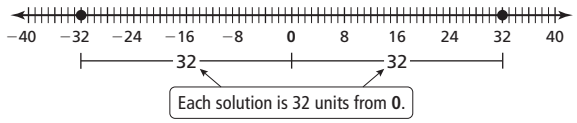
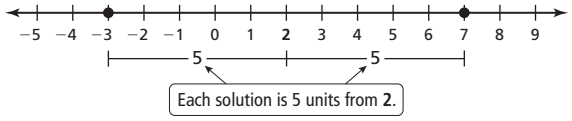
Answers

102. $y = -32, 32$

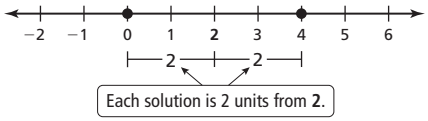


103. $x = -3, 7$



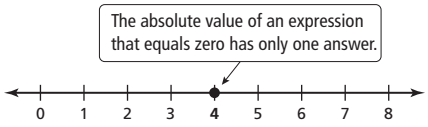
104. no solution

105. $n = 0, 4$



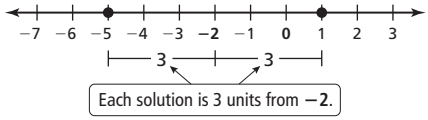
106. no solution

107. $n = 4$

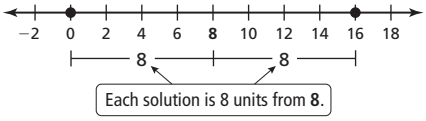


108. no solution

109. $v = -5, 1$



110. $y = 0, 16$



111. $|x - 54.5| = 1.5$; 53°, 56°

112. $|x - 41| = 2$; 39 lb/in.^{2}, 43 lb/in.^{2}

113. $|x - 16| = 0.3$; 15.7 oz, 16.3 oz

114. $x = 1$ **115.** $x = 2, 4$ **116.** $z = -1$

117. $y = 2x + 14$ **118.** $y = -6x + 2$

119. $y = 2x - 5$ **120.** $y = -4x - 5$

121. $y = -1$ **122.** $y = 9x - 9$

123. $x = \frac{y}{9}$ **124.** $x = \frac{m}{8}$ **125.** $x = \frac{w}{u + r}$

126. $x = \frac{C - 50}{30}$; 4 months; 7 months

Chapter 2

2.1 Start Thinking

Sample answer: the price of a car you could buy, if you have up to \$15,000 to spend

2.1 Warm Up

1. = **2.** > **3.** <

4. > **5.** > **6.** >

2.1 Cumulative Review Warm Up

1. $x = 4$ **2.** $p = -8$

3. $t = -11$ **4.** $r = -\frac{10}{9}$

5. $x = -1$ **6.** $w = 2$

2.1 Practice A

1. $x < 2$ **2.** $m + 4 \geq 7$

3. $10 \geq 6q$ **4.** $4p > 22$

5. $\frac{1}{3}t \leq 5$ **6.** $6 > d - 1$

7. $x + 65 \leq 84$

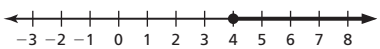
8. no **9.** yes **10.** yes

11. no **12.** no **13.** yes

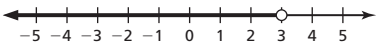
14. a. $x < 727$

b. no; It is not a solution because 750 is not less than 727.

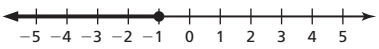
15.



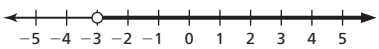
16.



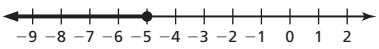
17.



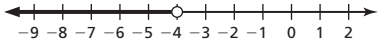
18.



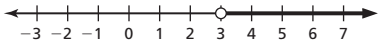
19.



Answers

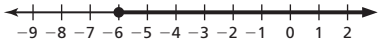
20. 

21. $x > 3$



22. $p \leq 0$

23. $w \geq -6$



24. $x \geq 5$

2.1 Practice B

1. $x + 10 > 2$ **2.** $12 \geq n + 3$

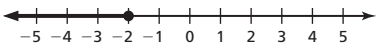
3. $\frac{1}{2}p \geq 100$ **4.** $6 \geq \frac{y}{2.5}$

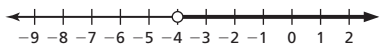
5. yes **6.** yes **7.** no

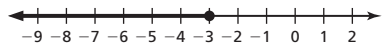
8. yes **9.** no **10.** no

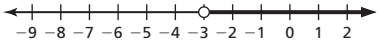
11. a. $245 - x \geq 72$

b. no; This is because 180 is not a solution to the inequality.

12. 

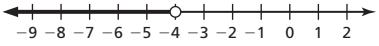
13. 

14. 

15. 

16. 

17. $n < -4$



18. $x < -2$ **19.** $x \geq 1$

20. a. $r \leq 3$

b. no; 3 h 9 min is not a solution.

2.1 Enrichment and Extension

1. a. $-\frac{2}{3}$; rational number **b.** $-\frac{1}{2}$; rational number
c. -2; integer, rational number

2. a. 1; whole number, integer, rational number
b. 0; whole number, integer, rational number
c. -1; integer, rational number

3. a. $\frac{2}{3}$; rational number **b.** $\frac{1}{2}$; rational number
c. 0; whole number, integer, rational number

4. a. 1; whole number, integer, rational number
b. 1; whole number, integer, rational number
c. 1; whole number, integer, rational number

5. $x - 1, x, x + 2$; no; Changing the sign of x would move the original numbers, but not their relative placement.

6. false; $\frac{6}{2} = 3$ **7.** true

8. false; $\frac{1}{2} + \frac{1}{2} = 1$ **9.** false; $\frac{2}{3} \bullet \frac{3}{2} = 1$

10. false; $-\frac{10}{2} = -5$ **11.** true

12. true **13.** true

14. false; The opposite of -2 is 2.

15. true

2.1 Puzzle Time

JUMP ROPE

2.2 Start Thinking

If you subtract the cost of the bread (b), the eggs (e), and cereal (c) from 20, that amount must be greater than or equal to the cost of the milk (m). So, you have the inequality $20 - b - e - c \geq m$.

2.2 Warm Up

1. $x = -1$ **2.** $y = 3$ **3.** $x = 6$

4. $x = -2$ **5.** $a = -20$ **6.** $x = 7$

2.2 Cumulative Review Warm Up

1. $x = 1$ or $x = 13$ **2.** $x = -4$ or $x = 10$

3. $x = -\frac{3}{4}$ or $x = \frac{1}{4}$ **4.** $x = -2$ or $x = \frac{1}{2}$

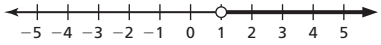
5. $m = -2$ or $m = 10$ **6.** $q = -22$ or $q = 4$

2.2 Practice A

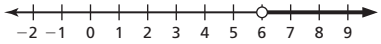
1. Subtract 3. **2.** Add 5. **3.** Add 1.

Answers

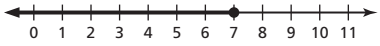
4. $t > 1$



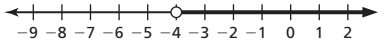
5. $6 < p$



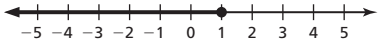
6. $7 \geq h$



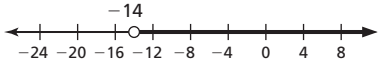
7. $v > -4$



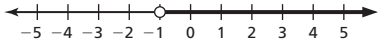
8. $p \leq 1$



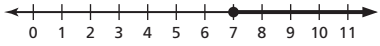
9. $-14 < t$



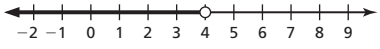
10. $k > -1$



11. $7 \leq r$



12. $w < 4$



13. $x - 2 > -10$; $x > -8$ **14.** $x + 7 \leq 4$; $x \leq -3$

15. $x - 6 < 1$; $x < 7$ **16.** $8 \geq x + 3$; $5 \geq x$

17. a. $156 + w \leq 1000 - 675$; $x \leq 169$

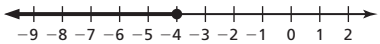
b. no; This is not within the limits because 182 is more than 169.

18. 25 or more

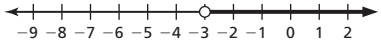
19. b, c; Add y to each side and subtract 5 from each side to get answer (b). Add y to each side and subtract 5 from each side to get $y < b - 5$, and then rearrange the order of the inequality to get answer (c).

2.2 Practice B

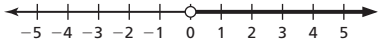
1. $w \leq -4$



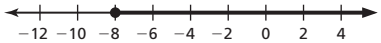
2. $m > -3$



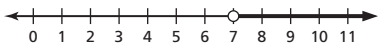
3. $0 < s$



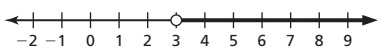
4. $-8 \leq x$



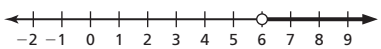
5. $p > 7$



6. $q > 3$

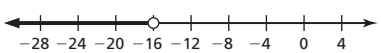


7. $t > 6$



8. $3 \leq a$

9. $c < -16$



10. $x + 10 < 34$; $x < 24$ **11.** $x - 8 \geq 14$; $x \geq 22$

12. $x + 7 < 15$; $x < 8$ **13.** $9 \leq x - 1$; $10 \leq x$

14. a. $69.95 + x \geq 75$; $x \geq 5.05$

b. yes; The cost of shipping is more than the cost of the additional needed item.

15. $12.5 + 11.8 + x < 37.8$; $x < 13.5$

16. $7.9 + 6.4 + 6.8 + x \leq 24.1$; $x \leq 3$

17. a. $x - 7 > -10$; $x > -3$

b. $x + 3 \leq 2.5$; $x \leq -0.5$

2.2 Enrichment and Extension

1. 6, Inverse Property of Addition

2. 1, Commutative Property of Addition

3. 0, Associative Property of Addition

4. 3, Distributive Property of Multiplication over Addition

Answers

5. 0

6. no; If all variables are negative, then $x + y + z - 1 + 1 - x - y - z$.

7. no; If x is negative, then $-x + y + z - 1 + 1 + x - y - z$.

8. no

9. no; In $-a^2$, the negative does not get squared. So, a^2 is always positive, and $-a^2$ is always negative; $(-1)^2 = 1$, $-(-1)^2 = -1$

10. yes; The negative in $(-a)^2$ does get squared, so both answers are always positive; $1^2 = 1 \bullet 1 = 1$, $(-1)^2 = (-1) \bullet (-1) = 1$

2.2 Puzzle Time

TO THE CRYSTAL BALL

2.3 Start Thinking

Sample answer:

$2 < 4$ $\times -1$ $\times -1$ no; $-2 \not< -4$ $\quad$ $2 < 4$ $\div -1$ $\div -1$ no; $-2 \not< -4$

$2 < 4$ $\times -2$ $\times -2$ no; $-4 \not< -8$ $\quad$ $2 < 4$ $\div -2$ $\div -2$ no $-1 \not< -2$

To keep the inequality true when multiplying or dividing by a negative number, you must change the direction of the inequality to its opposite.

2.3 Warm Up

1. $g = 3$ **2.** $p = 12$ **3.** $r = -9$

4. $x = 63$ **5.** $s = -7$ **6.** $q = 10$

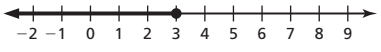
2.3 Cumulative Review Warm Up

1. 8 **2.** 26 **3.** 1 **4.** 13

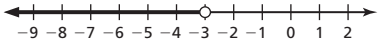
5. 14 **6.** 0 **7.** 0.7 **8.** -2

2.3 Practice A

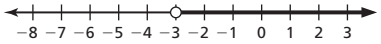
1. $x \leq 3$



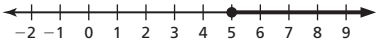
2. $m < -3$



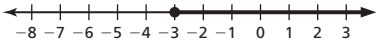
3. $-3 < t$



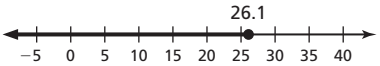
4. $5 \leq p$



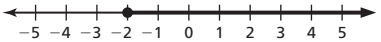
5. $b \geq -3$



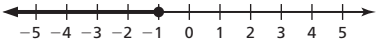
6. $x \leq 26.1$



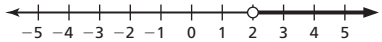
7. $j \geq -2$



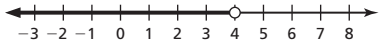
8. $t \leq -1$



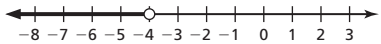
9. $2 < y$



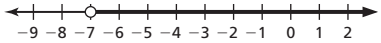
10. $4 > a$



11. $k < -4$



12. $h > -7$



13. $6x \leq 25$; $x \leq 4.17$

14. $6 \leq g$ **15.** $m > 5$ **16.** $-7 > d$

17. correctly finds the inequality $-15 > w$, but then writes the inequality incorrectly in the final answer; $5 < \frac{w}{-3}$; $-3 \bullet (5) > -3 \bullet \left(\frac{w}{-3}\right)$; $-15 > w$; The solution is $w < -15$.

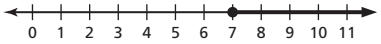
Answers

18. a. $x \le (2)(17.6); x \le 35.2$

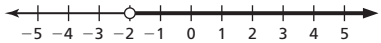
b. yes; $(17.6 \text{ mi/h})(6.5 \text{ h}) = 114.4$

2.3 Practice B

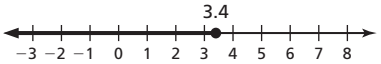
1. $b \ge 7$



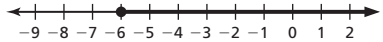
2. $t > -2$



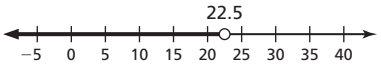
3. $x \le 3.4$



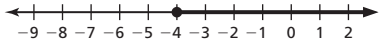
4. $p \ge -6$



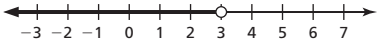
5. $w < 22.5$



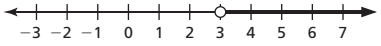
6. $h \ge -4$



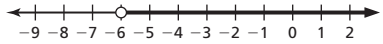
7. $a < 3$



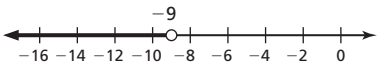
8. $u > 3$



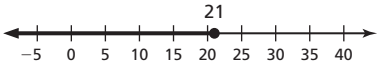
9. $n > -6$



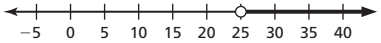
10. $w < -9$



11. $c \le 21$



12. $a > 25$



13. $16x \ge 136; x \ge 8.5$

14. $t < -9$ **15.** $g \le \frac{2}{15}$ **16.** $v > 6$

17. $(240 \text{ sq ft}) \times (\$x/\text{sq ft}) \le \$850; \$x \le \$3.54$

18. a. $x \le (3)(8.2); x \le 24.6$

b. no; You will run an additional 8.2 miles in the next hour, during which you will finish the marathon.

19. $\frac{2}{7}A < 10; A < 35$

2.3 Enrichment and Extension

1. 3 **2.** 2 **3.** 0

4. -7 **5.** $-\frac{2}{3}$

6. sometimes true; true when x and y are both positive, false if either x or y are negative

7. sometimes true;
true for 2 and 3 $(|2| + |3| \le |2 + 3|)$,
false for -2 and 3 $(|-2| + |3| > |-2 + 3|)$

8. sometimes true; true when both x and y are positive, false if either x or y is negative

9. sometimes true;
true for $x = 3,\ y = 2(|3| - |2| = |3 - 2|)$,
false for $x = 2,\ y = 3(|2| - |3| \ne |2 - 3|)$

10. sometimes true; true when both x and y are positive, false when y is negative; example: $x = 2$, $y = -1$ yields $|2^{-1}| = \frac{1}{2}$ on the left but $|2|^{|-1|} = 2^1 = 2$

11. always true; The sum of the numbers on the left side will always be positive, yielding a larger or equivalent answer as the sum on the right.

12. sometimes true; true when both x and y have the same sign, false when the signs of x and y are opposite

13. never; $(x + y)^2$ yields a middle term of $2xy$, not xy, and x and y do not both have to be positive.

Answers

2.3 Puzzle Time

WE WON'T TELL ANY MORE THEY SAID AND WE'RE NOT KITTEN ABOUT THAT EITHER

2.4 Start Thinking

The inequality to represent this situation is

$$4.99x - \left[175\left(\frac{x}{50}\right) + 0.49x\right] \geq 1500.$$

2.4 Warm Up

1. $v = 23$ **2.** $c = -2$ **3.** $z = 16$

4. $m = -1$ **5.** $g = -2$ **6.** $h = -3$

2.4 Cumulative Review Warm Up

1. $y = -x + 7$ **2.** $y = -19x - 27$

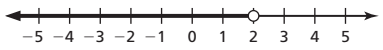
3. $y = -10x + 47$ **4.** $y = -\frac{3}{5}x$

5. $y = -10x + 10$ **6.** $y = -3x$

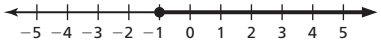
2.4 Practice A

1. C **2.** A **3.** B

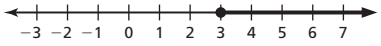
4. $x < 2$



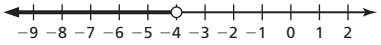
5. $t \geq -1$



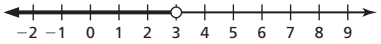
6. $y \geq 3$



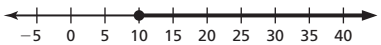
7. $t < -4$



8. $k < 3$



9. $p \geq 10$



10. $n < 3$ **11.** no solution

12. $n < -2$ **13.** $y < 1$

14. infinitely many solutions

15. infinitely many solutions

16. no solution **17.** no solution

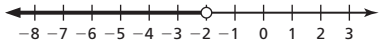
18. a. $10(3x + 2) \leq 140$; $x \leq 4$

b. no; If $x \leq 4$, then $3x + 2 \leq 14$.

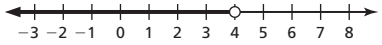
2.4 Practice B

1. B **2.** C **3.** A

4. $t < -2$

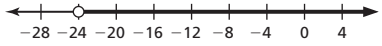


5. $m < 4$

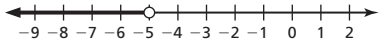


6. $k \leq 6$

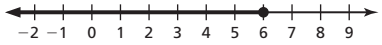
7. $d > -24$



8. $y < -5$



9. $w \leq 6$



10. $n < -2$

11. infinitely many solutions

12. no solution **13.** no solution

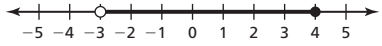
14. no solution **15.** no solution

16. a. $280 - 20x \geq 50$; $x \leq 11.5$

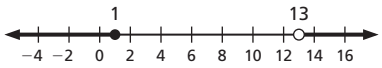
b. $280 - 22.5x \geq 50$; $x \leq 10.2$

2.4 Enrichment and Extension

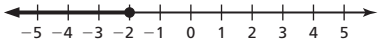
1. $\{x \in \mathbb{R} \mid -3 < x \leq 4\}$, $(-3, 4]$



2. $\{y \in \mathbb{R} \mid y \leq 1, y > 13\}$, $(-\infty, 1] \cup (13, \infty)$

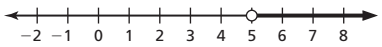


3. $\{x \in \mathbb{R} \mid x \leq -2\}$, $(-\infty, -2]$

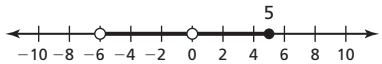


Answers

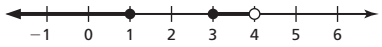
4. $\{p \in \mathbb{R} \mid p > 5\}$, $(5, \infty)$



5.
$\{x \in \mathbb{R} \mid -6 < x < 0,\ 0 < x \leq 5\}$, $(-6, 0) \cup (0, 5]$



6. $\{y \in \mathbb{R} \mid y \leq 1,\ 3 \leq y < 4\}$, $(-\infty, 1] \cup [3, 4)$



7. $\{y \in \mathbb{R} \mid y \leq -1,\ y \geq 4\}$, $(-\infty, -1] \cup [4, \infty)$

8. $\{x \in \mathbb{R} \mid -5 \leq x < 0\}$, $[-5, 0)$

9. $\{x \in \mathbb{R} \mid -0.5 < x < 2,\ x \geq 2.5\}$,
$(-0.5, 2) \cup [2.5, \infty)$

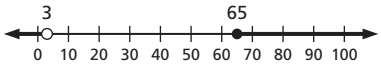
10. $\{y \in \mathbb{R} \mid y \neq 0\}$, $(-\infty, 0) \cup (0, \infty)$

2.4 Puzzle Time

IN THE KITTY POOL

2.5 Start Thinking

$x < 3$ or $x \geq 65$



The zoo charges an entry fee for people ages 3 and older who are less than 65 years old.

2.5 Warm Up

1. $x > 6$ **2.** $x < -3$ **3.** $x \geq 6$

4. $x < 2$ **5.** $x > 3$ **6.** $x < -2$

2.5 Cumulative Review Warm Up

1. $z = -10$ **2.** $h = 11$ **3.** $y = 6$

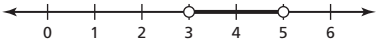
4. $v = 16$ **5.** $c = -8$

2.5 Practice A

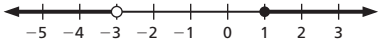
1. $-4 < x < 1$ **2.** $2 \leq x < 7$

3. $x < 2$ and $x \geq 5$

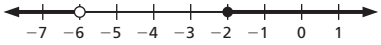
4. $3 < t < 5$



5. $m < -3$ or $m \geq 1$

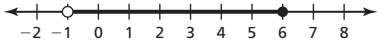


6. $s \geq -2$ or $s < -6$

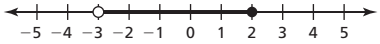


7. $36 \leq w \leq 42$

8. $-1 < x \leq 6$

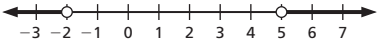


9. $-3 < t \leq 2$

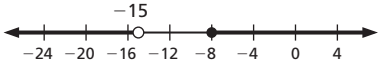


10. $3 \leq q \leq 5$

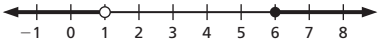
11. $h < -2$ *or* $h > 5$



12. $m < -15$ or $m \geq -8$



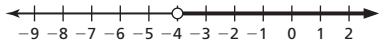
13. $w < 1$ *or* $w \geq 6$



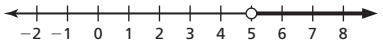
14. $0.6L < 18$ or $0.6L > 26$; $L < 30$ or $L > 43\frac{1}{3}$

15. no solution

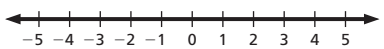
16. $p > -4$



17. $n > 5$



18. all real numbers



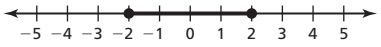
2.5 Practice B

1. $-2 \leq x < 6$ **2.** $x < -1$ or $x \geq 4$

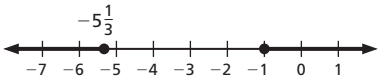
3. $x < 0$ or $x > 2$

Answers

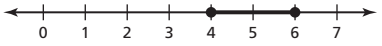
4. $-2 \leq d \leq 2$



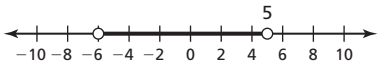
5. $m \geq -1$ *or* $m \leq -5\frac{1}{3}$



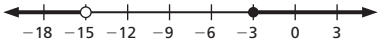
6. $4 \leq g \leq 6$



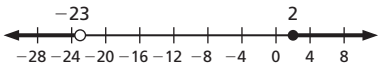
7. $-6 < p < 5$



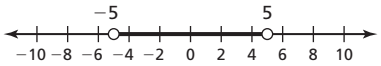
8. $q < -15$ or $q \geq -3$



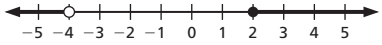
9. $v < -23$ or $v \geq 2$



10. $-5 < y < 5$

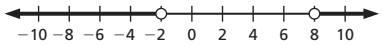


11. $k < -4$ or $k \geq 2$



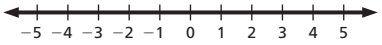
12. $1.2a < 20$ or $1.2a > 40$; $a < 16\frac{2}{3}$ or $a > 33\frac{1}{3}$

13. $w < -2$ or $w > 8$

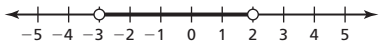


14. no solution

15. all real numbers



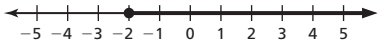
16. $-3 < x < 2$



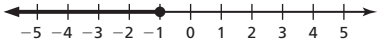
17. Your personal goal is to exercise a minimum of two hours per week and a maximum of five hours per week.

2.5 Enrichment and Extension

1. $x \geq -2$, $[-2, \infty)$

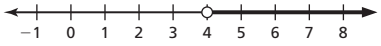


2. $x \leq -1$, $(-\infty, -1]$

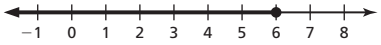


3. no solution

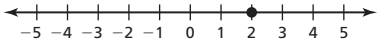
4. $x > 4$ or $x \geq 6$, $(4, \infty)$



5. $x \leq 6$, $(-\infty, 6]$



6. $x = 2$



2.5 Puzzle Time

GREAT RED SPOT

2.6 Start Thinking

Sample answer:

x	$\lvert x - 3 \rvert$	yes or no
−2	5	yes
−1	4	yes
0	3	yes
1	2	yes
2	1	no
3	0	no
4	1	no
5	2	yes
6	3	yes

no; Opposite values do not always give the same result because the order of operations prompts you to subtract 3 from the value before taking the absolute value.

2.6 Warm Up

1. $w = -7$ or 7

2. no solution

3. $m = -2$ or 10

4. $d = -7$ or 7

Answers

5. $b = -5$ or $\frac{17}{5}$ **6.** no solution

2.6 Cumulative Review Warm Up

1. $a = \frac{8x - 16}{3x - 12}$; Solve for a.

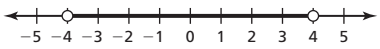
2. $a = \frac{10x + 7}{8x + 3}$; Solve for a.

3. $a = \frac{-7x + 12}{2}$; Solve for a.

4. $a = \frac{7x + 9}{8x + 1}$; Solve for a.

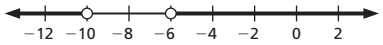
2.6 Practice A

1. $-4 < x < 4$

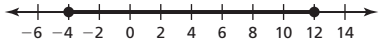


2. $y \leq -3.5$ *or* $y \geq 3.5$

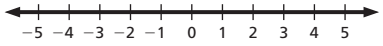
3. $k > -6$ *or* $k < -10$



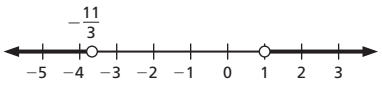
4. $-4 \leq y \leq 12$



5. all real numbers



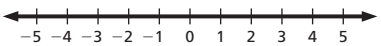
6. $c > 1$ *or* $c < -\frac{11}{3}$



7. no solution

8. $1 < r < \frac{13}{3}$

9. all real numbers



10. $|w - 300| \leq 20$; $280 \leq w \leq 320$

11. $|x + 2| < -3$; There is no solution.

12. $|x| < 4$; $-4 < x < 4$

13. $|x - 8| > 11$; $x < -3$ *or* $x > 19$

14. $\left|\frac{1}{2}x - 20\right| \geq 2$; $x \geq 44$ *or* $x \leq 36$

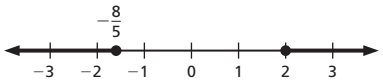
15. 0.42 and 0.55

16. $|4x - 12| \leq 6$; $\frac{3}{2} \leq x \leq \frac{9}{2}$

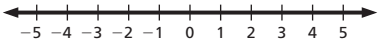
2.6 Practice B

1. no solution

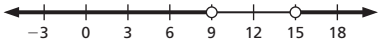
2. $q \leq -\frac{8}{5}$ *or* $q \geq 2$



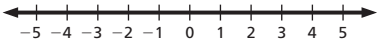
3. all real numbers



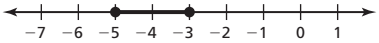
4. $r < 9$ *or* $r > 15$



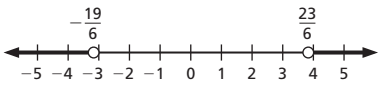
5. all real numbers



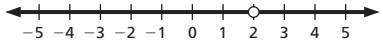
6. $-5 \leq a \leq -3$



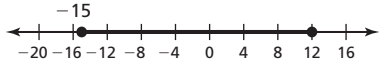
7. $h < -\frac{19}{6}$ *or* $h > \frac{23}{6}$



8. all real numbers except $p = 2$



9. $-15 \leq x \leq 12$



10. $|t + 2| \leq 3$; $-5 \leq t \leq 1$

11. Isolate the absolute value term first;
$|x - 5| + 2 < 8$; $|x - 5| < 6$; $-6 < x - 5 < 6$;
$-1 < x < 11$

Answers

12. $|x| > 12$; $x < -12$ *or* $x > 12$

13. $\left|\frac{1}{3}x - 31\right| \geq 5$; $x \leq 78$ *or* $x \geq 108$

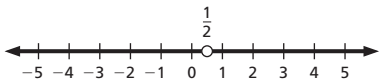
14. $|2x - 13| \leq 7$; $3 \leq x \leq 10$

15. $|2x| \leq 10$; $-5 \leq x \leq 5$

2.6 Enrichment and Extension

1. no solution

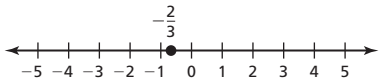
2. $x =$ all real numbers except $\frac{1}{2}$



interval notation: $\left(-\infty, \frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$

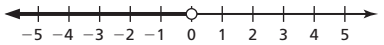
3. no solution

4. $x = -\frac{2}{3}$



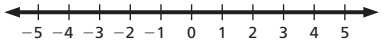
interval notation: $\left(-\infty, -\frac{2}{3}\right] \cap \left[-\frac{2}{3}, \infty\right)$

5. $x < 0$



interval notation: $(-\infty, 0)$

6. $x =$ all real numbers



interval notation: $(-\infty, \infty)$

2.6 Puzzle Time

ANTI-SHOCK SOCKS

Cumulative Review

1. -3 **2.** -18 **3.** 2 **4.** 17

5. -72 **6.** 38 **7.** -8 **8.** -20

9. -7 **10.** -13 **11.** 20 **12.** -2

13. \$7/h **14.** 4 packs of gum

15. 5 h

16. $x = 7$; Subtract 2 from each side.

17. $b = 7$; Divide 7 from each side.

18. $x = 61$; Add 10 to each side.

19. $y = 65$; Multiply 13 to each side.

20. $y = \frac{6}{11}$ **21.** $a = 12\pi$ **22.** $w = 3.6$

23. $1024 = 2f$; \$512

24. $510 = 375 + m$; \$135

25. $x = 0$ **26.** $u = 4$ **27.** $w = -10$

28. $c = 28$ **29.** $x = 4$ **30.** $z = 1$

31. $1031 = 231 + 200d$; 4 days

32. $x = 3$ **33.** $w = 2$ **34.** $h = 6$

35. $x = 12$ **36.** $k = -1$ **37.** $r = 5$

38. $x = -9$ **39.** $x = -5$ **40.** $y = 2$

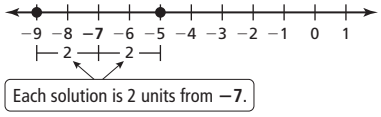
41. 17.9 g **42.** 3 months

43. infinitely many solutions

44. no solution **45.** $x = 4$; one solution

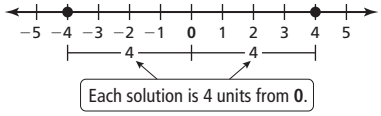
46. 2.8 **47.** -14 **48.** 0 **49.** 12

50. $x = -9, x = -5$

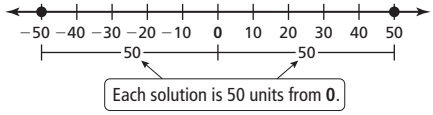


51. no solution

52. $r = -4, r = 4$

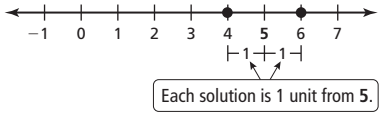


53. $y = -50, y = 50$



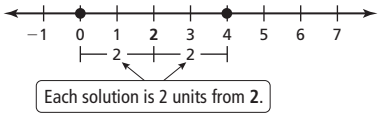
54. no solution

55. $n = 4, n = 6$



Answers

56. $n = 0, n = 4$



57. $|x - 8| = 0.2$; 7.8 and 8.2 pounds per square inch

58. $y = 3x + 9$

59. $y = -3x + 7$

60. $y = 4x - 8$

61. $n < 4$

62. $y - 8 \geq 10$

63. $21 \geq 3t$

64. $\frac{2}{3}b \leq 12$

65. not a solution

66. solution

67. solution

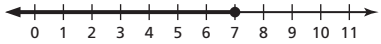
68. not a solution

69. a. $f \geq 2(15)$

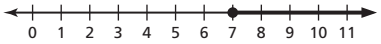
b. no; A solution has to be 30 inches or longer.

70. $y \geq 20$

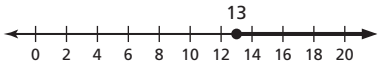
71. $c \leq 7$



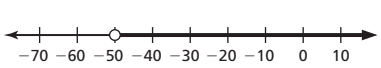
72. $h \geq 7$



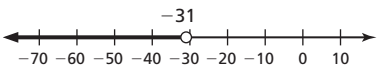
73. $b \geq 13$



74. $t > -50$



75. $z < -31$



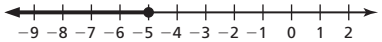
76. $n + 12 \leq 8$; $n \leq -4$

77. $20 - n \geq 15$; $n \leq 5$

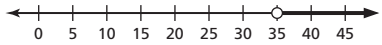
78. $2000 \geq 1835 + x$; $165 \geq x$

79. $w \leq 3$

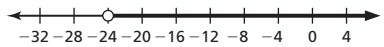
80. $y \leq -5$



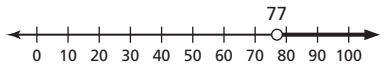
81. $a > 35$



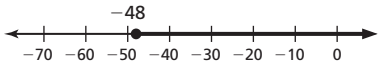
82. $g > -24$



83. $d > 77$

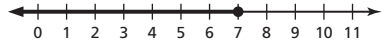


84. $w \geq -48$

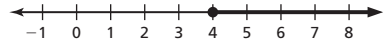


85. $150x \leq 900$; $x \leq \$6/\text{ft}^2$

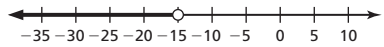
86. $u \leq 7$



87. $n \geq 4$



88. $p < -15$



89. $w < -1$

90. no solution

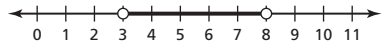
91. all real numbers

92. $144 + 12w \geq 300$; $w \geq 13$

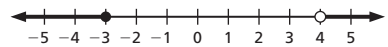
93. $-2 \leq x < 3$

94. $x < -7$ or $x \geq -1$

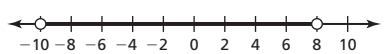
95. $3 < h < 8$



96. $m > 4$ or $m \leq -3$

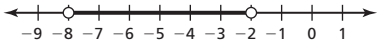


97. $-10 < n < 8$

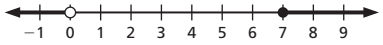


Answers

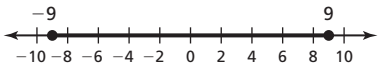
98. $-8 < k < -2$



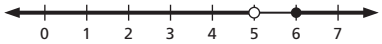
99. $g \geq 7$ *or* $g < 0$



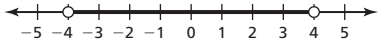
100. $-9 \leq t \leq 9$



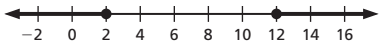
101. $x < 5$ *or* $x \geq 6$



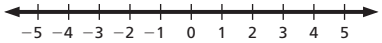
102. $-4 < y < 4$



103. $h \leq 2$ *or* $h \geq 12$

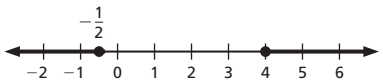


104. all real numbers

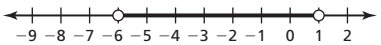


105. no solution

106. $w \geq 4$ *or* $w \leq -\frac{1}{2}$



107. $-6 < x < 1$



108. $|x - 88| \leq 0.007$; $87.993 \leq x \leq 88.007$

109. $|x - 78| \leq 3$; $75 \leq x \leq 81$

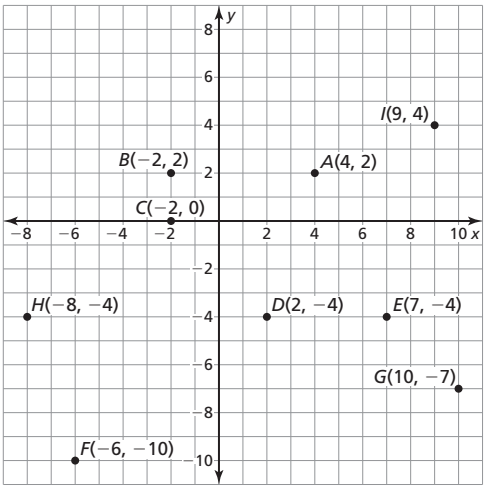
Chapter 3

3.1 Start Thinking

no; yes; Absolute value is a measure of distance, so y can never be negative.

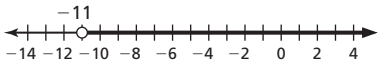
3.1 Warm Up

1–9.



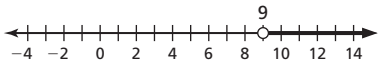
3.1 Cumulative Review Warm Up

1. $x > -11$

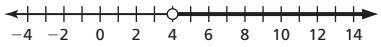


2. $m \geq 7$

3. $r > 9$

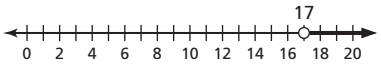


4. $w > 4$



5. $h \leq 6$

6. $j > 17$



7. $p \geq \frac{1}{5}$