Multi-Step Equations and Inequalities

Solutions Key

ARE YOU READY?

1. inverse operations

2. isolate the variable

3. equation

4. proportion

5. $24 + 16$
40

6. $-34 + (-47)$
-81

7. $35 + (-61)$
-26

8. $-12 + (-29) + 53$
$(-41) + 53$
12

9. $2.7 + 3.5$
6.2

10. $\frac{2}{3} + \frac{1}{2}$
$\frac{4}{6} + \frac{3}{6}$
$\frac{7}{6}$, or $1\frac{1}{6}$

11. $-5.87 + 10.6$
4.73

12. $\frac{8}{9} + \left(-\frac{9}{11}\right)$
$\frac{88}{99} + \left(-\frac{81}{99}\right)$
$\frac{7}{99}$

13. Evaluate for $a = 7$ and $b = -2$.
$a - b$
$7 - (-2)$
9

14. Evaluate for $a = 7$ and $b = -2$.
$b - a$
$(-2) - 7$
-9

15. Evaluate for $a = 7$ and $b = -2$.
$\frac{b}{a}$
$-\frac{2}{7}$

16. Evaluate for $a = 7$ and $b = -2$.
$2a + 3b$
$2(7) + 3(-2)$
$14 + (-6)$
8

17. Evaluate for $a = 7$ and $b = -2$.
$\frac{-4a}{b}$
$\frac{-4 \cdot 7}{-2}$
$\frac{-28}{-2}$
14

18. Evaluate for $a = 7$ and $b = -2$.
$3a - \frac{8}{b}$
$3(7) - \frac{8}{-2}$
$21 - (-4)$
25

19. Evaluate for $a = 7$ and $b = -2$.
$1.2a + 2.3b$
$1.2(7) + 2.3(-2)$
$8.4 + (-4.6)$
3.8

20. Evaluate for $a = 7$ and $b = -2$.
$-5a - (-6b)$
$-5(7) - (-6 \cdot -2)$
$-35 - 12$
-47

21. $8x = -72$
$\frac{8x}{8} = \frac{-72}{8}$
$x = -9$

22. $-12a = -60$
$\frac{-12a}{-12} = \frac{-60}{-12}$
$a = 5$

23. $\frac{2}{3}y = 16$
$\frac{3}{2} \cdot \frac{2}{3}y = 16 \cdot \frac{3}{2}$
$y = 24$

24. $-12b = 9$
$\frac{-12b}{-12} = \frac{9}{-12}$
$b = -\frac{3}{4}$

25. $12 = -4x$
$\frac{12}{-4} = \frac{-4x}{-4}$
$-3 = x$

26. $13 = \frac{1}{2}c$
$2 \cdot 13 = 2 \cdot \frac{1}{2}c$
$26 = c$

27. $-2.4 = -0.8p$
$\frac{-2.4}{-0.8} = \frac{-0.8p}{-0.8}$
$3 = p$

28. $\frac{3}{4} = 6x$
$\frac{1}{6} \cdot \frac{3}{4} = \frac{1}{6} \cdot 6x$
$\frac{3}{24}$ or $\frac{1}{8} = x$

29. $\frac{3}{4} = \frac{x}{24}$
$4x = 72$
$\frac{4x}{4} = \frac{72}{4}$
$x = 18$

30. $\frac{8}{9} = \frac{4}{a}$
$8a = 36$
$\frac{8a}{8} = \frac{36}{8}$
$a = 4.5$

31. $\frac{-12}{5} = \frac{15}{c}$
$-12c = 75$
$\frac{-12c}{-12} = \frac{75}{-12}$
$c = -6.25$

32. $\frac{y}{50} = \frac{35}{20}$
$20y = 1{,}750$
$\frac{20y}{20} = \frac{1{,}750}{20}$
$y = 87.5$

33. $\frac{2}{3} = \frac{18}{w}$
$2w = 54$
$\frac{2w}{2} = \frac{54}{2}$
$w = 27$

34. $\frac{35}{21} = \frac{d}{3}$
$21d = 105$
$\frac{21d}{21} = \frac{105}{21}$
$d = 5$

35. $\frac{7}{13} = \frac{h}{195}$
$13h = 1{,}365$
$\frac{13h}{13} = \frac{1{,}365}{13}$
$h = 105$

36. $\frac{9}{-15} = \frac{-27}{p}$
$9p = 405$
$\frac{9p}{9} = \frac{405}{9}$
$p = 45$

LESSON 1

Think and Discuss

1. Possible answer: You do whichever inverse operation is easier. Often, it is easier to either add or subtract a number on both sides and then multiply or divide.
2. Possible answer: First add 1 to both sides, and then divide both sides by 2.

Exercises

1. $3n + 8 = 29$
$-8 \quad -8$
$3n = 21$
$\frac{3n}{3} = \frac{21}{3}$
$n = 7$

2. $-4m - 7 = 17$
$+7 \quad +7$
$-4m = 24$
$\frac{-4m}{-4} = \frac{24}{-4}$
$m = -6$

3. $2 = -6x + 4$
$\frac{-4}{-2} = \frac{-4}{-6x}$
$\frac{-2}{-6} = \frac{-6x}{-6}$
$\frac{1}{3} = x$

4. $12 + \frac{b}{6} = 16$
$-12 \quad -12$
$\frac{b}{6} = 4$
$(6)\frac{b}{6} = 4(6)$
$b = 24$

5. $\frac{y}{8} - 15 = 2$
$+15 = +15$
$\frac{y}{8} = 17$
$(8)\frac{y}{8} = (8)\,17$
$y = 136$

6. $10 = -8 + \frac{n}{4}$
$+8 = +8$
$18 = \frac{n}{4}$
$18(4) = \frac{n}{4}(4)$
$72 = n$

7. Let x represent the number of refills.
$8.95 + 1.50x = 26.95$
$-8.95 \quad -8.95$
$1.50x = 18.00$
$\frac{1.50x}{1.50} = \frac{18.00}{1.50}$
$x = 12$
Rose bought 12 refills.

8. $5x + 6 = 41$
$-6 \quad -6$
$5x = 35$
$\frac{5x}{5} = \frac{35}{5}$
$x = 7$

9. $-9p - 15 = 93$
$+15 \quad +15$
$-9p = 108$
$\frac{-9p}{-9} = \frac{108}{-9}$
$p = -12$

10. $-2m + 14 = 10$
$-14 \quad -14$
$-2m = -4$
$\frac{-2m}{-2} = \frac{-4}{-2}$
$m = 2$

11. $-7 = 7d - 8$
$+8 \quad +8$
$1 = 7d$
$\frac{1}{7} = \frac{7d}{7}$
$\frac{1}{7} = d$

12. $-7 = -3c + 14$
$-14 \quad -14$
$-21 = -3c$
$\frac{-21}{-3} = \frac{-3c}{-3}$
$7 = c$

13. $12y - 11 = 49$
$+11 \quad +11$
$12y = 60$
$\frac{12y}{12} = \frac{60}{12}$
$y = 5$

14. $24 + \frac{h}{4} = 10$
$-24 \quad -24$
$\frac{h}{4} = -14$
$(4)\frac{h}{4} = (4)-14$
$h = -56$

15. $\frac{k}{5} - 13 = 4$
$+13 \quad +13$
$\frac{k}{5} = 17$
$(5)\frac{k}{5} = (5)17$
$k = 85$

16. $-17 + \frac{q}{8} = 13$
$+17 \quad +17$
$\frac{q}{8} = 30$
$(8)\frac{q}{8} = (8)30$
$q = 240$

17. $24 = \frac{m}{10} + 32$
$-32 \quad -32$
$-8 = \frac{m}{10}$
$-8(10) = \frac{m}{10}(10)$
$-80 = m$

18. $-9 = 15 + \frac{v}{3}$
$-15 \quad -15$
$-24 = \frac{v}{3}$
$-24(3) = \frac{v}{3}(3)$
$-72 = v$

19. $\frac{m}{-7} - 14 = 2$
$+14 \quad +14$
$\frac{m}{-7} = 16$
$\frac{m}{-7}(7) = 16(7)$
$m = -112$

20. Let x represent the number of weekday yoga classes.
$45 + 30x = 165$
$-45 \quad -45$
$30x = 120$
$\left(\frac{1}{30}\right)30x = \left(\frac{1}{30}\right)120$
$x = 4$

21. 6 more than a number divided by 3 equals 18.
$6 + \frac{m}{3} = 18$
$-6 \quad -6$
$\frac{m}{3} = 12$
$(3)\frac{m}{3} = (3)12$
$m = 36$

22. 15 more than 3 times a number equals 27.
$3x + 15 = 27$
$-15 \quad -15$
$3x = 12$
$\left(\frac{1}{3}\right)3x = \left(\frac{1}{3}\right)12$
$x = 4$

23. 2 equals 4 less than a number divided by 5.
$2 = \frac{n}{5} - 4$
$+4 \quad +4$
$6 = \frac{n}{5}$
$6(5) = \frac{n}{5}(5)$
$30 = n$

24. $18 + \frac{y}{4} = 12$
$-18 \quad -18$
$\frac{y}{4} = -6$
$(4)\frac{y}{4} = (4)-6$
$y = -24$

25. $5x + 30 = 40$
$-30 \quad -30$
$5x = 10$
$\left(\frac{1}{5}\right)5x = \left(\frac{1}{5}\right)10$
$x = 2$

26. $\frac{s}{12} - 7 = 8$

$+7 \quad +7$

$\frac{s}{12} = 15$

$(12)\frac{s}{12} = (12)15$

$s = 180$

27. $-10 + 6g = 110$

$+10 \quad +10$

$6g = 120$

$\left(\frac{1}{6}\right)6g = \left(\frac{1}{6}\right)120$

$g = 20$

28. $-8 = \frac{z}{7} + 2$

$-2 \quad -2$

$-10 = \frac{z}{7}$

$(7)-10 = (7)\frac{z}{7}$

$-70 = z$

29. $46 = -6w - 8$

$+8 \quad +8$

$54 = -6w$

$\left(\frac{1}{-6}\right)54 = \left(\frac{1}{-6}\right)-6w$

$-9 = w$

30. $15 = -7 + \frac{r}{3}$

$+7 \quad +7$

$22 = \frac{r}{3}$

$(3)22 = (3)\frac{r}{3}$

$66 = r$

31. $-20 = -4p - 12$

$+12 \quad +12$

$-8 = -4p$

$\left(\frac{1}{-4}\right)-8 = \left(\frac{1}{-4}\right)-4p$

$2 = p$

32. $\frac{1}{2} + \frac{r}{7} = \frac{5}{14}$

$-\frac{1}{2} \quad -\frac{1}{2}$

$\frac{r}{7} = -\frac{1}{7}$

$(7)\frac{r}{7} = (7)-\frac{1}{7}$

$r = -1$

33. Let x represent the minutes used after the first 25.

$1.01 + 0.09x = 9.56$

$-1.01 \quad -1.01$

$0.09x = 8.55$

$\frac{0.09x}{0.09} = \frac{8.55}{0.09}$

$x = 95$

$95 + 25 = 120$

The call lasted 120 minutes.

34. Let x represent the number of uniforms.

$1{,}836 = 612 + 25.50x$

$-612 \quad -612$

$1{,}224 = 25.50x$

$\frac{1{,}224}{25.50} = \frac{25.50x}{25.50}$

$48 = x$

The school purchased 48 uniforms.

35. Let x represent the number of calories children should consume.

$2x - 100 = 2{,}500$

$+100 \quad +100$

$2x = 2{,}600$

$\frac{2x}{2} = \frac{2{,}600}{2}$

$x = 1{,}300$

Children should consume 1,300 calories.

36. Let x represent the number of calories a teenage girl needs.

$\frac{1}{2}x + 700 = 1{,}800$

$-700 \quad -700$

$\frac{1}{2}x = 1{,}100$

$(2)\frac{1}{2}x = (2)1{,}100$

$x = 2{,}200$

A teenage girl needs 2,200 calories.

37. Let x represent the number of calories in the unknown food portion. Hector ate 2 portions twice or 4 portions.

$350 + 400 + 4x = 2{,}130$

$750 + 4x = 2{,}130$

$-750 \quad -750$

$4x = 1{,}380$

$\frac{4x}{4} = \frac{1{,}380}{4}$

$x = 345$

Hector ate 2 slices of pizza for lunch and again for dinner.

38. Let s represent the unknown milligrams of sodium.

$77 - \frac{s}{10} = 30$

$-77 \quad -77$

$-\frac{s}{10} = -47$

$(-10)-\frac{s}{10} = (-10)-47$

$s = 470$

It contains 470 milligrams of sodium.

39. a. $2x + 5 \stackrel{?}{=} 9$

$2(-2) + 5 \stackrel{?}{=} 9$

$-4 + 5 \stackrel{?}{=} 9$

$1 \neq 9$

b. $8 \stackrel{?}{=} 10 - x$

$8 \stackrel{?}{=} 10 - (-2)$

$8 \neq 12$

c. $\frac{x}{2} + 3 \stackrel{?}{=} 2$

$\frac{-2}{2} + 3 \stackrel{?}{=} 2$

$-1 + 3 \stackrel{?}{=} 2$

$2 = 2$

d. $-16 \stackrel{?}{=} -4x - 8$

$-16 \stackrel{?}{=} -4(-2) - 8$

$-16 \stackrel{?}{=} 8 - 8$

$-16 \neq 0$

C is the only correct answer.

40. $1.25 + 0.25x = 8.00$

$-1.25 \quad -1.25$

$0.25x = 6.75$

$\frac{0.25x}{0.25} = \frac{6.75}{0.25x}$

$x = 27$

Think and Discuss

1. Possible answer: Combine like terms to get $4n + 3 = 27$. Subtract 3 from both sides to get $4n = 24$. Divide both sides by 4 to get $n = 6$.
2. Possible answer: For the first equation, subtract 7 from both sides, and then multiply by $\frac{3}{2}$. For the second equation, first multiply both sides by 3, and then subtract 7. Finally, divide by 2. The solutions are different because the left sides of the equations are different.

Exercises

1. $14n + 2 - 7n = 37$
$7n + 2 = 37$
$-2 \quad -2$
$7n = 35$
$\frac{7n}{7} = \frac{35}{7}$
$n = 5$

2. $10x - 11 - 4x = 43$
$6x - 11 = 43$
$+11 \quad +11$
$6x = 54$
$\frac{6x}{6} = \frac{54}{6}$
$x = 9$

3. $1 = -3 + 4p - 2p$
$1 = -3 + 2p$
$+3 \quad +3$
$4 = 2p$
$\frac{4}{2} = \frac{2p}{2}$
$2 = p$

4. $12 - (x + 3) = 10$
$12 - x - 3 = 10$
$9 - x = 10$
$-9 \quad -9$
$-x = 1$
$\frac{-x}{-1} = \frac{1}{-1}$
$x = -1$

5. $15 = 2(q + 4) + 3$
$15 = 2q + 8 + 3$
$15 = 2q + 11$
$-11 \quad -11$
$4 = 2q$
$\frac{4}{2} = \frac{2q}{2}$
$2 = q$

6. $5(m - 2) + 36 = -4$
$5m - 10 + 36 = -4$
$5m + 26 = -4$
$-26 \quad -26$
$5m = -30$
$\frac{5m}{5} = \frac{-30}{5}$
$m = -6$

7. Let x represent the number of books Ben read. Then $2x$ represents the number Keisha read, and $\frac{2x - 4}{2}$ represents the number Sheldon read, which equals 10.

$\frac{2x - 4}{2} = 10$
$(2)\frac{2x - 4}{2} = (2)10$
$2x - 4 = 20$
$+4 \quad +4$
$2x = 24$
$\frac{2x}{2} = \frac{24}{2}$
$x = 12$

Ben read 12 books.

8. $b + 18 + 3b = 74$
$4b + 18 = 74$
$-18 \quad -18$
$4b = 56$
$\frac{4b}{4} = \frac{56}{4}$
$b = 14$

9. $10x - 3 - 2x = 4$
$8x - 3 = 4$
$+3 \quad +3$
$8x = 7$
$\frac{8x}{8} = \frac{7}{8}$
$x = \frac{7}{8}$

10. $18w - 10 - 6w = 50$
$12w - 10 = 50$
$+10 \quad +10$
$12w = 60$
$\frac{12w}{12} = \frac{60}{12}$
$w = 5$

11. $19 = 5n + 7 - 3n$
$19 = 2n + 7$
$-7 \quad -7$
$12 = 2n$
$\frac{12}{2} = \frac{2n}{2}$
$6 = n$

12. $-27 = -3p + 15 - 3p$
$-27 = -6p + 15$
$-15 \quad -15$
$-42 = -6p$
$\frac{-42}{-6} = \frac{-6p}{-6}$
$7 = p$

13. $-x - 8 + 14x = -34$
$13x - 8 = -34$
$+8 \quad +8$
$13x = -26$
$\frac{13x}{13} = \frac{-26}{13}$
$x = -2$

14. $2(x + 4) + 6 = 22$
$2x + 8 + 6 = 22$
$2x + 14 = 22$
$-14 \quad -14$
$2x = 8$
$\frac{2x}{2} = \frac{8}{2}$
$x = 4$

15. $1 - 3(n + 5) = -8$
$1 - 3n - 15 = -8$
$-3n - 14 = -8$
$+14 \quad +14$
$-3n = 6$
$\frac{-3n}{-3} = \frac{6}{-3}$
$n = -2$

16. $4.3 - 1.4(p + 7) = -9.7$
$4.3 - 1.4p - 9.8 = -9.7$
$-5.5 - 1.4p = -9.7$
$+5.5 \quad +5.5$
$-1.4p = -4.2$
$\frac{-1.4p}{-1.4} = \frac{-4.2}{-1.4}$
$p = 3$

17. $1.8 + 6n - 3.2 = 7.6$
$-1.4 + 6n = 7.6$
$+1.4 \quad +1.4$
$6n = 9$
$\frac{6n}{6} = \frac{9}{6}$
$n = 1.5$

18. $0 = 9\left(k - \frac{2}{3}\right) + 33$
$0 = 9k - 6 + 33$
$0 = 9k + 27$
$-27 \quad -27$
$-27 = 9k$
$\frac{-27}{9} = \frac{9k}{9}$
$-3 = k$

19. $6(t - 2) - 76 = -142$
$6t - 12 - 76 = -142$
$6t - 88 = -142$
$+88 \quad +88$
$6t = -54$
$\frac{6t}{6} = \frac{-54}{6}$
$t = -9$

20. Let x represent the number of laps Karen ran. Then $3x$ represents the number Abby ran, and $\frac{3x + 4}{7}$ represents the number Jill ran, which equals 1.

$\frac{3x + 4}{7} = 1$
$(7)\frac{3x + 4}{7} = (7)1$
$3x + 4 = 7$
$-4 \quad -4$
$3x = 3$
$\frac{3x}{3} = \frac{3}{3}$
$x = 1$

21. $\frac{0.5x + 7}{8} = 5$

$(8)\frac{0.5x + 7}{8} = (8)5$

$0.5x + 7 = 40$

$-7 \quad -7$

$0.5x = 33$

$\frac{0.5x}{0.5} = \frac{33}{0.5}$

$x = 66$

22. $4(t - 8) + 20 = 5$

$4t - 32 + 20 = 5$

$4t - 12 = 5$

$+12 \quad +12$

$4t = 17$

$\frac{4t}{4} = \frac{17}{4}$

$t = 4.25$

23. $63 = 8w + 2.6 - 3.6$

$63 = 8w - 1$

$+1 \quad +1$

$64 = 8w$

$\frac{64}{8} = \frac{8w}{8}$

$8 = w$

24. $17 = -5(3 + w) + 7$

$17 = -15 - 5w + 7$

$17 = -8 - 5w$

$+8 \quad +8$

$25 = -5w$

$\frac{25}{-5} = \frac{-5w}{-5}$

$-5 = w$

25. $\frac{\frac{1}{4}a - 12}{8} = 4$

$(8)\frac{\frac{1}{4}a - 12}{8} = (8)4$

$\frac{1}{4}a - 12 = 32$

$+12 \quad +12$

$\frac{1}{4}a = 44$

$(4)\frac{1}{4}a = (4)44$

$a = 176$

26. $9 = -(r - 5) + 11$

$9 = -r + 5 + 11$

$9 = -r + 16$

$-16 \quad -16$

$-7 = -r$

$\frac{-7}{-1} = \frac{-r}{-1}$

$7 = r$

27. $\frac{2b - 3.4}{0.6} = -29$

$(0.6)\frac{2b - 3.4}{0.6} = (0.6)(-29)$

$2b - 3.4 = -17.4$

$+3.4 \quad +3.4$

$2b = -14$

$\frac{2b}{2} = \frac{-14}{2}$

$b = -7$

28. $8.44 = \frac{34.6 + 4h}{5}$

$(5)8.44 = (5)\frac{34.6 + 4h}{5}$

$42.2 = 34.6 + 4h$

$-34.6 \quad -34.6$

$7.6 = 4h$

$\frac{7.6}{4} = \frac{4h}{4}$

$1.9 = h$

29. $5.7 = -2.5x + 18 - 1.6x$

$5.7 = -4.1x + 18$

$-18 \quad -18$

$-12.3 = -4.1x$

$\frac{-12.3}{-4.1} = \frac{-4.1x}{-4.1}$

$3 = x$

30. Let x represent the total bill for dinner before a tip.

$x + 0.15x = 3(10.35)$

$x + 0.15x = 31.05$

$1.15x = 31.05$

$\frac{1.15x}{1.15} = \frac{31.05}{1.15}$

$x = \$27$

31. Let x represent her normal pay rate.

$40x + 11(1.5x) = 378.55$

$40x + 16.5x = 378.55$

$56.5x = 378.55$

$\frac{56.5x}{56.5} = \frac{378.55}{56.5}$

$x = \$6.70$

32. Let x represent the measure of the base angles.

$x + x + .5x = 180$

$2.5x = 180$

$\frac{2.5x}{2.5} = \frac{180}{2.5}$

$x = 72$

The angles are 72°, 72°, and 36°.

33. Let x represent the cost of the sandals before tax.

$x + 0.08x - 15 = 12$

$1.08x - 15 = 12$

$+15 \quad +15$

$1.08x = 27$

$\frac{1.08x}{1.08} = \frac{27}{1.08}$

$x = \$25$

34. a. $1{,}946 = \frac{9}{5}C + 32$

$-32 \quad -32$

$1{,}914 = \frac{9}{5}C$

$\left(\frac{5}{9}\right)1{,}914 = \left(\frac{5}{9}\right)\frac{9}{5}C$

$1{,}063\frac{1}{3} = C$

Gold melts at about 1,063 °C.

b. $-432.2 = \frac{9}{5}C + 32$

$-32 \quad -32$

$-464.2 = \frac{9}{5}C$

$\left(\frac{5}{9}\right)-464.2 = \left(\frac{5}{9}\right)\frac{9}{5}C$

$-257.89 = C$

Hydrogen melts at -258 °C.

35. $\frac{86 + 93 + x}{3} = 90$

$(3)\frac{86 + 93 + x}{3} = (3)90$

$86 + 93 + x = 270$

$179 + x = 270$

$-179 \quad -179$

$x = 91$

Billy needs a 91 on the third test.

36. Possible answer: If the friends gave the driver a \$7.00 tip and then each friend paid \$11.25, what is the cost of the taxi ride before the tip?

37. Possible answer: Since $\frac{2x - 6}{5} = \frac{2x}{5} - \frac{6}{5}$, you would add $\frac{6}{5}$ to both sides and then multiply both sides by $\frac{5}{2}$ to solve for x. It is easier to multiply both sides by $\frac{5}{1}$ to clear the denominator and then solve for x.

38. Possible answer: They are the same. In the second equation, each term from the first equation has been multiplied by 4, so the two statements are equivalent.

39. a. $\frac{2x-2}{4} = 7$

$\frac{2(15)-2}{4} \stackrel{?}{=} 7$

$\frac{30-2}{4} \stackrel{?}{=} 7$

$\frac{28}{4} \stackrel{?}{=} 7$

$7 = 7$

b. $\frac{2x-2}{4} = 7$

$\frac{2(18)-2}{4} \stackrel{?}{=} 7$

$\frac{36-2}{4} \stackrel{?}{=} 7$

$\frac{34}{4} \stackrel{?}{=} 7$

$8\frac{1}{2} \neq 7$

c. $\frac{2x-2}{4} = 7$

$\frac{2(20)-2}{4} \stackrel{?}{=} 7$

$\frac{40-2}{4} \stackrel{?}{=} 7$

$\frac{38}{4} \stackrel{?}{=} 7$

$9\frac{1}{2} \neq 7$

d. $\frac{2x-2}{4} = 7$

$\frac{2(21)-2}{4} \stackrel{?}{=} 7$

$\frac{42-2}{4} \stackrel{?}{=} 7$

$\frac{40}{4} \stackrel{?}{=} 7$

$10 \neq 7$

A is the correct solution.

40. I. $2x - 5 + 3x = 10$

$2(3) - 5 + 3(3) = 10$

$6 - 5 + 9 = 10$

$10 = 10$

II. $\frac{-x+7}{2} = 2$

$\frac{-3+7}{2} = 2$

$\frac{4}{2} = 2$

$2 = 2$

III. $\frac{-4x}{6} = 2$

$\frac{-4(3)}{6} = 2$

$\frac{-12}{6} = 2$

$-2 \neq 2$

IV. $6.3x - 2.4 = 16.5$

$6.3(3) - 2.4 = 16.5$

$18.9 - 2.4 = 16.5$

$16.5 = 16.5$

J; I, II, and IV are the correct solutions.

LESSON 3

Think and Discuss

1. Possible answer: $\frac{2}{3} > \frac{1}{2}$, so subtract $\frac{1}{2}x$ from both sides. Use a common denominator to subtract. Then, add 2 to both sides of the equation. Finally, multiply both sides by 6 to solve; $x = 54$.

2. Possible answer: To keep the variables positive, add $3x$ to both sides of the equation to solve.

Exercises

1. $5n = 4n + 32$

$5n - 4n = 4n - 4n + 32$

$n = 32$

2. $-6x - 28 = 4x$

$-6x + 6x - 28 = 4x + 6x$

$-28 = 10x$

3. $8w = 32 - 4w$

$8w + 4w = 32 - 4w + 4w$

$12w = 32$

4. $4y = 2y + 40$

$4y - 2y = 2y - 2y + 40$

$2y = 40$

$\frac{2y}{2} = \frac{40}{2}$

$y = 20$

5. $8 + 6a = -2a + 24$

$8 + 6a + 2a = -2a + 2a + 24$

$8 + 8a = 24$

$8 - 8 + 8a = 24 - 8$

$8a = 16$

$\frac{8a}{8} = \frac{16}{8}$

$a = 2$

6. $\frac{3}{4}d + 4 = \frac{1}{4}d + 18$

$\frac{3}{4}d - \frac{1}{4}d + 4 = \frac{1}{4}d - \frac{1}{4}d + 18$

$\frac{1}{2}d + 4 = 18$

$\frac{1}{2}d + 4 - 4 = 18 - 4$

$\frac{1}{2}d = 14$

$(2)\frac{1}{2}d = (2)14$

$d = 28$

7. Let x represent the number of movies.

$30 + 1.95x = 7.95x$

$30 + 1.95x - 1.95x = 7.95x - 1.95x$

$30 = 6x$

$\frac{30}{6} = \frac{6x}{6}$

$5 = x$

They would have to see 5 movies.

8. $12h = 9h + 84$

$12h - 9h = 9h - 9h + 84$

$3h = 84$

9. $-10p - 8 = 2p$

$-10p + 10p - 8 = 2p + 10p$

$-8 = 12p$

10.
$$\begin{aligned} 6q &= 18 - 2q \\ 6q + 2q &= 18 - 2q + 2q \\ 8q &= 18 \end{aligned}$$

11.
$$\begin{aligned} -4c - 6 &= -2c \\ -4c + 4c - 6 &= -2c + 4c \\ -6 &= 2c \end{aligned}$$

12.
$$\begin{aligned} -7s + 12 &= -9s \\ -7s + 7s + 12 &= -9s + 7s \\ 12 &= -2s \\ \frac{12}{-1} &= \frac{-2s}{-1} \\ -12 &= 2s \end{aligned}$$

13.
$$\begin{aligned} 6 + \frac{4}{5}a &= \frac{9}{10}a \\ 6 + \frac{4}{5}a - \frac{4}{5}a &= \frac{9}{10}a - \frac{4}{5}a \\ 6 &= \frac{1}{10}a \end{aligned}$$

14.
$$\begin{aligned} 9t &= 4t + 120 \\ 9t - 4t &= 4t - 4t + 120 \\ 5t &= 120 \\ \frac{5t}{5} &= \frac{120}{5} \\ t &= 24 \end{aligned}$$

15.
$$\begin{aligned} 42 + 3b &= -4b - 14 \\ 42 + 3b + 4b &= -4b + 4b - 14 \\ 42 + 7b &= -14 \\ 42 - 42 + 7b &= -14 - 42 \\ 7b &= -56 \\ \frac{7b}{7} &= \frac{-56}{7} \\ b &= -8 \end{aligned}$$

16.
$$\begin{aligned} \frac{6}{11}x + 4 &= \frac{2}{11}x + 16 \\ \frac{6}{11}x - \frac{2}{11}x + 4 &= \frac{2}{11}x - \frac{2}{11}x + 16 \\ \frac{4}{11}x + 4 &= 16 \\ \frac{4}{11}x + 4 - 4 &= 16 - 4 \\ \frac{4}{11}x &= 12 \\ \left(\frac{11}{4}\right)\frac{4}{11}x &= \left(\frac{11}{4}\right)12 \\ x &= 33 \end{aligned}$$

17.
$$\begin{aligned} 1.5a + 6 &= 9a + 12 \\ 1.5a - 1.5a + 6 &= 9a - 1.5a + 12 \\ 6 &= 7.5a + 12 \\ 6 - 12 &= 7.5a + 12 - 12 \\ -6 &= 7.5a \\ \frac{-6}{7.5} &= \frac{7.5a}{7.5} \\ -0.8 &= a \end{aligned}$$

18.
$$\begin{aligned} 32 - \frac{3}{8}y &= \frac{3}{4}y + 5 \\ 32 - \frac{3}{8}y + \frac{3}{8}y &= \frac{3}{4}y + \frac{3}{8}y + 5 \\ 32 &= \frac{9}{8}y + 5 \\ 32 - 5 &= \frac{9}{8}y + 5 - 5 \\ \left(\frac{8}{9}\right)27 &= \left(\frac{8}{9}\right)\frac{9}{8}y \\ 24 &= y \end{aligned}$$

19.
$$\begin{aligned} -6 - 8c &= 3c + 16 \\ -6 - 8c + 8c &= 3c + 8c + 16 \\ -6 &= 11c + 16 \\ -6 - 16 &= 11c + 16 - 16 \\ -22 &= 11c \\ \frac{-22}{11} &= \frac{11c}{11} \\ -2 &= c \end{aligned}$$

20. Let x represent the number of lessons.
$$\begin{aligned} 5x + 60 &= 11x \\ 5x - 5x + 60 &= 11x - 5x \\ 60 &= 6x \\ \frac{60}{6} &= \frac{6x}{6} \\ 10 &= x \end{aligned}$$
They would have to take 10 lessons.

21.
$$\begin{aligned} 3y + 7 &= -6y - 56 \\ 3y + 6y + 7 &= -6y + 6y - 56 \\ 9y + 7 &= -56 \\ 9y + 7 - 7 &= -56 - 7 \\ 9y &= -63 \\ \frac{9y}{9} &= \frac{-63}{9} \\ y &= -7 \end{aligned}$$

22.
$$\begin{aligned} -\frac{7}{8}x - 6 &= -\frac{3}{8}x - 14 \\ -\frac{7}{8}x + \frac{7}{8}x - 6 &= -\frac{3}{8}x + \frac{7}{8}x - 14 \\ -6 &= \frac{1}{2}x - 14 \\ -6 + 14 &= \frac{1}{2}x - 14 + 14 \\ 8 &= \frac{1}{2}x \\ (2)8 &= (2)\frac{1}{2}x \\ 16 &= x \end{aligned}$$

23.
$$\begin{aligned} 5r + 6 - 2r &= 7r - 10 \\ 3r + 6 &= 7r - 10 \\ 3r - 3r + 6 &= 7r - 3r - 10 \\ 6 &= 4r - 10 \\ 6 + 10 &= 4r - 10 + 10 \\ 16 &= 4r \\ \frac{16}{4} &= \frac{4r}{4} \\ 4 &= r \end{aligned}$$

24.
$$\begin{aligned} -10p + 8 &= 7p + 12 \\ -10p + 10p + 8 &= 7p + 10p + 12 \\ 8 &= 17p + 12 \\ 8 - 12 &= 17p + 12 - 12 \\ -4 &= 17p \\ \frac{-4}{17} &= \frac{17p}{17} \\ -\frac{4}{17} &= p \end{aligned}$$

25.
$$\begin{aligned} 9 + 5r &= -17 - 8r \\ 9 + 5r + 8r &= -17 - 8r + 8r \\ 9 + 13r &= -17 \\ 9 - 9 + 13r &= -17 - 9 \\ 13r &= -26 \\ \frac{13r}{13} &= \frac{-26}{13} \\ r &= -2 \end{aligned}$$

26.
$$\begin{aligned} 0.8k + 7 &= -0.7k + 1 \\ 0.8k + 0.7k + 7 &= -0.7k + 0.7k + 1 \\ 1.5k + 7 &= 1 \\ 1.5k + 7 - 7 &= 1 - 7 \\ 1.5k &= -6 \\ \frac{1.5k}{1.5} &= \frac{-6}{1.5} \\ k &= -4 \end{aligned}$$

27. Let r equal the number of choir members in a row. On the first night, 5 rows of r members plus the 12 absent members equals the entire choir. On the second night, 6 rows of r members plus the one absent member equals the entire choir.

$$\begin{aligned} 5r + 12 &= 6r + 1 \\ 5r - 5r + 12 &= 6r - 5r + 1 \\ 12 &= r + 1 \\ 12 - 1 &= r + 1 - 1 \\ 11 &= r \end{aligned}$$

Substitute 11 for r for the first night.

$$\begin{aligned} 5(11) + 12 &= \\ 55 + 12 &= 67 \end{aligned}$$

There are 67 choir members.

28. Let t represent the number of tiles.

$$\begin{aligned} 0.99t + 24 &= 1.49t \\ 0.99t - 0.99t + 24 &= 1.49t - 0.99t \\ 24 &= 0.5t \\ \frac{24}{0.5} &= \frac{0.5t}{0.5} \\ 48 &= t \end{aligned}$$

Jaline would need to buy 48 tiles.

29.
$$\begin{aligned} x + x + (x + 4) + (x + 4) &= x + (x + 5) = (x + 9) \\ 4x + 8 &= 3x + 14 \\ 4x - 3x + 8 &= 3x - 3x + 14 \\ x + 8 &= 14 \\ x + 8 - 8 &= 14 - 8 \\ x &= 6 \end{aligned}$$

30.
$$\begin{aligned} 3s + 3s + (s + 7) + (s + 7) &= (2s + 12) + (2s + 12) + (2s + 12) \\ 8s + 14 &= 6s + 36 \\ 8s - 6s + 14 &= 6s - 6s + 36 \\ 2s + 14 &= 36 \\ 2s + 14 - 14 &= 36 - 14 \\ 2s &= 22 \\ \frac{2s}{2} &= \frac{22}{2} \\ s &= 11 \end{aligned}$$

31. Let x represent the number of days the gym is used.

$$\begin{aligned} 18x + 7x &= 400 + 5x \\ 25x &= 400 + 5x \\ 25x - 5x &= 400 + 5x - 5x \\ 20x &= 400 \\ \frac{20x}{20} &= \frac{400}{20} \\ x &= 20 \end{aligned}$$

Members and nonmembers must use the gym 20 days for the cost to be equal.

32. a. Let x represent the number of miles the Chows drove each day.

$$\begin{aligned} 6x &= 582 + 3x \\ 6x - 3x &= 582 + 3x - 3x \\ 3x &= 582 \\ \frac{3x}{3} &= \frac{582}{3} \\ x &= 194 \end{aligned}$$

They drove 194 miles each day.

b. $6(194) = 1{,}164$

It is 1,164 miles.

33. Possible answer: $2a$ was added to $-8a$ instead of being subtracted.
It should be $-10a = 38$.

34. Possible answer: Yes, within an equation, each variable represents a single value, regardless of where in the equation the variable appears.

35. $12x - 16 = 12x - 16$; no, because the expressions are equal for any value x.

36. a. $3x + 2 = 2 - x$

$3(0) + 2 \stackrel{?}{=} 2 - (0)$

$0 + 2 \stackrel{?}{=} 2 - 0$

$2 = 2$

b. $2.5x + 3 = x$

$2.5(0) + 3 \stackrel{?}{=} (0)$

$0 + 3 \stackrel{?}{=} 0$

$3 \neq 0$

c. $-x + 4 = 3x + 4$

$-(0) + 4 \stackrel{?}{=} 3(0) + 4$

$0 + 4 \stackrel{?}{=} 0 + 4$

$4 = 4$

d. $6x + 2 = x + 2$

$6(0) + 2 \stackrel{?}{=} (0) + 2$

$0 + 2 \stackrel{?}{=} 0 + 2$

$2 = 2$

B is the only equation for which $x = 0$ is not a solution.

37. Let m represent the number of long distance minutes.

$$\begin{aligned} 0.03m &= 2 + 0.01m \\ 0.03m - 0.01m &= 2 + 0.01m - 0.01m \\ 0.02m &= 2 \\ \frac{0.02m}{0.02} &= \frac{2}{0.02} \\ m &= 100 \end{aligned}$$

100 minutes makes the cost for long distance from both plans equal.

READY TO GO ON?

Exercises

1.
$$\begin{aligned} -4x + 6 &= 54 \\ -6 \quad &\quad -6 \\ -4x &= 48 \\ \frac{-4x}{-4} &= \frac{48}{-4} \\ x &= -12 \end{aligned}$$

2.
$$\begin{aligned} 15 + \frac{y}{3} &= 6 \\ -15 \quad &\quad -15 \\ \frac{y}{3} &= -9 \\ (3)\frac{y}{3} &= (3) - 9 \\ y &= -27 \end{aligned}$$

3. $\frac{z}{8} - 5 = -3$

$+5 \quad +5$

$\frac{z}{8} = 2$

$(8)\frac{z}{8} = (8)2$

$z = 16$

4. $-33 = -7a - 5$

$+5 \quad +5$

$-28 = -7a$

$\frac{-28}{-7} = \frac{-7a}{-7}$

$4 = a$

5. $-27 = \frac{r}{12} - 19$

$+19 \quad +19$

$-8 = \frac{r}{12}$

$(12) - 8 = (12)\frac{r}{12}$

$-96 = r$

6. $-13 = 11 - 2n$

$-11 \quad -11$

$-24 = -2n$

$\frac{-24}{-2} = \frac{-2n}{-2}$

$n = 12$

7. $3x + 13 = 37$

$-13 \quad -13$

$3x = 24$

$\frac{3x}{3} = \frac{24}{3}$

$x = 8$

8. $\frac{p}{-8} - 7 = 12$

$+7 \quad +7$

$\frac{p}{-8} = 19$

$(-8)\frac{p}{-8} = (-8)19$

$p = -152$

9. $\frac{u}{7} + 45 = -60$

$-45 \quad -45$

$\frac{u}{7} = -105$

$(7)\frac{u}{7} = (7) - 105$

$u = -735$

10. Let x represent the number of miles traveled.

$1.50 + 1.50x = 21.00$

$-1.50 \quad -1.50$

$1.50x = 19.50$

$\frac{1.50x}{1.50} = \frac{19.50}{1.50}$

$x = 13$

The taxi traveled 13 miles.

11. $\frac{3x - 4}{5} = 7$

$(5)\frac{3x - 4}{5} = (5)7$

$3x - 4 = 35$

$+4 = +4$

$3x = 39$

$\frac{3x}{3} = \frac{39}{3}$

$x = 13$

12. $3(3b + 2) = -30$

$9b + 6 = -30$

$-6 \quad -6$

$9b = -36$

$\frac{9b}{9} = \frac{-36}{9}$

$b = -4$

13. $-12 = \frac{15c + 3}{6}$

$(6) - 12 = (6)\frac{15c + 3}{6}$

$-72 = 15c + 3$

$-3 \quad -3$

$-75 = 15c$

$\frac{-75}{15} = \frac{15c}{15}$

$c = -5$

14. $\frac{24.6 + 3a}{4} = 9.54$

$(4)\frac{24.6 + 3a}{4} = (4)9.54$

$24.6 + 3a = 38.16$

$-24.6 \quad -24.6$

$3a = 13.56$

$\frac{3a}{3} = \frac{13.56}{3}$

$a = 4.52$

15. $\frac{2b + 9}{11} = 18$

$(11)\frac{2b + 9}{11} = (11)18$

$2b + 9 = 198$

$-9 \quad -9$

$2b = 189$

$\frac{2b}{2} = \frac{189}{2}$

$b = 94.5$

16. $2c + 3 + 5c = 13$

$7c + 3 = 13$

$-3 \quad -3$

$7c = 10$

$\frac{7c}{7} = \frac{10}{7}$

$c = \frac{10}{7}$ or $1\frac{3}{7}$

17. $\frac{1}{2}(8w - 6) = 17$

$4w - 3 = 17$

$+3 \quad +3$

$4w = 20$

$\frac{4w}{4} = \frac{20}{4}$

$w = 5$

18. $\frac{1.2s + 3.69}{0.3} = 47.9$

$(0.3)\frac{1.2s + 3.69}{0.3} = (0.3)47.9$

$1.2s + 3.69 = 14.37$

$-3.69 \quad -3.69$

$1.2s = 10.68$

$\frac{1.2s}{1.2} = \frac{10.68}{1.2}$

$s = 8.9$

19. $\frac{1}{2} = \frac{5p - 8}{12}$

$(12)\frac{1}{2} = (12)\frac{5p - 8}{12}$

$6 = 5p - 8$

$+8 \quad +8$

$14 = 5p$

$\frac{14}{5} = \frac{5p}{5}$

$\frac{14}{5}$ or $2\frac{4}{5} = p$

20. Let x represent the price of the meal.

$x + 0.15x - 5.00 = 2.36$

$1.15x - 5.00 = 2.36$

$+5.00 \quad +5.00$

$1.15x = 7.36$

$\frac{1.15x}{1.15} = \frac{7.36}{1.15}$

$x = 6.4$

Peter's meal cost $6.40.

21. Let x represent the total meal before tip.

$x + .15x = 99.50$

$1.15x = 99.50$

$\frac{1.15x}{1.15} = \frac{99.50}{1.15}$

$x = 86.52$

The total bill for lunch before tip is $86.52

22. $12m = 3m + 108$
$-3m \quad -3m$
$9m = 108$
$\frac{9m}{9} = \frac{108}{9}$
$m = 12$

23. $\frac{7}{8}n - 3 = \frac{5}{8}n + 12$
$-\frac{5}{8}n \quad -\frac{5}{8}n$
$\frac{1}{4}n - 3 = 12$
$+3 \quad +3$
$\frac{1}{4}n = 15$
$(4)\frac{1}{4}n = (4)15$
$n = 60$

24. $1.2x + 3.7 = 2.2x - 4.5$
$-1.2x \quad -1.2x$
$3.7 = x - 4.5$
$+4.5 \quad +4.5$
$8.2 = x$

25. $-7 - 7p = 3p + 23$
$+7p \quad +7p$
$-7 = 10p + 23$
$-23 \quad -23$
$-30 = 10p$
$\frac{-30}{10} = \frac{10p}{10}$
$-3 = p$

26. $-2.3q + 16 = -5q - 38$
$+5q \quad +5q$
$2.7q + 16 = -38$
$-16 \quad -16$
$2.7q = -54$
$\frac{2.7q}{2.7} = \frac{-54}{2.7}$
$q = -20$

27. $\frac{3}{5}k + \frac{7}{10} = \frac{11}{15}k - \frac{2}{5}$
$-\frac{9}{15}k \quad -\frac{9}{15}k$
$\frac{7}{10} = \frac{2}{15}k - \frac{2}{5}$
$+\frac{4}{10} \quad +\frac{4}{10}$
$\frac{11}{10} = \frac{2}{15}k$
$\left(\frac{15}{2}\right)\frac{11}{10} = \left(\frac{15}{2}\right)\frac{2}{15}k$
$\frac{33}{4}$ or $8\frac{1}{4} = k$

28. $-19m + 12 = -14m - 8$
$+19m \quad +19m$
$12 = 5m - 8$
$+8 \quad +8$
$20 = 5m$
$\frac{20}{5} = \frac{5m}{5}$
$4 = m$

29. $\frac{2}{3}v + \frac{1}{6} = \frac{7}{9}v - \frac{5}{6}$
$-\frac{2}{3}v \quad -\frac{2}{3}v$
$\frac{1}{6} = \frac{1}{9}v - \frac{5}{6}$
$+\frac{5}{6} \quad +\frac{5}{6}$
$1 = \frac{1}{9}v$
$(9)1 = (9)\frac{1}{9}v$
$9 = v$

30. $8.9 - 3.3j = -2.2j + 2.3$
$+3.3j \quad +3.3j$
$8.9 = 1.1j + 2.3$
$-2.3 \quad -2.3$
$6.6 = 1.1j$
$\frac{6.6}{1.1} = \frac{1.1j}{1.1}$
$6 = j$

31. $4a - 7 = -6a + 12$
$+6a \quad +6a$
$10a - 7 = 12$
$+7 \quad +7$
$10a = 19$
$\frac{10a}{10} = \frac{19}{10}$
$a = 1.9$

32. Let m represent the number of miles.
$10 + 0.10m = 0.35m$
$-0.10m \quad -0.10m$
$10 = 0.25m$
$\frac{10}{0.25} = \frac{0.25m}{0.25}$
$40 = m$
The cost of the two shuttle services would be equal if they travel 40 miles.

LESSON 4

Think and Discuss

1. Possible answer: The graphs are the same, except that the circle is closed for $y \geq 2$ and open for $y > 2$.

2. Possible answer: To graph an "and" inequality, shade between the values. To graph an "or" inequality, shade the ends of the number line.

Exercises

1. "No more than" means less than or equal to. Number of people ≤ 18

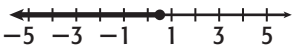
2. "Fewer than" means is less than. Number of fish < 8

3. "Above" means is greater than. Water level > 45

4. $x < 3$
3 is not a solution, so draw an open circle at 3. Shade the line to the left of 3.

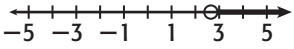
5. $\frac{1}{2} \geq r$

$\frac{1}{2}$ is a solution, so draw a closed circle at $\frac{1}{2}$.



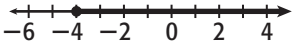
6. $2.8 < w$

2.8 is not a solution, so draw an open circle at 2.8. Shade the line to the right of 2.8.



7. $y \geq -4$

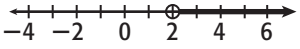
4 is a solution, so draw a closed circle at 4. Shade the line to the right of 4.



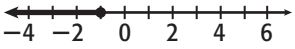
8. $a > 2$ or $a \leq -1$

First graph each inequality separately.

$a > 2$

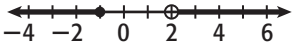


$a \leq -1$



Then combine the graphs.

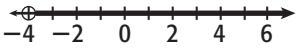
The solutions of $a > 2$ or $a \leq -1$ are the combined solutions of $a > 2$ and $a \leq -1$.



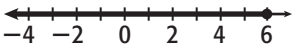
9. $-4 < p \leq 6$ can be written as $-4 < p$ and $p \leq 6$.

Graph each inequality.

$-4 < p$

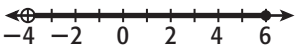


$p \leq 6$



Then combine the graphs.

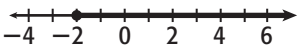
The solutions of $-4 < p \leq 6$ are the solutions common to $-4 < p$ and $p \leq 6$.



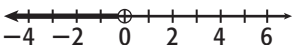
10. $-2 \leq n < 0$ can be written as $-2 \leq n$ and $n < 0$.

Graph each inequality.

$-2 \leq n$

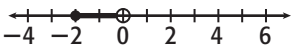


$n < 0$



Then combine the graphs.

The solutions of $-2 \leq n < 0$ are the solutions common to $-2 \leq n$ and $n < 0$.



11. "Below" means is less than. Temperature < 40

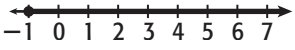
12. "At least" means greater than or equal to. Number of pictures ≥ 24

13. "No more than" means is less than or equal to. Number of tables ≤ 35

14. "Fewer than" means is less than. Number of people < 250

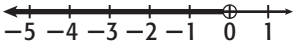
15. $s \geq -1$

-1 is a solution, so draw a closed circle at -1. Shade the line to the right of -1.



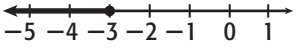
16. $y < 0$

0 is not a solution, so draw an open circle at 0. Shade the line to the left of 0.



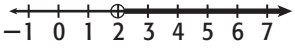
17. $n \leq -3$

-3 is a solution, so draw a closed circle at -3. Shade the line to the left of -3.



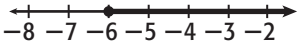
18. $2 < x$

2 is not a solution, so draw an open circle at 2. Shade the line to the right of 2.



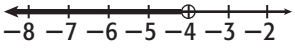
19. $-6 \leq b$

-6 is a solution, so draw a closed circle at -6. Shade the line to the right of -6.



20. $m < -4$

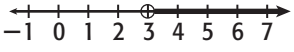
-4 is not a solution, so draw an open circle at -4. Shade the line to the left of -4.



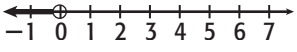
21. $p > 3$ or $p < 0$

First graph each inequality separately.

$p > 3$

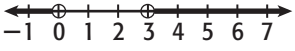


$p < 0$



Then combine the graphs.

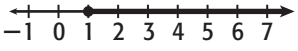
The solutions of $p > 3$ or $p < 0$ are the combined solutions of $p > 3$ and $p < 0$.



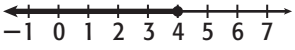
22. $1 \leq x \leq 4$ can be written as $1 \leq x$ and $x \leq 4$.

First graph each inequality separately.

$1 \leq x$

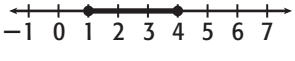


$x \leq 4$

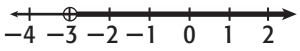


Then combine the graphs.

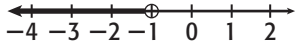
The solutions of $1 \leq x \leq 4$ are the solutions common to $1 \leq x$ and $x \leq 4$.



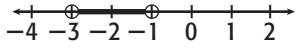
23. $-3 < y < -1$ can be written as $-3 < y$ and $y < -1$.
First graph each inequality separately.
$-3 < y$



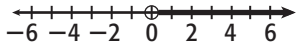
$y < -1$



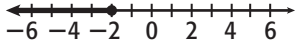
Then combine the graphs.
The solutions of $-3 < y < -1$ are the solutions common to $-3 < y$ and $y < -1$.



24. $k > 0$ or $k \leq -2$
First graph each inequality separately.
$k > 0$

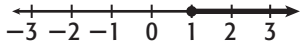


$k \leq -2$

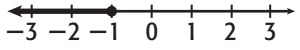


Then combine the graphs.
The solutions of $k > 0$ or $k \leq -2$ are the combined solutions of $k > 0$ and $k \leq -2$.

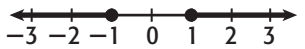
25. $n \geq 1$ or $n \leq -1$
First graph each inequality separately.
$n \geq 1$



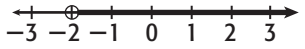
$n \leq -1$



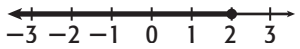
Then combine the graphs.
The solutions of $n \geq 1$ or $n \leq -1$ are the combined solutions of $n \geq 1$ and $n \leq -1$.



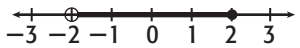
26. $-2 < w \leq 2$ can be written as $-2 < w$ and $w \leq 2$.
First graph each inequality separately.
$-2 < w$



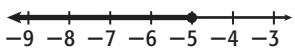
$w \leq 2$



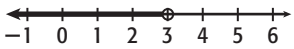
Then combine the graphs.
The solutions of $-2 < w \leq 2$ are the solutions common to $-2 < w$ and $w \leq 2$.



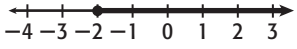
27. $z \leq -5$
-5 is a solution, so draw a closed circle at -5.
Shade the line to the left of -5.



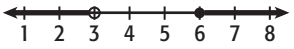
28. $3 > f$
3 is not a solution, so draw an open circle at 3.
Shade the line to the left of 3.



29. $m \geq -2$
-2 is a solution, so draw a closed circle at -2.
Shade the line to the right of -2.

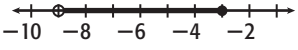


30. $3 < y$ or $y \geq 6$
First graph each inequality separately.
$3 < y$



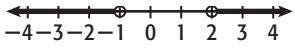
$y \geq 6$
Then combine the graphs.
The solutions of $3 < y$ or $y \geq 6$ are the combined solutions of $3 < y$ and $y \geq 6$.

31. $-9 < p \leq -3$ can be written as $-9 < p$ and $p \leq -3$.
First graph each inequality separately.
$-9 < p$



$p \leq -3$
Then combine the graphs.
The solutions of $-9 < p \leq -3$ are the solutions common to $-9 < p$ and $p \leq -3$.

32. $q > 2$ or $-1 > q$
First graph each inequality separately.
$q > 2$



$-1 > q$
Then combine the graphs.
The solutions of $q > 2$ or $-1 > q$ are the combined solutions of $q > 2$ and $-1 > q$.

33. Draw a closed circle at 13. The inequality states that x is less than or equal to 13, so you shade to the left of 13.

34. $2 < 2$, $3 \leq 3$, $5 > 5$, $7 \geq 7$; the Reflexive Property applies to $\geq$ and $\leq$, as in $3 \leq 3$ and $7 \geq 7$. It does not apply to $<$ and $>$, as in $3 < 6$ and $7 > 2$.

35. The depth is between 0 and -200.
$0 \geq$ depth ≥ -200 or $-200 \leq$ depth ≤ 0

36. The depth is between -200 and $-4{,}000$.
$-200 >$ depth $> -4{,}000$ or $-4{,}000 <$ depth < -200

37. Each of the depths are between 0 and the amount shown on the graph.
$0 \geq$ Manshu depth measurement $\geq -32{,}190$ ft
$0 \geq$ Challenger depth measurement $\geq -35{,}640$ ft
$0 \geq$ Horizon depth measurement $\geq -34{,}884$ ft
$0 \geq$ Vityaz depth measurement $\geq -36{,}200$ ft

38. Water is ice, a solid, at or below 32° F. This can be written as $t \leq 32°$ F.
Water is gas at or above 212° F. This can be written as $t \geq 212°$ F.
Water is a liquid in between these two temperatures, and can be written as $32° \text{ F} < t < 212°$ F.

39. B;

A. $-4 \geq n \geq 3$ is not representative of the statement because it includes -4 and 3 as solutions.

B. $-4 < n < 3$ is an inequality that represents the statement because it does not include -4 and 3 as solutions.

C. $-4 > n > 3$ is not representative of the statement because it makes n greater than 3 and less than -4.

D. $-4 \leq n \leq 3$ is not representative of the statement because it includes -4 and 3 as solutions.

40. J;

F. $x < -1$ or $x \leq 2$ is not an inequality represented by the graph because it does not include -1 and does include 2.

G. $x < -1$ or $x \geq 2$ is not an inequality represented by the graph because it does not include -1 and does include 2.

H. $x \leq -1$ or $x < 2$ is not an inequality represented by the graph because $x < 2$ would include the numbers on the graph between -1 and 2.

J. $x \leq -1$ or $x > 2$ is representative of the graph.

LESSON 5

Think and Discuss

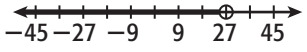
1. Possible answer: The procedures are identical except for the symbols that distinguish equations and inequalities.

2. Possible answer: Substitute -36 for s in $s - 5 > 1$. If the inequality is a true inequality, then -36 is a solution. If the inequality is false, then -36 is not a solution. $-36 - 5 = -41$, so -36 is not a solution.

Exercises

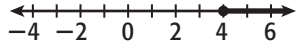
1. $x - 9 < 18$
$+9 \quad +9$
$x < 27$

27 is not a solution, so draw an open circle at 27. Then shade the line to include values less than 27.



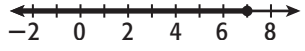
2. $y - 11 \geq -7$
$+11 \quad +11$
$y \geq 4$

4 is a solution, so draw a closed circle at 4. Then shade the line to include values greater than 4.



3. $4 \geq p - 3$
$+3 \quad +3$
$7 \geq p$

7 is a solution, so draw a closed circle at 7. Then shade the line to include values less than 7.



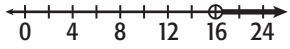
4. $n + 5 > 26$
$-5 \quad -5$
$n > 21$

5. $b + 21 \leq -3$
$-21 \quad -21$
$b \leq -24$

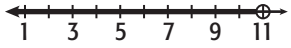
6. $9 \leq 12 + k$
$-12 \quad -12$
$-3 \leq k$

7. Let t represent the high temperature for tomorrow.
$30 + 12 \leq t$
$42 \leq t$
The temperature forecasted for tomorrow is no more than 42 °F.

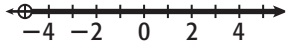
8. $s - 2 > 14$
$+2 \quad +2$
$s > 16$



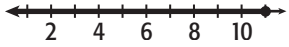
9. $m - 14 < -3$
$+14 \quad +14$
$m < 11$



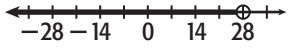
10. $b - 25 > -30$
$+25 \quad +25$
$b > -5$



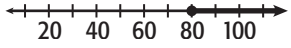
11. $c - 17 \leq -6$
$+17 \quad +17$
$c \leq 11$



12. $-25 > y - 53$
$+53 \quad +53$
$28 > y$



13. $71 \leq x - 9$
$+9 \quad +9$
$80 \leq x$



14. $w + 16 < 4$
$-16 \quad -16$
$w < -12$

15. $z + 9 > -3$
$-9 \quad -9$
$z > -12$

16. $p + 21 \leq -4$
$-21 \quad -21$
$p \leq -25$

17. $26 < f + 32$
$-32 \quad -32$
$-6 < f$

18. $65 > k + 54$
$-54 \quad -54$
$11 > k$

19. $n + 29 \geq 25$
$-29 \quad -29$
$n \geq -4$

20. Let c represent Clark's score.
$c \geq 15 + 12$
$c \geq 27$
Clark scored at least 27 points.

21. Let t represent the number of birds counted Tuesday.
$t + 8 \leq 32$
$-8 \quad -8$
$t \leq 24$
She counted at most 24 birds on Tuesday.

22. $k + 3.2 \geq 8$
$-3.2 \quad -3.2$
$k \geq 4.8$

23. $a - 1.3 > -1$
$+1.3 \quad +1.3$
$a > 0.3$

24. $c - 6\frac{1}{2} < -1\frac{1}{4}$
$+6\frac{1}{2} \quad +6\frac{1}{2}$
$c < 5\frac{1}{4}$

25. $-20 \geq 18 + m$
$-18 \quad -18$
$-38 \geq m$

26. $4 < x + 7.02$
$-7.02 \quad -7.02$
$-3.02 < x$

27. $g + 3\frac{2}{3} < 10$
$-3\frac{2}{3} \quad -3\frac{2}{3}$
$g < 6\frac{1}{3}$

28. $-109 > r - 58$
$+58 \quad +58$
$-51 > r$

29. $5.9 + w \leq 21.6$
$-5.9 \quad -5.9$
$w \leq 15.7$

30. $n - 21.6 > 26$
$+21.6 \quad +21.6$
$n > 47.6$

31. $t + 92 \geq -150$
$-92 \quad -92$
$t \geq -242$

32. $y + 4\frac{3}{4} \geq 1\frac{1}{8}$
$-4\frac{3}{4} \quad -4\frac{3}{4}$
$y \geq -3\frac{5}{8}$

33. $v - 0.9 \leq -1.5$
$+0.9 \quad +0.9$
$v \leq -0.6$

34. Let x represent the number of people signed up so far.
$x + 7 \geq 20$
$-7 \quad -7$
$x \geq 13)$
At most 13 people have signed up.

35. Let x represent the amount of money Mila needs.
$x + 12 \leq 20$
$-12 \leq -12$
$x \leq 8$
Mila needs at least $8.

36. Let x represent how many miles per hour the train can travel beyond its average speed.
$162.3 + x \leq 186$
$-162.3 \quad -162.3$
$x \leq 23.7$
at most 23.7 mi/h

37. Let x represent the spider crab width.
$x + 0.5 \leq 3.6$
$-0.5 \quad -0.5$
$x \leq 3.1$
no more than 3.1 meters across.

38. Let x represent how many miles she wants to bike in May.
$x - 17 \geq 5$
$+17 \quad +17$
$x \geq 22$
Amelia wants to ride at least 22 miles in May.

39. Let x represent the maximum hertz a dog can hear.
$x < 20{,}000 + 30{,}000$
$x < 50{,}000$
A dog can hear up to 50,000 hertz.

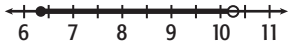
40. Work backward.
5 days ago was Sunday. So today is Friday. Yesterday was Thursday, and the day before yesterday was Wednesday.

41. Possible answer: Add 9 to both sides of the inequality: $n < -6$. Check by substituting a value less than -6 for n in $n - 9 < -15$.

42. $x + (4^2 - 2^3)^2 > -1$
$x + (16 - 8)^2 > -1$
$x + 8^2 > -1$
$x + 64 > -1$
$-64 \quad -64$
$x > -65$

43. B;
A. $x - 2 \geq -2$
$+2 \quad +2$
$x \geq 0$
This is not an equation for the graph because the solution includes some numbers less than 4.
B. $x + 3 \geq 7$
$-3 \quad -3$
$x \geq 4$
This is an equation for the graph because the solution includes the number 4 and all numbers greater than 4.
C. $x - 3 \leq 1$
$+3 \quad +3$
$x \leq 4$
This is not a possible equation because the solution includes all numbers less than 4.
D. $x + 5 < 9$
This is not a possible equation because it's solution would not be included because it only has a less than sign not less than or equal to.

44. Let w represent the wages earned at the movie theater.
$6.35 \leq w \leq 10.25$



LESSON 6

Think and Discuss

1. Possible answer: Although the procedures to solve inequalities and equations are the same, the direction of the inequality symbol reverses when both sides of an inequality are multiplied or divided by a negative number.

2. Possible answer: Divide both sides of the inequality by 0.5; $y > 9$.

Exercises

1. $\frac{w}{8} < -4$
$(8)\frac{w}{8} < (8)-4$
$w < -32$

2. $\frac{z}{-6} \geq 7$
$(-6)\frac{z}{-6} \geq (-6)7$
$z \leq -42$

3. $-4 < \frac{p}{-12}$

$(-12)-4 > (-12)\frac{p}{-12}$

$48 > p$

4. $3m > -15$

$\frac{3m}{3} > \frac{-15}{3}$

$m > -5$

5. $11 > -8y$

$\frac{11}{-8} < \frac{-8y}{-8}$

$\frac{11}{-8}$ or $-1\frac{3}{8} < y$

6. $25c \leq 200$

$\frac{25c}{25} \leq \frac{200}{25}$

$c \leq 8$

7. Since profit is the amount earned minus the amount spent, Deirdre needs to earn more than \$212.
Let c represent the number of candles she must sell.
$8c > 212$
$\frac{8c}{8} > \frac{212}{8}$
$c > 26.5$
Deirdre cannot sell 0.5 candle, so she needs to sell at least 27 candles to earn a profit.

8. $\frac{s}{5} > 1.4$

$(5)\frac{s}{5} > (5)1.4$

$s > 7$

9. $\frac{m}{-4} < -13$

$(-4)\frac{m}{-4} > (-4)-13$

$m > 52$

10. $\frac{b}{6} > -30$

$(6)\frac{b}{6} > (6)-30$

$b > -180$

11. $\frac{c}{-10} \leq 12$

$(-10)\frac{c}{-10} \geq (-10)12$

$c \geq -120$

12. $\frac{y}{9} < 2.5$

$(9)\frac{y}{9} < (9)2.5$

$y < 22.5$

13. $\frac{x}{1.1} \geq -1$

$(1.1)\frac{x}{1.1} \geq (1.1) - 1$

$x \geq -1.1$

14. $6w < 4$

$\frac{6w}{6} < \frac{4}{6}$

$w < \frac{2}{3}$

15. $-5z > -3$

$\frac{-5z}{-5} < \frac{-3}{-5}$

$z < \frac{3}{5}$

16. $15p \leq -45$

$\frac{15p}{15} \leq \frac{-45}{15}$

$p \leq -3$

17. $-9f > 27$

$\frac{-9f}{-9} < \frac{27}{-9}$

$f < -3$

18. $20k < 30$

$\frac{20k}{20} < \frac{30}{20}$

$k < \frac{3}{2}$ or $1\frac{1}{2}$

19. $-18n \geq 180$

$\frac{-18n}{-18} \leq \frac{180}{-18}$

$n \leq -10$

20. Let s represent the number of people who went to the museum on Saturday.
$s > 3(186)$
$s > 558$
More than 558 people went to the museum on Saturday.

21. Let w represent the number of wreaths he must sell.
$15w > 678$
$\frac{15w}{15} > \frac{678}{15}$
$w > 45.2$
George cannot sell 0.2 wreaths, so he needs to sell at least 46 wreaths to earn a profit.

22. $\frac{a}{65} \leq -10$

$(65)\frac{a}{65} \leq (65)-10$

$a \leq -650$

23. $0.4p > 1.6$

$\frac{0.4p}{0.4} > \frac{1.6}{0.4}$

$p > 4$

24. $\frac{-m}{5} < -20$

$(-5)\frac{-m}{5} > (-5)-20$

$m > 100$

25. $\frac{2}{3}y \geq 12$

$\left(\frac{3}{2}\right)\frac{2}{3}y \geq \left(\frac{3}{2}\right)12$

$y \geq 18$

26. $\frac{x}{-9} \leq \frac{3}{5}$

$(-9)\frac{x}{-9} \geq (-9)\frac{3}{5}$

$x \geq -\frac{27}{5}$

27. $\frac{g}{2.1} > 0.3$

$(2.1)\frac{g}{2.1} > (2.1)0.3$

$g > 0.63$

28. $\frac{r}{6} \geq \frac{2}{3}$

$(6)\frac{r}{6} \geq (6)\frac{2}{3}$

$r \geq 4$

29. $4w \leq 1\frac{1}{2}$

$4w \leq \frac{3}{2}$

$\frac{4w}{4} \leq \frac{\frac{3}{2}}{4}$

$w \leq \frac{3}{8}$

30. $-10n < 10^2$

$-10n < 100$

$\frac{-10n}{-10} > \frac{100}{-10}$

$n > -10$

31. $-1\frac{3}{5}t > -4$

$-\frac{8}{5}t > -4$

$\left(-\frac{5}{8}\right)-\frac{8}{5}t < \left(-\frac{5}{8}\right) - 4$

$t < \frac{5}{2}$

32. $-\frac{y}{12} < 3\frac{1}{2}$

$-\frac{y}{12} < \frac{7}{2}$

$(-12) - \frac{y}{12} > (-12)\frac{7}{2}$

$y > -42$

33. $5.6v \geq -14$

$\frac{5.6v}{5.6} \geq \frac{-14}{5.6}$

$v \geq -2.5$

34. Let p represent the number of plays the group wants to produce over the next two years.
$p \geq 1.5(8)$
$p \geq 12$
The group wants to produce at least 12 plays.

35. Let h represent the number of hours.
$h \geq \frac{350}{70}$
$h \geq 5$
It will take Tammy at least 5 hours to arrive.

36. a. Let x represent the number of Pacific Islanders that live in the Midwest.
$x < 874{,}000(.10)$
$x < 87{,}400$
less than 87,400

b. Let x represent the number of Pacific Islanders that live in the South.
$x \geq 874{,}000(.10)$ and $x \leq 874{,}000(.20)$
$x \geq 87{,}400$ and $x \leq 174{,}800$
Between 87,400 and 174,800

c. Less than 174,800

37. Let x represent the number of subscriptions they must sell.

$\frac{3}{4}x \geq 360$

$\left(\frac{4}{3}\right)\frac{3}{4}x \geq \left(\frac{4}{3}\right)360$

$x \geq 480$

They must sell at least 480 subscriptions.

38. Let x represent the number of vacation days.

$35x \leq 362$

$\frac{35x}{35} \leq \frac{362}{35}$

$x \leq 10.34$

Malcolm doesn't have enough for 11 days, so he can only vacation for 10 days.

39. Possible Answer: To be in the reading club, each member needs to read 7 books. Felicia read at least twice the minimum number of books required. How many books did she read? $x \geq 14$; Felicia read at least 14 books.

40. Possible Answer: Multiply both sides of the inequality by -8, and reverse the inequality symbol to "is greater than." Check by substituting a value greater than 320 for n in the inequality $\frac{n}{-8} < -40$.

41.
$$\begin{array}{r} 4x - 5 \leq 7x + 4 \\ \underline{-7x \qquad -7x} \\ -3x - 5 \leq 4 \\ \underline{+5 \qquad +5} \\ -3x \leq 9 \\ \frac{-3x}{-3} \geq \frac{9}{-3} \\ x \geq -3 \end{array}$$

42. A; $\frac{x}{4} > -2$

$(4)\frac{x}{4} > (4)-2$

$x > -8$

43. Let x represent the number of tomatoes.

$0.50x > 150$

$\frac{0.50x}{0.50} > \frac{150}{0.50}$

$x > 300$

John and Jamie must sell 301 tomatoes to make a profit.

LESSON 7

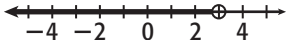
Think and Discuss

1. Possible answer: Subtract 5 from both sides; then divide both sides of the inequality by 8; $x < \frac{15}{8}$ or $1\frac{7}{8}$

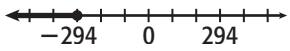
2. Possible answer: The band members are trying to raise at least \$5,000. At least means greater than or equal to.

Exercises

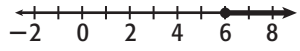
1.
$$\begin{array}{r} 5x + 3 < 18 \\ \underline{-3 \qquad -3} \\ 5x < 15 \\ \frac{5x}{5} < \frac{15}{5} \\ x < 3 \end{array}$$



2.
$$\begin{array}{r} -19 \geq \frac{z}{7} + 23 \\ \underline{-23 \qquad -23} \\ -42 \geq \frac{z}{7} \\ (7)-42 \geq (7)\frac{z}{7} \\ -294 \geq z \end{array}$$



3.
$$\begin{array}{r} 3y - 4 \geq 14 \\ \underline{+4 \qquad +4} \\ 3y \geq 18 \\ \frac{3y}{3} \geq \frac{18}{3} \\ y \geq 6 \end{array}$$



4.
$$\begin{array}{r} 5m - 1 + 2m < 20 \\ 7m - 1 < 20 \\ 7m < 21 \\ m < 3 \end{array}$$

Check: 0 is less than 3, so substitute 0 for m.

$5m - 1 + 2m < 20$

$5(0) - 1 + 2(0) \stackrel{?}{<} 20$

$-1 \stackrel{?}{<} 20$ ✓

5.
$$\begin{array}{r} 28 \leq 6(x + 4) \\ 28 \leq 6x + 24 \\ 4 \leq 6x \\ \frac{2}{3} \leq x \end{array}$$

Check: 1 is greater than $\frac{2}{3}$, so substitute 1 for x.

$28 \leq 6(x + 4)$

$28 \stackrel{?}{\leq} 6(1 + 4)$

$28 \stackrel{?}{\leq} 30$ ✓

6.
$$\begin{array}{r} 5t > 3t - 10 \\ 2t > -10 \\ t \geq -5 \end{array}$$

Check: 0 is greater than or equal to -5, so substitute 0 for t.

$5t > 3t - 10$

$5(0) \stackrel{?}{>} 3(0) - 10$

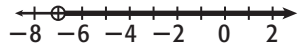
$0 \stackrel{?}{>} -10$ ✓

7. Let x represent the amount each student earned.

$$\begin{array}{r} 3x + 15 > 93 \\ \underline{-15 \qquad -15} \\ 3x > 78 \\ \frac{3x}{3} > \frac{78}{3} \\ x > 26 \end{array}$$

They earned more than \$26 each.

8.
$$\begin{array}{r} 5s - 7 > -42 \\ \underline{+7 \qquad +7} \\ 5s > -35 \\ \frac{5s}{5} > \frac{-35}{5} \\ s > -7 \end{array}$$



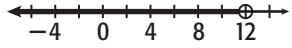
9. $\frac{b}{2} + 3 < 9$

$-3 \quad -3$

$\frac{b}{2} < 6$

$(2)\frac{b}{2} < (2)6$

$b < 12$



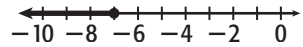
10. $-2q + 5 \geq 19$

$-5 \quad -5$

$-2q \geq 14$

$\frac{-2q}{-2} \leq \frac{14}{-2}$

$q \leq -7$



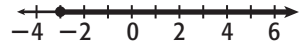
11. $-8c - 11 \leq 13$

$+11 \quad +11$

$-8c \leq 24$

$\frac{-8c}{-8} \geq \frac{24}{-8}$

$c \geq -3$



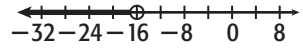
12. $\frac{y}{-4} + 6 > 10$

$-6 \quad -6$

$\frac{y}{-4} > 4$

$(-4)\frac{y}{-4} < (-4)4$

$y < -16$



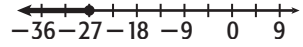
13. $\frac{x}{9} - 5 \leq -8$

$+5 \quad +5$

$\frac{x}{9} \leq -3$

$(9)\frac{x}{9} \leq (9)-3$

$x \leq -27$



14. $4(4 - r) + 1 > 13$

$16 - 4r + 1 > 13$

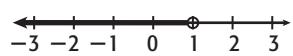
$17 - 4r > 13$

$-17 \quad -17$

$-4r > -4$

$\frac{-4r}{-4} < \frac{-4}{-4}$

$r < 1$



15. $3j - 8 - 5j \geq -16$

$-2j - 8 \geq -16$

$+8 \quad +8$

$-2j \geq -8$

$\frac{-2j}{-2} \leq \frac{-8}{-2}$

$j \leq 4$

16. $4d - 12 + 2d < 6$

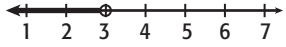
$6d - 12 < 6$

$+12 \quad +12$

$6d < 18$

$\frac{6d}{6} < \frac{18}{6}$

$d < 3$



17. Let x represent the number of bagels Rico can buy.

$1 + 0.65x \leq 5$

$-1 \quad -1$

$0.065x \leq 4$

$\frac{0.65x}{0.65} \leq \frac{4}{0.65}$

$x \leq 6.15$

Rico can buy at most 6 bagels.

18. Let x represent the average amount each member should still raise.

$500 + 35x \geq 1{,}200$

$-500 \quad -500$

$35x \geq 700$

$\frac{35x}{35} \geq \frac{700}{35}$

$x \geq 20$

On average, each member should raise at least $20.

19. $-4x + 8 \leq 32$

$-8 \quad -8$

$-4x \leq 24$

$\frac{-4x}{-4} \geq \frac{24}{-4}$

$x \geq -6$

20. $0.5 + \frac{n}{5} > -0.5$

$-0.5 \quad -0.5$

$\frac{n}{5} > -1$

$(5)\frac{n}{5} > (5) - 1$

$n > -5$

21. $1.4 + \frac{c}{3} < 2$

$-1.4 \quad -1.4$

$\frac{c}{3} < 0.6$

$(3)\frac{c}{3} < (3)0.6$

$c < 1.8$

22. $-\frac{3}{4}b - 2.2 > -1$

$+2.2 \quad +2.2$

$-\frac{3}{4}b > 1.2$

$\left(\frac{-4}{3}\right) - \frac{3}{4}b < \left(\frac{-4}{3}\right)1.2$

$b < -1.6$

23. $12 + 2w - 8 \leq 20$

$4 + 2w \leq 20$

$-4 \quad -4$

$2w \leq 16$

$\frac{2w}{2} \leq \frac{16}{2}$

$w \leq 8$

24. $5k + 6 - k \geq -14$

$4k + 6 \geq -14$

$-6 \quad -6$

$4k \geq -20$

$\frac{4k}{4} \geq \frac{-20}{4}$

$k \geq -5$

25. $\frac{s}{2} + 9 > 12 - 15$

$\frac{s}{2} + 9 > -3$

$-9 \quad -9$

$\frac{s}{2} > -12$

$(2)\frac{s}{2} > (2)-12$

$s > -24$

26. $2(4t - 6) - 10t < -6$

$8t - 12 - 10t < -6$

$2t - 12 < -6$

$-2t < 6$

$\left(-\frac{1}{2}\right) - 2t < \left(-\frac{1}{2}\right)(6)$

$t > -3$

27. $\frac{d}{2} + 1 + \frac{d}{2} \leq 5$

$d + 1 \leq 5$

$-1 \quad -1$

$d \leq 4$

28. Let x represent the amount of prizes needed.

$79 + x \geq 117(2)$

$79 + x \geq 234$

$-79 \quad -79$

$x \geq 155$

Mr. Monroe needs to buy at least 155 prizes.

29. Let x represent the cost of the shirts.

$5x \leq 20 + 50$

$5x \leq 70$

$\frac{5x}{5} \leq \frac{70}{5}$

$x \leq 14$

The shirts must cost no more than \$14 each.

30. Let x represent the amount of sales she needs.

$1{,}400 + 0.04x \geq 1{,}600$

$-1{,}400 \quad -1{,}400$

$0.04x \geq 200$

$\frac{0.04x}{0.04} \geq \frac{200}{0.04}$

$x \geq 5{,}000$

Darcy needs at least \$5,000 in sales.

31. Find the average of the past four years.

$\frac{210 + 199 + 243 + 207}{4} = \frac{859}{4} = 214.75$

$x \geq 214.75 + 10$

$x \geq 224.75$

The goal is for at least 225 students.

32. Let x represent the number of shirts.

$18 + 14x \leq 70$

$-18 \quad -18$

$14x \leq 52$

$\frac{14x}{14} \leq \frac{52}{14}$

$x \leq 3.71$

Michael can buy at most 3 shirts.

33. $\frac{1}{3}$ of $30\% = 10\%$

If the rock is at least 30% quartz, then it is at least 10% biotite mica.

$10\% + 30\% = 40\%$

At least 40% of the rock is quartz and biotite mica.

$100\% - 40\% = 60\%$

Therefore, the rock is at most 60% feldspar.

34. Possible Answer: the student multiplied both sides of the inequality by 9 instead of by -9. The correct answer is $x < -63$.

35. Possible Answer: Subtract 6 from both sides of the inequality: $4y < -8$. Then divide both sides by 4: $y < -2$.

36. $\frac{92 + 87 + 85 + x + x}{5} \geq 90$

Multiply both sides by 5.

$264 + 2x \geq 450$

$-264 \quad -264$

$2x \geq 186$

$\frac{2x}{2} \geq \frac{186}{2}$

$x \geq 93$

She must get an average of 93 on the next two tests.

37. B;

A. $2x - 5 > 1$

$+5 \quad +5$

$2x > 6$

$\frac{2x}{2} > \frac{6}{2}$

$x > 3$

This is not an equation for the graph because it only includes numbers greater than 3.

B. $-x + 3 < 6$

$-3 \quad -3$

$-x < 3$

$\frac{-x}{-1} > \frac{3}{-1}$

$x > -3$

This is an equation for the graph.

C. $3x - 12 < -3$

$+12 \quad +12$

$3x < 9$

$\frac{3x}{3} < \frac{9}{3}$

$x < 3$

This is not an equation for the graph because it includes all numbers less than three.

D. $-5x - 2 > -13$

$+2 \quad +2$

$-5x > -11$

$\frac{-5x}{-5} < \frac{-11}{-5}$

$x < \frac{11}{5}$

This is not an equation for the graph.

38. Let x represent how much she must sell.

$450 + .10x \geq 650$

$-450 \quad -450$

$.10x \geq 200$

$\frac{.10x}{.10} \geq \frac{200}{.10}$

$x \geq 2{,}000$

Gretta must sell \$2,000 per week.

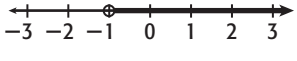
READY TO GO ON?

Exercises

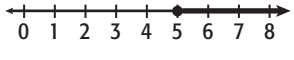
1. $g \geq 25$

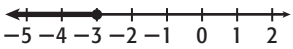
2. $r \leq 50$

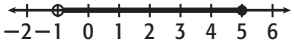
3.

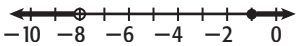


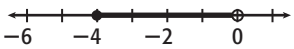
4.



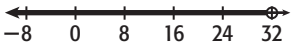
5. 

6. 

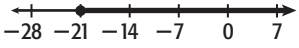
7. 

8. 

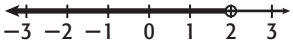
9. $28 > m - 4$
$+4 \quad +4$
$32 > m$



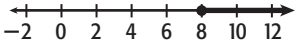
10. $8 + c \geq -13$
$-8 \quad -8$
$c \geq -21$



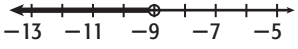
11. $-1 + v < 1$
$+1 \quad +1$
$v < 2$



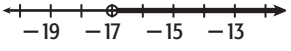
12. $5 \leq p - 3$
$+3 \quad +3$
$8 \leq p$



13. $-8 > f + 1$
$-1 \quad -1$
$-9 > f$



14. $-7 - w < 10$
$+7 \quad +7$
$-w < 17$
$\frac{-w}{-1} > \frac{17}{-1}$
$w > -17$



15. Let x represent the distance in feet they need to climb.
$29{,}035 - 17{,}500 \geq x$
$x \geq 11{,}535$
at least 11,535 ft

16. $-8s > 16$
$\frac{-8s}{-8} < \frac{16}{-8}$
$s < -2$

17. $\frac{x}{-2} \leq 9$
$(-2)\frac{x}{-2} \geq (-2)9$
$x \geq -18$

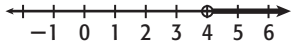
18. $-7 \leq \frac{b}{3}$
$(3) - 7 \leq (3)\frac{b}{3}$
$-21 \leq b$

19. $\frac{c}{-3} \geq -4$
$(-3)\frac{c}{-3} \leq (-3) - 4$
$c \leq 12$

20. $28 > 7h$
$\frac{28}{7} > \frac{7h}{7}$
$4 > h$

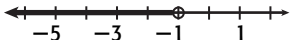
21. $6y < -2$
$\frac{6y}{6} < \frac{-2}{6}$
$y < -\frac{1}{3}$

22. $2x - 3 > 5$
$+3 \quad +3$
$2x > 8$
$\frac{2x}{2} > \frac{8}{2}$
$x > 4$

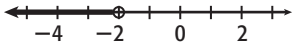


23. $3 \geq -2d + 4$
$-4 \quad -4$
$-1 \geq -2d$
$\frac{-1}{-2} \leq \frac{-2d}{-2}$
$\frac{1}{2} \leq d$

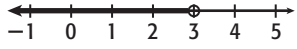
24. $3g - 2 - 10g > 5$
$-7g - 2 > 5$
$+2 \quad +2$
$-7g > 7$
$\frac{-7g}{-7} < \frac{7}{-7}$
$g < -1$



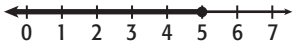
25. $14 < -4a + 6$
$-6 \quad -6$
$8 < -4a$
$\frac{8}{-4} > \frac{-4a}{-4}$
$-2 > a$



26. $3.6 + 7.2k < 25.2$
$-3.6 \quad -3.6$
$7.2k < 21.6$
$\frac{7.2k}{7.2} < \frac{21.6}{7.2}$
$k < 3$



27. $3z - 2 \leq 13$
$+2 \quad +2$
$3z \leq 15$
$\frac{3z}{3} \leq \frac{15}{3}$
$z \leq 5$



28. Let x represent the chairs in each row.
$60 + 26x \leq 450$
$-60 \quad -60$
$26x \leq 390$
$\frac{26x}{26} \leq \frac{390}{26}$
$x \leq 15$
at most 15 per row

29. $1{,}180 + 23x \geq 2{,}100$
$-1{,}180 \quad -1{,}180$
$23x \geq 920$

$$\frac{23x}{23} \geq \frac{920}{23}$$
$$x \geq 40$$

at least \$40 per student

STUDY GUIDE REVIEW

Exercises

1. inequality

2. compound inequality

3. solution set

4.
$$\begin{aligned} -5y + 6 &= -34 \\ -6 \quad & \quad -6 \\ -5y &= -40 \\ \frac{-5y}{-5} &= \frac{-40}{-5} \\ y &= 8 \end{aligned}$$

5.
$$\begin{aligned} 9 + \frac{z}{6} &= 14 \\ -9 \quad & \quad -9 \\ \frac{z}{6} &= 5 \\ (6)\frac{z}{6} &= (6)5 \\ z &= 30 \end{aligned}$$

6.
$$\begin{aligned} -8 &= \frac{w}{-7} + 13 \\ -13 \quad & \quad -13 \\ -21 &= \frac{w}{-7} \\ (-7) - 21 &= (-7)\frac{w}{-7} \\ 147 &= w \end{aligned}$$

7.
$$\begin{aligned} 7a + 4 - 13a &= 46 \\ -6a + 4 &= 46 \\ -4 \quad & \quad -4 \\ -6a &= 42 \\ \frac{-6a}{-6} &= \frac{42}{-6} \\ a &= -7 \end{aligned}$$

8.
$$\begin{aligned} \frac{6j - 18}{4} &= 9 \\ (4)\frac{6j - 18}{4} &= (4)9 \\ 6j - 18 &= 36 \\ +18 \quad & \quad +18 \\ 6j &= 54 \\ \frac{6j}{6} &= \frac{54}{6} \\ j &= 9 \end{aligned}$$

9.
$$\begin{aligned} \frac{8b - 5}{3} &= 9 \\ (3)\frac{8b - 5}{3} &= (3)9 \\ 8b - 5 &= 27 \\ +5 \quad & \quad +5 \\ 8b &= 32 \\ \frac{8b}{8} &= \frac{32}{8} \\ b &= 4 \end{aligned}$$

10.
$$\begin{aligned} -9 + 16y - 19 &= 52 \\ -28 + 16y &= 52 \\ +28 \quad & \quad +28 \\ 16y &= 80 \\ \frac{16y}{16} &= \frac{80}{16} \\ y &= 5 \end{aligned}$$

11. Let x represent the number of miles Leila biked.
$$\begin{aligned} \frac{2x + 2}{3} &= 18 \\ (3)\frac{2x + 2}{3} &= (3)18 \\ 2x + 2 &= 54 \\ -2 \quad & \quad -2 \\ 2x &= 52 \\ \frac{2x}{2} &= \frac{52}{2} \\ x &= 26 \end{aligned}$$
Leila biked 26 miles.

12.
$$\begin{aligned} -6b + 9 &= 12b \\ +6b \quad & \quad +6b \\ 9 &= 18b \\ \frac{9}{18} &= \frac{18b}{18} \\ \frac{1}{2} &= b \end{aligned}$$

13.
$$\begin{aligned} 5 - 7c &= -3c - 19 \\ +19 \quad & \quad +19 \\ 24 - 7c &= -3c \\ +7c \quad & \quad +7c \\ 24 &= 4c \\ \frac{24}{4} &= \frac{4c}{4} \\ 6 &= c \end{aligned}$$

14.
$$\begin{aligned} 18m - 14 &= 12m + 2 \\ +14 \quad & \quad +14 \\ 18m &= 12m + 16 \\ -12m \quad & \quad -12m \\ 6m &= 16 \\ \frac{6m}{6} &= \frac{16}{6} \\ m &= \frac{8}{3} \text{ or } 2\frac{2}{3} \end{aligned}$$

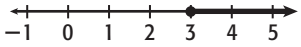
15.
$$\begin{aligned} 4 - \frac{2}{5}x &= \frac{1}{5}x - 8 \\ +\frac{2}{5}x \quad & \quad +\frac{2}{5}x \\ 4 &= \frac{3}{5}x - 8 \\ +8 \quad & \quad +8 \\ 12 &= \frac{3}{5}x \\ \left(\frac{5}{3}\right)12 &= \left(\frac{5}{3}\right)\frac{3}{5}x \\ 20 &= x \end{aligned}$$

16.
$$\begin{aligned} 50m &= 40m + 100 \\ 50m - 40m &= 40m - 40m + 100 \\ 10m &= 100 \\ m &= 100 \end{aligned}$$
In 10 months, Mercedes and Ken will have saved the same amount of money.

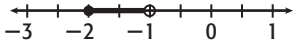
17. Weight limit $\leq$ 9 tons

18. Age $>$ 200 years old

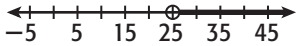
19. $y \geq 3$



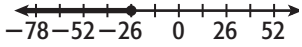
20. $-2 \leq k < -1$



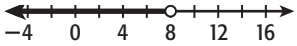
21.
$$\begin{aligned} r - 16 &> 9 \\ +16 \quad & \quad +16 \\ r &> 25 \end{aligned}$$



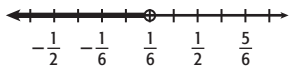
22.
$$\begin{aligned} 12 + x &\leq -14 \\ -12 \quad & \quad -12 \\ x &\leq -26 \end{aligned}$$



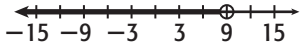
23.
$$\begin{aligned} \frac{3}{4} + g &< 8\frac{3}{4} \\ -\frac{3}{4} \quad & \quad -\frac{3}{4} \\ g &< 8 \end{aligned}$$



24.
$$\begin{aligned} \frac{5}{6} &> \frac{2}{3} + t \\ -\frac{2}{3} \quad & \quad -\frac{2}{3} \\ \frac{1}{6} &> t \end{aligned}$$



25. $7.46 > r - 1.54$
$+1.54 \quad +1.54$
$9 > r$



26. $u - 57.7 \geq -123.7$
$+57.7 \quad +57.7$
$u \geq -66$

27. Let x represent the Wildcats score.
$x \geq 25 + 13$
$x \geq 38$
at least 38 points

28. Let x represent the amount Gabe's brother saved.
$x + 19 \leq 113$
$-19 \quad -19$
$x \leq 94$
at most \$94

29. $\frac{n}{-8} > 6.9$
$(-8)\frac{n}{-8} < (-8)6.9$
$n < -55.2$

30. $-3p \geq -18$
$\frac{-3p}{-3} \leq \frac{-18}{-3}$
$p \leq 6$

31. $\frac{k}{13} < -10$
$(13)\frac{k}{13} < (13) - 10$
$k < -130$

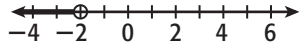
32. $-5p > -25$
$\frac{-5p}{-5} < \frac{-25}{-5}$
$p < 5$

33. $2.3 \leq \frac{v}{1.2}$
$(1.2)2.3 \leq (1.2)\frac{v}{1.2}$
$2.76 \leq v$

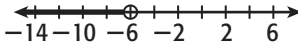
34. $\frac{c}{-11} < -3$
$(-11)\frac{c}{-11} > (-11)-3$
$c > 33$

35. Let p represent the number of purses.
$13p > 204$
$\frac{13p}{13} > \frac{204}{13}$
$p > 15.69$
Carlita cannot make .69 purses, so she must make at least 16 purses to make a profit.

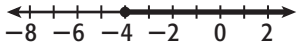
36. $-7b - 16 > -2$
$+16 \quad +16$
$-7b > 14$
$\frac{-7b}{-7} < \frac{14}{-7}$
$b < -2$



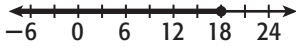
37. $3.8 + \frac{d}{5} < 2.6$
$-3.8 \quad -3.8$
$\frac{d}{5} < -1.2$
$(5)\frac{d}{5} < (5) - 1.2$
$d < -6$



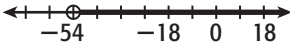
38. $15 - 4n + 9 \leq 40$
$24 - 4n \leq 40$
$-24 \quad -24$
$-4n \leq 16$
$\frac{-4n}{-4} \geq \frac{16}{-4}$
$n \geq -4$



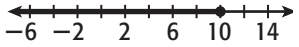
39. $\frac{y}{-3} + 18 \geq 12$
$-18 \quad -18$
$\frac{y}{-3} \geq -6$
$(-3)\frac{y}{-3} \leq (-3) - 6$
$y \leq 18$



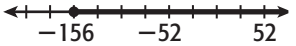
40. $\frac{c}{3} + 7 > -11$
$-7 \quad -7$
$\frac{c}{3} > -18$
$(3)\frac{c}{3} > (3) - 18$
$c > -54$



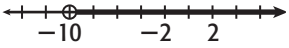
41. $32 \geq 4x - 8$
$+8 \quad +8$
$40 \geq 4x$
$\frac{40}{4} \geq \frac{4x}{4}$
$10 \geq x$



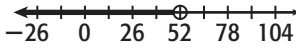
42. $18 + \frac{h}{6} \geq -8$
$-18 \quad -18$
$\frac{h}{6} \geq -26$
$(6)\frac{h}{6} \geq (6) - 26$
$h \geq -156$



43. $14 > -2t - 6$
$+6 \quad +6$
$20 > -2t$
$\frac{20}{-2} < \frac{-2t}{-2}$
$-10 < t$



44. $-3 < \frac{w}{-4} + 10$
$-10 \quad -10$
$-13 < \frac{w}{-4}$
$(-4) - 13 < (-4)\frac{w}{-4}$
$52 > w$



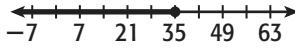
45. $\frac{y}{7} + 3.9 \leq 8.9$

$-3.9 \quad -3.9$

$\frac{y}{7} \leq 5$

$(7)\frac{y}{7} \leq (7)5$

$y \leq 35$



46. Let t represent the number of T-shirts.

$8.95t + 16.75 \leq 53.55$

$-16.75 \quad -16.75$

$8.95t \leq 36.80$

$\frac{8.95t}{8.95} \leq \frac{36.80}{8.95}$

$t \leq 4.11$

Luis cannot buy part of a T-shirt, so he can buy at most 4 T-shirts.

47. Let x represent what they each earned.

$3x + 34 \geq 475$

$-34 \quad -34$

$3x \geq 441$

$\frac{3x}{3} \geq \frac{441}{3}$

$x \geq 147$

They each earned more than $147.

CHAPTER TEST

Exercises

1. $3y - 8 = 16$

$+8 \quad +8$

$3y = 24$

$\frac{3y}{3} = \frac{24}{3}$

$y = 8$

2. $\frac{x}{3} + 12 = -4$

$-12 \quad -12$

$\frac{x}{3} = -16$

$(3)\frac{x}{3} = (3) - 16$

$x = -48$

3. $\frac{a}{6} - 7 = -4$

$+7 \quad +7$

$\frac{a}{6} = 3$

$(6)\frac{a}{6} = (6)3$

$a = 18$

4. $-7b + 5 = -51$

$-5 \quad -5$

$-7b = -56$

$\frac{-7b}{-7} = \frac{-56}{-7}$

$b = 8$

5. $\frac{5y - 4}{3} = 7$

$(3)\frac{5y - 4}{3} = (3)7$

$5y - 4 = 21$

$+4 \quad +4$

$5y = 25$

$\frac{5y}{5} = \frac{25}{5}$

$y = 5$

6. $8r + 7 - 13 = 58$

$8r - 6 = 58$

$+6 \quad +6$

$8r = 64$

$\frac{8r}{8} = \frac{64}{8}$

$r = 8$

7. $6 = \frac{12s - 6}{5}$

$(5)6 = (5)\frac{12s - 6}{5}$

$30 = 12s - 6$

$+6 \quad +6$

$36 = 12s$

$\frac{36}{12} = \frac{12s}{12}$

$3 = s$

8. $8.7 = \frac{19.8 - 4t}{3}$

$(3)8.7 = (3)\frac{19.8 - 4t}{3}$

$26.1 = 19.8 - 4t$

$-19.8 \quad -19.8$

$6.3 = -4t$

$\frac{6.3}{-4} = \frac{-4t}{-4}$

$-1.575 = t$

9. $-14q = 4q - 126$

$-4q \quad -4q$

$-18q = -126$

$\frac{-18q}{-18} = \frac{-126}{-18}$

$q = 7$

10. $\frac{5}{6}p + 4 = \frac{1}{6}p - 16$

$-\frac{1}{6}p \quad -\frac{1}{6}p$

$\frac{2}{3}p + 4 = -16$

$-4 \quad -4$

$\frac{2}{3}p = -20$

$\left(\frac{3}{2}\right)\frac{2}{3}p = \left(\frac{3}{2}\right) - 20$

$p = -30$

11. $9 - 6k = 3k - 54$

$+6k \quad +6k$

$9 = 9k - 54$

$+54 \quad +54$

$63 = 9k$

$\frac{63}{9} = \frac{9k}{9}$

$7 = k$

12. $-3.6d = -7d + 34$

$+7d \quad +7d$

$3.4d = 34$

$\frac{3.4d}{3.4} = \frac{34}{3.4}$

$d = 10$

13. Let x represent the number of hours.

$44 + 45x = 179$

$-44 \quad -44$

$45x = 135$

$\frac{45x}{45} = \frac{135}{45}$

$x = 3$

It took 3 hours to repair the computer.

14. Let x represent how many dozen they need to sell.

$15.75 + 2.25x = 4.50x$

$-2.25x \quad -2.25x$

$15.75 = 2.25x$

$\frac{15.75}{2.25} = \frac{2.25x}{2.25}$

$7 = x$

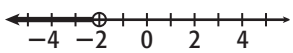
They need to sell 7 dozen to cover their costs.

15. Height > 4 ft

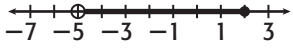
16. Speed ≤ 65 mi/h

17. $a < -2$

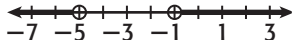
-2 is not a solution, so draw an open circle at -2. Shade the line to the left of -2.



18. The solutions $-5 < d \leq 2$ are the solutions common to $-5 < d$ and $d \leq 2$.

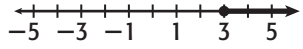


19. The solutions of $c > -1$ or $c < -5$ are the combined solutions of $c > -1$ and $c < -5$.



20. $b \geq 3$

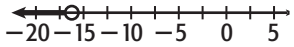
3 is a solution, so draw a closed circle on 3. Shade the line to the right of 3.



21. $n + 8 < -9$

$-8 \quad -8$

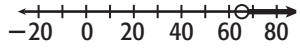
$n < -17$



22. $n - 124 > -59$

$+124 \quad +124$

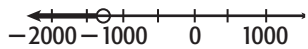
$n > 65$



23. $-40 > \frac{x}{32}$

$(32)\,-40 > (32)\frac{x}{32}$

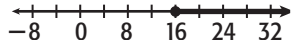
$-1{,}280 > x$



24. $-\frac{3}{4}y \leq -12$

$\left(-\frac{4}{3}\right)-\frac{3}{4}y \geq \left(-\frac{4}{3}\right)-12$

$y \geq 16$



25. Let x represent the amount she needs to save.

$46 + x \geq 125$

$-46 \quad -46$

$x \geq 79$

Rosa needs to save at least $79.

26. Let x represent the number of gallons.

$2.75x \leq 22.00$

$\frac{2.75x}{2.75} \leq \frac{22.00}{2.75}$

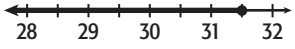
$x \leq 8$

At most 8 gallons can be bought.

27. $m - 7.8 \leq 23.7$

$+7.8 \quad +7.8$

$m \leq 31.5$

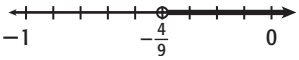


28. $6z > -2\frac{2}{3}$

$6z > -\frac{8}{3}$

$\left(\frac{1}{6}\right)6z > \left(\frac{1}{6}\right)-\frac{8}{3}$

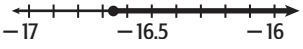
$z > -\frac{4}{9}$



29. $\frac{w}{-4.9} \leq 3.4$

$(-4.9)\frac{w}{-4.9} \geq (-4.9)3.4$

$w \geq -16.66$



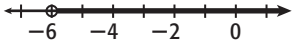
30. $-15 < 4a + 9$

$-9 \quad -9$

$-24 < 4a$

$\frac{-24}{4} < \frac{4a}{4}$

$-6 < a$



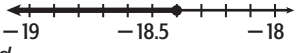
31. $2.8 - \frac{c}{4} \geq 7.4$

$-2.8 \quad -2.8$

$-\frac{c}{4} \geq 4.6$

$(-4)\,-\frac{c}{4} \leq (-4)4.6$

$c \leq -18.4$



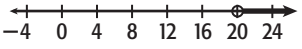
32. $\frac{d}{5} - 8 > -4$

$+8 \quad +8$

$\frac{d}{5} > 4$

$(5)\frac{d}{5} > (5)4$

$d > 20$



33. Let x represent how much money they must collect.

$198(20) + 198x \geq 7{,}500$

$3{,}960 + 198x \geq 7{,}500$

$-3{,}960 \quad -3{,}960$

$198x \geq 3{,}540$

$\frac{198x}{198} \geq \frac{3{,}540}{198}$

$x \geq 17.87$

Each student must raise at least $17.88.