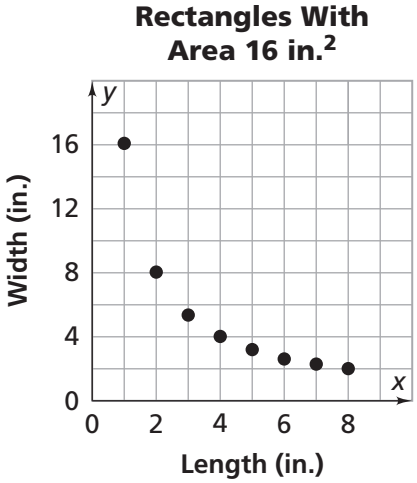
Applications

1. a. (See Figure 1.)

b.

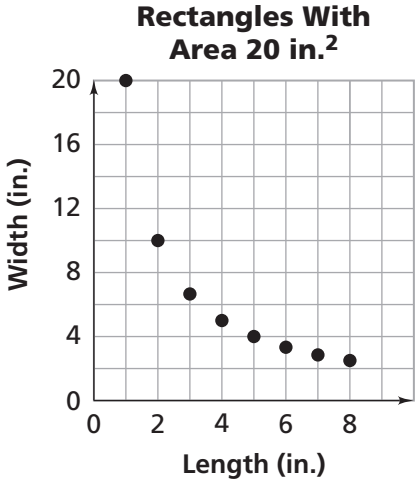


c. As length increases, width decreases at a decreasing rate.

d. $w = \frac{16}{\ell}$ (or $w\ell = 16$, or $\ell = \frac{16}{w}$); not linear

2. a. Values in table will vary. Sample: (See Figure 2.)

b. Points will vary. Sample:



c. $w = \frac{20}{\ell}$; not linear

d. The graphs are similar in shape, but the coordinates of the points are different.

e. The equations have the same form, but the constant is different.

Figure 1

Rectangles With Area 16 in.²

Length (in.)	1	2	3	4	5	6	7	8
Width (in.)	16	8	$\frac{16}{3}$	4	$\frac{16}{5}$	$\frac{16}{6}$	$\frac{16}{7}$	2

Figure 2

Rectangles With Area 20 in.²

Length (in.)	1	2	3	4	5	6	7	8
Width (in.)	20	10	$\frac{20}{3}$	5	4	$\frac{10}{3}$	$\frac{20}{7}$	$\frac{5}{2}$

3. Analyzing breaking weight data.

a. Answers will vary, but $y = \frac{24}{x}$, where x is the length and y is the breaking weight, is a reasonable choice.

b. In the equation $y = \frac{24}{x}$, x (or length) is in the denominator, so as x increases, y (or breaking weight) decreases. This is reasonable because the data show that as the length of a bridge increases, the strength decreases.

4. not an inverse variation

5. inverse variation; $y = \frac{48}{x}$

6. inverse variation; $y = \frac{100}{x}$

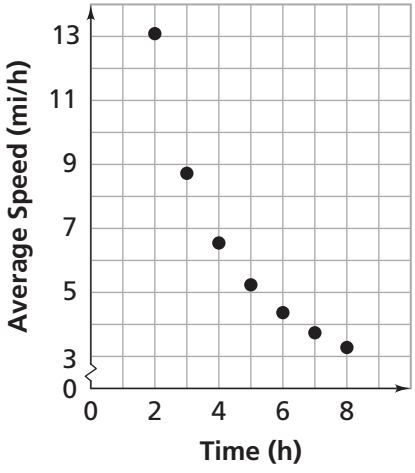
7. not an inverse variation

8. **a.** Answers will vary, but should fit the patterns in the table and graph below.

Marathon Speeds

Time (h)	Running Speed (mi/h)
2	13.1
3	8.73
4	6.55
5	5.24
6	4.37
7	3.74
8	3.28

Marathon Speeds



b. $s = \frac{26.2}{t}$

c. decreases by 4.37 mi/h; decreases by 2.18 mi/h; decreases by 1.31 mi/h

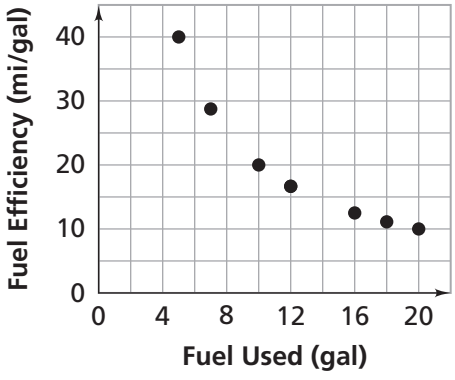
d. Equal changes in time do not always result in equal changes in average speed.

9. **a.**

Vehicle Type	Fuel Used (gal)	Fuel Efficiency (mi/gal)
Large Truck	20	10
Large SUV	18	11.11
Limousine	16	12.5
Large Sedan	12	16.67
Small Truck	10	20
Sports Car	12	16.67
Compact Car	7	28.57
Sub-Compact Car	5	40

b.

Fuel Efficiency



c. $e = 200 \div f$, where f is the amount of fuel used

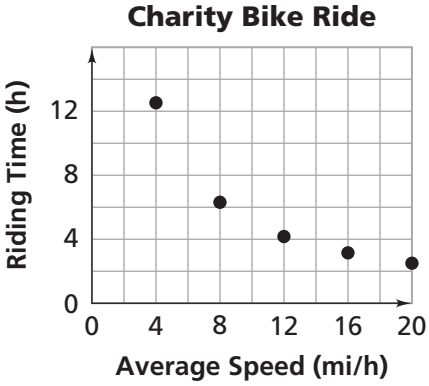
d. decreases by 20 mpg; decreases by 6.67 mpg; decreases by 3.33 mpg

e. Equal changes in fuel use do not always lead to equal changes in fuel efficiency.

10. **a.**

Charity Bike Ride

Time (h)	Riding Speed (mi/h)
4	12.5
8	6.25
12	4.17
16	3.125
20	2.5

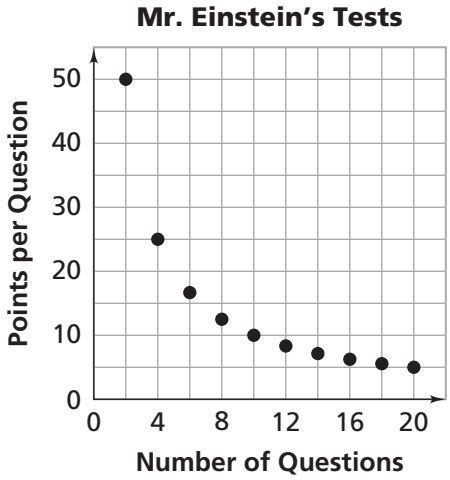


b. $t = 50 \div s$, where s is the speed in miles per hour.

c. decreases by 6.25 hours; decreases by 2.08 hours; decreases by 1.05 hours

d. For constant change in average riding speed, the change in time is not constant.

11. a. (See Figure 3.)



b. $p = \frac{100}{n}$

c. decreases by 25 points per question; decreases by 8.33 points per question; decreases by 4.17 points per question; decreases by 2.5 points per question

d. For constant change in the number of questions, the change in points per question is not constant.

Connections

12. a. slope positive, y-intercept 0, passes through the origin at (0, 0)

b. slope positive, y-intercept positive, crosses the x-axis to the left of the origin

c. slope 0, y-intercept negative, never crosses the x-axis

d. slope negative, y-intercept positive, crosses the x-axis to the right of the origin

e. slope negative, y-intercept negative, crosses the x-axis to the left of the origin

13. a.

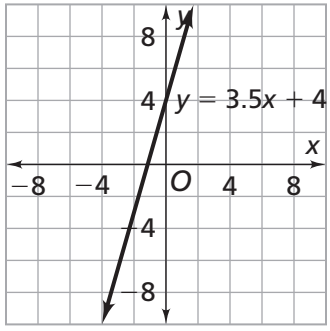
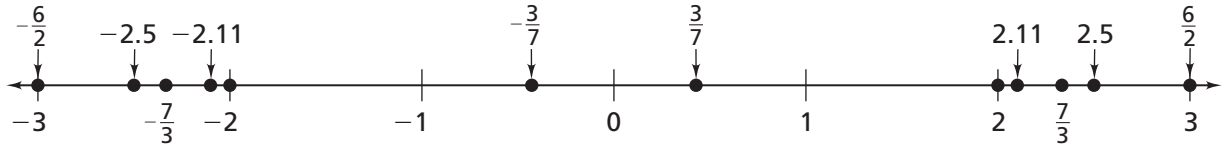
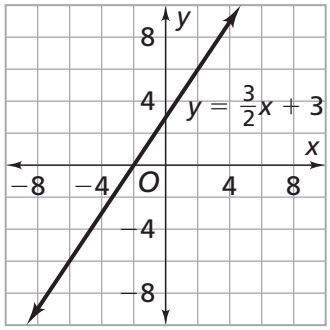


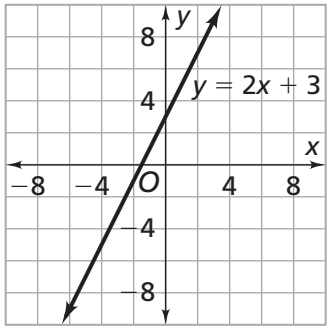
Figure 3



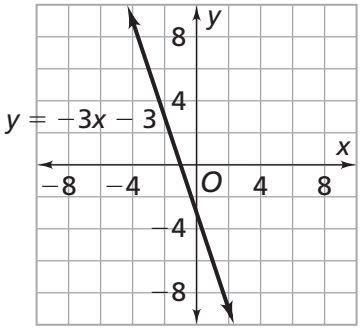
b.



c.

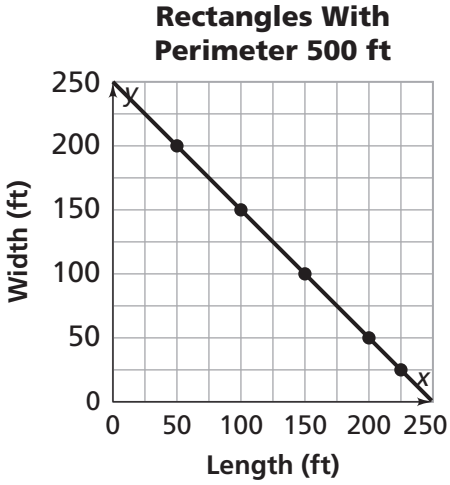


d.



14. a. (See Figure 4.)

b.



c. As length increases, width decreases. The rate of change is constant.

d. $w = 250 - \ell$ or $w = \frac{500 - 2\ell}{2}$. This function is linear. The graph is a straight line and the equation has the form $y = mx + b$.

15. −2

16. 3

17. −2.5

18. 2.11

19. $-\frac{7}{3}$

20. $-\frac{3}{7}$

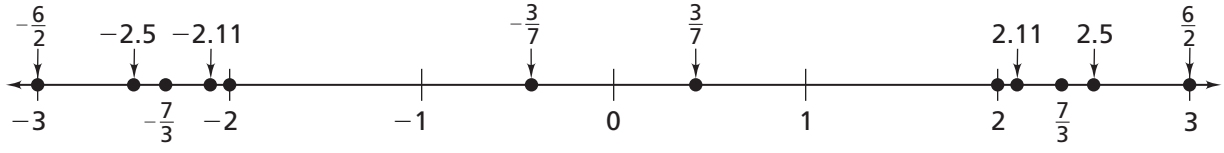
21. A number and its additive inverse are the same distance from 0 on the number line. The labeled number line has reflection symmetry.
(See Figure 5.)

Figure 4

Rectangles With Perimeter 500 ft

Length (ft)	50	100	150	200	225
Width (ft)	200	150	100	50	25

Figure 5



22. $\frac{1}{2}$

23. $-\frac{1}{2}$

24. 2

25. $\frac{1}{4}$

26. $\frac{4}{3}$

27. $\frac{3}{5}$

28. Numbers greater than 1 have multiplicative inverses between 0 and 1. Numbers less than -1 have multiplicative inverses between -1 and 0.
(See Figure 6.)

29. C

30. **a.** 6.67

b. 7.62

c. because the relationship between number of quizzes and average quiz scores is not linear

31. $x = 5$

$5x - 28 = -3$

$5x = 25$

$x = 5$

To solve with a graph, graph $y = 5x - 28$ and find the x-coordinate of the point where $y = -3$. To solve with a table, make a table of (x, y) values for $y = 5x - 28$, find the x-value corresponding to $y = -3$.

32. $x = 2$

$10 - 3x = 7x - 10$

$10 = 10x - 10$

$20 = 10x$

$x = 2$

To solve with a graph, graph $y = 10 - 3x$ and $y = 7x - 10$, and find the x-coordinate of the intersection point. To solve with a table, make a table of (x, y) values for $y = 7x - 10$ and $y = 10 - 3x$. Then find the x-value for which the y-values for the two equations are the same.

33. $y = \frac{1}{2}x + 5$

34. $y = 3x - 4$

35. $y = -2x + 12$

36. $y = \frac{1}{6}x + 7$. To find the slope, take the points (30, 12) and (0, 7) on the line and find the vertical change (5) and the horizontal change (30). Slope is the ratio $\frac{\text{rise}}{\text{run}} = \frac{5}{30} = \frac{1}{6}$.

37. **a.** $A = 5n$ (Problem 3.3 Question D) and $d = 50t$ (Problem 3.2 Question C). The ratio is 5 and the ratio is 50.

b. The ratio equals k in both cases.

c. y changes by k as x changes by 1. This pattern results in a straight-line graph with slope k.

d. With a direct variation the graph is a line, and the equation is of the form $y = kx$ where the slope of the line equals k. With an inverse variation, the graph is a curve, and the equation is of the form $y = \frac{k}{x}$.

38. Super Market charges about $\$.58$ per tomato and Gus's Groceries charges about $\$.67$.

38. Super Market; Gus's Groceries charges about $\$.44$ per cucumber and Super Market charges $\$.40$.

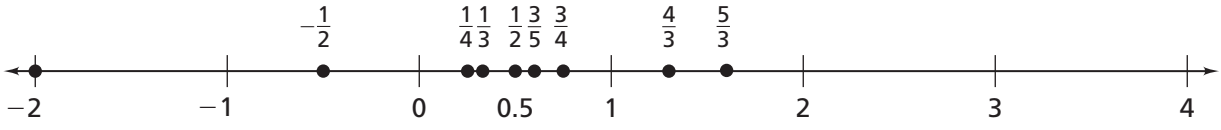
40. Gus's Groceries; Gus's Groceries charges $\$.50$ per apple and Super Market charges about $\$.58$.

41. **a.** about $\$0.53$; $\$3.20 \div 6 \approx 0.53$.

b. about $\$5.30$; $0.53 \times 10 \approx 5.3$

c. about $0.53n$ (or exactly $\frac{8}{15}n$)

Figure 6



Extensions

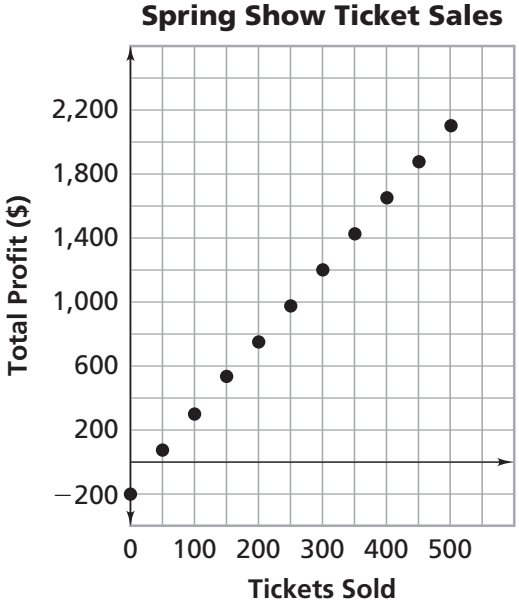
42. a. If x is the number of tickets sold and y is the profit, then $y = 4.5x - 150$.

b.

Spring Show Ticket Sales

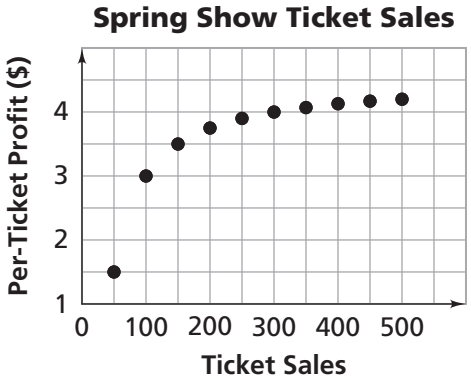
Tickets Sold	Total Profit	Per-Ticket Profit
0	−150	___
50	$75	$1.50
100	$300	$3.00
150	$525	$3.50
200	$750	$3.75
250	$975	$3.90
300	$1,200	$4.00
350	$1,425	$4.07
400	$1,650	$4.13
450	$1,875	$4.17
500	$2,100	$4.20

c.



d. See part (b) above.

e.



f. The pattern for total profit is linear; the pattern for per-ticket profit is not. The graph for total profit is a straight line; the graph for per-ticket profit is a curve. In the column for total profit, there is a constant difference in values; in the column for per-ticket profit, there is not. The per-ticket profit increases by smaller and smaller amounts as the number of tickets sold increases.

43. a. $250\,cm^3$

b. 10 cm by 10 cm by 2.5 cm

c. The surface area of the original prism is $250\,cm^2$. The surface area of the prism in part (b) is $300\,cm^2$. The surface area of the original prism is smaller.

44. Ms. Singh traveled 80 mi in 3 hr, for an average speed of $\frac{80}{3}$ mi/h ≈ 26.67 mi/h.

45. (3, 16), (12, 4); $12c = 48$, $c = 4$.

46. (3, 9), $\left(4, \frac{27}{4}\right)$; $4c = 27$, $c = \frac{27}{4}$

47. (3, 4), (4, 3); $4c = 12$, $c = 3$.

48. A

49. G

50. A