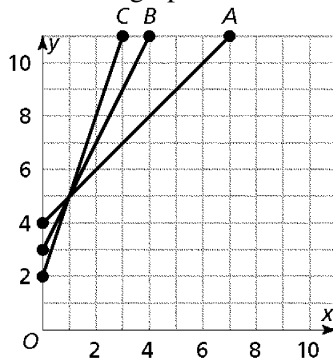
5. A line with slope 3.5 and y-intercept (0, 4)
6. A line with slope  $\frac{3}{2}$  that passes through the point (-2, 0)
7. A line that passes through the points (2, 1) and (6, 9)

Write an equation for the line shown. Identify the slope and y-intercept.

8.



9. Below are the graphs of three lines.



a. Match each line with its rule.

$$y = x + 4$$

$$y = 2x + 3$$

$$y = 3x + 2$$

b. What are the y-values when  $x = 3$ ? When  $x = 4$ ?

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

ID: A

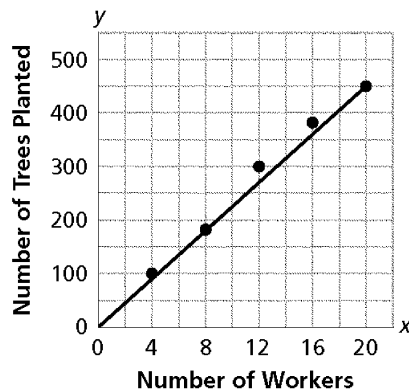
10. How are the length and width of rectangles related if the area is fixed at  $60 \text{ cm}^2$ ?
- a. Make a table of lengths and widths. Draw a graph of these data.
  - b. Use the letters  $l$  and  $w$  to write an equation showing the relationship between length and width.
  
  - d. Is the relationship between *length* and *width* linear when the area is constant? How does the graph show this?

## Mathematical Models Test 2

### Answer Section

#### SHORT ANSWER

1. ANS:
2. a. Possible line:



In the remaining parts for this problem, answers will vary slightly with different models.

b. Possible equation:  $T = \frac{45}{2}w$

c. 315 trees;  $T = \frac{45}{2}(14) = 315$  trees

d. 12 workers; Starting with  $270 = \frac{45}{2}(x)$  and dividing both sides of the equation by  $\frac{45}{2}$  gives that  $x = 270 \div \frac{45}{2} = 12$  workers.

e.  $m = \frac{45}{2}$ ; for every 2 workers, 45 trees are planted.

PTS: 1                    DIF: L2                    REF: Thinking with Mathematical Models | Partner Quiz  
 OBJ: Investigation 2: Linear Models and Equations  
 NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e  
 STA: 8MI A.PA.08.02| 8MI A.PA.08.03| 8MI A.FO.08.12| 8MI A.FO.08.13| 8MI A.FO.08.10| 8MI A.FO.08.11a| 8MI A.FO.08.11b                    TOP: Problem 2.2 Equations for Linear Relationships  
 KEY: graphing | writing equations | linear equations | slope | substitute

2. ANS:
- The relationship is not linear, since the constant increment of 7 for  $x$  does not result in a constant change in  $y$ . The relationship is inverse because  $x$  and  $y$  make a constant product, 84.
  - $y = \frac{84}{x}$  or  $x = \frac{84}{y}$  or  $xy = 84$

PTS: 1                    DIF: L2                    REF: Thinking with Mathematical Models | Question Bank  
 OBJ: Investigation 3: Inverse Variation  
 NAT: NAEP A2a| NAEP A2b| NAEP A3a| NAEP D1a| NAEP D2e  
 STA: 8MI A.RP.08.01a| 8MI A.PA.08.02| 8MI A.PA.08.03  
 TOP: Problem 3.3 Inverse Variation Patterns  
 KEY: linear equations | inverse variation | writing equations

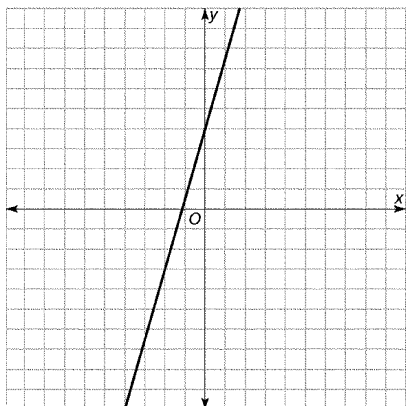
3. ANS:
- $y = 6 + 2x$ , where  $y$  is the pay rate and  $x$  is the number of years she has worked.
  - \$16 per hour.

PTS: 1                    DIF: L2                    REF: Thinking with Mathematical Models | Question Bank  
 OBJ: Investigation 2: Linear Models and Equations  
 NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e  
 STA: 8MI A.PA.08.02| 8MI A.PA.08.03| 8MI A.FO.08.12| 8MI A.FO.08.13| 8MI A.FO.08.10| 8MI A.FO.08.11a| 8MI A.FO.08.11b                    TOP: Problem 2.2 Equations for Linear Relationships  
 KEY: writing equations | substitute

4. ANS:  
 Graph a; This is not a linear situation, and the graph should be decreasing.

PTS: 1                    DIF: L2                    REF: Thinking with Mathematical Models | Question Bank  
 OBJ: Investigation 3: Inverse Variation  
 NAT: NAEP A2a| NAEP A2b| NAEP A3a| NAEP D1a| NAEP D2e  
 STA: 8MI A.RP.08.01a| 8MI A.PA.08.02| 8MI A.PA.08.03  
 TOP: Problem 3.3 Inverse Variation Patterns                    KEY: table | graphing

5. ANS:  
 $y = 3.5x + 4$



PTS: 1

DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 2

OBJ: Investigation 2: Linear Models and Equations

NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e

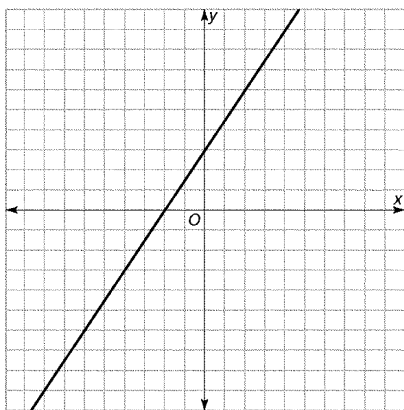
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TOP: Problem 2.2 Equations for Linear Relationships

KEY: graphing | linear equations | writing equations

6. ANS:

$$y = \frac{3}{2}x + 3$$



PTS: 1

DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 2

OBJ: Investigation 2: Linear Models and Equations

NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e

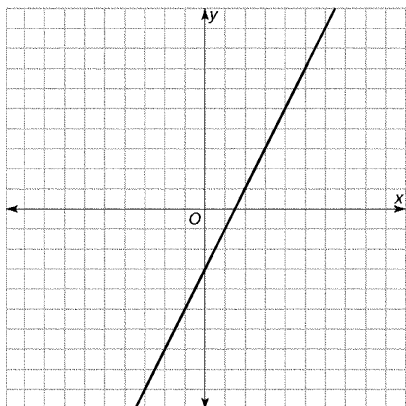
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TOP: Problem 2.2 Equations for Linear Relationships

KEY: graphing | linear equations | writing equations



7. ANS:  
 $y = 2x - 3$



PTS: 1                    DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 2

OBJ: Investigation 2: Linear Models and Equations

NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e

STA: 8MI A.PA.08.02| 8MI A.PA.08.03| 8MI A.FO.08.12| 8MI A.FO.08.13| 8MI A.FO.08.10| 8MI A.FO.08.11a| 8MI A.FO.08.11b                    TOP: Problem 2.2 Equations for Linear Relationships

KEY: graphing | linear equations | writing equations

8. ANS:  
 $y = 3x$ , slope = 3, y-intercept = 0

PTS: 1                    DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 2

OBJ: Investigation 2: Linear Models and Equations

NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e

STA: 8MI A.PA.08.02| 8MI A.PA.08.03| 8MI A.FO.08.12| 8MI A.FO.08.13| 8MI A.FO.08.10| 8MI A.FO.08.11a| 8MI A.FO.08.11b                    TOP: Problem 2.2 Equations for Linear Relationships

KEY: graphing | linear equations | writing equations | slope | y-intercept

9. ANS:

- a. A:  $y = x + 4$ ;      B:  $y = 2x + 3$       C:  $y = 3x + 2$
- b. 7, 9, 11; and 8, 11, 14
- c. Because the  $x$  values are multiplied by numbers greater than 1.

PTS: 1      DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 2

OBJ: Investigation 2: Linear Models and Equations

NAT: NAEP A1f| NAEP A2b| NAEP A2c| NAEP A2d| NAEP A4a| NAEP A4c| NAEP A4d| NAEP D1a| NAEP D2e

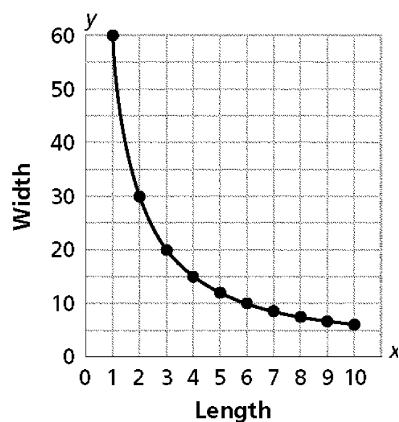
STA: 8MI A.PA.08.02| 8MI A.PA.08.03| 8MI A.FO.08.12| 8MI A.FO.08.13| 8MI A.FO.08.10| 8MI A.FO.08.11a| 8MI A.FO.08.11b      TOP: Problem 2.3 Solving Linear Equations

KEY: graphing | writing equations

10. ANS:

a.

Length	1	2	3	4	5	6	7	8	9	10
Width	60	30	20	15	12	10	8.6	7.5	6.7	6



- b. yes, because measurements are continuous data, so the points in between the dots can be interpreted in this situation
- c.  $lw = 60$
- d. No, the graph is not a straight line.

PTS: 1      DIF: L2

REF: Thinking with Mathematical Models | Additional Practice Investigation 3

OBJ: Investigation 3: Inverse Variation

NAT: NAEP A2a| NAEP A2b| NAEP A3a| NAEP D1a| NAEP D2e

STA: 8MI A.RP.08.01a| 8MI A.PA.08.02| 8MI A.PA.08.03

TOP: Problem 3.1 Relating Length and Width

KEY: area | table | graphing | writing equations