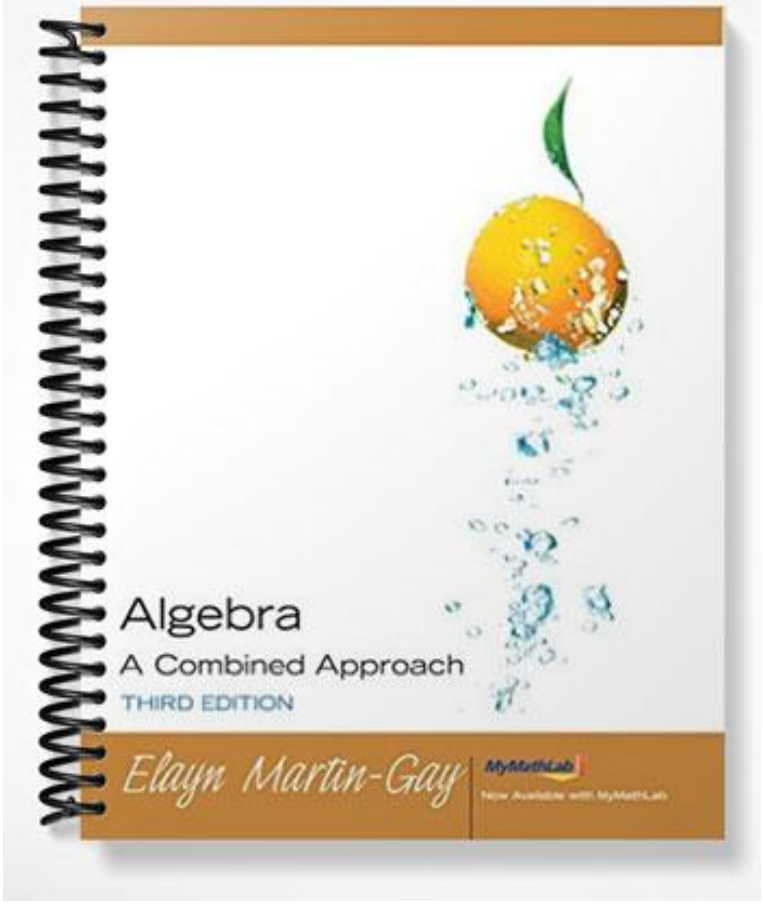
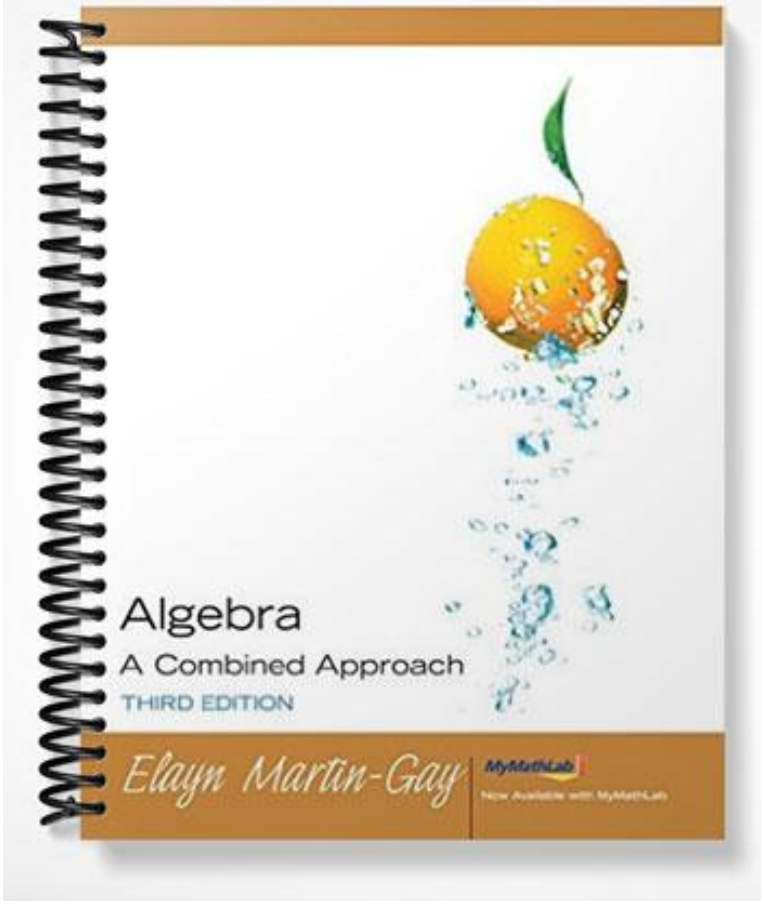
SOLUTIONS MANUAL



SOLUTIONS MANUAL



Chapter 2

Section 2.1 Practice Problems

1. $x-5=8$

$x-5+5=8+5$

$x=13$

Check: $x-5=8$

$13-5 \stackrel{?}{=} 8$

$8=8$ True

The solution is 13.

2. $y+1.7=0.3$

$y+1.7-1.7=0.3-1.7$

$y=-1.4$

Check: $y+1.7=0.3$

$-1.4+1.7 \stackrel{?}{=} 0.3$

$0.3=0.3$ True

The solution is −1.4.

3. $\frac{7}{8}=y-\frac{1}{3}$

$\frac{7}{8}+\frac{1}{3}=y-\frac{1}{3}+\frac{1}{3}$

$\frac{7}{8}\cdot\frac{3}{3}+\frac{1}{3}\cdot\frac{8}{8}=y$

$\frac{21}{24}+\frac{8}{24}=y$

$\frac{29}{24}=y$

Check: $\frac{7}{8}=y-\frac{1}{3}$

$\frac{7}{8} \stackrel{?}{=} \frac{29}{24}-\frac{1}{3}$

$\frac{7}{8} \stackrel{?}{=} \frac{29}{24}-\frac{8}{24}$

$\frac{7}{8} \stackrel{?}{=} \frac{21}{24}$

$\frac{7}{8}=\frac{7}{8}$ True

The solution is $\frac{29}{24}$.

4. $3x+10=4x$

$3x+10-3x=4x-3x$

$10=x$

Check: $3x+10=4x$

$3(10)+10 \stackrel{?}{=} 4(10)$

$30+10 \stackrel{?}{=} 40$

$40=40$ True

The solution is 10.

5. $10w+3-4w+4=-2w+3+7w$

$6w+7=5w+3$

$-5w+6w+7=-5w+5w+3$

$w+7=3$

$w+7-7=3-7$

$w=-4$

Check:

$10w+3-4w+4=-2w+3+7w$

$10(-4)+3-4(-4)+4 \stackrel{?}{=} -2(-4)+3+7(-4)$

$-40+3+16+4 \stackrel{?}{=} 8+3-28$

$-17=-17$ True

The solution is −4.

6. $3(2w-5)-(5w+1)=-3$

$3(2w)-3(5)-1(5w)-1(1)=-3$

$6w-15-5w-1=-3$

$w-16=-3$

$w-16+16=-3+16$

$w=13$

Check: $3(2w-5)-(5w+1)=-3$

$3(2\cdot 13-5)-(5\cdot 13+1) \stackrel{?}{=} -3$

$3(26-5)-(65+1) \stackrel{?}{=} -3$

$3(21)-66 \stackrel{?}{=} -3$

$63-66 \stackrel{?}{=} -3$

$-3=-3$ True

The solution is 13.

7. $12-y=9$

$12-y-12=9-12$

$-y=-3$

$y=3$

Check: $12-y=9$

$12-3 \stackrel{?}{=} 9$

$9=9$ True

The solution is 3.

8. a. If the sum of two numbers is 11 and one number is 4, find the other number by subtracting 4 from 11. The other number is 11 − 4, or 7.

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b. If the sum of two numbers is 11 and one number is x, find the other number by subtracting x from 11. The other number is $11 - x$.

c. If the sum of two numbers is 56 and one number is a, find the other number by subtracting a from 56. The other number is $56 - a$.

9. Lucille received 49,489 more votes than Wayne, who received n votes. So, she received $(n + 49{,}489)$ votes.

Mental Math

1. $x + 4 = 6$
$x = 2$

2. $x + 7 = 17$
$x = 10$

3. $n + 18 = 30$
$n = 12$

4. $z + 22 = 40$
$z = 18$

5. $b - 11 = 6$
$b = 17$

6. $d - 16 = 5$
$d = 21$

Exercise Set 2.1

1. $x + 7 = 10$
$x + 7 - 7 = 10 - 7$
$x = 3$
Check: $x + 7 = 10$
$3 + 7 \stackrel{?}{=} 10$
$10 = 10$ True
The solution is 3.

2. $x + 14 = 25$
$x + 14 - 14 = 25 - 14$
$x = 11$
Check: $x + 14 = 25$
$11 + 14 \stackrel{?}{=} 25$
$25 = 25$ True
The solution is 11.

3. $x - 2 = -4$
$x - 2 + 2 = -4 + 2$
$x = -2$
Check: $x - 2 = -4$
$-2 - 2 \stackrel{?}{=} -4$
$-4 = -4$ True
The solution is -2.

4. $y - 9 = 1$
$y - 9 + 9 = 1 + 9$
$y = 10$
Check: $y - 9 = 1$
$10 - 9 \stackrel{?}{=} 1$
$1 = 1$ True
The solution is 10.

5. $-11 = 3 + x$
$-11 - 3 = 3 + x - 3$
$-14 = x$
Check: $-11 = 3 + x$
$-11 \stackrel{?}{=} 3 + (-14)$
$-11 = -11$ True
The solution is -14.

6. $-8 = 8 + z$
$-8 - 8 = -8 + 8 + z$
$-16 = z$
Check: $-8 = 8 + z$
$-8 \stackrel{?}{=} 8 + (-16)$
$-8 = -8$ True
The solution is -16.

7. $r - 8.6 = -8.1$
$r - 8.6 + 8.6 = -8.1 + 8.6$
$r = 0.5$
Check: $r - 8.6 = -8.1$
$0.5 - 8.6 \stackrel{?}{=} -8.1$
$-8.1 = -8.1$ True
The solution is 0.5.

8. $t - 9.2 = -6.8$
$9.2 + t - 9.2 = 9.2 - 6.8$
$t = 2.4$
Check: $t - 9.2 = -6.8$
$2.4 - 9.2 \stackrel{?}{=} -6.8$
$-6.8 = -6.8$ True
The solution is 2.4.

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9. $x-\frac{2}{5}=-\frac{3}{20}$

$x-\frac{2}{5}+\frac{2}{5}=-\frac{3}{20}+\frac{2}{5}$

$x=-\frac{3}{20}+\frac{8}{20}$

$x=\frac{5}{20}$

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

Check: $x-\frac{2}{5}=-\frac{3}{20}$

$\frac{1}{4}-\frac{2}{5}\stackrel{?}{=}-\frac{3}{20}$

$\frac{5}{20}-\frac{8}{20}\stackrel{?}{=}-\frac{3}{20}$

$-\frac{3}{20}=-\frac{3}{20}$ True

The solution is $\frac{1}{4}$.

10. $y-\frac{4}{7}=-\frac{3}{14}$

$y-\frac{4}{7}+\frac{4}{7}=-\frac{3}{14}+\frac{4}{7}$

$y=-\frac{3}{14}+\frac{8}{14}$

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

Check: $y-\frac{4}{7}=-\frac{3}{14}$

$\frac{5}{14}-\frac{4}{7}\stackrel{?}{=}-\frac{3}{14}$

$\frac{5}{14}-\frac{8}{14}\stackrel{?}{=}-\frac{3}{14}$

$-\frac{3}{14}=-\frac{3}{14}$ True

The solution is $\frac{5}{14}$.

11. $\frac{1}{3}+f=\frac{3}{4}$

$-\frac{1}{3}+\frac{1}{3}+f=-\frac{1}{3}+\frac{3}{4}$

$f=-\frac{4}{12}+\frac{9}{12}$

$f=\frac{5}{12}$

Check: $\frac{1}{3}+f=\frac{3}{4}$

$\frac{1}{3}+\frac{5}{12}\stackrel{?}{=}\frac{3}{4}$

$\frac{4}{12}+\frac{5}{12}\stackrel{?}{=}\frac{3}{4}$

$\frac{9}{12}\stackrel{?}{=}\frac{3}{4}$

$\frac{3}{4}=\frac{3}{4}$ True

The solution is $\frac{5}{12}$.

12. $c+\frac{1}{6}=\frac{3}{8}$

$c+\frac{1}{6}-\frac{1}{6}=\frac{3}{8}-\frac{1}{6}$

$c=\frac{9}{24}-\frac{4}{24}$

$c=\frac{5}{24}$

Check: $c+\frac{1}{6}=\frac{3}{8}$

$\frac{5}{24}+\frac{1}{6}\stackrel{?}{=}\frac{3}{8}$

$\frac{5}{24}+\frac{4}{24}\stackrel{?}{=}\frac{3}{8}$

$\frac{9}{24}\stackrel{?}{=}\frac{3}{8}$

$\frac{3}{8}=\frac{3}{8}$ True

The solution is $\frac{5}{24}$.

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13. $7x+2x=8x-3$
$9x=8x-3$
$9x-8x=8x-3-8x$
$x=-3$
Check: $7x+2x=8x-3$
$7(-3)+2(-3) \stackrel{?}{=} 8(-3)-3$
$-21-6 \stackrel{?}{=} -24-3$
$-27=-27$ True
The solution is -3.

14. $3n+2n=7+4n$
$5n=7+4n$
$5n-4n=7+4n-4n$
$n=7$
Check: $3n+2n=7+4n$
$3(7)+2(7) \stackrel{?}{=} 7+4(7)$
$21+14 \stackrel{?}{=} 7+28$
$35=35$ True
The solution is 7.

15. $\frac{5}{6}x+\frac{1}{6}x=-9$
$\frac{6}{6}x=-9$
$x=-9$
Check: $\frac{5}{6}x+\frac{1}{6}x=-9$
$\frac{5}{6}(-9)+\frac{1}{6}(-9) \stackrel{?}{=} -9$
$-\frac{45}{6}-\frac{9}{6} \stackrel{?}{=} -9$
$-\frac{54}{6} \stackrel{?}{=} -9$
$-9=-9$ True
The solution is -9.

16. $\frac{13}{11}y-\frac{2}{11}y=-3$
$\frac{11}{11}y=-3$
$y=-3$
Check: $\frac{13}{11}y-\frac{2}{11}y=-3$
$\frac{13}{11}(-3)-\frac{2}{11}(-3) \stackrel{?}{=} -3$
$-\frac{39}{11}+\frac{6}{11} \stackrel{?}{=} -3$
$-\frac{33}{11} \stackrel{?}{=} -3$
$-3=-3$ True
The solution is -3.

17. $2y+10=5y-4y$
$2y+10=y$
$2y+10-2y=y-2y$
$10=-y$
$-10=y$
Check: $2y+10=5y-4y$
$2(-10)+10 \stackrel{?}{=} 5(-10)-4(-10)$
$-20+10 \stackrel{?}{=} -50+40$
$-10=-10$ True
The solution is -10.

18. $4x-4=10x-7x$
$4x-4=3x$
$4x-4-4x=3x-4x$
$-4=-x$
$4=x$
Check: $4x-4=10x-7x$
$4(4)-4 \stackrel{?}{=} 10(4)-7(4)$
$16-4 \stackrel{?}{=} 40-28$
$12=12$ True
The solution is 4.

19. $-5(n-2)=8-4n$
$-5n+10=8-4n$
$5n-5n+10=5n+8-4n$
$10=n+8$
$10-8=n+8-8$
$2=n$
Check: $-5(n-2)=8-4n$
$-5(2-2) \stackrel{?}{=} 8-4(2)$
$-5(0) \stackrel{?}{=} 8-8$
$0=0$ True
The solution is 2.

20. $-4(z-3)=2-3z$
$-4z+12=2-3z$
$-4z+12+3z=2-3z+3z$
$-z+12=2$
$-z+12-12=2-12$
$-z=-10$
$z=10$
Check: $-4(z-3)=2-3z$
$-4(10-3) \stackrel{?}{=} 2-3(10)$
$-4(7) \stackrel{?}{=} 2-30$
$-28=-28$ True
The solution is 10.

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21. $\frac{3}{7}x+2=-\frac{4}{7}x-5$

$\frac{3}{7}x+2+\frac{4}{7}x=-\frac{4}{7}x-5+\frac{4}{7}x$

$x+2=-5$

$x+2-2=-5-2$

$x=-7$

Check: $\frac{3}{7}x+2=-\frac{4}{7}x-5$

$\frac{3}{7}(-7)+2 \stackrel{?}{=} -\frac{4}{7}(-7)-5$

$-3+2 \stackrel{?}{=} 4-5$

$-1=-1$ True

The solution is -7.

22. $\frac{1}{5}x-1=-\frac{4}{5}x-13$

$\frac{4}{5}x+\frac{1}{5}x-1=\frac{4}{5}x-\frac{4}{5}x-13$

$\frac{5}{5}x-1=-13$

$x-1=-13$

$x-1+1=-13+1$

$x=-12$

Check: $\frac{1}{5}x-1=-\frac{4}{5}x-13$

$\frac{1}{5}(-12)-1 \stackrel{?}{=} -\frac{4}{5}(-12)-13$

$-\frac{12}{5}-\frac{5}{5} \stackrel{?}{=} \frac{48}{5}-\frac{65}{5}$

$-\frac{17}{5}=-\frac{17}{5}$ True

The solution is -12.

23. $5x-6=6x-5$

$-5x+5x-6=-5x+6x-5$

$-6=x-5$

$-6+5=x-5+5$

$-1=x$

Check: $5x-6=6x-5$

$5(-1)-6 \stackrel{?}{=} 6(-1)-5$

$-5-6 \stackrel{?}{=} -6-5$

$-11=-11$ True

The solution is -1.

24. $2x+7=x-10$

$-x+2x+7=-x+x-10$

$x+7=-10$

$x+7-7=-10-7$

$x=-17$

Check: $2x+7=x-10$

$2(-17)+7 \stackrel{?}{=} -17-10$

$-34+7 \stackrel{?}{=} -27$

$-27=-27$ True

The solution is -17.

25. $8y+2-6y=3+y-10$

$2y+2=y-7$

$2y+2-y=y-7-y$

$y+2=-7$

$y+2-2=-7-2$

$y=-9$

Check: $8y+2-6y=3+y-10$

$8(-9)+2-6(-9) \stackrel{?}{=} 3+(-9)-10$

$-72+2+54 \stackrel{?}{=} 3-9-10$

$-16=-16$ True

The solution is -9.

26. $4p-11-p=2+2p-20$

$3p-11=2p-18$

$-2p+3p-11=-2p+2p-18$

$p-11=-18$

$p-11+11=-18+11$

$p=-7$

Check: $4p-11-p=2+2p-20$

$4(-7)-11-(-7) \stackrel{?}{=} 2+2(-7)-20$

$-28-11+7 \stackrel{?}{=} 2-14-20$

$-32=-32$ True

The solution is -7.

27. $-3(x-4)=-4x$

$-3x+12=-4x$

$3x-3x+12=3x-4x$

$12=-x$

$-12=x$

Check: $-3(x-4)=-4x$

$-3(-12-4) \stackrel{?}{=} -4(-12)$

$-3(-16) \stackrel{?}{=} 48$

$48=48$ True

The solution is -12.

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28. $-2(x-1) = -3x$

$-2x+2 = -3x$

$2x-2x+2 = 2x-3x$

$2 = -x$

$-2 = x$

Check: $-2(x-1) = -3x$

$-2(-2-1) \stackrel{?}{=} -3(-2)$

$-2(-3) \stackrel{?}{=} 6$

$6 = 6$ True

The solution is –2.

29. $\frac{3}{8}x - \frac{1}{6} = -\frac{5}{8}x - \frac{2}{3}$

$\frac{3}{8}x - \frac{1}{6} + \frac{5}{8}x = -\frac{5}{8}x - \frac{2}{3} + \frac{5}{8}x$

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

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

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

$x = -\frac{3}{6}$

$x = -\frac{1}{2}$

Check: $\frac{3}{8}x - \frac{1}{6} = -\frac{5}{8}x - \frac{2}{3}$

$\frac{3}{8}\left(-\frac{1}{2}\right) - \frac{1}{6} \stackrel{?}{=} -\frac{5}{8}\left(-\frac{1}{2}\right) - \frac{2}{3}$

$-\frac{3}{16} - \frac{1}{6} \stackrel{?}{=} \frac{5}{16} - \frac{2}{3}$

$-\frac{9}{48} - \frac{8}{48} \stackrel{?}{=} \frac{15}{48} - \frac{32}{48}$

$-\frac{17}{48} = -\frac{17}{48}$ True

The solution is $-\frac{1}{2}$.

30. $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$

$\frac{2}{5}x - \frac{1}{12} + \frac{3}{5}x = -\frac{3}{5}x - \frac{3}{4} + \frac{3}{5}x$

$\frac{5}{5}x - \frac{1}{12} = -\frac{3}{4}$

$x - \frac{1}{12} = -\frac{3}{4}$

$x - \frac{1}{12} + \frac{1}{12} = -\frac{3}{4} + \frac{1}{12}$

$x = -\frac{9}{12} + \frac{1}{12}$

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

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

Check: $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$

$\frac{2}{5}\left(-\frac{2}{3}\right) - \frac{1}{12} \stackrel{?}{=} -\frac{3}{5}\left(-\frac{2}{3}\right) - \frac{3}{4}$

$-\frac{4}{15} - \frac{1}{12} \stackrel{?}{=} \frac{6}{15} - \frac{3}{4}$

$-\frac{16}{60} - \frac{5}{60} \stackrel{?}{=} \frac{24}{60} - \frac{45}{60}$

$-\frac{21}{60} = -\frac{21}{60}$ True

The solution is $-\frac{2}{3}$.

31. $2(x-4) = x+3$

$2x-8 = x+3$

$-x+2x-8 = -x+x+3$

$x-8 = 3$

$x-8+8 = 3+8$

$x = 11$

Check: $2(x-4) = x+3$

$2(11-4) \stackrel{?}{=} 11+3$

$2(7) \stackrel{?}{=} 14$

$14 = 14$ True

The solution is 7.

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32. $3(y+7)=2y-5$
$3y+21=2y-5$
$-2y+3y+21=-2y+2y-5$
$y+21=-5$
$y+21-21=-5-21$
$y=-26$

Check: $3(y+7)=2y-5$
$3(-26+7) \stackrel{?}{=} 2(-26)-5$
$3(-19) \stackrel{?}{=} -52-5$
$-57=-57$ True

The solution is –26.

33. $3(n-5)-(6-2n)=4n$
$3n-15-6+2n=4n$
$5n-21=4n$
$5n-21-5n=4n-5n$
$-21=-n$
$21=n$

Check: $3(n-5)-(6-2n)=4n$
$3(21-5)-(6-2\cdot 21) \stackrel{?}{=} 4(21)$
$3(21-5)-(6-42) \stackrel{?}{=} 84$
$3(16)-(-36) \stackrel{?}{=} 84$
$48+36 \stackrel{?}{=} 84$
$84=84$ True

The solution is 21.

34. $5(3+z)-(8z+9)=-4z$
$15+5z-8z-9=-4z$
$-3z+6=-4z$
$3z-3z+6=3z-4z$
$6=-z$
$-6=z$

Check: $5(3+z)-(8z+9)=-4z$
$5(3+(-6))-(8(-6)+9) \stackrel{?}{=} -4(-6)$
$5(-3)-(-48+9) \stackrel{?}{=} 24$
$-15-(-39) \stackrel{?}{=} 24$
$-15+39 \stackrel{?}{=} 24$
$24=24$ True

The solution is –6.

35. $-2(x+6)+3(2x-5)=3(x-4)+10$
$-2x-12+6x-15=3x-12+10$
$4x-27=3x-2$
$-3x+4x-27=-3x+3x-2$
$x-27=-2$
$x-27+27=-2+27$
$x=25$

Check: $-2(x+6)+3(2x-5)=3(x-4)+10$
$-2(25+6)+3(2\cdot 25-5) \stackrel{?}{=} 3(25-4)+10$
$-2(31)+3(50-5) \stackrel{?}{=} 3(21)+10$
$-62+3(45) \stackrel{?}{=} 63+10$
$-62+135 \stackrel{?}{=} 73$
$73=73$ True

The solution is 25.

36. $-5(x+1)+4(2x-3)=2(x+2)-8$
$-5x-5+8x-12=2x+4-8$
$3x-17=2x-4$
$3x-17-2x=2x-4-2x$
$x-17=-4$
$x-17+17=-4+17$
$x=13$

Check: $-5(x+1)+4(2x-3)=2(x+2)-8$
$-5(13+1)+4(2\cdot 13-3) \stackrel{?}{=} 2(13+2)-8$
$-5(14)+4(26-3) \stackrel{?}{=} 2(15)-8$
$-70+4(23) \stackrel{?}{=} 30-8$
$-70+92 \stackrel{?}{=} 22$
$22=22$ True

The solution is 13.

37. $13x-3=14x$
$13x-3-13x=14x-13x$
$-3=x$

38. $18x-9=19x$
$18x-9-18x=19x-18x$
$-9=x$

39. $5b-0.7=6b$
$5b-0.7-5b=6b-5b$
$-0.7=b$

40. $9x+5.5=10x$
$9x+5.5-9x=10x-9x$
$5.5=x$

41. $3x-6=2x+5$
$3x-6+6=2x+5+6$
$3x=2x+11$
$3x-2x=2x+11-2x$
$x=11$

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42. $7y+2=6y+2$
$7y+2-6y=6y+2-6y$
$y+2=2$
$y+2-2=2-2$
$y=0$

43. $13x-9+2x-5=12x-1+2x$
$15x-14=14x-1$
$15x-14-14x=14x-1-14x$
$x-14=-1$
$x-14+14=-1+14$
$x=13$

44. $15x+20-10x-9=25x+8-21x-7$
$5x+11=4x+1$
$-4x+5x+11=-4x+4x+1$
$x+11=1$
$x+11-11=1-11$
$x=-10$

45. $7(6+w)=6(2+w)$
$42+7w=12+6w$
$42+7w-6w=12+6w-6w$
$42+w=12$
$42+w-42=12-42$
$w=-30$

46. $6(5+c)=5(c-4)$
$30+6c=5c-20$
$30+6c-5c=5c-20-5c$
$30+c=-20$
$-30+30+c=-30-20$
$c=-50$

47. $n+4=3.6$
$n+4-4=3.6-4$
$n=-0.4$

48. $m+2=7.1$
$m+2-2=7.1-2$
$m=5.1$

49. $10-(2x-4)=7-3x$
$10-2x+4=7-3x$
$14-2x=7-3x$
$14-2x+3x=7-3x+3x$
$14+x=7$
$14+x-14=7-14$
$x=-7$

50. $15-(6-7k)=2+6k$
$15-6+7k=2+6k$
$9+7k=2+6k$
$9+7k-6k=2+6k-6k$
$9+k=2$
$-9+9+k=-9+2$
$k=-7$

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

52. $\frac{1}{11}=y+\frac{10}{11}$
$\frac{1}{11}-\frac{10}{11}=y+\frac{10}{11}-\frac{10}{11}$
$-\frac{9}{11}=y$

53. $-6.5-4x-1.6-3x=-6x+9.8$
$-8.1-7x=-6x+9.8$
$-8.1-7x+7x=-6x+9.8+7x$
$-8.1=x+9.8$
$-8.1-9.8=x+9.8-9.8$
$-17.9=x$

54. $-1.4-7x-3.6-2x=-8x+4.4$
$-9x-5=-8x+4.4$
$8x-9x-5=8x-8x+4.4$
$-x-5=4.4$
$-x-5+5=4.4+5$
$-x=9.4$
$x=-9.4$

55. If the sum of the lengths of the two pieces is 10 feet and one piece is x feet, then the other piece has a length of $(10-x)$ feet.

56. If the sum of the lengths of the two pieces is 5 feet and one piece is x feet, then the other piece has a length of $(5-x)$ feet.

57. If the sum of the measures of two angles is 180° and one angle measures x°, then the other angle measures $(180-x)$°.

58. If the sum of the measures of two angles is 90° and one angle measures x°, then the other angle measures $(90-x)$°.

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59. If the number of undergraduate students is n, and the number of graduate students is 28,000 fewer than n, then the number of graduate students is $n - 28{,}000$.

60. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

61. If the area of the Gobi Desert is x square miles and the area of the Sahara Desert is 7 times the area of the Gobi Desert, then the area of the Sahara Desert is $7x$ square miles.

62. If the weight of the Armanty meteorite is y kilograms and the weight of the Hoba West meteorite is 3 times the weight of the Armanty meteorite, then the weight of the Hoba West meteorite is $3y$ kilograms.

63. The multiplicative inverse of $\frac{5}{8}$ is $\frac{8}{5}$, since $\frac{5}{8}\cdot\frac{8}{5}=1$.

64. The multiplicative inverse of $\frac{7}{6}$ is $\frac{6}{7}$, since $\frac{7}{6}\cdot\frac{6}{7}=1$.

65. The multiplicative inverse of 2 is $\frac{1}{2}$, since $2\cdot\frac{1}{2}=1$.

66. The multiplicative inverse of 5 is $\frac{1}{5}$, since $5\cdot\frac{1}{5}=1$.

67. The multiplicative inverse of $-\frac{1}{9}$ is -9, since $-\frac{1}{9}\cdot(-9)=1$.

68. The multiplicative inverse of $-\frac{3}{5}$ is $-\frac{5}{3}$ since $-\frac{3}{5}\cdot\left(-\frac{5}{3}\right)=1$.

69. $\frac{3x}{3}=\frac{3\cdot x}{3\cdot 1}=\frac{x}{1}=x$

70. $\frac{-2y}{-2}=\frac{-2\cdot y}{-2\cdot 1}=\frac{y}{1}=y$

71. $-5\left(-\frac{1}{5}y\right)=\left[-5\cdot\left(-\frac{1}{5}\right)\right]y=1y=y$

72. $7\left(\frac{1}{7}r\right)=\left(7\cdot\frac{1}{7}\right)r=1r=r$

73. $\frac{3}{5}\left(\frac{5}{3}x\right)=\left(\frac{3}{5}\cdot\frac{5}{3}\right)x=1x=x$

74. $\frac{9}{2}\left(\frac{2}{9}x\right)=\left(\frac{9}{2}\cdot\frac{2}{9}\right)x=1x=x$

75. answers may vary

76. answers may vary

77.
$$\begin{aligned} x-4&=-9\\ x-4+4&=-9+4\\ x&=-5\end{aligned}$$

78.
$$\begin{aligned} a+9&=15\\ a+9+(-9)&=15+(-9)\\ a&=6\end{aligned}$$

79. answers may vary

80. answers may vary

81.
$$\begin{aligned} 180-x-(2x+7)&=180-x-2x-7\\ &=173-3x\end{aligned}$$
The measure of the third angle is $(173 - 3x)°$.

82. $360 - x - 3x - 5x = 360 - 9x$
The measure of the fourth angle is $(360 - 9x)°$.

83. answers may vary

84. answers may vary

85.
$$\begin{aligned} 36.766+x&=-108.712\\ 36.766+x-36.766&=-108.712-36.766\\ x&=-145.478\end{aligned}$$

86.
$$\begin{aligned} -85.325&=x-97.985\\ -85.325+97.985&=x-97.985+97.985\\ 12.66&=x\end{aligned}$$

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Section 2.2 Practice Problems

1. $\frac{3}{7}x = 9$

$\frac{7}{3}\cdot\left(\frac{3}{7}x\right) = \frac{7}{3}\cdot 9$

$\left(\frac{7}{3}\cdot\frac{3}{7}\right)x = \frac{7}{3}\cdot 9$

$1x = 21$

$x = 21$

Check: $\frac{3}{7}x = 9$

$\frac{3}{7}(21) \stackrel{?}{=} 9$

$9 = 9$ True

The solution is 21.

2. $7x = 42$

$\frac{7x}{7} = \frac{42}{7}$

$1\cdot x = 6$

$x = 6$

Check: $7x = 42$

$7\cdot 6 \stackrel{?}{=} 42$

$42 = 42$ True

The solution is 6.

3. $-4x = 52$

$\frac{-4x}{-4} = \frac{52}{-4}$

$1x = -13$

$x = -13$

Check: $-4x = 52$

$-4(-13) \stackrel{?}{=} 52$

$52 = 52$ True

The solution is −13.

4. $\frac{y}{5} = 13$

$\frac{1}{5}y = 13$

$5\cdot\frac{1}{5}y = 5\cdot 13$

$1y = 65$

$y = 65$

Check: $\frac{y}{5} = 13$

$\frac{65}{5} \stackrel{?}{=} 13$

$13 = 13$ True

The solution is 65.

5. $2.6x = 13.52$

$\frac{2.6x}{2.6} = \frac{13.52}{2.6}$

$x = 5.2$

Check: $2.6x = 13.52$

$2.6(5.2) \stackrel{?}{=} 13.52$

$13.52 = 13.52$ True

The solution is 5.2.

6. $-\frac{5}{6}y = -\frac{3}{5}$

$-\frac{6}{5}\cdot -\frac{5}{6}y = -\frac{6}{5}\cdot -\frac{3}{5}$

$y = \frac{18}{25}$

Check: $-\frac{5}{6}y = -\frac{3}{5}$

$-\frac{5}{6}\left(\frac{18}{25}\right) \stackrel{?}{=} -\frac{3}{5}$

$-\frac{3}{5} = -\frac{3}{5}$ True

The solution is $\frac{18}{25}$.

7. $-x + 7 = -12$

$-x + 7 - 7 = -12 - 7$

$-x = -19$

$\frac{-x}{-1} = \frac{-19}{-1}$

$1x = 19$

$x = 19$

Check: $-x + 7 = -12$

$-19 + 7 \stackrel{?}{=} -12$

$-12 = -12$ True

The solution is 19.

8. $-7x + 2x + 3 - 20 = -2$

$-5x - 17 = -2$

$-5x - 17 + 17 = -2 + 17$

$-5x = 15$

$\frac{-5x}{-5} = \frac{15}{-5}$

$x = -3$

Check: $-7x + 2x + 3 - 20 = -2$

$-7(-3) + 2(-3) + 3 - 20 \stackrel{?}{=} -2$

$21 - 6 + 3 - 20 \stackrel{?}{=} -2$

$-2 = -2$ True

The solution is −3.

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9. $10x-4=7x+14$
$10x-4-7x=7x+14-7x$
$3x-4=14$
$3x-4+4=14+4$
$3x=18$
$\frac{3x}{3}=\frac{18}{3}$
$x=6$
Check: $10x-4=7x+14$
$10(6)-4 \stackrel{?}{=} 7(6)+14$
$60-4 \stackrel{?}{=} 42+14$
$56=56$ True
The solution is 6.

10. $4(3x-2)=-1+4$
$4(3x)-4(2)=-1+4$
$12x-8=3$
$12x-8+8=3+8$
$12x=11$
$\frac{12x}{12}=\frac{11}{12}$
$x=\frac{11}{12}$
Check: $4(3x-2)=-1+4$
$4\left(3\cdot\frac{11}{12}-2\right) \stackrel{?}{=} -1+4$
$4\left(\frac{11}{4}-2\right) \stackrel{?}{=} -1+4$
$11-8 \stackrel{?}{=} 3$
$3=3$ True
The solution is $\frac{11}{12}$.

11. a. Let x be the first integer.
Then $x + 1$ is the second integer.
Their sum is $x + (x + 1) = x + x + 1 = 2x + 1$.

b. Let x be the first even integer.
Then $x + 2$ is the second consecutive even integer.
Their sum is $x + (x + 2) = x + x + 2 = 2x + 2$.

Mental Math

1. $3a = 27$
$a = 9$

2. $9c = 54$
$c = 6$

3. $5b = 10$
$b = 2$

4. $7t = 14$
$t = 2$

5. $6x = -30$
$x = -5$

6. $8r = -64$
$r = -8$

Exercise Set 2.2

1. $-5x = -20$
$\frac{-5x}{-5}=\frac{-20}{-5}$
$x = 4$
Check: $-5x = -20$
$-5(4) \stackrel{?}{=} -20$
$-20 = -20$ True
The solution is 4.

2. $-7x = -49$
$\frac{-7x}{-7}=\frac{-49}{-7}$
$x = 7$
Check: $-7x = -49$
$-7(7) \stackrel{?}{=} -49$
$-49 = -49$ True
The solution is 7.

3. $3x = 0$
$\frac{3x}{3}=\frac{0}{3}$
$x = 0$
Check: $3x = 0$
$3 \cdot 0 \stackrel{?}{=} 0$
$0 = 0$ True
The solution is 0.

4. $2x = 0$
$\frac{2x}{2}=\frac{0}{2}$
$x = 0$
Check: $2x = 0$
$2(0) \stackrel{?}{=} 0$
$0 = 0$ True
The solution is 0.

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5. $-x = -12$

$\frac{-x}{-1} = \frac{-12}{-1}$

$x = 12$

Check: $-x = -12$

$-12 = -12$ True

The solution is 12.

6. $-y = 8$

$\frac{-y}{-1} = \frac{8}{-1}$

$y = -8$

Check: $-y = 8$

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

$8 = 8$ True

The solution is −8.

7. $\frac{2}{3}x = -8$

$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot (-8)$

$x = -12$

Check: $\frac{2}{3}x = -8$

$\frac{2}{3}(-12) \stackrel{?}{=} -8$

$-8 = -8$ True

The solution is −12.

8. $\frac{3}{4}n = -15$

$\frac{4}{3} \cdot \frac{3}{4}n = \frac{4}{3} \cdot (-15)$

$n = -20$

Check: $\frac{3}{4}n = -15$

$\frac{3}{4}(-20) \stackrel{?}{=} -15$

$-15 = -15$ True

The solution is −20.

9. $\frac{1}{6}d = \frac{1}{2}$

$6 \cdot \frac{1}{6}d = 6 \cdot \frac{1}{2}$

$d = 3$

Check: $\frac{1}{6}d = \frac{1}{2}$

$\frac{1}{6}(3) \stackrel{?}{=} \frac{1}{2}$

$\frac{1}{2} = \frac{1}{2}$ True

The solution is 3.

10. $\frac{1}{8}v = \frac{1}{4}$

$8 \cdot \frac{1}{8}v = 8 \cdot \frac{1}{4}$

$v = 2$

Check: $\frac{1}{8}v = \frac{1}{4}$

$\frac{1}{8} \cdot 2 \stackrel{?}{=} \frac{1}{4}$

$\frac{1}{4} = \frac{1}{4}$ True

The solution is 2.

11. $\frac{a}{2} = 1$

$2 \cdot \frac{a}{2} = 2 \cdot 1$

$a = 2$

Check: $\frac{a}{2} = 1$

$\frac{2}{2} \stackrel{?}{=} 1$

$1 = 1$ True

The solution is 2.

12. $\frac{d}{15} = 2$

$15 \cdot \frac{d}{15} = 15 \cdot 2$

$d = 30$

Check: $\frac{d}{15} = 2$

$\frac{30}{15} \stackrel{?}{=} 2$

$2 = 2$ True

The solution is 30.

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13. $\dfrac{k}{-7}=0$

$-7\left(\dfrac{k}{-7}\right)=-7(0)$

$k=0$

Check: $\dfrac{k}{-7}=0$

$\dfrac{0}{-7}\stackrel{?}{=}0$

$0=0$ True

The solution is 0.

14. $\dfrac{f}{-5}=0$

$-5\cdot\left(\dfrac{f}{-5}\right)=-5\cdot 0$

$f=0$

Check: $\dfrac{f}{-5}=0$

$\dfrac{0}{-5}\stackrel{?}{=}0$

$0=0$ True

The solution is 0.

15. $1.7x=10.71$

$\dfrac{1.7x}{1.7}=\dfrac{10.71}{1.7}$

$x=6.3$

Check: $1.7x=10.71$

$1.7(6.3)\stackrel{?}{=}10.71$

$10.71=10.71$ True

The solution is 6.3.

16. $8.5y=19.55$

$\dfrac{8.5y}{8.5}=\dfrac{19.55}{8.5}$

$y=2.3$

Check: $8.5y=19.55$

$8.5(2.3)\stackrel{?}{=}19.55$

$19.55=19.55$ True

The solution is 2.3.

17. $2x-4=16$

$2x-4+4=16+4$

$2x=20$

$\dfrac{2x}{2}=\dfrac{20}{2}$

$x=10$

Check: $2x-4=16$

$2(10)-4\stackrel{?}{=}16$

$20-4\stackrel{?}{=}16$

$16=16$ True

The solution is 10.

18. $3x-1=26$

$3x-1+1=26+1$

$3x=27$

$\dfrac{3x}{3}=\dfrac{27}{3}$

$x=9$

Check: $3x-1=26$

$3\cdot 9-1\stackrel{?}{=}26$

$27-1\stackrel{?}{=}26$

$26=26$ True

The solution is 9.

19. $-x+2=22$

$-x+2-2=22-2$

$-x=20$

$\dfrac{-x}{-1}=\dfrac{20}{-1}$

$x=-20$

Check: $-x+2=22$

$-(-20)+2\stackrel{?}{=}22$

$20+2\stackrel{?}{=}22$

$22=22$ True

The solution is -20.

20. $-x+4=-24$

$-x+4-4=-24-4$

$-x=-28$

$\dfrac{-x}{-1}=\dfrac{-28}{-1}$

$x=28$

Check: $-x+4=-24$

$-28+4\stackrel{?}{=}-24$

$-24=-24$ True

The solution is 28.

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21. $6a+3=3$

$6a+3-3=3-3$

$6a=0$

$\frac{6a}{6}=\frac{0}{6}$

$a=0$

Check: $6a+3=3$

$6(0)+3 \stackrel{?}{=} 3$

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

$3=3$ True

The solution is 0.

22. $8t+5=5$

$8t+5-5=5-5$

$8t=0$

$\frac{8t}{8}=\frac{0}{8}$

$t=0$

Check: $8t+5=5$

$8\cdot 0+5 \stackrel{?}{=} 5$

$0+5 \stackrel{?}{=} 5$

$5=5$ True

The solution is 0.

23. $\frac{x}{3}-2=-5$

$\frac{x}{3}-2+2=-5+2$

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

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

$x=-9$

Check: $\frac{x}{3}-2=-5$

$\frac{-9}{3}-2 \stackrel{?}{=} -5$

$-3-2 \stackrel{?}{=} -5$

$-5=-5$ True

The solution is –9.

24. $\frac{b}{4}-1=-7$

$\frac{b}{4}-1+1=-7+1$

$\frac{b}{4}=-6$

$4\cdot\frac{b}{4}=4\cdot(-6)$

$b=-24$

Check: $\frac{b}{4}-1=-7$

$\frac{-24}{4}-1 \stackrel{?}{=} -7$

$-6-1 \stackrel{?}{=} -7$

$-7=-7$ True

The solution is –24.

25. $6z-8-z+3=0$

$5z-5=0$

$5z-5+5=0+5$

$5z=5$

$\frac{5z}{5}=\frac{5}{5}$

$z=1$

Check: $6z-8-z+3=0$

$6(1)-8-1+3 \stackrel{?}{=} 0$

$6-8-1+3 \stackrel{?}{=} 0$

$0=0$ True

The solution is 1.

26. $4a+1+a-11=0$

$5a-10=0$

$5a-10+10=0+10$

$5a=10$

$\frac{5a}{5}=\frac{10}{5}$

$a=2$

Check: $4a+1+a-11=0$

$4\cdot 2+1+2-11 \stackrel{?}{=} 0$

$8+1+2-11 \stackrel{?}{=} 0$

$0=0$ True

The solution is 2.

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27. $1 = 0.4x - 0.6x - 5$

$1 = -0.2x - 5$

$1 + 5 = -0.2x - 5 + 5$

$6 = -0.2x$

$\frac{6}{-0.2} = \frac{-0.2x}{-0.2}$

$-30 = x$

Check: $1 = 0.4x - 0.6x - 5$

$1 \stackrel{?}{=} 0.4(-30) - 0.6(-30) - 5$

$1 \stackrel{?}{=} -12 + 18 - 5$

$1 = 1$ True

The solution is −30.

28. $19 = 0.4x - 0.9x - 6$

$19 = -0.5x - 6$

$19 + 6 = -0.5x - 6 + 6$

$25 = -0.5x$

$\frac{25}{-0.5} = \frac{-0.5x}{-0.5}$

$-50 = x$

Check: $19 = 0.4x - 0.9x - 6$

$19 \stackrel{?}{=} 0.4(-50) - 0.9(-50) - 6$

$19 \stackrel{?}{=} -20 + 45 - 6$

$19 = 19$ True

The solution is −50.

29. $\frac{2}{3}y - 11 = -9$

$\frac{2}{3}y - 11 + 11 = -9 + 11$

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

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

$y = 3$

Check: $\frac{2}{3}y - 11 = -9$

$\frac{2}{3}(3) - 11 \stackrel{?}{=} -9$

$2 - 11 \stackrel{?}{=} -9$

$-9 = -9$ True

The solution is 3.

30. $\frac{3}{5}x - 14 = -8$

$\frac{3}{5}x - 14 + 14 = -8 + 14$

$\frac{3}{5}x = 6$

$\frac{5}{3} \cdot \frac{3}{5}x = \frac{5}{3} \cdot 6$

$x = 10$

Check: $\frac{3}{5}x - 14 = -8$

$\frac{3}{5} \cdot 10 - 14 \stackrel{?}{=} -8$

$6 - 14 \stackrel{?}{=} -8$

$-8 = -8$ True

The solution is 10.

31. $\frac{3}{4}t - \frac{1}{2} = \frac{1}{3}$

$\frac{3}{4}t - \frac{1}{2} + \frac{1}{2} = \frac{1}{3} + \frac{1}{2}$

$\frac{3}{4}t = \frac{2}{6} + \frac{3}{6}$

$\frac{3}{4}t = \frac{5}{6}$

$\frac{4}{3} \cdot \frac{3}{4}t = \frac{4}{3} \cdot \frac{5}{6}$

$t = \frac{10}{9}$

Check: $\frac{3}{4}t - \frac{1}{2} = \frac{1}{3}$

$\frac{3}{4} \cdot \frac{10}{9} - \frac{1}{2} \stackrel{?}{=} \frac{1}{3}$

$\frac{5}{6} - \frac{3}{6} \stackrel{?}{=} \frac{1}{3}$

$\frac{2}{6} \stackrel{?}{=} \frac{1}{3}$

$\frac{1}{3} = \frac{1}{3}$ True

The solution is $\frac{10}{9}$.

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32. $\frac{2}{7}z-\frac{1}{5}=\frac{1}{2}$

$\frac{2}{7}z-\frac{1}{5}+\frac{1}{5}=\frac{1}{2}+\frac{1}{5}$

$\frac{2}{7}z=\frac{5}{10}+\frac{2}{10}$

$\frac{2}{7}z=\frac{7}{10}$

$\frac{7}{2}\cdot\frac{2}{7}z=\frac{7}{2}\cdot\frac{7}{10}$

$z=\frac{49}{20}$

Check: $\frac{2}{7}z-\frac{1}{5}=\frac{1}{2}$

$\frac{2}{7}\left(\frac{49}{20}\right)-\frac{1}{5}\stackrel{?}{=}\frac{1}{2}$

$\frac{7}{10}-\frac{1}{5}\stackrel{?}{=}\frac{1}{2}$

$\frac{7}{10}-\frac{2}{10}\stackrel{?}{=}\frac{1}{2}$

$\frac{5}{10}\stackrel{?}{=}\frac{1}{2}$

$\frac{1}{2}=\frac{1}{2}$ True

The solution is $\frac{49}{20}$.

33. $8x+20=6x+18$

$8x+20-6x=6x+18-6x$

$2x+20=18$

$2x+20-20=18-20$

$2x=-2$

$\frac{2x}{2}=\frac{-2}{2}$

$x=-1$

34. $11x+13=9x+9$

$11x+13-9x=9x+9-9x$

$2x+13=9$

$2x+13-13=9-13$

$2x=-4$

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

$x=-2$

35. $3(2x+5)=-18+9$

$6x+15=-18+9$

$6x+15=-9$

$6x+15-15=-9-15$

$6x=-24$

$\frac{6x}{6}=\frac{-24}{6}$

$x=-4$

36. $2(4x+1)=-12+6$

$8x+2=-12+6$

$8x+2=-6$

$8x+2-2=-6-2$

$8x=-8$

$\frac{8x}{8}=\frac{-8}{8}$

$x=-1$

37. $2x-5=20x+4$

$2x-5-20x=20x+4-20x$

$-18x-5=4$

$-18x-5+5=4+5$

$-18x=9$

$\frac{-18x}{-18}=\frac{9}{-18}$

$x=-\frac{1}{2}$

38. $6x-4=-2x-10$

$6x-4+2x=-2x-10+2x$

$8x-4=-10$

$8x-4+4=-10+4$

$8x=-6$

$\frac{8x}{8}=\frac{-6}{8}$

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

39. $2+14=-4(3x-4)$

$2+14=-12x+16$

$16=-12x+16$

$16-16=-12x+16-16$

$0=-12x$

$\frac{0}{-12}=\frac{-12x}{-12}$

$0=x$

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40.
$$\begin{aligned} 8+4 &= -6(5x-2) \\ 8+4 &= -30x+12 \\ 12 &= -30x+12 \\ 12-12 &= -30x+12-12 \\ 0 &= -30x \\ \frac{0}{-30} &= \frac{-30x}{-30} \\ 0 &= x \end{aligned}$$

41.
$$\begin{aligned} -6y-3 &= -5y-7 \\ -6y-3+6y &= -5y-7+6y \\ -3 &= y-7 \\ -3+7 &= y-7+7 \\ 4 &= y \end{aligned}$$

42.
$$\begin{aligned} -17z-4 &= -16z-20 \\ 17z-17z-4 &= 17z-16z-20 \\ -4 &= z-20 \\ -4+20 &= z-20+20 \\ 16 &= z \end{aligned}$$

43.
$$\begin{aligned} \frac{1}{2}(2x-1) &= -\frac{1}{7}-\frac{3}{7} \\ x-\frac{1}{2} &= -\frac{4}{7} \\ x-\frac{1}{2}+\frac{1}{2} &= -\frac{4}{7}+\frac{1}{2} \\ x &= -\frac{8}{14}+\frac{7}{14} \\ x &= -\frac{1}{14} \end{aligned}$$

44.
$$\begin{aligned} \frac{1}{3}(3x-1) &= -\frac{1}{10}-\frac{2}{10} \\ x-\frac{1}{3} &= -\frac{3}{10} \\ x-\frac{1}{3}+\frac{1}{3} &= -\frac{3}{10}+\frac{1}{3} \\ x &= -\frac{9}{30}+\frac{10}{30} \\ x &= \frac{1}{30} \end{aligned}$$

45.
$$\begin{aligned} -10z-0.5 &= -20z+1.6 \\ -10z-0.5+20z &= -20z+1.6+20z \\ 10z-0.5 &= 1.6 \\ 10z-0.5+0.5 &= 1.6+0.5 \\ 10z &= 2.1 \\ \frac{10z}{10} &= \frac{2.1}{10} \\ z &= 0.21 \end{aligned}$$

46.
$$\begin{aligned} -14y-1.8 &= -24y+3.9 \\ -14y-1.8+14y &= -24y+3.9+14y \\ -1.8 &= -10y+3.9 \\ -1.8-3.9 &= -10y+3.9-3.9 \\ -5.7 &= -10y \\ \frac{-5.7}{-10} &= \frac{-10y}{-10} \\ 0.57 &= y \end{aligned}$$

47.
$$\begin{aligned} -4x+20 &= 4x-20 \\ -4x-4x+20 &= -4x+4x-20 \\ -8x+20 &= -20 \\ -8x+20-20 &= -20-20 \\ -8x &= -40 \\ \frac{-8x}{-8} &= \frac{-40}{-8} \\ x &= 5 \end{aligned}$$

48.
$$\begin{aligned} -3x+15 &= 3x-15 \\ -3x-3x+15 &= -3x+3x-15 \\ -6x+15 &= -15 \\ -6x+15-15 &= -15-15 \\ -6x &= -30 \\ \frac{-6x}{-6} &= \frac{-30}{-6} \\ x &= 5 \end{aligned}$$

49.
$$\begin{aligned} 42 &= 7x \\ \frac{42}{7} &= \frac{7x}{7} \\ 6 &= x \end{aligned}$$

50.
$$\begin{aligned} 81 &= 3x \\ \frac{81}{3} &= \frac{3x}{3} \\ 27 &= x \end{aligned}$$

51.
$$\begin{aligned} 4.4 &= -0.8x \\ \frac{4.4}{-0.8} &= \frac{-0.8x}{-0.8} \\ -5.5 &= x \end{aligned}$$

52.
$$\begin{aligned} 6.3 &= -0.6x \\ \frac{6.3}{-0.6} &= \frac{-0.6x}{-0.6} \\ -10.5 &= x \end{aligned}$$

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53.
$$\begin{aligned} 6x+10&=-20\\ 6x+10-10&=-20-10\\ 6x&=-30\\ \frac{6x}{6}&=\frac{-30}{6}\\ x&=-5 \end{aligned}$$

54.
$$\begin{aligned} 10y+15&=-5\\ 10y+15-15&=-5-15\\ 10y&=-20\\ \frac{10y}{10}&=\frac{-20}{10}\\ y&=-2 \end{aligned}$$

55.
$$\begin{aligned} 5-0.3k&=5\\ -5+5-0.3k&=-5+5\\ -0.3k&=0\\ \frac{-0.3k}{-0.3}&=\frac{0}{-0.3}\\ k&=0 \end{aligned}$$

56.
$$\begin{aligned} 2-0.4p&=2\\ -2+2-0.4p&=-2+2\\ -0.4p&=0\\ \frac{-0.4p}{-0.4}&=\frac{0}{-0.4}\\ p&=0 \end{aligned}$$

57.
$$\begin{aligned} 13x-5&=11x-11\\ 13x-5+5&=11x-11+5\\ 13x&=11x-6\\ 13x-11x&=11x-11x-6\\ 2x&=-6\\ \frac{2x}{2}&=\frac{-6}{2}\\ x&=-3 \end{aligned}$$

58.
$$\begin{aligned} 20x-20&=16x-40\\ 20x-20+20&=16x-40+20\\ 20x&=16x-20\\ 20x-16x&=16x-20-16x\\ 4x&=-20\\ \frac{4x}{4}&=\frac{-20}{4}\\ x&=-5 \end{aligned}$$

59.
$$\begin{aligned} 9(3x+1)&=4x-5x\\ 27x+9&=-x\\ -27x+27x+9&=-27x-x\\ 9&=-28x\\ \frac{9}{-28}&=\frac{-28x}{-28}\\ -\frac{9}{28}&=x \end{aligned}$$

60.
$$\begin{aligned} 7(2x+1)&=18x-19x\\ 14x+7&=-x\\ -14x+14x+7&=-14x-x\\ 7&=-15x\\ \frac{7}{-15}&=\frac{-15x}{-15}\\ -\frac{7}{15}&=x \end{aligned}$$

61.
$$\begin{aligned} -\frac{3}{7}p&=-2\\ -\frac{7}{3}\left(-\frac{3}{7}p\right)&=-\frac{7}{3}(-2)\\ p&=\frac{14}{3} \end{aligned}$$

62.
$$\begin{aligned} -\frac{4}{5}r&=-5\\ -\frac{5}{4}\cdot\left(-\frac{4}{5}r\right)&=-\frac{5}{4}\cdot(-5)\\ r&=\frac{25}{4} \end{aligned}$$

63.
$$\begin{aligned} -\frac{4}{3}x&=12\\ -\frac{3}{4}\cdot\left(-\frac{4}{3}x\right)&=-\frac{3}{4}\cdot 12\\ x&=-9 \end{aligned}$$

64.
$$\begin{aligned} -\frac{10}{3}x&=30\\ -\frac{3}{10}\cdot\left(-\frac{10}{3}x\right)&=-\frac{3}{10}\cdot 30\\ x&=-9 \end{aligned}$$

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65.
$$\begin{aligned} -2x-\frac{1}{2}&=\frac{7}{2}\\ -2x-\frac{1}{2}+\frac{1}{2}&=\frac{7}{2}+\frac{1}{2}\\ -2x&=\frac{8}{2}\\ -2x&=4\\ \frac{-2x}{-2}&=\frac{4}{-2}\\ x&=-2 \end{aligned}$$

66.
$$\begin{aligned} -3n-\frac{1}{3}&=\frac{8}{3}\\ -3n-\frac{1}{3}+\frac{1}{3}&=\frac{8}{3}+\frac{1}{3}\\ -3n&=\frac{9}{3}\\ -3n&=3\\ \frac{-3n}{-3}&=\frac{3}{-3}\\ n&=-1 \end{aligned}$$

67.
$$\begin{aligned} 10&=2x-1\\ 10+1&=2x-1+1\\ 11&=2x\\ \frac{11}{2}&=\frac{2x}{2}\\ \frac{11}{2}&=x \end{aligned}$$

68.
$$\begin{aligned} 12&=3j-4\\ 12+4&=3j-4+4\\ 16&=3j\\ \frac{16}{3}&=\frac{3j}{3}\\ \frac{16}{3}&=j \end{aligned}$$

69.
$$\begin{aligned} 10-3x-6-9x&=7\\ 4-12x&=7\\ 4-12x-4&=7-4\\ -12x&=3\\ \frac{-12x}{-12}&=\frac{3}{-12}\\ x&=-\frac{1}{4} \end{aligned}$$

70.
$$\begin{aligned} 12x+30+8x-6&=10\\ 20x+24&=10\\ 20x+24-24&=10-24\\ 20x&=-14\\ \frac{20x}{20}&=\frac{-14}{20}\\ x&=-\frac{14}{20}\\ x&=-\frac{7}{10} \end{aligned}$$

71.
$$\begin{aligned} z-5z&=7z-9-z\\ -4z&=6z-9\\ -4z-6z&=6z-9-6z\\ -10z&=-9\\ \frac{-10z}{-10}&=\frac{-9}{-10}\\ z&=\frac{9}{10} \end{aligned}$$

72.
$$\begin{aligned} t-6t&=-13+t-3t\\ -5t&=-13-2t\\ -5t+2t&=-13-2t+2t\\ -3t&=-13\\ \frac{-3t}{-3}&=\frac{-13}{-3}\\ t&=\frac{13}{3} \end{aligned}$$

73.
$$\begin{aligned} -x-\frac{4}{5}&=x+\frac{1}{2}+\frac{2}{5}\\ -x-\frac{4}{5}&=x+\frac{5}{10}+\frac{4}{10}\\ -x-\frac{4}{5}&=x+\frac{9}{10}\\ -x-\frac{4}{5}+x&=x+\frac{9}{10}+x\\ -\frac{4}{5}&=2x+\frac{9}{10}\\ -\frac{4}{5}-\frac{9}{10}&=2x\\ -\frac{8}{10}-\frac{9}{10}&=2x\\ -\frac{17}{10}&=2x\\ \frac{1}{2}\left(-\frac{17}{10}\right)&=\frac{1}{2}(2x)\\ -\frac{17}{20}&=x \end{aligned}$$

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74.
$$\begin{aligned} x+\frac{3}{7} &= -x+\frac{1}{3}+\frac{4}{7} \\ x+\frac{3}{7} &= -x+\frac{7}{21}+\frac{12}{21} \\ x+\frac{3}{7} &= -x+\frac{19}{21} \\ x+\frac{3}{7}-\frac{3}{7} &= -x+\frac{19}{21}-\frac{3}{7} \\ x &= -x+\frac{19}{21}-\frac{9}{21} \\ x &= -x+\frac{10}{21} \\ x+x &= -x+\frac{10}{21}+x \\ 2x &= \frac{10}{21} \\ \frac{1}{2}\cdot 2x &= \frac{1}{2}\cdot\frac{10}{21} \\ x &= \frac{5}{21} \end{aligned}$$

75.
$$\begin{aligned} -15+37 &= -2(x+5) \\ 22 &= -2x-10 \\ 22+10 &= -2x-10+10 \\ 32 &= -2x \\ \frac{32}{-2} &= \frac{-2x}{-2} \\ -16 &= x \end{aligned}$$

76.
$$\begin{aligned} -19+74 &= -5(x+3) \\ 55 &= -5x-15 \\ 55+15 &= -5x-15+15 \\ 70 &= -5x \\ \frac{70}{-5} &= \frac{-5x}{-5} \\ -14 &= x \end{aligned}$$

77. If x represents the first of two consecutive odd integers, then $x + 2$ represents the second. Thus, the sum is represented by $x + x + 2 = 2x + 2$.

78. If x represents the first of three consecutive even integers, then $x + 2$ and $x + 4$ represent the second and third even integers, respectively. Thus, the sum is represented by $x + x + 2 + x + 4 = 3x + 6$.

79. If x represents the first integer, then $x + 1$, $x + 2$, and $x + 3$ represent the second, third, and fourth integers, respectively. The sum of the first and third integers is represented by $x + x + 2 = 2x + 2$.

80. If x represents the first integer, then $x + 1$ represents the second consecutive integer. The sum of 20 and the second integer is represented by $20 + x + 1 = x + 21$.

81. If x represents the number on the first door, then the next four door numbers are represented by $x + 2$, $x + 4$, $x + 6$, and $x + 8$.
The sum of the numbers is
$x + x + 2 + x + 4 + x + 6 + x + 8 = 5x + 20$.

82. If x represents the first odd integer, then $x + 2$ represents the next consecutive odd integer. The sum of the lengths is
$x + x + 2 + x + x + 2 = 4x + 4$.

83.
$$\begin{aligned} 5x+2(x-6) &= 5x+2\cdot x+2\cdot(-6) \\ &= 5x+2x-12 \\ &= 7x-12 \end{aligned}$$

84.
$$\begin{aligned} -7y+2y-3(y+1) &= -7y+2y-3\cdot y-3\cdot 1 \\ &= -7y+2y-3y-3 \\ &= -8y-3 \end{aligned}$$

85.
$$\begin{aligned} 6(2z+4)+20 &= 6\cdot 2z+6\cdot 4+20 \\ &= 12z+24+20 \\ &= 12z+44 \end{aligned}$$

86.
$$\begin{aligned} -(3a-3)+2a-6 &= -3a+3+2a-6 \\ &= -3a+2a+3-6 \\ &= -a-3 \end{aligned}$$

87. $-(x-1)+x = -x+1+x = -x+x+1 = 0+1 = 1$

88.
$$\begin{aligned} 8(z-6)+7z-1 &= 8z-48+7z-1 \\ &= 8z+7z-48-1 \\ &= 15z-49 \end{aligned}$$

89. If the solution is −8, then replacing x by −8 results in a true statement.
$6x = 6(-8) = -48$
The missing number is −48.

90. If the solution is $\frac{1}{2}$, then replacing x by $\frac{1}{2}$ results in a true statement.
$$\begin{aligned} \_\_\cdot\frac{1}{2} &= 10 \\ \_\_\cdot\frac{1}{2}\cdot 2 &= 10\cdot 2 \\ \_\_ &= 20 \end{aligned}$$
The missing number is 20.

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91. answers may vary

92. answers may vary

93. answers may vary

94. answers may vary

95.
$$0.07x - 5.06 = -4.92$$
$$0.07x - 5.06 + 5.06 = -4.92 + 5.06$$
$$0.07x = 0.14$$
$$\frac{0.07x}{0.07} = \frac{0.14}{0.07}$$
$$x = 2$$

96.
$$0.06y + 2.63 = 2.5562$$
$$0.06y + 2.63 - 2.63 = 2.5562 - 2.63$$
$$0.06y = -0.0738$$
$$\frac{0.06y}{0.06} = \frac{-0.0738}{0.06}$$
$$y = -1.23$$

Section 2.3 Practice Problems

1.
$$5(3x-1)+2 = 12x+6$$
$$15x-5+2 = 12x+6$$
$$15x-3 = 12x+6$$
$$15x-3-12x = 12x+6-12x$$
$$3x-3 = 6$$
$$3x-3+3 = 6+3$$
$$3x = 9$$
$$\frac{3x}{3} = \frac{9}{3}$$
$$x = 3$$

Check:
$$5(3x-1)+2 = 12x+6$$
$$5[3(3)-1]+2 \stackrel{?}{=} 12(3)+6$$
$$5(9-1)+2 \stackrel{?}{=} 36+6$$
$$5(8)+2 \stackrel{?}{=} 42$$
$$40+2 \stackrel{?}{=} 42$$
$$42 = 42 \quad \text{True}$$

The solution is 3.

2.
$$9(5-x) = -3x$$
$$45-9x = -3x$$
$$45-9x+9x = -3x+9x$$
$$45 = 6x$$
$$\frac{45}{6} = \frac{6x}{6}$$
$$\frac{15}{2} = x$$

Check:
$$9(5-x) = -3x$$
$$9\left(5-\frac{15}{2}\right) \stackrel{?}{=} -3\left(\frac{15}{2}\right)$$
$$9\left(\frac{10}{2}-\frac{15}{2}\right) \stackrel{?}{=} -\frac{45}{2}$$
$$9\left(-\frac{5}{2}\right) \stackrel{?}{=} -\frac{45}{2}$$
$$-\frac{45}{2} = -\frac{45}{2} \quad \text{True}$$

The solution is $\frac{15}{2}$.

3.
$$\frac{5}{2}x-1 = \frac{3}{2}x-4$$
$$2\left(\frac{5}{2}x-1\right) = 2\left(\frac{3}{2}x-4\right)$$
$$5x-2 = 3x-8$$
$$5x-2-3x = 3x-8-3x$$
$$2x-2 = -8$$
$$2x-2+2 = -8+2$$
$$2x = -6$$
$$\frac{2x}{2} = \frac{-6}{2}$$
$$x = -3$$

Check:
$$\frac{5}{2}x-1 = \frac{3}{2}x-4$$
$$\frac{5}{2}(-3)-1 \stackrel{?}{=} \frac{3}{2}(-3)-4$$
$$-\frac{15}{2}-1 \stackrel{?}{=} -\frac{9}{2}-4$$
$$-\frac{15}{2}-\frac{2}{2} \stackrel{?}{=} -\frac{9}{2}-\frac{8}{2}$$
$$-\frac{17}{2} = -\frac{17}{2} \quad \text{True}$$

The solution is –3.

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4. $\dfrac{3(x-2)}{5} = 3x+6$

$5\cdot\dfrac{3(x-2)}{5} = 5(3x+6)$

$3(x-2) = 5(3x+6)$

$3x-6 = 15x+30$

$3x-6-3x = 15x+30-3x$

$-6 = 12x+30$

$-6-30 = 12x+30-30$

$-36 = 12x$

$\dfrac{-36}{12} = \dfrac{12x}{12}$

$-3 = x$

Check: $\dfrac{3(x-2)}{5} = 3x+6$

$\dfrac{3(-3-2)}{5} \stackrel{?}{=} 3(-3)+6$

$\dfrac{3(-5)}{5} \stackrel{?}{=} -9+6$

$\dfrac{-15}{5} \stackrel{?}{=} -3$

$-3 = -3$

The solution is –3.

5. $0.06x-0.10(x-2) = -0.02(8)$

$100[0.06x-0.10(x-2)] = 100[-0.02(8)]$

$6x-10(x-2) = -2(8)$

$6x-10x+20 = -16$

$-4x+20 = -16$

$-4x+20-20 = -16-20$

$-4x = -36$

$\dfrac{-4x}{-4} = \dfrac{-36}{-4}$

$x = 9$

To check, replace x with 9 in the original equation. The solution is 9.

6. $5(2-x)+8x = 3(x-6)$

$10-5x+8x = 3x-18$

$10+3x = 3x-18$

$10+3x-3x = 3x-18-3x$

$10 = -18$

Since the statement $10 = -18$ is false, the equation has no solution.

7. $-6(2x+1)-14 = -10(x+2)-2x$

$-12x-6-14 = -10x-20-2x$

$-12x-20 = -12x-20$

$12x-12x-20 = 12x-12x-20$

$-20 = -20$

Since $-20 = -20$ is a true statement, every real number is a solution.

Calculator Explorations

1. $2x = 48 + 6x$

2 × –12 = Display: –24

48 + 6 × –12 = Display: –24

Since the left side equals the right side, $x = -12$ is a solution.

2. $-3x - 7 = 3x - 1$

–3 × –1 – 7 = Display: –4

3 × –1 – 1 = Display: –4

Since the left side equals the right side, $x = -1$ is a solution.

3. $5x - 2.6 = 2(x + 0.8)$

5 × 4.4 – 2.6 = Display: 19.4

2 (4.4 + 0.8) = Display: 10.4

Since the left side does not equal the right side, $x = 4.4$ is not a solution.

4. $-1.6x - 3.9 = -6.9x - 25.6$

–1.6 × 5 – 3.9 = Display: –11.9

–6.9 × 5 – 25.6 = Display: –60.1

Since the left side does not equal the right side, $x = 5$ is not a solution.

5. $\dfrac{564x}{4} = 200x - 11(649)$

(564 × 121) ÷ 4 = Display: 17061

200 × 121 – 11 × 649 = Display: 17061

Since the left side equals the right side, $x = 121$ is a solution.

6. $20(x - 39) = 5x - 432$

20 (23.2 – 39) = Display: –316

5 × 23.2 – 432 = Display: –316

Since the left side equals the right side, $x = 23.2$ is a solution.

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Exercise Set 2.3

1.
$$\begin{aligned} -4y+10 &= -2(3y+1) \\ -4y+10 &= -6y-2 \\ -4y+10-10 &= -6y-2-10 \\ -4y &= -6y-12 \\ -4y+6y &= -6y-12+6y \\ 2y &= -12 \\ \frac{2y}{2} &= \frac{-12}{2} \\ y &= -6 \end{aligned}$$

2.
$$\begin{aligned} -3x+1 &= -2(4x+2) \\ -3x+1 &= -8x-4 \\ -3x+1+8x &= -8x-4+8x \\ 5x+1 &= -4 \\ 5x+1-1 &= -4-1 \\ 5x &= -5 \\ \frac{5x}{5} &= \frac{-5}{5} \\ x &= -1 \end{aligned}$$

3.
$$\begin{aligned} 15x-8 &= 10+9x \\ 15x-8-9x &= 10+9x-9x \\ 6x-8 &= 10 \\ 6x-8+8 &= 10+8 \\ 6x &= 18 \\ \frac{6x}{6} &= \frac{18}{6} \\ x &= 3 \end{aligned}$$

4.
$$\begin{aligned} 15x-5 &= 7+12x \\ 15x-5-12x &= 7+12x-12x \\ 3x-5 &= 7 \\ 3x-5+5 &= 7+5 \\ 3x &= 12 \\ \frac{3x}{3} &= \frac{12}{3} \\ x &= 4 \end{aligned}$$

5.
$$\begin{aligned} -2(3x-4) &= 2x \\ -6x+8 &= 2x \\ -6x+8+6x &= 2x+6x \\ 8 &= 8x \\ \frac{8}{8} &= \frac{8x}{8} \\ 1 &= x \end{aligned}$$

6.
$$\begin{aligned} -(5x-10) &= 5x \\ -5x+10 &= 5x \\ 5x-5x+10 &= 5x+5x \\ 10 &= 10x \\ \frac{10}{10} &= \frac{10x}{10} \\ 1 &= x \end{aligned}$$

7.
$$\begin{aligned} 5(2x-1)-2(3x) &= 1 \\ 10x-5-6x &= 1 \\ -5+4x &= 1 \\ 5-5+4x &= 5+1 \\ 4x &= 6 \\ \frac{4x}{4} &= \frac{6}{4} \\ x &= \frac{3}{2} \end{aligned}$$

8.
$$\begin{aligned} 3(2-5x)+4(6x) &= 12 \\ 6-15x+24x &= 12 \\ 6+9x &= 12 \\ 6+9x-6 &= 12-6 \\ 9x &= 6 \\ \frac{9x}{9} &= \frac{6}{9} \\ x &= \frac{2}{3} \end{aligned}$$

9.
$$\begin{aligned} -6(x-3)-26 &= -8 \\ -6x+18-26 &= -8 \\ -6x-8 &= -8 \\ -6x-8+8 &= -8+8 \\ -6x &= 0 \\ \frac{-6x}{-6} &= \frac{0}{-6} \\ x &= 0 \end{aligned}$$

10.
$$\begin{aligned} -4(n-4)-23 &= -7 \\ -4n+16-23 &= -7 \\ -4n-7 &= -7 \\ -4n-7+7 &= -7+7 \\ -4n &= 0 \\ \frac{-4n}{-4} &= \frac{0}{-4} \\ n &= 0 \end{aligned}$$

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11. $8-2(a+1)=9+a$
$8-2a-2=9+a$
$-2a+6=9+a$
$-2a+6-a=9+a-a$
$-3a+6=9$
$-3a+6-6=9-6$
$-3a=3$
$\frac{-3a}{-3}=\frac{3}{-3}$
$a=-1$

12. $5-6(2+b)=b-14$
$5-12-6b=b-14$
$-7-6b=b-14$
$-7-6b+6b=b-14+6b$
$-7=7b-14$
$-7+14=7b-14+14$
$7=7b$
$\frac{7}{7}=\frac{7b}{7}$
$1=b$

13. $4x+3=-3+2x+14$
$4x+3=11+2x$
$4x+3-2x=11+2x-2x$
$2x+3=11$
$2x+3-3=11-3$
$2x=8$
$\frac{2x}{2}=\frac{8}{2}$
$x=4$

14. $6y-8=-6+3y+13$
$6y-8=7+3y$
$6y-8-3y=7+3y-3y$
$3y-8=7$
$3y-8+8=7+8$
$3y=15$
$\frac{3y}{3}=\frac{15}{3}$
$y=5$

15. $-2y-10=5y+18$
$-2y-10+10=5y+18+10$
$-2y=5y+28$
$-2y-5y=5y+28-5y$
$-7y=28$
$\frac{-7y}{-7}=\frac{28}{-7}$
$y=-4$

16. $-7n+5=8n-10$
$-7n+5+7n=8n-10+7n$
$5=15n-10$
$5+10=15n-10+10$
$15=15n$
$\frac{15}{15}=\frac{15n}{15}$
$1=n$

17. $\frac{2}{3}x+\frac{4}{3}=-\frac{2}{3}$
$3\left(\frac{2}{3}x+\frac{4}{3}\right)=3\left(-\frac{2}{3}\right)$
$2x+4=-2$
$2x+4-4=-2-4$
$2x=-6$
$\frac{2x}{2}=\frac{-6}{2}$
$x=-3$

18. $\frac{4}{5}x-\frac{8}{5}=-\frac{16}{5}$
$5\left(\frac{4}{5}x-\frac{8}{5}\right)=5\left(-\frac{16}{5}\right)$
$4x-8=-16$
$4x-8+8=-16+8$
$4x=-8$
$\frac{4x}{4}=\frac{-8}{4}$
$x=-2$

19. $\frac{3}{4}x-\frac{1}{2}=1$
$4\left(\frac{3}{4}x-\frac{1}{2}\right)=4(1)$
$3x-2=4$
$3x-2+2=4+2$
$3x=6$
$\frac{3x}{3}=\frac{6}{3}$
$x=2$

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20.
$$\frac{2}{9}x-\frac{1}{3}=1$$
$$9\left(\frac{2}{9}x-\frac{1}{3}\right)=9(1)$$
$$2x-3=9$$
$$2x-3+3=9+3$$
$$2x=12$$
$$\frac{2x}{2}=\frac{12}{2}$$
$$x=6$$

21.
$$0.50x+0.15(70)=35.5$$
$$50x+15(70)=3550$$
$$50x+1050=3550$$
$$50x+1050-1050=3550-1050$$
$$50x=2500$$
$$\frac{50x}{50}=\frac{2500}{50}$$
$$x=50$$

22.
$$0.40x+0.06(30)=9.8$$
$$40x+6(30)=980$$
$$40x+180=980$$
$$40x+180-180=980-180$$
$$40x=800$$
$$\frac{40x}{40}=\frac{800}{40}$$
$$x=20$$

23.
$$\frac{2(x+1)}{4}=3x-2$$
$$4\left[\frac{2(x+1)}{4}\right]=4(3x-2)$$
$$2(x+1)=4(3x-2)$$
$$2x+2=12x-8$$
$$2x+2+8=12x-8+8$$
$$2x+10=12x$$
$$2x+10-2x=12x-2x$$
$$10=10x$$
$$\frac{10}{10}=\frac{10x}{10}$$
$$1=x$$

24.
$$\frac{3(y+3)}{5}=2y+6$$
$$5\left[\frac{3(y+3)}{5}\right]=5(2y+6)$$
$$3(y+3)=5(2y+6)$$
$$3y+9=10y+30$$
$$3y+9-30=10y+30-30$$
$$3y-21=10y$$
$$3y-21-3y=10y-3y$$
$$-21=7y$$
$$\frac{-21}{7}=\frac{7y}{7}$$
$$-3=y$$

25.
$$x+\frac{7}{6}=2x-\frac{7}{6}$$
$$6\left(x+\frac{7}{6}\right)=6\left(2x-\frac{7}{6}\right)$$
$$6x+7=12x-7$$
$$6x+7+7=12x-7+7$$
$$6x+14=12x$$
$$6x+14-6x=12x-6x$$
$$14=6x$$
$$\frac{14}{6}=\frac{6x}{6}$$
$$\frac{7}{3}=x$$

26.
$$\frac{5}{2}x-1=x+\frac{1}{4}$$
$$4\left(\frac{5}{2}x-1\right)=4\left(x+\frac{1}{4}\right)$$
$$10x-4=4x+1$$
$$10x-4-4x=4x+1-4x$$
$$6x-4=1$$
$$6x-4+4=1+4$$
$$6x=5$$
$$\frac{6x}{6}=\frac{5}{6}$$
$$x=\frac{5}{6}$$

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27. $0.12(y-6)+0.06y=0.08y-0.7$
$12(y-6)+6y=8y-70$
$12y-72+6y=8y-70$
$18y-72=8y-70$
$18y-72-8y=8y-70-8y$
$10y-72=-70$
$10y-72+72=-70+72$
$10y=2$
$\frac{10y}{10}=\frac{2}{10}$
$y=0.2$

28. $0.60(z-300)+0.05z=0.70z-205$
$60(z-300)+5z=70z-20,500$
$60z-18,000+5z=70z-20,500$
$65z-18,000=70z-20,500$
$65z-18,000-65z=70z-20,500-65z$
$-18,000=5z-20,500$
$-18,000+20,500=5z-20,500+20,500$
$2500=5z$
$\frac{2500}{5}=\frac{5z}{5}$
$500=z$

29. $4(3x+2)=12x+8$
$12x+8=12x+8$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

30. $14x+7=7(2x+1)$
$14x+7=14x+7$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

31. $\frac{x}{4}+1=\frac{x}{4}$
$\frac{x}{4}+1-\frac{x}{4}=\frac{x}{4}-\frac{x}{4}$
$1=0$
Since the statement 1 = 0 is false, the equation has no solution.

32. $\frac{x}{3}-2=\frac{x}{3}$
$\frac{x}{3}-2-\frac{x}{3}=\frac{x}{3}-\frac{x}{3}$
$-2=0$
Since the statement −2 = 0 is false, the equation has no solution.

33. $3x-7=3(x+1)$
$3x-7=3x+3$
$3x-7-3x=3x+3-3x$
$-7=3$
Since the statement −7 = 3 is false, the equation has no solution.

34. $2(x-5)=2x+10$
$2x-10=2x+10$
$2x-10-2x=2x+10-2x$
$-10=10$
Since the statement −10 = 10 is false, the equation has no solution.

35. $-2(6x-5)+4=-12x+14$
$-12x+10+4=-12x+14$
$-12x+14=-12x+14$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

36. $-5(4y-3)+2=-20y+17$
$-20y+15+2=-20y+17$
$-20y+17=-20y+17$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

37. $\frac{6(3-z)}{5}=-z$
$5\cdot\frac{6(3-z)}{5}=5(-z)$
$6(3-z)=-5z$
$18-6z=-5z$
$18-6z+6z=-5z+6z$
$18=z$

38. $\frac{4(5-w)}{3}=-w$
$3\cdot\frac{4(5-w)}{3}=3(-w)$
$4(5-w)=-3w$
$20-4w=-3w$
$20-4w+4w=-3w+4w$
$20=w$

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39. $-3(2t-5)+2t=5t-4$
$-6t+15+2t=5t-4$
$-4t+15=5t-4$
$-4t+15+4t=5t-4+4t$
$15=9t-4$
$15+4=9t-4+4$
$19=9t$
$\frac{19}{9}=\frac{9t}{9}$
$\frac{19}{9}=t$

40. $-(4a-7)-5a=10+a$
$-4a+7-5a=10+a$
$-9a+7=10+a$
$-9a+7+9a=10+a+9a$
$7=10+10a$
$7-10=10+10a-10$
$-3=10a$
$\frac{-3}{10}=\frac{10a}{10}$
$-\frac{3}{10}=a$

41. $5y+2(y-6)=4(y+1)-2$
$5y+2y-12=4y+4-2$
$7y-12=4y+2$
$7y-12+12=4y+2+12$
$7y=4y+14$
$7y-4y=4y+14-4y$
$3y=14$
$\frac{3y}{3}=\frac{14}{3}$
$y=\frac{14}{3}$

42 $9x+3(x-4)=10(x-5)+7$
$9x+3x-12=10x-50+7$
$12x-12=10x-43$
$12x-12-10x=10x-43-10x$
$2x-12=-43$
$2x-12+12=-43+12$
$2x=-31$
$\frac{2x}{2}=\frac{-31}{2}$
$x=-\frac{31}{2}$

.

43. $\frac{3(x-5)}{2}=\frac{2(x+5)}{3}$
$6\left[\frac{3(x-5)}{2}\right]=6\left[\frac{2(x+5)}{3}\right]$
$9(x-5)=4(x+5)$
$9x-45=4x+20$
$9x-45+45=4x+20+45$
$9x=4x+65$
$9x-4x=4x+65-4x$
$5x=65$
$\frac{5x}{5}=\frac{65}{5}$
$x=13$

44. $\frac{5(x-1)}{4}=\frac{3(x+1)}{2}$
$4\left[\frac{5(x-1)}{4}\right]=4\left[\frac{3(x+1)}{2}\right]$
$5(x-1)=6(x+1)$
$5x-5=6x+6$
$5x-5-5x=6x+6-5x$
$-5=x+6$
$-5-6=x+6-6$
$-11=x$

45. $0.7x-2.3=0.5$
$7x-23=5$
$7x-23+23=5+23$
$7x=28$
$\frac{7x}{7}=\frac{28}{7}$
$x=4$

46. $0.9x-4.1=0.4$
$9x-41=4$
$9x-41+41=4+41$
$9x=45$
$\frac{9x}{9}=\frac{45}{9}$
$x=5$

47. $5x-5=2(x+1)+3x-7$
$5x-5=2x+2+3x-7$
$5x-5=5x-5$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

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48. $3(2x-1)+5=6x+2$
$6x-3+5=6x+2$
$6x+2=6x+2$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

49. $4(2n+1)=3(6n+3)+1$
$8n+4=18n+9+1$
$8n+4=18n+10$
$8n+4-10=18n+10-10$
$8n-6=18n$
$8n-6-8n=18n-8n$
$-6=10n$
$\frac{-6}{10}=\frac{10n}{10}$
$-\frac{3}{5}=n$

50. $4(4y+2)=2(1+6y)+8$
$16y+8=2+12y+8$
$16y+8=10+12y$
$16y+8-16y=10+12y-16y$
$8=10-4y$
$8-10=10-4y-10$
$-2=-4y$
$\frac{-2}{-4}=\frac{-4y}{-4}$
$\frac{1}{2}=y$

51. $x+\frac{5}{4}=\frac{3}{4}x$
$4\left(x+\frac{5}{4}\right)=4\left(\frac{3}{4}x\right)$
$4x+5=3x$
$4x+5-4x=3x-4x$
$5=-x$
$\frac{5}{-1}=\frac{-x}{-1}$
$-5=x$

52. $\frac{7}{8}x+\frac{1}{4}=\frac{3}{4}x$
$8\left(\frac{7}{8}x+\frac{1}{4}\right)=8\left(\frac{3}{4}x\right)$
$7x+2=6x$
$7x+2-7x=6x-7x$
$2=-x$
$\frac{2}{-1}=\frac{-x}{-1}$
$-2=x$

53. $\frac{x}{2}-1=\frac{x}{5}+2$
$10\left(\frac{x}{2}-1\right)=10\left(\frac{x}{5}+2\right)$
$5x-10=2x+20$
$5x-10+10=2x+20+10$
$5x=2x+30$
$5x-2x=2x+30-2x$
$3x=30$
$\frac{3x}{3}=\frac{30}{3}$
$x=10$

54. $\frac{x}{5}-7=\frac{x}{3}-5$
$15\left(\frac{x}{5}-7\right)=15\left(\frac{x}{3}-5\right)$
$3x-105=5x-75$
$3x-105-3x=5x-75-3x$
$-105=-75+2x$
$75-105=75-75+2x$
$-30=2x$
$\frac{-30}{2}=\frac{2x}{2}$
$-15=x$

55. $2(x+3)-5=5x-3(1+x)$
$2x+6-5=5x-3-3x$
$2x+1=2x-3$
$2x+1-2x=2x-3-2x$
$1=-3$
Since the statement $1=-3$ is false, the equation has no solution.

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56. $4(2+x)+1 = 7x-3(x-2)$
$8+4x+1 = 7x-3x+6$
$9+4x = 4x+6$
$9+4x-4x = 4x+6-4x$
$9 = 6$
Since the statement 9 = 6 is false, the equation has no solution.

57. $0.06-0.01(x+1) = -0.02(2-x)$
$6-1(x+1) = -2(2-x)$
$6-x-1 = -4+2x$
$5-x = -4+2x$
$5-x+x = -4+2x+x$
$5 = -4+3x$
$5+4 = -4+3x+4$
$9 = 3x$
$\frac{9}{3} = \frac{3x}{3}$
$3 = x$

58. $-0.01(5x+4) = 0.04-0.01(x+4)$
$-1(5x+4) = 4-1(x+4)$
$-5x-4 = 4-x-4$
$-5x-4 = -x$
$-5x-4+5x = -x+5x$
$-4 = 4x$
$\frac{-4}{4} = \frac{4x}{4}$
$-1 = x$

59. $\frac{9}{2}+\frac{5}{2}y = 2y-4$
$2\left(\frac{9}{2}+\frac{5}{2}y\right) = 2(2y-4)$
$9+5y = 4y-8$
$9+5y-4y = 4y-8-4y$
$9+y = -8$
$9+y-9 = -8-9$
$y = -17$

60. $3-\frac{1}{2}x = 5x-8$
$2\left(3-\frac{1}{2}x\right) = 2(5x-8)$
$6-x = 10x-16$
$6-x+x = 10x-16+x$
$6 = 11x-16$
$6+16 = 11x-16+16$
$22 = 11x$
$\frac{22}{11} = \frac{11x}{11}$
$2 = x$

61. The perimeter is the sum of the lengths of the sides.
$x+(2x-3)+(3x-5) = x+2x-3+3x-5$
$= 6x-8$
The perimeter is $(6x-8)$ meters.

62. The total length is the sum of the two lengths.
$x+(7x-9) = x+7x-9$
$= 8x-9$
The total length is $(8x-9)$ feet.

63. A number subtracted from −8 is $-8-x$.

64. Three times a number is $3x$.

65. The sum of −3 and twice a number is $-3+2x$.

66. The difference of 8 and twice a number is $8-2x$.

67. The product of 9 and the sum of a number and 20 is $9(x+20)$.

68. The quotient of −12 and the difference of a number and 3 is $\frac{-12}{x-3}$.

69. **a.** Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

b. answers may vary

c. answers may vary

70. **a.** $x+3 = x+5$
$x+3-x = x+5-x$
$3 = 5$
Since the statement 3 = 5 is false, the equation has no solution.

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b. answers may vary

c. answers may vary

71. $5x + 1 = 5x + 1$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution. The choice is a.

72.
$$\begin{aligned} 3x+1 &= 3x+2 \\ 3x+1-3x &= 3x+2-3x \\ 1 &= 2 \end{aligned}$$
Since the statement 1 = 2 is false, the equation has no solution. The choice is b.

73.
$$\begin{aligned} 2x-6x-10 &= -4x+3-10 \\ -4x-10 &= -4x-7 \\ -4x-10+4x &= -4x-7+4x \\ -10 &= -7 \end{aligned}$$
Since the statement $-10 = -7$ is false, the equation has no solution. The choice is b.

74.
$$\begin{aligned} x-11x-3 &= -10x-1-2 \\ -10x-3 &= -10x-3 \end{aligned}$$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution. The choice is a.

75.
$$\begin{aligned} 9x-20 &= 8x-20 \\ 9x-20-8x &= 8x-20-8x \\ x-20 &= -20 \\ x-20+20 &= -20+20 \\ x &= 0 \end{aligned}$$
The choice is c.

76.
$$\begin{aligned} -x+15 &= x+15 \\ -x+15-15 &= x+15-15 \\ -x &= x \\ -x-x &= x-x \\ -2x &= 0 \\ \frac{-2x}{-2} &= \frac{0}{-2} \\ x &= 0 \end{aligned}$$
The choice is c.

77. answers may vary

78. answers may vary

79. **a.** The perimeter is the sum of the lengths of the sides.
$x + x + x + 2x + 2x = 28$

b.
$$\begin{aligned} x+x+x+2x+2x &= 28 \\ 7x &= 28 \\ \frac{7x}{7} &= \frac{28}{7} \\ x &= 4 \end{aligned}$$

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c. The sides of length x are 4 cm and the sides of length $2x$ are $2(4) = 8$ cm.

80. a. The perimeter is the sum of the lengths of the sides.
$x + (2x + 1) + (3x - 2) = 35$

b.
$$\begin{aligned} x+2x+1+3x-2 &= 35 \\ 6x-1 &= 35 \\ 6x-1+1 &= 35+1 \\ 6x &= 36 \\ \frac{6x}{6} &= \frac{36}{6} \\ x &= 6 \end{aligned}$$
The lengths of the sides are:
$x = 6$ meters
$2x + 1 = 2(6) + 1 = 12 + 1 = 13$ meters
$3x - 2 = 3(6) - 2 = 18 - 2 = 16$ meters

81. answers may vary

82. answers may vary

83.
$$\begin{aligned} 1000(7x-10) &= 50(412+100x) \\ 7000x-10,000 &= 20,600+5000x \\ 7000x-10,000-5000x &= 20,600+5000x-5000x \\ 2000x-10,000 &= 20,600 \\ 2000x-10,000+10,000 &= 20,600+10,000 \\ 2000x &= 30,600 \\ \frac{2000x}{2000} &= \frac{30,600}{2000} \\ x &= 15.3 \end{aligned}$$

84.
$$\begin{aligned} 1000(x+40) &= 100(16+7x) \\ 1000x+40,000 &= 1600+700x \\ 1000x+40,000-700x &= 1600+700x-700x \\ 40,000+300x &= 1600 \\ 40,000+300x-40,000 &= 1600-40,000 \\ 300x &= -38,400 \\ \frac{300x}{300} &= \frac{-38,400}{300} \\ x &= -128 \end{aligned}$$

85.
$$\begin{aligned} 0.035x+5.112 &= 0.010x+5.107 \\ 35x+5112 &= 10x+5107 \\ 35x+5112-10x &= 10x+5107-10x \\ 25x+5112 &= 5107 \\ 25x+5112-5112 &= 5107-5112 \\ 25x &= -5 \\ \frac{25x}{25} &= \frac{-5}{25} \\ x &= -\frac{1}{5} \\ x &= -0.2 \end{aligned}$$

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86. $0.127x - 2.685 = 0.027x - 2.38$
$127x - 2685 = 27x - 2380$
$127x - 2685 - 27x = 27x - 2380 - 27x$
$100x - 2685 = -2380$
$100x - 2685 + 2685 = -2380 + 2685$
$100x = 305$
$\frac{100x}{100} = \frac{305}{100}$
$x = 3.05$

Integrated Review

1. $x - 10 = -4$
$x - 10 + 10 = -4 + 10$
$x = 6$

2. $y + 14 = -3$
$y + 14 - 14 = -3 - 14$
$y = -17$

3. $9y = 108$
$\frac{9y}{9} = \frac{108}{9}$
$y = 12$

4. $-3x = 78$
$\frac{-3x}{-3} = \frac{78}{-3}$
$x = -26$

5. $-6x + 7 = 25$
$-6x + 7 - 7 = 25 - 7$
$-6x = 18$
$\frac{-6x}{-6} = \frac{18}{-6}$
$x = -3$

6. $5y - 42 = -47$
$5y - 42 + 42 = -47 + 42$
$5y = -5$
$\frac{5y}{5} = \frac{-5}{5}$
$y = -1$

7. $\frac{2}{3}x = 9$
$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot 9$
$x = \frac{27}{2}$

8. $\frac{4}{5}z = 10$
$\frac{5}{4} \cdot \frac{4}{5}z = \frac{5}{4} \cdot 10$
$z = \frac{50}{4}$
$z = \frac{25}{2}$

9. $\frac{r}{-4} = -2$
$-4 \cdot \frac{r}{-4} = -4 \cdot (-2)$
$r = 8$

10. $\frac{y}{-8} = 8$
$-8 \cdot \frac{y}{-8} = -8 \cdot 8$
$y = -64$

11. $6 - 2x + 8 = 10$
$-2x + 14 = 10$
$-2x + 14 - 14 = 10 - 14$
$-2x = -4$
$\frac{-2x}{-2} = \frac{-4}{-2}$
$x = 2$

12. $-5 - 6y + 6 = 19$
$-6y + 1 = 19$
$-6y + 1 - 1 = 19 - 1$
$-6y = 18$
$\frac{-6y}{-6} = \frac{18}{-6}$
$y = -3$

13. $2x - 7 = 6x - 27$
$2x - 7 + 7 = 6x - 27 + 7$
$2x = 6x - 20$
$2x - 6x = 6x - 20 - 6x$
$-4x = -20$
$\frac{-4x}{-4} = \frac{-20}{-4}$
$x = 5$

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14. $3+8y=3y-2$
$3+8y-3y=3y-2-3y$
$3+5y=-2$
$-3+3+5y=-3-2$
$5y=-5$
$\frac{5y}{5}=\frac{-5}{5}$
$y=-1$

15. $9(3x-1)=-4+49$
$27x-9=45$
$27x-9+9=45+9$
$27x=54$
$\frac{27x}{27}=\frac{54}{27}$
$x=2$

16. $12(2x+1)=-6+66$
$24x+12=60$
$24x+12-12=60-12$
$24x=48$
$\frac{24x}{24}=\frac{48}{24}$
$x=2$

17. $-3a+6+5a=7a-8a$
$6+2a=-a$
$6+2a-2a=-a-2a$
$6=-3a$
$\frac{6}{-3}=\frac{-3a}{-3}$
$-2=a$

18. $4b-8-b=10b-3b$
$3b-8=7b$
$-3b+3b-8=-3b+7b$
$-8=4b$
$\frac{-8}{4}=\frac{4b}{4}$
$-2=b$

19. $-\frac{2}{3}x=\frac{5}{9}$
$-\frac{3}{2}\cdot\left(-\frac{2}{3}x\right)=-\frac{3}{2}\cdot\frac{5}{9}$
$x=-\frac{15}{18}$
$x=-\frac{5}{6}$

20. $-\frac{3}{8}y=-\frac{1}{16}$
$-\frac{8}{3}\cdot\left(-\frac{3}{8}y\right)=-\frac{8}{3}\cdot\left(-\frac{1}{16}\right)$
$y=\frac{1}{6}$

21. $10=-6n+16$
$10-16=-6n+16-16$
$-6=-6n$
$\frac{-6}{-6}=\frac{-6n}{-6}$
$1=n$

22. $-5=-2m+7$
$-5-7=-2m+7-7$
$-12=-2m$
$\frac{-12}{-2}=\frac{-2m}{-2}$
$6=m$

23. $3(5c-1)-2=13c+3$
$15c-3-2=13c+3$
$15c-5=13c+3$
$15c-5+5=13c+3+5$
$15c=13c+8$
$15c-13c=13c+8-13c$
$2c=8$
$\frac{2c}{2}=\frac{8}{2}$
$c=4$

24. $4(3t+4)-20=3+5t$
$12t+16-20=3+5t$
$12t-4=3+5t$
$12t-4-5t=3+5t-5t$
$7t-4=3$
$7t-4+4=3+4$
$7t=7$
$\frac{7t}{7}=\frac{7}{7}$
$t=1$

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25.
$$\frac{2(z+3)}{3} = 5 - z$$
$$3\left[\frac{2(z+3)}{3}\right] = 3(5-z)$$
$$2(z+3) = 3(5-z)$$
$$2z+6 = 15-3z$$
$$2z+6+3z = 15-3z+3z$$
$$6+5z = 15$$
$$6+5z-6 = 15-6$$
$$5z = 9$$
$$\frac{5z}{5} = \frac{9}{5}$$
$$z = \frac{9}{5}$$

26.
$$\frac{3(w+2)}{4} = 2w+3$$
$$4\left[\frac{3(w+2)}{4}\right] = 4(2w+3)$$
$$3(w+2) = 4(2w+3)$$
$$3w+6 = 8w+12$$
$$3w+6-6 = 8w+12-6$$
$$3w = 8w+6$$
$$3w-8w = 8w+6-8w$$
$$-5w = 6$$
$$\frac{-5w}{-5} = \frac{6}{-5}$$
$$w = -\frac{6}{5}$$

27.
$$-2(2x-5) = -3x+7-x+3$$
$$-4x+10 = -4x+10$$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

28.
$$-4(5x-2) = -12x+4-8x+4$$
$$-20x+8 = -20x+8$$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

29.
$$0.02(6t-3) = 0.04(t-2)+0.02$$
$$2(6t-3) = 4(t-2)+2$$
$$12t-6 = 4t-8+2$$
$$12t-6 = 4t-6$$
$$12t-6-4t = 4t-6-4t$$
$$8t-6 = -6$$
$$8t-6+6 = -6+6$$
$$8t = 0$$
$$\frac{8t}{8} = \frac{0}{8}$$
$$t = 0$$

30.
$$0.03(m+7) = 0.02(5-m)+0.03$$
$$3(m+7) = 2(5-m)+3$$
$$3m+21 = 10-2m+3$$
$$3m+21 = 13-2m$$
$$3m+21+2m = 13-2m+2m$$
$$5m+21 = 13$$
$$5m+21-21 = 13-21$$
$$5m = -8$$
$$\frac{5m}{5} = \frac{-8}{5}$$
$$m = -1.6$$

31.
$$-3y = \frac{4(y-1)}{5}$$
$$5(-3y) = 5\left[\frac{4(y-1)}{5}\right]$$
$$-15y = 4(y-1)$$
$$-15y = 4y-4$$
$$-15y-4y = 4y-4-4y$$
$$-19y = -4$$
$$\frac{-19y}{-19} = \frac{-4}{-19}$$
$$y = \frac{4}{19}$$

32.
$$-4x = \frac{5(1-x)}{6}$$
$$6(-4x) = 6\cdot\frac{5(1-x)}{6}$$
$$-24x = 5(1-x)$$
$$-24x = 5-5x$$
$$-24x+5x = 5-5x+5x$$
$$-19x = 5$$
$$\frac{-19x}{-19} = \frac{5}{-19}$$
$$x = -\frac{5}{19}$$

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33.
$$\frac{5}{3}x-\frac{7}{3}=x$$
$$3\left(\frac{5}{3}x-\frac{7}{3}\right)=3x$$
$$5x-7=3x$$
$$-5x+5x-7=-5x+3x$$
$$-7=-2x$$
$$\frac{-7}{-2}=\frac{-2x}{-2}$$
$$\frac{7}{2}=x$$

34.
$$\frac{7}{5}n+\frac{3}{5}=-n$$
$$5\left(\frac{7}{5}n+\frac{3}{5}\right)=5(-n)$$
$$7n+3=-5n$$
$$-7n+7n+3=-7n-5n$$
$$3=-12n$$
$$\frac{3}{-12}=\frac{-12n}{-12}$$
$$-\frac{1}{4}=n$$

35.
$$\frac{1}{10}(3x-7)=\frac{3}{10}x+5$$
$$\frac{3}{10}x-\frac{7}{10}=\frac{3}{10}x+5$$
$$-\frac{3}{10}x+\frac{3}{10}x-\frac{7}{10}=-\frac{3}{10}x+\frac{3}{10}x+5$$
$$-\frac{7}{10}=5$$

Since the statement $-\frac{7}{10}=5$ is false, the equation has no solution.

36.
$$\frac{1}{7}(2x-5)=\frac{2}{7}x+1$$
$$7\cdot\frac{1}{7}(2x-5)=7\left(\frac{2}{7}x+1\right)$$
$$2x-5=2x+7$$
$$2x-5-2x=2x+7-2x$$
$$-5=7$$

Since the statement $-5 = 7$ is false, the equation has no solution.

37.
$$5+2(3x-6)=-4(6x-7)$$
$$5+6x-12=-24x+28$$
$$6x-7=-24x+28$$
$$24x+6x-7=24x-24x+28$$
$$30x-7=28$$
$$30x-7+7=28+7$$
$$30x=35$$
$$\frac{30x}{30}=\frac{35}{30}$$
$$x=\frac{7}{6}$$

38.
$$3+5(2x-4)=-7(5x+2)$$
$$3+10x-20=-35x-14$$
$$10x-17=-35x-14$$
$$10x-17+35x=-35x-14+35x$$
$$45x-17=-14$$
$$45x-17+17=-14+17$$
$$45x=3$$
$$\frac{45x}{45}=\frac{3}{45}$$
$$x=\frac{1}{15}$$

Section 2.4 Practice Problems

1. Let x represent the number.
$$3(x-5)=2x-3$$
$$3x-15=2x-3$$
$$3x-15-2x=2x-3-2x$$
$$x-15=-3$$
$$x-15+15=-3+15$$
$$x=12$$
The number is 12.

2. If x is the first even integer, then $x + 2$ and $x + 4$ are the next two even integers.
$$x+x+2+x+4=144$$
$$3x+6=144$$
$$3x+6-6=144-6$$
$$3x=138$$
$$\frac{3x}{3}=\frac{138}{3}$$
$$x=46$$
If $x = 46$, then $x + 2 = 48$ and $x + 4 = 50$. The integers are 46, 48, 50.

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3. Let x represent the length of the shorter piece. Then $5x$ represents the length of the longer piece. Their sum is 18 feet.

$$x + 5x = 18$$
$$6x = 18$$
$$\frac{6x}{6} = \frac{18}{6}$$
$$x = 3$$

The shorter piece is 3 feet and the longer piece is 5(3) = 15 feet.

4. Let x represent the number of votes for Texas. Then $x + 21$ represents the number of votes for California. Their sum is 89.

$$x + x + 21 = 89$$
$$2x + 21 = 89$$
$$2x + 21 - 21 = 89 - 21$$
$$2x = 68$$
$$\frac{2x}{2} = \frac{68}{2}$$
$$x = 34$$

Texas has 34 electoral votes and California had 34 + 21 = 55 electoral votes.

5. Let x represent the number of miles driven. The cost for x miles is $0.15x$. The daily cost is \$28.

$$0.15x + 28 = 52$$
$$0.15x + 28 - 28 = 52 - 28$$
$$0.15x = 24$$
$$\frac{0.15x}{0.15} = \frac{24}{0.15}$$
$$x = 160$$

You drove 160 miles.

6. Let x represent the measure of the smallest angle. Then $2x$ represents the measure of the second angle and $3x$ represents the measure of the third angle. The sum of the measures of the angles of a triangle equals 180.

$$x + 2x + 3x = 180$$
$$6x = 180$$
$$\frac{6x}{6} = \frac{180}{6}$$
$$x = 30$$

If $x = 30$, then $2x = 2(30) = 60$ and $3x = 3(30) = 90$.

The smallest is 30°, second is 60°, and third is 90°.

Exercise Set 2.4

1.
$$2(x-8) = 3(x+3)$$
$$2x - 16 = 3x + 9$$
$$2x - 16 - 2x = 3x + 9 - 2x$$
$$-16 = x + 9$$
$$-16 - 9 = x + 9 - 9$$
$$-25 = x$$

The number is −25.

2.
$$5[x + (-1)] = 6x$$
$$5(x - 1) = 6x$$
$$5x - 5 = 6x$$
$$5x - 5 - 5x = 6x - 5x$$
$$-5 = x$$

The number is −5.

3.
$$2x(3) = 5x - \frac{3}{4}$$
$$6x = 5x - \frac{3}{4}$$
$$6x - 5x = 5x - \frac{3}{4} - 5x$$
$$x = -\frac{3}{4}$$

The number is $-\frac{3}{4}$.

4.
$$2(x-4) = x - \frac{1}{4}$$
$$2x - 8 = x - \frac{1}{4}$$
$$2x - 8 - x = x - \frac{1}{4} - x$$
$$x - 8 = -\frac{1}{4}$$
$$x - 8 + 8 = -\frac{1}{4} + 8$$
$$x = -\frac{1}{4} + \frac{32}{4}$$
$$x = \frac{31}{4}$$

The number is $\frac{31}{4}$.

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5. If x is the first integer, the next consecutive integer is $x + 1$.

$$\begin{aligned} x + x + 1 &= 469 \\ 2x + 1 &= 469 \\ 2x + 1 - 1 &= 469 - 1 \\ 2x &= 468 \\ \frac{2x}{2} &= \frac{468}{2} \\ x &= 234 \end{aligned}$$

The page numbers are 234 and 234 + 1 = 235.

6. If x is the first even integer, the next consecutive even integer is $x + 2$.

$$\begin{aligned} x + x + 2 &= 654 \\ 2x + 2 &= 654 \\ 2x + 2 - 2 &= 654 - 2 \\ 2x &= 652 \\ \frac{2x}{2} &= \frac{652}{2} \\ x &= 326 \end{aligned}$$

The room numbers are 326 and 326 + 2 = 328.

7. If x is the first integer, the next two consecutive integers are $x + 1$ and $x + 2$.

$$\begin{aligned} x + x + 1 + x + 2 &= 99 \\ 3x + 3 &= 99 \\ 3x + 3 - 3 &= 99 - 3 \\ 3x &= 96 \\ \frac{3x}{3} &= \frac{96}{3} \\ x &= 32 \end{aligned}$$

The code for Belgium is 32, France is 32 + 1 = 33, and Spain is 32 + 2 = 34.

8. If x is the first odd integer, the next two odd integers are $x + 2$ and $x + 4$.

$$\begin{aligned} x + x + 2 + x + 4 &= 51 \\ 3x + 6 &= 51 \\ 3x + 6 - 6 &= 51 - 6 \\ 3x &= 45 \\ \frac{3x}{3} &= \frac{45}{3} \\ x &= 15 \end{aligned}$$

The code is 15, 15 + 2 = 17, 15 + 4 = 19.

9. The sum of the three lengths is 25 inches.

$$\begin{aligned} x + 2x + 1 + 5x &= 25 \\ 1 + 8x &= 25 \\ 1 + 8x - 1 &= 25 - 1 \\ 8x &= 24 \\ \frac{8x}{8} &= \frac{24}{8} \\ x &= 3 \end{aligned}$$

$2x = 2(3) = 6$

$1 + 5x = 1 + 5(3) = 1 + 15 = 16$

The lengths are 3 inches, 6 inches, and 16 inches.

10. The sum of the three lengths is 46 feet.

$$\begin{aligned} x + 3x + 2 + 7x &= 46 \\ 11x + 2 &= 46 \\ 11x + 2 - 2 &= 46 - 2 \\ 11x &= 44 \\ \frac{11x}{11} &= \frac{44}{11} \\ x &= 4 \end{aligned}$$

$3x = 3(4) = 12$

$2 + 7x = 2 + 7(4) = 2 + 28 = 30$

The lengths are 4 feet, 12 feet, and 30 feet.

11. Let x be the length of the first piece. Then the second piece is $2x$ and the third piece is $5x$. The sum of the lengths is 40 inches.

$$\begin{aligned} x + 2x + 5x &= 40 \\ 8x &= 40 \\ \frac{8x}{8} &= \frac{40}{8} \\ x &= 5 \end{aligned}$$

$2x = 2(5) = 10$

$5x = 5(5) = 25$

The 1st piece is 5 inches, 2nd piece is 10 inches, and 3rd piece is 25 inches.

12. Let x be the length of the shorter piece. Then $3x + 1$ is the length of the longer piece. The sum of the lengths is 21 feet.

$$\begin{aligned} x + 3x + 1 &= 21 \\ 4x + 1 &= 21 \\ 4x + 1 - 1 &= 21 - 1 \\ 4x &= 20 \\ \frac{4x}{4} &= \frac{20}{4} \\ x &= 5 \end{aligned}$$

$3x + 1 = 3(5) + 1 = 15 + 1 = 16$

The shorter piece is 5 feet and the longer piece is 16 feet.

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13. Let x represent the salary of the Governor of Florida. Then $x + 50{,}425$ represents the salary of the Governor of California.

$$\begin{aligned} x + x + 50{,}425 &= 299{,}575 \\ 2x + 50{,}425 &= 299{,}575 \\ 2x + 50{,}425 - 50{,}425 &= 299{,}575 - 50{,}425 \\ 2x &= 249{,}150 \\ \frac{2x}{2} &= \frac{249{,}150}{2} \\ x &= 124{,}575 \end{aligned}$$

$x + 50{,}425 = 124{,}575 + 50{,}425 = 175{,}000$

The salary of the Governor of Florida is \$124,575, while that of the Governor of California is \$175,000.

14. Let x represent the number of gold medals won by the Chinese. Then $x + 3$ represents the number of gold medals won by the United States.

$$\begin{aligned} x + x + 3 &= 67 \\ 2x + 3 &= 67 \\ 2x + 3 - 3 &= 67 - 3 \\ 2x &= 64 \\ \frac{2x}{2} &= \frac{64}{2} \\ x &= 32 \end{aligned}$$

$x + 3 = 32 + 3 = 35$

The Chinese won 32 gold medals and the U.S. won 35 gold medals.

15. Let x be the number of miles. Then the cost for x miles is $0.29x$. Each day costs \$24.95.

$$\begin{aligned} 0.29x + 2(24.95) &= 100 \\ 0.29x + 49.9 &= 100 \\ 0.29x + 49.9 - 49.9 &= 100 - 49.9 \\ 0.29x &= 50.1 \\ \frac{0.29x}{0.29} &= \frac{50.1}{0.29} \\ x &\approx 172.8 \end{aligned}$$

You can drive 172 whole miles on a \$100 budget.

16. Let x be the number of hours. Then the total cost is $27x + 80$.

$$\begin{aligned} 27x + 80 &= 404 \\ 27x + 80 - 80 &= 404 - 80 \\ 27x &= 324 \\ \frac{27x}{27} &= \frac{324}{27} \\ x &= 12 \end{aligned}$$

She expects the job to take 12 hours.

17. Let x be the number of miles. Then the total fare is $3 + 0.8x + 4.5$.

$$\begin{aligned} 3 + 0.8x + 4.5 &= 27.5 \\ 30 + 8x + 45 &= 275 \\ 8x + 75 &= 275 \\ 8x + 75 - 75 &= 275 - 75 \\ 8x &= 200 \\ \frac{8x}{8} &= \frac{200}{8} \\ x &= 25 \end{aligned}$$

You can travel 25 miles from the airport by taxi for \$27.50.

18. Let x be the number of hours. Then the total cost is $25.50x + 30$.

$$\begin{aligned} 25.5x + 30 &= 119.25 \\ 25.5x + 30 - 30 &= 119.25 - 30 \\ 25.5x &= 89.25 \\ \frac{25.5x}{25.5} &= \frac{89.25}{25.5} \\ x &= 3.5 \end{aligned}$$

You were charged for 3.5 hours.

19. Let x be the measure of each of the two equal angles. Then $2x + 30$ is the measure of the third angle. Their sum is 180°.

$$\begin{aligned} x + x + 2x + 30 &= 180 \\ 4x + 30 &= 180 \\ 4x + 30 - 30 &= 180 - 30 \\ 4x &= 150 \\ \frac{4x}{4} &= \frac{150}{4} \\ x &= 37.5 \end{aligned}$$

$2x + 30 = 2(37.5) + 30 = 75 + 30 = 105$

The 1st angle measures 37.5°, the 2nd angle measures 37.5°, and the 3rd angle measures 105°.

20. Let x be the measure of the smaller angle. Then $2x - 15$ is the measure of the larger angle. The sum of the four angles is 360°.

$$\begin{aligned} 2x + 2(2x - 15) &= 360 \\ 2x + 4x - 30 &= 360 \\ 6x - 30 &= 360 \\ 6x - 30 + 30 &= 360 + 30 \\ 6x &= 390 \\ \frac{6x}{6} &= \frac{390}{6} \\ x &= 65 \end{aligned}$$

$2x - 15 = 2(65) - 15 = 130 - 15 = 115$

Two angles measure 65° and two angles measure 115°.

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21. Angles A and D both measure $x°$, while angles C and B both measure $(2x)°$. The sum of the angle measures is 360°.

$$x + 2x + x + 2x = 360$$
$$6x = 360$$
$$\frac{6x}{6} = \frac{360}{6}$$
$$x = 60$$

$2x = 2(60) = 120$

Angles A and D measure 60°; angles B and C measure 120°.

22. Let angles B and C have measure x. Then angle A has measure $x - 42$. The sum of the measures is 180°.

$$x + x + x - 42 = 180$$
$$3x - 42 = 180$$
$$3x - 42 + 42 = 180 + 42$$
$$3x = 222$$
$$\frac{3x}{3} = \frac{222}{3}$$
$$x = 74$$

$x - 42 = 74 - 42 = 32$

Angles B and C measure 74° and angle A measures 32°.

23. Let x be the length of the shorter piece. Then $2x + 2$ is the length of the longer piece. The measures sum to 17 feet.

$$x + 2x + 2 = 17$$
$$3x + 2 = 17$$
$$3x + 2 - 2 = 17 - 2$$
$$3x = 5$$
$$\frac{3x}{3} = \frac{15}{3}$$
$$x = 5$$

$2x + 2 = 2(5) + 2 = 10 + 2 = 12$

The pieces measure 5 feet and 12 feet.

24. Let x be the measure of the shorter piece. Then $5x + 1$ is the measure of the longer piece. The measures sum to 25 feet.

$$x + 5x + 1 = 25$$
$$6x + 1 = 25$$
$$6x + 1 - 1 = 25 - 1$$
$$6x = 24$$
$$\frac{6x}{6} = \frac{24}{6}$$
$$x = 4$$

$5x + 1 = 5(4) + 1 = 20 + 1 = 21$

The pieces measure 4 feet and 21 feet.

25. Let x represent the number of prescriptions written in 1997, in millions. Then the number written in 2001 was $(x + 5.5)$ million.

$$x + x + 5.5 = 35.7$$
$$2x + 5.5 = 35.7$$
$$2x + 5.5 - 5.5 = 35.7 - 5.5$$
$$2x = 30.2$$
$$\frac{2x}{2} = \frac{30.2}{2}$$
$$x = 15.1$$

$x + 5.5 = 15.1 + 5.5 = 20.6$

There were 15.1 million prescriptions for ADHD drugs written in 1997, and 20.6 million prescriptions written in 2001.

26. Let x represent the floor area of the Empire State Building, in million square feet. Then the Pentagon has a floor area of $3x$.

$$3x = 6.5$$
$$\frac{3x}{3} = \frac{6.5}{3}$$
$$x \approx 2.2$$

The floor area of the Empire State Building is about 2.2 million square feet.

27. Let x be the measure of the smaller angle. Then the larger angle measures $3x$. Their sum is 180°.

$$x + 3x = 180$$
$$4x = 180$$
$$\frac{4x}{4} = \frac{180}{4}$$
$$x = 45$$

$3x = 3(45) = 135$

The angles measure 45° and 135°.

28. The sum of the measures is 90°.

$$x + (2x - 3) = 90$$
$$x + 2x - 3 = 90$$
$$3x - 3 = 90$$
$$3x - 3 + 3 = 90 + 3$$
$$3x = 93$$
$$\frac{3x}{3} = \frac{93}{3}$$
$$x = 31$$

$2x - 3 = 2(31) - 3 = 62 - 3 = 59$

The angles measure 31° and 59°.

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29. Let x be the first even integer. Then the next two consecutive even integers are $x + 2$ and $x + 4$. The sum of the measures of the angles of a triangle is 180°.

$$x + x + 2 + x + 4 = 180$$
$$3x + 6 = 180$$
$$3x + 6 - 6 = 180 - 6$$
$$3x = 174$$
$$\frac{3x}{3} = \frac{174}{3}$$
$$x = 58$$

$x + 2 = 58 + 2 = 60$
$x + 4 = 58 + 4 = 62$
The angles measure 58°, 60°, and 62°.

30. Let x be the first odd integer. Then the next three consecutive odd integers are $x + 2$, $x + 4$, and $x + 6$. The sum of the measures is 360°.

$$x + x + 2 + x + 4 + x + 6 = 360$$
$$4x + 12 = 360$$
$$4x + 12 - 12 = 360 - 12$$
$$4x = 348$$
$$\frac{4x}{4} = \frac{348}{4}$$
$$x = 87$$

$x + 2 = 87 + 2 = 89$
$x + 4 = 87 + 4 = 91$
$x + 6 = 87 + 6 = 93$
The angles measure 87°, 89°, 91°, and 93°.

31.
$$\frac{1}{5} + 2x = 3x - \frac{4}{5}$$
$$\frac{1}{5} + 2x - 2x = 3x - \frac{4}{5} - 2x$$
$$\frac{1}{5} = x - \frac{4}{5}$$
$$\frac{1}{5} + \frac{4}{5} = x - \frac{4}{5} + \frac{4}{5}$$
$$\frac{5}{5} = x$$
$$1 = x$$

The number is 1.

32.
$$\frac{2}{3} + 4x = 5x - \frac{5}{6}$$
$$6 \cdot \left(\frac{2}{3} + 4x\right) = 6 \cdot \left(5x - \frac{5}{6}\right)$$
$$4 + 24x = 30x - 5$$
$$4 + 24x - 24x = 30x - 5 - 24x$$
$$4 = 6x - 5$$
$$4 + 5 = 6x - 5 + 5$$
$$9 = 6x$$
$$\frac{9}{6} = \frac{6x}{6}$$
$$\frac{3}{2} = x$$

The number is $\frac{3}{2}$.

33. Let x be the number of miles. Then the charge for driving x miles in one day is $39 + 0.2x$.

$$39 + 0.2x = 95$$
$$390 + 2x = 950$$
$$390 + 2x - 390 = 950 - 390$$
$$2x = 560$$
$$\frac{2x}{2} = \frac{560}{2}$$
$$x = 280$$

You drove 280 miles.

34. Let x be the amount the son receives. Then $2x$ is the amount the husband receives. The sum of the amounts is \$15,000.

$$x + 2x = 15,000$$
$$3x = 15,000$$
$$\frac{3x}{3} = \frac{15,000}{3}$$
$$x = 5,000$$

$2x = 2(5{,}000) = 10{,}000$
The son receives \$5000 and the husband receives \$10,000.

35. Let x be the number of points earned by Johnson. Then $x + 90$ is the number of points earned by Kenseth. Together they earned 9954 points.

$$x + x + 90 = 9954$$
$$2x + 90 = 9954$$
$$2x + 90 - 90 = 9954 - 90$$
$$2x = 9864$$
$$\frac{2x}{2} = \frac{9864}{2}$$
$$x = 4932$$

$x + 90 = 4932 + 90 = 5022$
Johnson earned 4932 points and Kenseth earned 5022 points.

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36. Let x represent the points scored by Texas-El Paso. Then $x + 5$ represents the points scored by Colorado. Their combined scores total 61 points.

$$\begin{aligned} x + x + 5 &= 61 \\ 2x + 5 &= 61 \\ 2x + 5 - 5 &= 61 - 5 \\ 2x &= 56 \\ \frac{2x}{2} &= \frac{56}{2} \\ x &= 28 \end{aligned}$$

$x + 5 = 28 + 5 = 33$
Texas-El Paso scored 28 points and Colorado scored 33 points.

37. Let x represent the number of counties in Montana. Then $x + 2$ represents the number of counties in California.

$$\begin{aligned} x + x + 2 &= 114 \\ 2x + 2 &= 114 \\ 2x + 2 - 2 &= 114 - 2 \\ 2x &= 112 \\ \frac{2x}{2} &= \frac{112}{2} \\ x &= 56 \end{aligned}$$

$x + 2 = 56 + 2 = 58$
Montana has 56 counties and California has 58 counties.

38. Let x represent the number of Democratic governors. Then $x + 2$ represents the number of Republican governors. There are a total of 50 governors.

$$\begin{aligned} x + x + 2 &= 50 \\ 2x + 2 &= 50 \\ 2x + 2 - 2 &= 50 - 2 \\ 2x &= 48 \\ \frac{2x}{2} &= \frac{48}{2} \\ x &= 24 \end{aligned}$$

$x + 2 = 24 + 2 = 26$
There were 24 Democratic governors and 26 Republican governors.

39. Let x represent the number of moons for Neptune. Then $x + 13$ represents the number of moons for Uranus and $2x + 2$ represents the number of moons for Saturn. The total is 47.

$$\begin{aligned} x + x + 13 + 2x + 2 &= 47 \\ 4x + 15 &= 47 \\ 4x + 15 - 15 &= 47 - 15 \\ 4x &= 32 \\ \frac{4x}{4} &= \frac{32}{4} \\ x &= 8 \end{aligned}$$

$x + 13 = 8 + 13 = 21$
$2x + 2 = 2(8) + 2 = 16 + 2 = 18$
Neptune has 8 moons, Uranus has 21 moons, and Saturn has 18 moons.

40. Let x represent the diameter. Then $5x + 8$ represents the height.

$$\begin{aligned} x + 5x + 8 &= 14 \\ 6x + 8 &= 14 \\ 6x + 8 - 8 &= 14 - 8 \\ 6x &= 6 \\ \frac{6x}{6} &= \frac{6}{6} \\ x &= 1 \end{aligned}$$

$5x + 8 = 5(1) + 8 = 5 + 8 = 13$
The diameter is 1 meter and the height is 13 meters.

41.

$$\begin{aligned} 3(x + 5) &= 2x - 1 \\ 3x + 15 &= 2x - 1 \\ 3x + 15 - 2x &= 2x - 1 - 2x \\ x + 15 &= -1 \\ x + 15 - 15 &= -1 - 15 \\ x &= -16 \end{aligned}$$

The number is -16.

42.

$$\begin{aligned} 2(x + 6) &= 3(x + 4) \\ 2x + 12 &= 3x + 12 \\ 2x + 12 - 2x &= 3x + 12 - 2x \\ 12 &= x + 12 \\ 12 - 12 &= x + 12 - 12 \\ 0 &= x \end{aligned}$$

The number is 0.

43. Let x represent the area of the Gobi Desert, in square miles. Then $7x$ represents the area of the Sahara Desert.

$$\begin{aligned} x + 7x &= 4,000,000 \\ 8x &= 4,000,000 \\ \frac{8x}{8} &= \frac{4,000,000}{8} \\ x &= 500,000 \end{aligned}$$

$7x = 7(500{,}000) = 3{,}500{,}000$
The Gobi Desert's area is 500,000 square miles and the Sahara Desert's area is 3,500,000 square miles.

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44. Let x represent the weight of the Armanty meteorite. Then $3x$ represents the weight of the Hoba West meteorite.

$$x + 3x = 88$$
$$4x = 88$$
$$\frac{4x}{4} = \frac{88}{4}$$
$$x = 22$$

$3x = 3(22) = 66$

The Armanty meteorite weights 22 tons and the Hoba West meteorite weighs 66 tons.

45. Let x represent the number of gold medals won by Korea. Then Italy won $x + 1$ gold medals and France won $x + 2$ gold medals.

$$x + x + 1 + x + 2 = 30$$
$$3x + 3 = 30$$
$$3x + 3 - 3 = 30 - 3$$
$$3x = 27$$
$$\frac{3x}{3} = \frac{27}{3}$$
$$x = 9$$

$x + 1 = 9 + 1 = 10$

$x + 2 = 9 + 2 = 11$

Korea won 9 gold medals, Italy won 10, and France won 11.

46. Let x represent the first odd integer. Then $x + 2$ and $x + 4$ represent the next two consecutive odd integers.

$$x + x + 2 + x + 4 = 675$$
$$3x + 6 = 675$$
$$3x + 6 - 6 = 675 - 6$$
$$3x = 669$$
$$\frac{3x}{3} = \frac{669}{3}$$
$$x = 223$$

$x + 2 = 223 + 2 = 225$

$x + 4 = 223 + 4 = 227$

Mali Republic's code is 223, Côte d'Ivoire's code is 225, and Niger's code is 227.

47. Let x be the number of votes for Bill Randall. Then $x + 13{,}288$ is the number of votes for Corrine Brown.

$$x + x + 13{,}288 = 119{,}436$$
$$2x + 13{,}288 = 119{,}436$$
$$2x + 13{,}288 - 13{,}288 = 119{,}436 - 13{,}288$$
$$2x = 106{,}148$$
$$\frac{2x}{2} = \frac{106{,}148}{2}$$
$$x = 53{,}074$$

$x + 13{,}288 = 53{,}074 + 13{,}288 = 66{,}362$

Randall received 53,074 votes and Brown received 66,362 votes.

48. Let x be the number of votes for Dennis Boerner. Then $x + 25{,}557$ is the number of votes for Max Sandlin.

$$x + x + 25{,}557 = 135{,}821$$
$$2x + 25{,}557 = 135{,}821$$
$$2x + 25{,}557 - 25{,}557 = 135{,}821 - 25{,}557$$
$$2x = 110{,}264$$
$$\frac{2x}{2} = \frac{110{,}264}{2}$$
$$x = 55{,}132$$

$x + 25{,}557 = 55{,}132 + 25{,}557 = 80{,}689$

Boerner received 55,132 votes and Sandlin received 80,689 votes.

49. The tallest bar represents the amount spent by Illinois, so Illinois spends the most on tourism.

50. The bars ending between 25 and 35 represent the amounts spent by Texas and Florida, so Texas and Florida spent between \$25 and \$30 million on tourism.

51. Let x be the amount spent by Florida. Then $x + 2.2$ is the amount spent by Texas.

$$x + x + 2.2 = 56.6$$
$$2x + 2.2 = 56.6$$
$$2x + 2.2 - 2.2 = 56.6 - 2.2$$
$$2x = 54.4$$
$$\frac{2x}{2} = \frac{54.4}{2}$$
$$x = 27.2$$

$x + 2.2 = 27.2 + 2.2 = 29.4$

Florida spent \$27.2 million and Texas spent \$29.4 million.

52. Let x be the amount spent by Pennsylvania. Then $2x - 8.1$ is the amount spent by Hawaii.

$$x + 2x - 8.1 = 60.9$$
$$3x - 8.1 = 60.9$$
$$3x - 8.1 + 8.1 = 60.9 + 8.1$$
$$3x = 69.0$$
$$\frac{3x}{3} = \frac{69}{3}$$
$$x = 23$$

$2x - 8.1 = 2(23) - 8.1 = 46 - 8.1 = 37.9$

Pennsylvania spent \$23 million and Hawaii spent \$37.9 million.

53. answers may vary

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54. answers may vary

55. Replace W by 7 and L by 10.
$2W + 2L = 2(7) + 2(10) = 14 + 20 = 34$

56. Replace B by 14 and h by 22.
$\frac{1}{2}Bh = \frac{1}{2}(14)(22) = 7(22) = 154$

57. Replace r by 15.
$\pi r^2 = \pi(15)^2 = \pi(225) = 225\pi$

58. Replace r by 15 and t by 2.
$r \cdot t = 15 \cdot 2 = 30$

59. Let x represent the width. Then $1.6x$ represents the length. The perimeter is
$2 \cdot \text{length} + 2 \cdot \text{width}$.
$2(1.6x) + 2x = 78$
$3.2x + 2x = 78$
$5.2x = 78$
$\frac{5.2x}{5.2} = \frac{78}{5.2}$
$x = 15$
$1.6x = 1.6(15) = 24$
The dimensions of the garden are 15 feet by 24 feet.

60. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $3x$ is the measure of the third angle. The measures sum to 180°.
$x + 2x + 3x = 180$
$6x = 180$
$\frac{6x}{6} = \frac{180}{6}$
$x = 30$
$2x = 2(30) = 60$
$3x = 3(30) = 90$
Yes, the triangle exists and has angles of measure 30°, 60°, and 90°.

61. One blink every 5 seconds is $\frac{1 \text{ blink}}{5 \text{ sec}}$.
There are $60 \cdot 60 = 3600$ seconds in one hour.
$\frac{1 \text{ blink}}{5 \text{ sec}} \cdot 3600 \text{ sec} = 720 \text{ blinks}$
The average eye blinks 720 times each hour.
$16 \cdot 720 = 11{,}520$
The average eye blinks 11,520 times while awake for a 16-hour day.
$11{,}520 \cdot 365 = 4{,}204{,}800$
The average eye blinks 4,204,800 times in one year.

62. answers may vary

63. answers may vary

64. answers may vary

65. answers may vary

66. Measurements may vary. Rectangle (c) best approximates the shape of the golden rectangle.

Section 2.5 Practice Problems

1. Use $d = rt$ when $d = 1180$ and $r = 50$.
$d = rt$
$1180 = 50t$
$\frac{1180}{50} = \frac{50t}{50}$
$23.6 = t$
They will spend 23.6 hours driving.

2. Use $A = lw$ when $w = 18$.
$A = lw$
$450 = l \cdot 18$
$\frac{450}{18} = \frac{18l}{18}$
$25 = l$
The length of the deck is 25 feet.

3. Use $F = \frac{9}{5}C + 32$ with $C = 5$.
$F = \frac{9}{5}C + 32$
$F = \frac{9}{5} \cdot 5 + 32$
$F = 9 + 32$
$F = 41$
Thus, 5°C is equivalent to 41°F.

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4. Let x be the width. Then $4x + 1$ is the length. The perimeter is 52 meters.

$$\begin{aligned} P &= 2l + 2w \\ 52 &= 2(4x+1) + 2x \\ 52 &= 8x + 2 + 2x \\ 52 &= 10x + 2 \\ 52 - 2 &= 10x + 2 - 2 \\ 50 &= 10x \\ \frac{50}{10} &= \frac{10x}{10} \\ 5 &= x \end{aligned}$$

$4x + 1 = 4(5) + 1 = 20 + 1 = 21$

The width is 5 meters and the length is 21 meters.

5.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\ \frac{C}{2\pi} &= r \text{ or } r = \frac{C}{2\pi} \end{aligned}$$

6.
$$\begin{aligned} P &= 2l + 2w \\ P - 2w &= 2l + 2w - 2w \\ P - 2w &= 2l \\ \frac{P-2w}{2} &= \frac{2l}{2} \\ \frac{P-2w}{2} &= l \text{ or } l = \frac{P-2w}{2} \end{aligned}$$

7.
$$\begin{aligned} P &= 2a + b - c \\ P + c &= 2a + b - c + c \\ P + c &= 2a + b \\ P + c - b &= 2a + b - b \\ P + c - b &= 2a \\ \frac{P+c-b}{2} &= a \text{ or } a = \frac{P-b-c}{2} \end{aligned}$$

8.
$$\begin{aligned} A &= \frac{a+b}{2} \\ 2A &= 2 \cdot \frac{a+b}{2} \\ 2A &= a + b \\ 2A - a &= a + b - a \\ 2A - a &= b \text{ or } b = 2A - a \end{aligned}$$

Exercise Set 2.5

1. Use $A = bh$ when $A = 45$ and $b = 15$.

$$\begin{aligned} A &= bh \\ 45 &= 15 \cdot h \\ \frac{45}{15} &= \frac{15h}{15} \\ 3 &= h \end{aligned}$$

2. Use $d = rt$ when $d = 195$ and $t = 3$.

$$\begin{aligned} d &= rt \\ 195 &= r \cdot 3 \\ \frac{195}{3} &= \frac{3r}{3} \\ 65 &= r \end{aligned}$$

3. Use $S = 4lw + 2wh$ when $S = 102$, $l = 7$, and $w = 3$.

$$\begin{aligned} S &= 4lw + 2wh \\ 102 &= 4 \cdot 7 \cdot 3 + 2 \cdot 3 \cdot h \\ 102 &= 84 + 6h \\ 102 - 84 &= 84 + 6h - 84 \\ 18 &= 6h \\ \frac{18}{6} &= \frac{6h}{6} \\ 3 &= h \end{aligned}$$

4. Use $V = lwh$ when $l = 14$, $w = 8$, and $h = 3$.

$$\begin{aligned} V &= lwh \\ V &= 14 \cdot 8 \cdot 3 \\ V &= 336 \end{aligned}$$

5. Use $A = \frac{1}{2}h(B + b)$ when $A = 180$, $B = 11$, and $b = 7$.

$$\begin{aligned} A &= \frac{1}{2}h(B+b) \\ 180 &= \frac{1}{2}h(11+7) \\ 180 &= \frac{1}{2}h(18) \\ 180 &= 9h \\ \frac{180}{9} &= \frac{9h}{9} \\ 20 &= h \end{aligned}$$

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6. Use $A=\frac{1}{2}h(B+b)$ when $A = 60$, $B = 7$, and $b = 3$.

$$A=\frac{1}{2}h(B+b)$$
$$60=\frac{1}{2}h(7+3)$$
$$60=\frac{1}{2}h(10)$$
$$60=5h$$
$$\frac{60}{5}=\frac{5h}{5}$$
$$12=h$$

7. Use $P = a + b + c$ when $P = 30$, $a = 8$, and $b = 10$.

$$P=a+b+c$$
$$30=8+10+c$$
$$30=18+c$$
$$30-18=18+c-18$$
$$12=c$$

8. Use $V=\frac{1}{3}Ah$ when $V = 45$ and $h = 5$.

$$V=\frac{1}{3}Ah$$
$$45=\frac{1}{3}A\cdot 5$$
$$45=\frac{5}{3}A$$
$$\frac{3}{5}\cdot 45=\frac{3}{5}\cdot\frac{5}{3}A$$
$$27=A$$

9. Use $C = 2\pi r$ when $C = 15.7$ and 3.14 is used as an approximation for π.

$$C=2\pi r$$
$$15.7=2(3.14)r$$
$$15.7=6.28r$$
$$\frac{15.7}{6.28}=\frac{6.28r}{6.28}$$
$$2.5=r$$

10. Use $A=\pi r^2$ when $r = 4$ and 3.14 is used as an approximation for π.

$$A=\pi r^2$$
$$A=3.14\cdot 4^2$$
$$A=3.14\cdot 16$$
$$A=50.24$$

11.
$$f=5gh$$
$$\frac{f}{5g}=\frac{5gh}{5g}$$
$$\frac{f}{5g}=h$$

12.
$$C=2\pi r$$
$$\frac{C}{2\pi}=\frac{2\pi r}{2\pi}$$
$$\frac{C}{2\pi}=r$$

13.
$$V=lwh$$
$$\frac{V}{lh}=\frac{lwh}{lh}$$
$$\frac{V}{lh}=w$$

14.
$$T=mnr$$
$$\frac{T}{mr}=\frac{mnr}{mr}$$
$$\frac{T}{mr}=n$$

15.
$$3x+y=7$$
$$3x+y-3x=7-3x$$
$$y=7-3x$$

16.
$$-x+y=13$$
$$x-x+y=x+13$$
$$y=x+13$$

17.
$$A=P+PRT$$
$$A-P=P+PRT-P$$
$$A-P=PRT$$
$$\frac{A-P}{PT}=\frac{PRT}{PT}$$
$$\frac{A-P}{PT}=R$$

18.
$$A=P+PRT$$
$$A-P=P+PRT-P$$
$$A-P=PRT$$
$$\frac{A-P}{PR}=\frac{PRT}{PR}$$
$$\frac{A-P}{PR}=T$$

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19. $V = \frac{1}{3}Ah$

$3V = 3 \cdot \frac{1}{3}Ah$

$3V = Ah$

$\frac{3V}{h} = \frac{Ah}{h}$

$\frac{3V}{h} = A$

20. $D = \frac{1}{4}fk$

$4D = 4 \cdot \frac{1}{4}fk$

$4D = fk$

$\frac{4D}{f} = \frac{fk}{f}$

$\frac{4D}{f} = k$

21. $P = a + b + c$

$P - b - c = a + b + c - b - c$

$P - b - c = a$

22. $PR = x + y + z + w$

$PR - x - y - w = x + y + z - x - y - w$

$PR - x - y - w = z$

23. $S = 2\pi rh + 2\pi r^2$

$S - 2\pi r^2 = 2\pi rh + 2\pi r^2 - 2\pi r^2$

$S - 2\pi r^2 = 2\pi rh$

$\frac{S - 2\pi r^2}{2\pi r} = \frac{2\pi rh}{2\pi r}$

$\frac{S - 2\pi r^2}{2\pi r} = h$

24. $S = 4lw + 2wh$

$S - 4lw = 4lw + 2wh - 4lw$

$S - 4lw = 2wh$

$\frac{S - 4lw}{2w} = \frac{2wh}{2w}$

$\frac{S - 4lw}{2w} = h$

25. a. Area $= l \cdot w = (11.5)(9) = 103.5$

Perimeter $= 2l + 2w$

$= 2(11.5) + 2(9)$

$= 23 + 18$

$= 41$

The area is 103.5 square feet and the perimeter is 41 feet.

b. The baseboard goes around the edges of the room, so it involves the perimeter. The carpet covers the floor of the room, so it involves area.

26. a. Area $= \frac{1}{2}bh = \frac{1}{2}(36)(27) = 486$

Perimeter = 27 + 36 + 45 = 108

The area is 486 square feet and the perimeter is 108 feet.

b. The fence goes around the edges of the yard, so it involves perimeter. The grass covers the yard, so it involves area.

27. a. Area $= \frac{1}{2}h(B + b)$

$= \frac{1}{2} \cdot 12(56 + 24)$

$= 6(80)$

$= 480$

Perimeter = 24 + 20 + 56 + 20 = 120

The area is 480 square inches and the perimeter is 120 inches.

b. The frame goes around the edges of the picture, so it involves perimeter. The glass covers the picture, so it involves area.

28. a. Area $= bh = 9.3(7) = 65.1$

Perimeter $= 2(11.7) + 2(9.3)$

$= 23.4 + 18.6$

$= 42$

The area is 65.1 square feet and the perimeter is 42 feet.

b. The border goes around the edges, so it involves perimeter. The paint covers the wall, so it involves area.

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29. Use $A = lw$ when $A = 3990$ and $w = 57$.

$$A = lw$$
$$3990 = l(57)$$
$$\frac{3990}{57} = \frac{57l}{57}$$
$$70 = l$$

The length (height) of the billboard was 70 feet.

30. Use $A = lw$ when $A = 52{,}400$ and $l = 400$.

$$A = lw$$
$$52{,}400 = 400 \cdot w$$
$$\frac{52{,}400}{400} = \frac{400w}{400}$$
$$131 = w$$

The width of the sign is 131 feet.

31. Use $F = \frac{9}{5}C + 32$ when $F = 14$.

$$F = \frac{9}{5}C + 32$$
$$14 = \frac{9}{5}C + 32$$
$$14 - 32 = \frac{9}{5}C + 32 - 32$$
$$-18 = \frac{9}{5}C$$
$$\frac{5}{9} \cdot (-18) = \frac{5}{9} \cdot \frac{9}{5}C$$
$$-10 = C$$

Thus, 14°F is equivalent to −10°C.

32. Use $F = \frac{9}{5}C + 32$ when $C = -5$.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5}(-5) + 32$$
$$F = \frac{9}{5}(-5) + 32$$
$$F = -9 + 32$$
$$F = 23$$

Thus, −5°C is equivalent to 23°F.

33. Use $d = rt$ when $d = 25{,}000$ and $r = 4000$.

$$d = rt$$
$$25{,}000 = 4000t$$
$$\frac{25{,}000}{4000} = \frac{4000t}{4000}$$
$$6.25 = t$$

It will take the X-30 6.25 hours to travel around the Earth.

34. Use $d = rt$ when $d = 303$ and $t = 8\frac{1}{2}$.

$$d = rt$$
$$303 = r \cdot 8\frac{1}{2}$$
$$303 = \frac{17}{2}r$$
$$\frac{2}{17} \cdot 303 = \frac{2}{17} \cdot \frac{17}{2}r$$
$$\frac{606}{17} = r$$
$$35\frac{11}{17} = r$$

The average rate during the fligth was $35\frac{11}{17}$ mph.

35. Let x be the length. Then $\frac{2}{3}x$ is the width. Use $P = 2 \cdot \text{length} + 2 \cdot \text{width}$ when $P = 260$.

$$P = 2 \cdot \text{length} + 2 \cdot \text{width}$$
$$260 = 2x + 2 \cdot \frac{2}{3}x$$
$$260 = 2x + \frac{4}{3}x$$
$$260 = \frac{6}{3}x + \frac{4}{3}x$$
$$260 = \frac{10}{3}x$$
$$\frac{3}{10} \cdot 260 = \frac{3}{10} \cdot \frac{10}{3}x$$
$$78 = x$$

The length is 78 feet and the width is $\frac{2}{3} \cdot 78 = 52$ feet.

36. Let x be the width. Then $2x - 10$ is the length. Use $P = 2 \cdot \text{length} + 2 \cdot \text{width}$ when $P = 400$.

$$P = 2 \cdot \text{length} + 2 \cdot \text{width}$$
$$400 = 2(2x - 10) + 2x$$
$$400 = 4x - 20 + 2x$$
$$400 = 6x - 20$$
$$400 + 20 = 6x - 20 + 20$$
$$420 = 6x$$
$$\frac{420}{6} = \frac{6x}{6}$$
$$70 = x$$

The width is 70 meters and the length is $2(70) - 10 = 140 - 10 = 130$ meters.

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37. Let x represent the length of the shortest side. Then the second side has length $2x$ and the third side has length $30 + x$. The perimeter is the sum of the lengths of the sides.

$$x + 2x + 30 + x = 102$$
$$4x + 30 = 102$$
$$4x + 30 - 30 = 102 - 30$$
$$4x = 72$$
$$\frac{4x}{4} = \frac{72}{4}$$
$$x = 18$$

$2x = 2(18) = 36$
$30 + x = 30 + 18 = 48$
The flower bed has sides of length 18 feet, 36 feet, and 48 feet.

38. Let x represent the length of each of the equal sides. Then the shortest side is $x - 2$. The perimeter is the sum of the lengths of the sides.

$$x + x + x - 2 = 22$$
$$3x - 2 = 22$$
$$3x - 2 + 2 = 22 + 2$$
$$3x = 24$$
$$\frac{3x}{3} = \frac{24}{3}$$
$$x = 8$$

The shortest side is 6 feet.

39. Use $d = rt$ when $r = 55$ and $t = 2\frac{1}{2}$.

$$d = rt$$
$$d = 55 \cdot 2\frac{1}{2}$$
$$d = 55 \cdot 2.5$$
$$d = 137.5$$

The distance between Bar Harbor and Yarmouth is 137.5 miles.

40. Use $d = rt$ when $d = 700$ and $r = 55$.

$$d = rt$$
$$700 = 55t$$
$$\frac{700}{55} = \frac{55t}{55}$$
$$12\frac{8}{11} = t$$

The trip will take $12\frac{8}{11}$ hours.

41. To find the amount of water in the tank, use $V = lwh$ with $l = 8$, $w = 3$, and $h = 6$.
$V = lwh = 8 \cdot 3 \cdot 6 = 144$
The tank holds 144 cubic feet of water. Let x represent the number of piranhas the tank could hold. Then $1.5x = 144$.

$$1.5x = 144$$
$$\frac{1.5x}{1.5} = \frac{144}{1.5}$$
$$x = 96$$

The tank could hold 96 piranhas.

42. To find the amount of water in the tank, use $V = \pi r^2 h$ with $r = \frac{8}{2} = 4$, $h = 3$, and $\pi \approx 3.14$.

$$V = \pi r^2 h = 3.14(4)^2 \cdot 3 = 3.14(16) \cdot 3 = 150.72$$

The tank holds 150.72 cubic meters of water. Let x represent the number of goldfish the tank could hold. Then $2x = 150.72$.

$$2x = 150.72$$
$$\frac{2x}{2} = \frac{150.72}{2}$$
$$x = 75.36$$

The tank could hold 75 goldfish.

43. Use $A = \frac{1}{2}h(B + b)$ to find the area of the lawn.

$$A = \frac{1}{2}h(B + b)$$
$$A = \frac{1}{2}(60)(130 + 70) = 30(200) = 6000$$

Let x be the number of bags of fertilizer.

$$4000x = 6000$$
$$\frac{4000x}{4000} = \frac{6000}{4000}$$
$$x = 1.5$$

Since $\frac{1}{2}$ bag cannot be purchased, 2 bags must be purchased to cover the lawn.

44. Use $A = \frac{1}{2}bh$ when $A = 20$ and $b = 5$.

$$A = \frac{1}{2}bh$$
$$20 = \frac{1}{2} \cdot 5 \cdot h$$
$$\frac{2}{5} \cdot 20 = \frac{2}{5} \cdot \frac{5}{2} \cdot h$$
$$8 = h$$

The height of the sail is 8 feet.

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45. Use $A = \pi r^2$ to find the area of a pizza.

For the 16-inch pizza, $r = \frac{16}{2} = 8$.

$A = \pi r^2 = \pi(8)^2 = 64\pi$

For a 10-inch pizza, $r = \frac{10}{2} = 5$.

$A = \pi r^2 = \pi(5)^2 = 25\pi$

Two 10-inch pizzas have an area of $2 \cdot 25\pi = 50\pi$ square inches. Since $50\pi < 64\pi$, you get more pizza by buying the 16-inch pizza.

46. Use $C = 2\pi r$ when $r = 4000$ and $\pi \approx 3.14$.

$C = 2\pi r$

$C = 2 \cdot 3.14 \cdot 4000$

$C = 25{,}120$

Thus, 25,120 miles of rope is needed to wrap around the Earth.

47. Use $d = rt$ when $r = 552$ and $d = 42.8$.

$$d = rt$$
$$42.8 = 552t$$
$$\frac{42.8}{552} = \frac{552t}{552}$$
$$0.0775 = t$$

It would last 0.0775 hour or $0.0775(60) \approx 465$ minutes.

48. Use $d = rt$ when $r = 0.5$ and $d = 6$.

$$d = rt$$
$$6 = 0.5t$$
$$\frac{6}{0.5} = \frac{0.5t}{0.5}$$
$$12 = t$$

It took roughly 12 hours.

49. Let s represent the length of one side of the square. Then the perimeter of the square is $4s$. A side of the triangle is $s + 5$ and the triangle's perimeter is $3(s + 5)$.

$$3(s+5) = 4s+7$$
$$3s+15 = 4s+7$$
$$3s+15-3s = 4s+7-3s$$
$$15 = s+7$$
$$15-7 = s+7-7$$
$$8 = s$$

$s + 5 = 8 + 5 = 13$

Each side of the triangle has length 13 inches.

50. Let x be the length of the sides of the square pen. Then $2x - 15$ is the length of the sides of the triangular pen. The perimeters are equal.

$$4x = 3(2x-15)$$
$$4x = 6x-45$$
$$4x-6x = 6x-45-6x$$
$$-2x = -45$$
$$\frac{-2x}{-2} = \frac{-45}{-2}$$
$$x = 22.5$$

$2x - 15 = 2(22.5) - 15 = 45 - 15 = 30$

The square's side length is 22.5 units and the triangle's side length is 30 units.

51. Use $d = rt$ when $d = 135$ an $r = 60$.

$$d = rt$$
$$135 = 60t$$
$$\frac{135}{60} = \frac{60t}{60}$$
$$2.25 = t$$

It will take 2.25 hours.

52. Use $d = rt$ when $d = 150$ and $r = 45$.

$$d = rt$$
$$150 = 45t$$
$$\frac{150}{45} = \frac{45t}{45}$$
$$3\frac{1}{3} = t \text{ or } t = 3 \text{ hr } 20 \text{ min}$$

If he left at 4 A.M., then he will arrive at 4 A.M. + 3 hr 20 min = 7:20 A.M.

53. Use $A = lw$ when $A = 1{,}813{,}500$ and $w = 150$.

$$A = lw$$
$$1{,}813{,}500 = l(150)$$
$$\frac{1{,}813{,}500}{150} = \frac{150l}{150}$$
$$12{,}090 = l$$

The length of the runway is 12,090 feet (more than 2 miles!).

54. Let x be the number of times the bolt can travel around the world in one second.

$$25{,}120x = 270{,}000$$
$$\frac{25{,}120x}{25{,}120} = \frac{270{,}000}{25{,}120}$$
$$x = 10.7$$

The bolt can travel 10.7 times around the world.

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55. Use $F = \frac{9}{5}C + 32$ when $F = 122$.

$$122 = \frac{9}{5}C + 32$$
$$122 - 32 = \frac{9}{5}C + 32 - 32$$
$$90 = \frac{9}{5}C$$
$$\frac{5}{9} \cdot 90 = \frac{5}{9} \cdot \frac{9}{5}C$$
$$50 = C$$

Thus, 122°F is equivalent to 50°C.

56. Use $F = \frac{9}{5}C + 32$ when $C = -10$.

$$F = \frac{9}{5}C + 32 = \frac{9}{5}(-10) + 32 = -18 + 32 = 14$$

Thus, −10°C is equivalent to 14°F.

57. Use $V = lwh$ when $l = 199$, $w = 78.5$, and $h = 33$.
$V = lwh = 199(78.5)(33) = 515{,}509.5$
The smallest possible shipping crate has a volume of 515,509.5 cubic inches.

58. Use $d = rt$ when $d = 2810$ and $r = 105$.

$$2810 = 105t$$
$$\frac{2810}{105} = \frac{105t}{105}$$
$$26.8 \approx t$$

It would take about 26.8 hours.

59. Use $V = \frac{4}{3}\pi r^3$ when $r = \frac{9.5}{2} = 4.75$ and $\pi = 3.14$.

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(4.75)^3 \approx 449$$

The volume of the sphere is 449 cubic inches.

60. Use $V = \frac{4}{3}\pi r^3$ when $r = \frac{30}{2} = 15$ and $\pi = 3.14$.

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(15)^3 = 14{,}130$$

The volume of the sphere is 14,130 cubic inches.

61. Use $F = \frac{9}{5}C + 32$ when $C = 167$.

$$F = \frac{9}{5}C + 32$$
$$= \frac{9}{5}(167) + 32$$
$$= 300.6 + 32$$
$$= 332.6$$
$$\approx 333$$

The average temperature on the planet Mercury is 333°F.

62. Use $F = \frac{9}{5}C + 32$ when $F = -227$.

$$F = \frac{9}{5}C + 32$$
$$-227 = \frac{9}{5}C + 32$$
$$-227 - 32 = \frac{9}{5}C + 32 - 32$$
$$-259 = \frac{9}{5}C$$
$$-259 \cdot \frac{5}{9} = \frac{5}{9} \cdot \frac{9}{5}C$$
$$-144 \approx C$$

The average temperature on Jupiter is −144°C.

63. 32% = 0.32

64. 8% = 0.08

65. 200% = 2.00 or 2

66. 0.5% = 0.005

67. 0.17 = 0.17(100%) = 17%

68. 0.03 = 0.03(100%) = 3%

69. 7.2 = 7.2(100%) = 720%

70. 5 = 5(100%) = 500%

71.

$$N = R + \frac{V}{G}$$
$$N - R = R + \frac{V}{G} - R$$
$$N - R = \frac{V}{G}$$
$$G(N - R) = G \cdot \frac{V}{G}$$
$$G(N - R) = V$$

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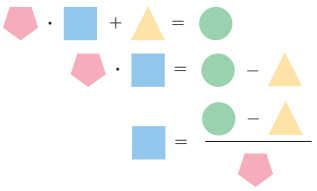
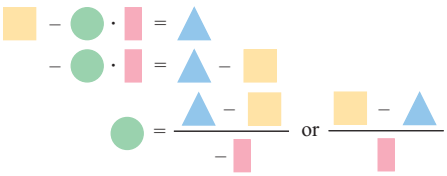
72.
$$B = \frac{F}{P-V}$$
$$B(P-V) = \frac{F}{P-V}(P-V)$$
$$B(P-V) = F$$
$$BP - BV = F$$
$$BP - BV - BP = F - BP$$
$$-BV = F - BP$$
$$\frac{-BV}{-B} = \frac{F-BP}{-B}$$
$$V = \frac{BP-F}{B}$$
$$V = \frac{BP}{B} - \frac{F}{B}$$
$$V = P - \frac{F}{B}$$

73. Use $V = lwh$. If the length is doubled, the new length is $2l$. If the width and height are doubled, the new width and height are $2w$ and $2h$, respectively.
$V = (2l)(2w)(2h) = 2 \cdot 2 \cdot 2lwh = 8lwh$
The volume of the box is multiplied by 8.

74. Use $A = bh$. If the base is doubled, the new base is $2b$. If the height is doubled, the new height is $2h$.
$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$
The area is multiplied by 4.

75. Let x be the temperature. Use $F = \frac{9}{5}C + 32$ when $F = C = x$.
$$F = \frac{9}{5}C + 32$$
$$x = \frac{9}{5}x + 32$$
$$x - \frac{9}{5}x = \frac{9}{5}x + 32 - \frac{9}{5}x$$
$$\frac{5}{5}x - \frac{9}{5}x = 32$$
$$-\frac{4}{5}x = 32$$
$$-\frac{5}{4}\cdot\left(-\frac{4}{5}x\right) = -\frac{5}{4}\cdot 32$$
$$x = -40$$
They are the same when the temperature is $-40°$.

76.


77.


78.
$$\frac{20 \text{ inches}}{1 \text{ day}} \cdot \frac{1 \text{ foot}}{12 \text{ inches}} \cdot \frac{365 \text{ days}}{1 \text{ year}}$$
$$= \frac{20 \cdot 365 \text{ feet}}{12 \text{ year}}$$
$$\approx 608.33 \text{ feet/year}$$
The glacier moves 608.33 feet per year.

79.
$$\frac{20 \text{ miles}}{1 \text{ hour}} \cdot \frac{5280 \text{ feet}}{1 \text{ mile}} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \cdot \frac{1 \text{ minute}}{60 \text{ seconds}}$$
$$= \frac{20 \cdot 5280 \text{ feet}}{60 \cdot 60 \text{ seconds}}$$
$$\approx 29.3 \text{ feet/second}$$
Use $d = rt$ when $d = 1300$ and $r = 29.3$.
$$d = rt$$
$$1300 = 29.3t$$
$$\frac{1300}{29.3} = \frac{29.3t}{29.3}$$
$$44.3 \approx t$$
It took 44.3 seconds to travel that distance.

80. Use $I = PRT$ when $I = 3750$, $P = 25{,}000$ and $R = 0.05$.
$$I = PRT$$
$$3750 = 25{,}000(0.05)T$$
$$3750 = 1250T$$
$$\frac{3750}{1250} = \frac{1250T}{1250}$$
$$3 = T$$

81. Use $I = PRT$ when $I = 1{,}056{,}000$, $R = 0.055$, and $T = 6$.
$$I = PRT$$
$$1{,}056{,}000 = P(0.055)(6)$$
$$1{,}056{,}000 = 0.33P$$
$$\frac{1{,}056{,}000}{0.33} = \frac{0.33P}{0.33}$$
$$3{,}200{,}000 = P$$

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82. Use $V = \frac{1}{3}\pi r^2 h$ when $V = 565.2$ and $r = 6$.

$$V = \frac{1}{3}\pi r^2 h$$
$$565.2 = \frac{1}{3}\pi \cdot 6^2 h$$
$$\frac{3}{\pi \cdot 6^2} \cdot 565.2 = \frac{3}{\pi \cdot 6^2} \cdot \frac{1}{3}\pi \cdot 6^2 h$$
$$15 \approx h$$

83. Use $V = \frac{4}{3}\pi r^3$ when $r = 3$.

$$V = \frac{4}{3}\pi \cdot 3^3$$
$$V \approx 113.1$$

Section 2.6 Practice Problems

1. Let x be the unknown percent.

$$22 = x \cdot 40$$
$$22 = 40x$$
$$\frac{22}{40} = \frac{40x}{40}$$
$$0.55 = x$$
$$55\% = x$$

The number 22 is 55% of 40.

2. Let x be the unknown number.

$$150 = 40\% \cdot x$$
$$150 = 0.4x$$
$$\frac{150}{0.4} = \frac{0.4x}{0.4}$$
$$375 = x$$

The number 150 is 40% of 375.

3. a. From the graph, we see 66% are for solely pleasure.

b. From the graph, 66% are for pleasure and 4% are for combined business/pleasure. The sum is 66% + 4% = 70%.

c. Find 66% of 250.
0.66(250) = 165
We expect 165 people to be traveling solely for pleasure.

4.
$$\text{discount} = \text{percent} \cdot \text{original price}$$
$$= 40\% \cdot \$400$$
$$= 0.40 \cdot \$400$$
$$= \$160$$
$$\text{new price} = \text{original price} - \text{discount}$$
$$= \$400 - \$160$$
$$= \$240$$

The discount in price is \$160 and the new price is \$240.

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5. increase = new − old = 200 − 120 = 80
Let x be the percent increase.

$$80 = x \cdot 120$$
$$\frac{80}{120} = \frac{120x}{120}$$
$$0.667 \approx x$$
$$66.7\% \approx x$$

The percent increase is 66.7%.

6. Let x be the original price.

$$x - 0.20x = 46$$
$$0.8x = 46$$
$$\frac{0.8x}{0.8} = \frac{46}{0.8}$$
$$x = 57.5$$

The original price is $57.50.

7. Let x represent the liters of 20% solution.

	Number of Liters	Dye Strength	Amount
20% solution	x	20%	$0.2x$
50% solution	$6 - x$	50%	$0.5(6 - x)$
40% solution	6	40%	0.4(6)

$$0.2x + 0.5(6 - x) = 0.4(6)$$
$$0.2x + 3 - 0.5x = 2.4$$
$$-0.3x + 3 = 2.4$$
$$-0.3x + 3 - 3 = 2.4 - 3$$
$$-0.3x = -0.6$$
$$\frac{-0.3x}{-0.3} = \frac{-0.6}{-0.3}$$
$$x = 2$$

$6 - x = 6 - 2 = 4$
If 2 liters of 20% solution are mixed with 4 liters of 50% solution, the result is 6 liters of 40% solution.

Mental Math

1. no; 25% + 25% + 40% ≠ 100%

2. no; 30% + 30% + 30% ≠ 100%

3. yes; 25% + 25% + 25% + 25% = 100%

4. yes; 40% + 50% + 10% = 100%

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Exercise Set 2.6

1. Let x be the unknown number.
$x = 16\% \cdot 70$
$x = 0.16 \cdot 70$
$x = 11.2$
11.2 is 16% of 70.

2. Let x be the unknown number.
$x = 88\% \cdot 1000$
$x = 0.88 \cdot 1000$
$x = 880$
880 is 88% of 1000.

3. Let x be the unknown percent.
$$28.6 = x \cdot 52$$
$$\frac{28.6}{52} = \frac{52x}{52}$$
$$0.55 = x$$
$$55\% = x$$
The number 28.6 is 55% of 52.

4. Let x be the unknown percent.
$$87.2 = x \cdot 436$$
$$\frac{87.2}{436} = \frac{436x}{436}$$
$$0.2 = x$$
$$20\% = x$$
The number 87.2 is 20% of 436.

5. Let x be the unknown number.
$$45 = 25\% \cdot x$$
$$45 = 0.25 \cdot x$$
$$\frac{45}{0.25} = \frac{0.25x}{0.25}$$
$$180 = x$$
45 is 25% of 180.

6. Let x be the unknown number.
$$126 = 35\% \cdot x$$
$$126 = 0.35 \cdot x$$
$$\frac{126}{0.35} = \frac{0.35x}{0.35}$$
$$360 = x$$
126 is 35% of 360.

7. From the graph, 4% of adults spend more than 121 minutes on the phone each day.

8. From the graph, 3% of adults spend 0 minutes on the phone each day.

9. 37% of adults talk 16–60 minutes on the phone each day.
$37\% \cdot 27{,}000 = 0.37 \cdot 27{,}000 = 9990$
You would expect 9990 of the adults in Florence to talk 16–60 minutes each day.

10. 8% of adults talk 61–120 minutes on the phone each day.
$8\% \cdot 29{,}250 = 0.08 \cdot 29{,}250 = 2340$
You would expect 2340 of the adults in Columbus to talk 61–120 minutes each day.

11. $\text{discount} = \text{percent} \cdot \text{original price}$
$= 8\% \cdot \$18{,}500$
$= 0.08 \cdot \$18{,}500$
$= \$1480$
$\text{new price} = \text{original price} - \text{discount}$
$= \$18{,}500 - \$1480$
$= \$17{,}020$
The discount is \$1480 and the new price is \$17,020.

12. $\text{discount} = \text{percent} \cdot \text{original price}$
$= 25\% \cdot \$12.50$
$= 0.25 \cdot \$12.50$
$\approx \$3.13$
$\text{new price} = \text{original price} - \text{discount}$
$= \$12.50 - \$3.13$
$= \$9.37$
The discount is \$3.13 and the new price is \$9.37.

13. $15\% \cdot 40.50 = 0.15 \cdot 40.5 = 6.075$
The tip is \$6.08.
40.5 + 6.08 = 46.58
The total cost of the meal is \$46.58.

14. $20\% \cdot 65.40 = 0.20 \cdot 65.4 = 13.08$
The tip is \$13.08.
65.4 + 13.08 = 78.48
The total cost of the dinner is \$78.48.

15. $$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{380{,}000 - 220{,}000}{220{,}000}$$
$$= \frac{160{,}000}{220{,}000}$$
$$\approx 0.73$$
The number of complaints increased by 73%.

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16. $$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{1100 - 996}{996}$$
$$= 996$$
$$\approx 0.10$$
The number of text messages increased by 10%.

17. $$\text{percent decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$$
$$= \frac{40 - 28}{40}$$
$$= \frac{12}{40}$$
$$= 0.3$$
The area decreased by 30%.

18. $$\text{percent decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$$
$$= \frac{100 - 81}{100}$$
$$= \frac{19}{100}$$
$$= 0.19$$
The area decreased by 19%.

19. Let x represent the original price.
$$x - 25\% \cdot x = 78$$
$$x - 0.25x = 78$$
$$0.75x = 78$$
$$\frac{0.75x}{0.75} = \frac{78}{0.75}$$
$$x = 104$$
The original price of the shoes was \$104.

20. Let x represent the original price.
$$x + 25\% \cdot x = 80$$
$$x + 0.25x = 80$$
$$1.25x = 80$$
$$\frac{1.25x}{1.25} = \frac{80}{1.25}$$
$$x = 64$$
The original price of the shoes was \$65.

21. Let x represent last year's salary.
$$x + 4\% \cdot x = 44,200$$
$$x + 0.04x = 44,200$$
$$1.04x = 44,200$$
$$\frac{1.04x}{1.04} = \frac{44,200}{1.04}$$
$$x = 42,500$$
Last year's salary was \$42,500.

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22. Let x represent last year's salary.

$$x + 3\% \cdot x = 55,620$$
$$x + 0.03x = 55,620$$
$$1.03x = 55,620$$
$$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$$
$$x = 54,000$$

Last year's salary was \$54,000.

23. Let x represent the number of gallons of pure acid.

	Number of Gallons	· Acid Strength	= Amount of Acid
Pure Acid	x	100%	$1x$
40% Acid Solution	2	40%	$0.4x$
70% Acid Solution Needed	$x + 2$	70%	$0.7(x + 2)$

The amount of acid being combined must be the same as that in the mixture.

$$x + 0.4x = 0.7(x + 2)$$
$$1.4x = 0.7x + 1.4$$
$$1.4x - 0.7x = 0.7x + 1.4 - 0.7x$$
$$0.7x = 1.4$$
$$\frac{0.7x}{0.7} = \frac{1.4}{0.7}$$
$$x = 2$$

Thus, 2 gallons of pure acid should be used.

24. Let x represent the cubic centimeters of 25% solution.

	Number of Cubic cm	· Antibiotic Strength	= Amount of Antibiotic
25% Antibiotic Solution	x	25%	$0.25x$
60% Antibiotic Solution	10	60%	0.6(10)
30% Antibiotic Solution Needed	$x + 10$	30%	$0.3(x + 10)$

The amount of antibiotic being combined must be the same as that in the mixture.

$$0.25x + 0.6(10) = 0.3(x + 10)$$
$$0.25x + 6 = 0.3x + 3$$
$$0.25x + 6 - 3 = 0.3x + 3 - 3$$
$$0.25x + 3 = 0.3x$$
$$0.25x + 3 - 0.25x = 0.3x - 0.25x$$
$$3 = 0.05x$$
$$\frac{3}{0.05} = \frac{0.05x}{0.05}$$
$$60 = x$$

Thus, 60 cubic centimeters should be used.

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25. Let x represent the number of pounds of coffee worth \$7 a pound.

	Number of pounds	· Cost per pound	= Value
\$7/lb coffee	x	7	$7x$
\$4/lb coffee	14	4	$4 \cdot 14 = 56$
\$5/lb coffee wanted	$x + 14$	5	$5(x + 14)$

The value of the coffee being combined must be the same as the value of the mixture.

$$\begin{aligned} 7x + 56 &= 5(x + 14) \\ 7x + 56 &= 5x + 70 \\ 7x + 56 - 5x &= 5x + 70 - 5x \\ 2x + 56 &= 70 \\ 2x + 56 - 56 &= 70 - 56 \\ 2x &= 14 \\ \frac{2x}{2} &= \frac{14}{2} \\ x &= 7 \end{aligned}$$

7 pounds of the \$4 a pound coffee should be used.

26. Let x represent the number of pounds of cashews.

	Number of pounds	· Cost per pound	= Value
\$3 per lb Peanuts	20	3	$3 \cdot 20 = 60$
\$5 per lb Cashews	x	5	$5x$
\$3.50 per lb Mixture Wanted	$20 + x$	3.5	$3.5(20 + x)$

The value of the nuts being combined must be the same as the value of the mixture.

$$\begin{aligned} 60 + 5x &= 3.5(20 + x) \\ 60 + 5x &= 70 + 3.5x \\ 60 + 5x - 3.5x &= 70 + 3.5x - 3.5x \\ 60 + 1.5x &= 70 \\ 60 + 1.5x - 60 &= 70 - 60 \\ 1.5x &= 10 \\ \frac{1.5x}{1.5} &= \frac{10}{1.5} \\ x &= 6\frac{2}{3} \end{aligned}$$

Mix $6\frac{2}{3}$ pounds of cashews with the peanuts.

27. $23\% \cdot 20 = 0.23 \cdot 20 = 4.6$

28. $140\% \cdot 86 = 1.4 \cdot 86 = 120.4$

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29. Let x represent the unknown number.

$$40 = 80\% \cdot x$$
$$40 = 0.80 \cdot x$$
$$\frac{40}{0.8} = \frac{0.8x}{0.8}$$
$$50 = x$$

40 is 80% of 50.

30. Let x represent the unknown number.

$$56.25 = 45\% \cdot x$$
$$56.25 = 0.45 \cdot x$$
$$\frac{56.25}{0.45} = \frac{0.45x}{0.45}$$
$$125 = x$$

56.25 is 45% of 125.

31. Let x represent the unknown percent.

$$144 = x \cdot 480$$
$$\frac{144}{480} = \frac{480x}{480}$$
$$0.3 = x$$
$$30\% = x$$

144 is 30% of 480.

32. Let x represent the unknown percent.

$$42 = x \cdot 35$$
$$\frac{42}{35} = \frac{35x}{35}$$
$$1.2 = x$$
$$120\% = x$$

42 is 120% of 35.

33. From the graph, it appears that 71% of the population of Fairbanks, Alaska shops by catalog.

34. From the graph, it appears that 65% of the population of Charlottesville, Virginia shops by catalog.

35. $65\% \cdot 270{,}951 = 0.65 \cdot 270{,}951 \approx 176{,}118$
We predict 176,118 catalog shoppers live in Anchorage.

36. $81\% \cdot 31{,}187 = 0.81 \cdot 31{,}187 \approx 25{,}261$
We predict 25,261 catalog shoppers live in Juneau.

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37.

Ford Motor Company Model Year 2004 Vehicle Sales Worldwide		
	Thousands of vehicles	Percent of Total (Rounded to nearest percent)
North America	3277	$\frac{3277}{5462} \approx 0.59996 \approx 60\%$
Europe	1474	$\frac{1474}{5462} \approx 0.26986 \approx 27\%$
Asia-Pacific	328	$\frac{328}{5462} \approx 0.06005 \approx 6\%$
Rest of the world	383	$\frac{383}{5462} \approx 0.07012 \approx 7\%$
Total	5462	

38.

Kraft Foods North America Year 2003 Volume Food Produced		
Food Group	Volume (in pounds)	Percent (Round to Nearest Percent)
Cheese, Meals, and Enhancers	6183	$\frac{6183}{13,741} \approx 45\%$
Biscuits, Snacks, and Confectionaries	2083	$\frac{2083}{13,741} \approx 15\%$
Beverages, Desserts, and Cereals	3905	$\frac{3905}{13,741} \approx 2\%$
Oscar Mayer and Pizza	1570	$\frac{1570}{13,741} \approx 11\%$
Total	13,741	
Source: Kraft Foods, North America		

39. $$\begin{aligned}\text{percent increase} &= \frac{\text{amount of increase}}{\text{original amount}} \\ &= \frac{70-40}{40} \\ &= \frac{30}{40} \\ &= 0.75\end{aligned}$$

The price increased by 75%.

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40. $$\text{percent decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$$
$$= \frac{25.6 - 22.4}{25.6}$$
$$= \frac{3.2}{25.6}$$
$$= 0.125$$
The percent decrease is 12.5%.

41. Let x represent the amount Charles paid for the car.
$$x + 20\% \cdot x = 4680$$
$$x + 0.20x = 4680$$
$$1.2x = 4680$$
$$\frac{1.2x}{1.2} = \frac{4680}{1.2}$$
$$x = 3900$$
Charles paid $3900 for the car.

42. Let x represent the number of cards issued in 2001.
$$x + 1.17x = 500,000,000$$
$$2.17x = 500,000,000$$
$$\frac{2.17x}{2.17} = \frac{500,000,000}{2.17}$$
$$x \approx 230,000,000$$
About 230 million cards were issued in 2001.

43. $$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{144 - 36}{36}$$
$$= \frac{108}{36}$$
$$= 3$$
The area increased by 300%.

44. $$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{24 - 6}{6}$$
$$= \frac{18}{6}$$
$$= 3$$
The area increased by 300%.

45. Markup = $5\% \cdot 2.20 = 0.05 \cdot 2.2 = 0.11$
New price = 2.20 + 0.11 = 2.31
The markup is \$0.11 and the new price is \$2.31.

46. Markup = $10\% \cdot 89.90 = 0.10 \cdot 89.9 = 8.99$
New price = 89.90 + 8.99 = 98.89
The markup is \$8.99 and the new price is \$98.89.

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47. Let x be the ounces of alloy that is 20% copper.

	ounces	concentration	amount
20% copper	x	20%	$0.2x$
50% copper	200	50%	$0.5(200)$
30% copper	$200 + x$	30%	$0.3(200 + x)$

The amount of copper being combined must be the same as that in the mixture.

$$\begin{aligned}
0.2x + 0.5(200) &= 0.3(200 + x) \\
0.2x + 100 &= 60 + 0.3x \\
0.2x + 100 - 0.2x &= 60 + 0.3x - 0.2x \\
100 &= 60 + 0.1x \\
100 - 60 &= 60 + 0.1x - 60 \\
40 &= 0.1x \\
\frac{40}{0.1} &= \frac{0.1x}{0.1} \\
400 &= x
\end{aligned}$$

Thus 400 ounces should be used.

48. Let x be the gallons of water.

	gallons	concentration	amount
water	x	0%	$0x = 0$
70% antifreeze	30	70%	$0.7(30)$
60% antifreeze	$x + 30$	60%	$0.6(x + 30)$

The amount of antifreeze being combined must be the same as that in the mixture.

$$\begin{aligned}
0 + 0.7(30) &= 0.6(x + 30) \\
21 &= 0.6x + 18 \\
21 - 18 &= 0.6x + 18 - 18 \\
3 &= 0.6x \\
\frac{3}{0.6} &= \frac{0.6x}{0.6} \\
5 &= x
\end{aligned}$$

Thus, 5 gallons of water should be used.

49.
$$\begin{aligned}
\text{percent decrease} &= \frac{\text{amount of decrease}}{\text{original amount}} \\
&= \frac{151 - 73}{151} \\
&= \frac{78}{151} \\
&\approx 0.517
\end{aligned}$$

The number of decisions by the Supreme Court decreased by 51.7%.

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50. $$\text{percent decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$$
$$= \frac{6.3 - 2.1}{6.3}$$
$$= \frac{4.2}{6.3}$$
$$\approx 0.667$$
The percent decrease in the number of farms is 66.7%.

51. Let x be the prior number of employees.
$$x - 0.35x = 78$$
$$0.65x = 78$$
$$\frac{0.65x}{0.65} = \frac{78}{0.65}$$
$$x = 120$$
There were 120 employees prior to the layoffs.

52. Let x be the average number of children per woman in 1920.
$$x - 0.44x = 1.9$$
$$0.56x = 1.9$$
$$\frac{0.56x}{0.56} = \frac{1.9}{0.56}$$
$$x \approx 3.4$$
There were 3.4 children per woman in 1920.

53. decrease = $25\% \cdot 256 = 0.25 \cdot 256 = 64$
$256 - 64 = 192$
The price of the coat decreased by \$64. The sale price was \$192.

54. decrease = $15\% \cdot 0.95 = 0.15 \cdot 0.95 \approx 0.14$
$0.95 - 0.14 = 0.81$
The decrease in price was \$0.14. The new price was \$0.81.

55. increase = $48\% \cdot 577 = 0.48 \cdot 577 = 276.96$
$577 + 276.96 = 853.96$
The Naga Jolokia pepper measures 854 thousand Scoville units.

56. $$\text{increase} = 80.4\% \cdot 138.56$$
$$= 0.804 \cdot 138.56$$
$$\approx 111.4$$
$138.56 + 111.4 \approx 250$
Christian Sandstrom's world record was 250 meters.

57. $42\% \cdot 860 = 0.42 \cdot 860 = 361.2$
You would expect 361 students to rank flexible hours as their top priority.

58. $64\% \cdot 9800 = 0.64 \cdot 9800 = 6272$
You would expect 6272 post-secondary institutions to have Internet access in their classrooms.

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59. Let x be the ounces of self-tanning lotion.

	ounces	cost ($)	value
self-tanning	x	3	$3x$
everyday	800	0.30	0.3(800)
experimental	$800 + x$	1.20	$1.2(800 + x)$

The value of those being combined must be the same as the value of the mixture.

$$\begin{aligned} 3x + 0.3(800) &= 1.2(800 + x) \\ 3x + 240 &= 960 + 1.2x \\ 3x + 240 - 1.2x &= 960 + 1.2x - 1.2x \\ 1.8x + 240 &= 960 \\ 1.8x + 240 - 240 &= 960 - 240 \\ 1.8x &= 720 \\ \frac{1.8x}{1.8} &= \frac{720}{1.8} \\ x &= 400 \end{aligned}$$

Therefore, 400 ounces of the self-tanning lotion should be used.

60. Let x be the pounds of chocolate-covered peanuts.

	pounds	cost ($)	value
chocolate-covered	x	5	$5x$
granola bites	10	2	2(10)
trail mix	$x + 10$	3	$3(x + 10)$

The value of those being combined must be the same as the value as the mixture.

$$\begin{aligned} 5x + 2(10) &= 3(x + 10) \\ 5x + 20 &= 3x + 30 \\ 5x + 20 - 3x &= 3x + 30 - 3x \\ 2x + 20 &= 30 \\ 2x + 20 - 20 &= 30 - 20 \\ 2x &= 10 \\ \frac{2x}{2} &= \frac{10}{2} \\ x &= 5 \end{aligned}$$

Therefore, 5 pounds of chocolate-covered peanuts should be used.

61. $-5 > -7$ since -5 is to the right of -7 on a number line.

62. $\frac{12}{3} = 4, \ 2^2 = 4$

$\frac{12}{3} = 2^2$ since 4 = 4.

63. $|-5| = 5$

$-(-5) = 5$

$|-5| = -(-5)$ since 5 = 5.

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64. $-3^3 = -3 \cdot 3 \cdot 3 = -27$
$(-3)^3 = (-3)(-3)(-3) = -27$
$-3^3 = (-3)^3$ since $-27 = -27$.

65. $(-3)^2 = (-3)(-3) = 9$
$-3^2 = -(3 \cdot 3) = -9$
Since $9 > -9$, $(-3)^2 > -3^2$.

66. $|-2| = 2$
$-|-2| = -2$
$|-2| > -|-2|$ since 2 is to the right of -2 on a number line.

67. no; answers may vary

68. yes; answers may vary

69. 230 mg is what percent of 2400 mg?
Let x represent the unknown percent.
$x \cdot 2400 = 230$
$\frac{2400x}{2400} = \frac{230}{2400}$
$x = 0.0958\overline{3}$
This food contains 9.6% of the daily value of sodium in one serving.

70. 23 g is what percent of 300 g? Let y represent the unknown percent.
$y \cdot 300 = 23$
$\frac{300y}{300} = \frac{23}{300}$
$y \approx 0.07\overline{6}$
This food contains 7.7% of the daily value of total carbohydrate in one serving.

71. 35 is what percent of 130? Let x be the unknown percent.
$35 = x \cdot 130$
$\frac{35}{130} = \frac{130x}{130}$
$0.269 \approx x$
The percent calories from fat is 26.9%. Yes, this food satisfies the recommendation since $26.9\% \le 30\%$.

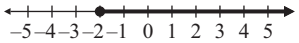
72. 6g · 9 calories/gram = 54 calories
54 of the 280 calories come from fat.
$\frac{54}{280} \approx 0.193$
19.3% of the calories in this food come from fat.

73. 12 g · 4 calories/gram = 48 calories
48 of the 280 calories come from protein.
$\frac{48}{280} \approx 0.171$
17.1% of the calories in this food come from protein.

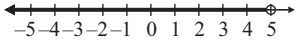
74. answers may vary

Section 2.7 Practice Problems

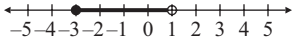
1. $x \ge -2$



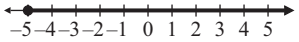
2. $5 > x$ or $x < 5$



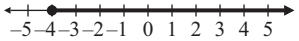
3. $-3 \le x < 1$



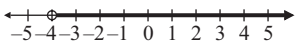
4. $x - 6 \ge -11$
$x - 6 + 6 \ge -11 + 6$
$x \ge -5$



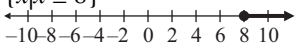
5. $-3x \le 12$
$\frac{-3x}{-3} \ge \frac{12}{-3}$
$x \ge -4$



6. $5x > -20$
$\frac{5x}{5} > \frac{-20}{5}$
$x > -4$



7. $-3x + 11 \le -13$
$-3x + 11 - 11 \le -13 - 11$
$-3x \le -24$
$\frac{-3x}{-3} \ge \frac{-24}{-3}$
$x \ge 8$
$\{x | x \ge 8\}$



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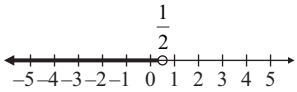
8.
$$\begin{aligned} 2x-3 &> 4(x-1) \\ 2x-3 &> 4x-4 \\ 2x-3-4x &> 4x-4-4x \\ -2x-3 &> -4 \\ -2x-3+3 &> -4+3 \\ -2x &> -1 \\ \frac{-2x}{-2} &< \frac{-1}{-6} \\ x &< \frac{1}{2} \end{aligned}$$

$\left\{x \middle| x < \frac{1}{2}\right\}$



9.
$$\begin{aligned} 3(x+5)-1 &\geq 5(x-1)+7 \\ 3x+15-1 &\geq 5x-5+7 \\ 3x+14 &\geq 5x+2 \\ 3x+14-5x &\geq 5x+2-5x \\ -2x+14 &\geq 2 \\ -2x+14-14 &\geq 2-14 \\ -2x &\geq -12 \\ \frac{-2x}{-2} &\leq \frac{-12}{-2} \\ x &\leq 6 \end{aligned}$$

$\{x|x \leq 6\}$

10. Let x be the unknown number.
$$\begin{aligned} 35-2x &> 15 \\ 35-2x-35 &> 15-35 \\ -2x &> -20 \\ \frac{-2x}{-2} &< \frac{-20}{-2} \\ x &< 10 \end{aligned}$$

11. Let x represent the minimum sales.
$$\begin{aligned} 600+0.04x &\geq 3000 \\ 0.04x &\geq 2400 \\ x &\geq 60,000 \end{aligned}$$
Alex must have minimum sales of $60,000.

Mental Math

1. $5x > 10$
$x > 2$

2. $4x < 20$
$x < 5$

3. $2x \geq 16$
$x \geq 8$

4. $9x \leq 63$
$x \leq 7$

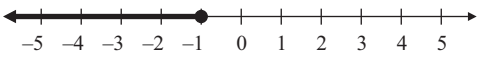
5. $x \geq -3$
-5 is not a solution.

6. $x < 6$
$|-6| = 6$ is not a solution.

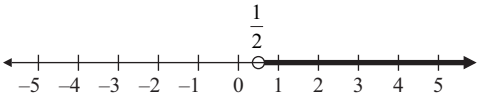
7. $x < 4.01$
4.1 is not a solution.

8. $x \geq -3$
-4 is not a solution.

Exercise Set 2.7

1.


2.


3.


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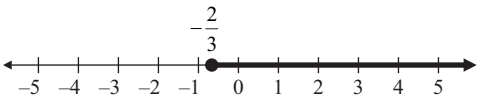

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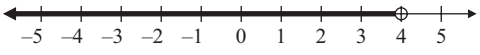

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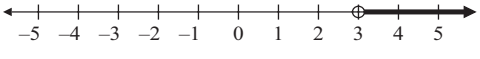

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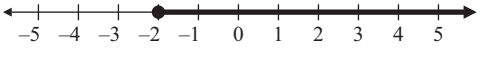

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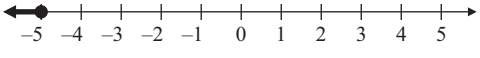

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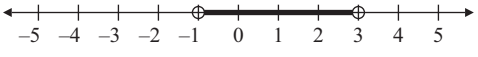

10.


11.


12.


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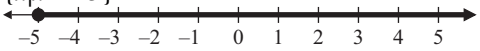
13. $x-2\ge -7$

$x-2+2\ge -7+2$

$x\ge -5$

$\{x|x\ge -5\}$

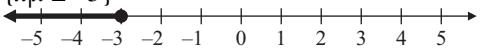


14. $x+4\le 1$

$x+4-4\le 1-4$

$x\le -3$

$\{x|x\le -3\}$

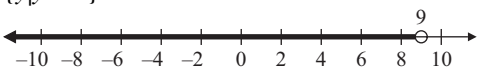


15. $-9+y<0$

$9-9+y<9+0$

$y<9$

$\{y|y<9\}$

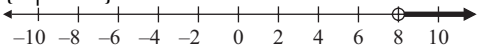


16. $-3+m>5$

$3-3+m>3+5$

$m>8$

$\{m|m>8\}$



17. $3x-5>2x-8$

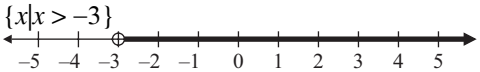
$3x-5-2x>2x-8-2x$

$x-5>-8$

$x-5+5>-8+5$

$x>-3$

$\{x|x>-3\}$



18. $3-7x\ge 10-8x$

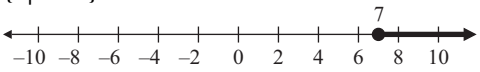
$3-7x+8x\ge 10-8x+8x$

$3+x\ge 10$

$3+x-3\ge 10-3$

$x\ge 7$

$\{x|x\ge 7\}$



19. $4x-1\le 5x-2x$

$4x-1\le 3x$

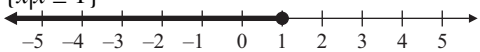
$4x-1-4x\le 3x-4x$

$-1\le -x$

$\frac{-1}{-1}\ge \frac{-x}{-1}$

$1\ge x$ or $x\le 1$

$\{x|x\le 1\}$



20. $7x+3<9x-3x$

$7x+3<6x$

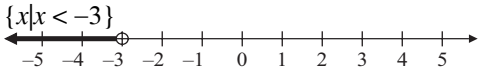
$7x+3-7x<6x-7x$

$3<-x$

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

$-3>x$ or $x<-3$

$\{x|x<-3\}$

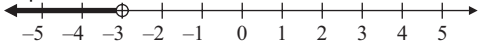


21. $2x<-6$

$\frac{2x}{2}<\frac{-6}{2}$

$x<-3$

$\{x|x<-3\}$



22. $3x>-9$

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

$x>-3$

$\{x|x>-3\}$

23. $-8x\le 16$

$\frac{-8x}{-8}\ge \frac{16}{-8}$

$x\ge -2$

$\{x|x\ge -2\}$

24. $-5x<20$

$\frac{-5x}{-5}>\frac{20}{-5}$

$x>-4$

$\{x|x>-4\}$

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25. $-x > 0$

$(-1)(-x) < (-1)(0)$

$x < 0$

$\{x|x < 0\}$

26. $-y \geq 0$

$(-1)(-y) \leq (-1)(0)$

$y \leq 0$

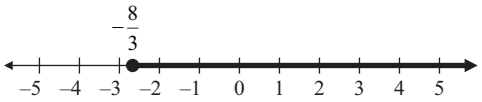
$\{y|y \leq 0\}$

27. $\frac{3}{4}y \geq -2$

$\frac{4}{3}\cdot\frac{3}{4}y \geq \frac{4}{3}\cdot(-2)$

$y \geq -\frac{8}{3}$

$\left\{y \middle| y \geq -\frac{8}{3}\right\}$

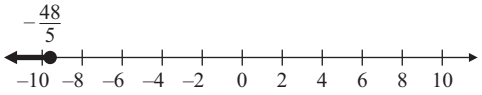


28. $\frac{5}{6}x \leq -8$

$\frac{6}{5}\cdot\frac{5}{6}x \leq \frac{6}{5}\cdot(-8)$

$x \leq -\frac{48}{5}$

$\left\{x \middle| x \leq -\frac{48}{5}\right\}$

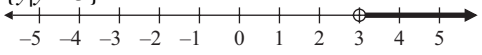


29. $-0.6y < -1.8$

$\frac{-0.6y}{-0.6} > \frac{-1.8}{-0.6}$

$y > 3$

$\{y|y > 3\}$



30. $-0.3x > -2.4$

$\frac{-0.3x}{-0.3} < \frac{-2.4}{-0.3}$

$x < 8$

$\{x|x < 8\}$

31. $-8 < x + 7$

$-8 - 7 < x + 7 - 7$

$-15 < x$

$\{x|x > -15\}$

32. $-11 > x + 4$

$-11 - 4 > x + 4 - 4$

$-15 > x$

$\{x|x < -15\}$

33. $7(x+1) - 6x \geq -4$

$7x + 7 - 6x \geq -4$

$x + 7 \geq -4$

$x + 7 - 7 \geq -4 - 7$

$x \geq -11$

$\{x|x \geq -11\}$

34. $10(x+2) - 9x \leq -1$

$10x + 20 - 9x \leq -1$

$x + 20 \leq -1$

$x + 20 - 20 \leq -1 - 20$

$x \leq -21$

$\{x|x \leq -21\}$

35. $4x > 1$

$\frac{4x}{4} > \frac{1}{4}$

$x > \frac{1}{4}$

$\left\{x \middle| x > \frac{1}{4}\right\}$

36. $6x < 5$

$\frac{6x}{6} < \frac{5}{6}$

$x < \frac{5}{6}$

$\left\{x \middle| x < \frac{5}{6}\right\}$

37. $-\frac{2}{3}y \leq 8$

$-\frac{3}{2}\left(-\frac{2}{3}y\right) \geq -\frac{3}{2}(8)$

$y \geq -12$

$\{y|y \geq -12\}$

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38.
$$-\frac{3}{4}y \ge 9$$
$$-\frac{4}{3}\left(-\frac{3}{4}y\right) \le -\frac{4}{3}\cdot 9$$
$$y \le -12$$
$$\{y|y \le -12\}$$

39.
$$4(2z+1) < 4$$
$$8z+4 < 4$$
$$8z+4-4 < 4-4$$
$$8z < 0$$
$$\frac{8z}{8} < \frac{0}{8}$$
$$z < 0$$
$$\{z|z < 0\}$$

40.
$$6(2-z) \ge 12$$
$$12-6z \ge 12$$
$$12-6z-12 \ge 12-12$$
$$-6z \ge 0$$
$$\frac{-6z}{-6} \le \frac{0}{-6}$$
$$z \le 0$$
$$\{z|z \le 0\}$$

41.
$$3x-7 < 6x+2$$
$$3x-7-3x < 6x+2-3x$$
$$-7 < 3x+2$$
$$-7-2 < 3x+2-2$$
$$-9 < 3x$$
$$\frac{-9}{3} < \frac{3x}{3}$$
$$-3 < x$$
$$\{x|x > -3\}$$

42.
$$2x-1 \ge 4x-5$$
$$2x-1-4x \ge 4x-5-4x$$
$$-2x-1 \ge -5$$
$$-2x-1+1 \ge -5+1$$
$$-2x \ge -4$$
$$\frac{-2x}{-2} \le \frac{-4}{-2}$$
$$x \le 2$$
$$\{x|x \le 2\}$$

43.
$$5x-7x \le x+2$$
$$-2x \le x+2$$
$$-2x-x \le x+2-x$$
$$-3x \le 2$$
$$\frac{-3x}{-3} \ge \frac{2}{-3}$$
$$x \ge -\frac{2}{3}$$
$$\left\{x \middle| x \ge -\frac{2}{3}\right\}$$

44.
$$4-x < 8x+2x$$
$$4-x < 10x$$
$$4-x+x < 10x+x$$
$$4 < 11x$$
$$\frac{4}{11} < \frac{11x}{11}$$
$$\frac{4}{11} < x$$
$$\left\{x \middle| x > \frac{4}{11}\right\}$$

45.
$$-6x+2 \ge 2(5-x)$$
$$-6x+2 \ge 10-2x$$
$$-6x+2+6x \ge 10-2x+6x$$
$$2 \ge 10+4x$$
$$2-10 \ge 10+4x-10$$
$$-8 \ge 4x$$
$$\frac{-8}{4} \ge \frac{4x}{4}$$
$$-2 \ge x$$
$$\{x|x \le -2\}$$

46.
$$-7x+4 > 3(4-x)$$
$$-7x+4 > 12-3x$$
$$-7x+4+3x > 12-3x+3x$$
$$-4x+4 > 12$$
$$-4x+4-4 > 12-4$$
$$-4x > 8$$
$$\frac{-4x}{-4} < \frac{8}{-4}$$
$$x < -2$$
$$\{x|x < -2\}$$

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47. $3(x-5) < 2(2x-1)$
$3x-15 < 4x-2$
$3x-15-3x < 4x-2-3x$
$-15 < x-2$
$-15+2 < x-2+2$
$-13 < x$
$\{x|x > -13\}$

48. $5(x-2) \le 3(2x-1)$
$5x-10 \le 6x-3$
$5x-10-5x \le 6x-3-5x$
$-10 \le x-3$
$-10+3 \le x-3+3$
$-7 \le x$
$\{x|x \ge -7\}$

49. $4(3x-1) \le 5(2x-4)$
$12x-4 \le 10x-20$
$12x-4-10x \le 10x-20-10x$
$2x-4 \le -20$
$2x-4+4 \le -20+4$
$2x \le -16$
$\frac{2x}{2} \le \frac{-16}{2}$
$x \le -8$
$\{x|x \le -8\}$

50. $3(5x-4) \le 4(3x-2)$
$15x-12 \le 12x-8$
$15x-12-12x \le 12x-8-12x$
$3x-12 \le -8$
$3x-12+12 \le -8+12$
$3x \le 4$
$\frac{3x}{3} \le \frac{4}{3}$
$x \le \frac{4}{3}$
$\left\{x \middle| x \le \frac{4}{3}\right\}$

51. $3(x+2)-6 > -2(x-3)+14$
$3x+6-6 > -2x+6+14$
$3x > -2x+20$
$3x+2x > -2x+20+2x$
$5x > 20$
$\frac{5x}{5} > \frac{20}{5}$
$x > 4$
$\{x|x > 4\}$

52. $7(x-2)+x \le -4(5-x)-12$
$7x-14+x \le -20+4x-12$
$8x-14 \le 4x-32$
$8x-14-4x \le 4x-32-4x$
$4x-14 \le -32$
$4x-14+14 \le -32+14$
$4x \le -18$
$\frac{4x}{4} \le \frac{-18}{4}$
$x \le -\frac{9}{2}$
$\left\{x \middle| x \le -\frac{9}{2}\right\}$

53. $-5(1-x)+x \le -(6-2x)+6$
$-5+5x+x \le -6+2x+6$
$-5+6x \le 2x$
$-5+6x-6x \le 2x-6x$
$-5 \le -4x$
$\frac{-5}{-4} \ge \frac{-4x}{-4}$
$\frac{5}{4} \ge x$
$\left\{x \middle| x \le \frac{5}{4}\right\}$

54. $-2(x-4)-3x < -(4x+1)+2x$
$-2x+8-3x < -4x-1+2x$
$-5x+8 < -2x-1$
$-5x+8+2x < -2x-1+2x$
$-3x+8 < -1$
$-3x+8-8 < -1-8$
$-3x < -9$
$\frac{-3x}{-3} > \frac{-9}{-3}$
$x > 3$
$\{x|x > 3\}$

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55.
$$\frac{1}{4}(x+4) < \frac{1}{5}(2x+3)$$
$$20\cdot\frac{1}{4}(x+4) < 20\cdot\frac{1}{5}(2x+3)$$
$$5(x+4) < 4(2x+3)$$
$$5x+20 < 8x+12$$
$$5x+20-5x < 8x+12-5x$$
$$20 < 3x+12$$
$$20-12 < 3x+12-12$$
$$8 < 3x$$
$$\frac{8}{3} < \frac{3x}{3}$$
$$\frac{8}{3} < x$$
$$\left\{x \middle| x > \frac{8}{3}\right\}$$

56.
$$\frac{1}{2}(x-5) < \frac{1}{3}(2x-1)$$
$$6\cdot\frac{1}{2}(x-5) < 6\cdot\frac{1}{3}(2x-1)$$
$$3(x-5) < 2(2x-1)$$
$$3x-15 < 4x-2$$
$$3x-15-3x < 4x-2-3x$$
$$-15 < x-2$$
$$-15+2 < x-2+2$$
$$-13 < x$$
$$\{x|x > -13\}$$

57.
$$-5x+4 \le -4(x-1)$$
$$-5x+4 \le -4x+4$$
$$-5x+4+4x \le -4x+4+4x$$
$$-x+4 \le 4$$
$$-x+4-4 \le 4-4$$
$$-x \le 0$$
$$-1(-x) \ge -1(0)$$
$$x \ge 0$$
$$\{x|x \ge 0\}$$

58.
$$-6x+2 < -3(x+4)$$
$$-6x+2 < -3x-12$$
$$-6x+2+3x < -3x-12+3x$$
$$-3x+2 < -12$$
$$-3x+2-2 < -12-2$$
$$-3x < -14$$
$$\frac{-3x}{-3} > \frac{-14}{-3}$$
$$x > \frac{14}{3}$$
$$\left\{x \middle| x > \frac{14}{3}\right\}$$

59. Let x be the number.
$$2x+6 > -14$$
$$2x+6-6 > -14-6$$
$$2x > -20$$
$$\frac{2x}{2} > \frac{-20}{2}$$
$$x > -10$$
All numbers greater than -10 make this statement true.

60. Let x be the number.
$$5x+1 \le 10$$
$$5x+1-1 \le 10-1$$
$$5x \le 9$$
$$\frac{5x}{5} \le \frac{9}{5}$$
$$x \le \frac{9}{5}$$
All numbers less than or equal to $\frac{9}{5}$ make this statement true.

61. Use $P = 2l + 2w$ when $w = 15$ and $P \le 100$.
$$2l+2(15) \le 100$$
$$2l+30 \le 100$$
$$2l+30-30 \le 100-30$$
$$2l \le 70$$
$$\frac{2l}{2} \le \frac{70}{2}$$
$$l \le 35$$
The maximum length of the rectangle is 35 cm.

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62. Use $P = a + b + c$ when $a = x$, $b = 4x$, $c = 12$, and $P \le 87$.

$$x + 4x + 12 \le 87$$
$$5x + 12 \le 87$$
$$5x + 12 - 12 \le 87 - 12$$
$$5x \le 75$$
$$\frac{5x}{5} \le \frac{75}{5}$$
$$x \le 15$$

$4x \le 4(15) = 60$

The maximum lengths of the other two sides are 15 inches and 60 inches.

63. Let x be the score in his third game.

$$\frac{146 + 201 + x}{3} \ge 180$$
$$\frac{347 + x}{3} \ge 180$$
$$3 \cdot \frac{347 + x}{3} \ge 3 \cdot 180$$
$$347 + x \ge 540$$
$$347 + x - 347 \ge 540 - 347$$
$$x \ge 193$$

He must bowl at least 193 on the third game.

64. Convert heights to inches.

$6'8" = 6 \cdot 12 + 8 = 80$
$6'6" = 6 \cdot 12 + 6 = 78$
$6'0" = 6 \cdot 12 + 0 = 72$
$5'9" = 5 \cdot 12 + 9 = 69$
$6'5" = 6 \cdot 12 + 5 = 77$

Let x be the height of the center.

$$\frac{x + 80 + 78 + 72 + 69}{5} \ge 77$$
$$\frac{x + 299}{5} \ge 77$$
$$5 \cdot \frac{x + 299}{5} \ge 5 \cdot 77$$
$$x + 299 \ge 385$$
$$x + 299 - 299 \ge 385 - 299$$
$$x \ge 86$$

$86" = 7'2"$

The center should be at least $7'2"$.

65. Let x represent the number of people. Then the cost is $50 + 34x$.

$$50 + 34x \le 3000$$
$$50 + 34x - 50 \le 3000 - 50$$
$$34x \le 2950$$
$$\frac{34x}{34} \le \frac{2950}{34}$$
$$x \le \frac{2950}{34} \approx 86.76$$

They can invite at most 86 people.

66. Let x represent the number of people. Then the cost is $40 + 15x$.

$$40 + 15x \le 860$$
$$40 + 15x - 40 \le 860 - 40$$
$$15x \le 820$$
$$\frac{15x}{15} \le \frac{820}{15}$$
$$x \le \frac{820}{15} \approx 54$$

They can invite at most 54 people.

67. Let x represent the number of minutes.

$$5.8x \ge 200$$
$$\frac{5.8x}{5.8} \ge \frac{200}{5.8}$$
$$x \ge \frac{200}{5.8} \approx 35$$

The person must walk at least 35 minutes.

68. Let x represent the number of minutes.

$$5.3x \ge 200$$
$$\frac{5.3x}{5.3} \ge \frac{200}{5.3}$$
$$x \ge \frac{200}{5.3} \approx 38$$

The person must bicycle at least 38 minutes.

69. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

70. $4^3 = 4 \cdot 4 \cdot 4 = 64$

71. $1^8 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1$

72. $0^7 = 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 = 0$

73. $\left(\frac{7}{8}\right)^2 = \left(\frac{7}{8}\right)\left(\frac{7}{8}\right) = \frac{49}{64}$

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74. $\left(\frac{2}{3}\right)^3 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) = \frac{8}{27}$

75. There were about 120 Krispy Kreme locations in 1998.

76. There were about 275 Krispy Kreme locations in 2003.

77. The greatest increase occurred between 2003 and 2004.

78. In year 2000 there were approximately 150 Krispy Kreme locations.

79. During 2001 the number of Krispy Kreme locations rose above 200.

80. During 2003 the number of Krispy Kreme locations rose above 300.

81. Since $3 < 5$, $3(-4) > 5(-4)$.

82. Since $m \le n$, then $2m \le 2n$.

83. If $m \le n$, then $-2m \ge -2n$.

84. If $-x < y$, then $x > -y$.

85. Reverse the direction of the inequality symbol when multiplying or dividing by a negative number.

86. No; answers may vary

87. Let x be the score on his final exam. Since the final counts as two tests, his final course average is $\frac{75+83+85+2x}{5}$.

$$\frac{75+83+85+2x}{5} \ge 80$$
$$\frac{243+2x}{5} \ge 80$$
$$5\left(\frac{243+2x}{5}\right) \ge 5(80)$$
$$243+2x \ge 400$$
$$243+2x-243 \ge 400-243$$
$$2x \ge 157$$
$$\frac{2x}{2} \ge \frac{157}{2}$$
$$x \ge 78.5$$

His final exam score must be at least 78.5 for him to get a B.

88. Let x be the score on her final exam. Since the final counts as two tests, her final course average is $\frac{85+95+92+3x}{6}$.

$$\frac{85+95+92+3x}{6} \ge 90$$
$$\frac{272+3x}{6} \ge 90$$
$$6\left(\frac{272+3x}{6}\right) \ge 6(90)$$
$$272+3x \ge 540$$
$$272+2x-272 \ge 540-272$$
$$3x \ge 268$$
$$\frac{3x}{3} \ge \frac{268}{3}$$
$$x \ge 89.3$$

Her final exam score must be at least 89.3 for her to get an A.

The Bigger Picture

1.
$$-5x = 15$$
$$\frac{-5x}{-5} = \frac{15}{-5}$$
$$x = -3$$

2.
$$-5x > 15$$
$$\frac{-5x}{-5} < \frac{15}{-5}$$
$$x < -3$$
$$\{x | x < -3\}$$

3.
$$9y - 14 = -12$$
$$9y - 14 + 14 = -12 + 14$$
$$9y = 2$$
$$\frac{9y}{9} = \frac{2}{9}$$
$$y = \frac{2}{9}$$

4.
$$9x - 3 = 5x - 4$$
$$9x - 3 + 3 = 5x - 4 + 3$$
$$9x = 5x - 1$$
$$9x - 5x = 5x - 1 - 5x$$
$$4x = -1$$
$$\frac{4x}{4} = \frac{-1}{4}$$
$$x = -\frac{1}{4}$$

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5. $4(x-2) \le 5x+7$
$4x-8 \le 5x+7$
$4x-8-5x \le 5x+7-5x$
$-x-8 \le 7$
$-x-8+8 \le 7+8$
$-x \le 15$
$\frac{-x}{-1} \ge \frac{15}{-1}$
$x \ge -15$
$\{x|x \ge -15\}$

6. $5(4x-1) = 2(10x-1)$
$20x-5 = 20x-2$
$20x-5-20x = 20x-2-20x$
$-5 = -2$
Since the statement $-5 = -2$ is false, there is no solution.

7. $-5.4 = 0.6x-9.6$
$-5.4+9.6 = 0.6x-9.6+9.6$
$4.2 = 0.6x$
$\frac{4.6}{0.6} = \frac{0.6x}{0.6}$
$7 = x$

8. $\frac{1}{3}(x-4) < \frac{1}{4}(x+7)$
$12 \cdot \frac{1}{3}(x-4) < 12 \cdot \frac{1}{4}(x+7)$
$4(x-4) < 3(x+7)$
$4x-16 < 3x+21$
$4x-16-3x < 3x+21-3x$
$x-16 < 21$
$x-16+16 < 21+16$
$x < 37$
$\{x|x < 37\}$

9. $3y-5(y-4) = -2(y-10)$
$3y-5y+20 = -2y+20$
$-2y+20 = -2y+20$
$-2y+20+2y = -2y+20+2y$
$20 = 20$
Since the statement $20 = 20$ is an identity, all real numbers satisfy the equation.

10. $\frac{7(x-1)}{3} = \frac{2(x+1)}{5}$
$15\left[\frac{7(x-1)}{3}\right] = 15\left[\frac{2(x+1)}{5}\right]$
$35(x-1) = 6(x+1)$
$35x-35 = 6x+6$
$35x-35-6x = 6x+6-6x$
$29x-35 = 6$
$29x-35+35 = 6+35$
$29x = 41$
$\frac{29x}{29} = \frac{41}{29}$
$x = \frac{41}{29}$

Chapter 2 Vocabulary Check

1. A linear equation in one variable can be written in the form $ax + b = c$.

2. Equations that have the same solution are called equivalent equations.

3. An equation that describes a known relationship among quantities is called a formula.

4. A linear inequality in one variable can be written in the form $ax + b < c$, (or $>, \le, \ge$).

5. The solution(s) to the equation $x + 5 = x + 5$ is/are all real numbers.

6. The solution(s) to the equation $x + 5 = x + 4$ is/are no solution.

7. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is the same.

8. If both sides of an inequality are multiplied by the same negative number, the direction of the inequality symbol is reversed.

Chapter 2 Review

1. $8x+4 = 9x$
$8x+4-8x = 9x-8x$
$4 = x$

2. $5y-3 = 6y$
$5y-3-5y = 6y-5y$
$-3 = y$

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3. $\frac{2}{7}x+\frac{5}{7}x=6$

$\frac{7}{7}x=6$

$1x=6$

$x=6$

4. $3x-5=4x+1$

$3x-5-3x=4x+1-3x$

$-5=x+1$

$-5-1=x+1-1$

$-6=x$

5. $2x-6=x-6$

$2x-6-x=x-6-x$

$x-6=-6$

$x-6+6=-6+6$

$x=0$

6. $4(x+3)=3(1+x)$

$4x+12=3+3x$

$4x+12-3x=3+3x-3x$

$12+x=3$

$-12+12+x=-12+3$

$x=-9$

7. $6(3+n)=5(n-1)$

$18+6n=5n-5$

$18+6n-5n=5n-5-5n$

$18+n=-5$

$-18+18+n=-18-5$

$n=-23$

8. $5(2+x)-3(3x+2)=-5(x-6)+2$

$10+5x-9x-6=-5x+30+2$

$-4x+4=-5x+32$

$5x-4x+4=5x-5x+32$

$x+4=32$

$x+4-4=32-4$

$x=28$

9. If the sum is 10 and one number is x, then the other number is $10-x$. The choice is b.

10. Since Mandy is 5 inches taller than Melissa, and x represents Mandy's height, then $x-5$ represents Melissa's height. The choice is a.

11. Complementary angles sum to 90°. The complement of angle x is $90-x$. The choice is b.

12. Supplementary angles sum to 180°. The supplement to $(x+5)°$ is $180-(x+5)=180-x-5=175-x$. The choice is c.

13. $\frac{3}{4}x=-9$

$\frac{4}{3}\cdot\frac{3}{4}x=\frac{4}{3}\cdot(-9)$

$x=-12$

14. $\frac{x}{6}=\frac{2}{3}$

$6\cdot\frac{x}{6}=6\cdot\frac{2}{3}$

$x=4$

15. $-5x=0$

$\frac{-5x}{-5}=\frac{0}{-5}$

$x=0$

16. $-y=7$

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

$y=-7$

17. $0.2x=0.15$

$20x=15$

$\frac{20x}{20}=\frac{15}{20}$

$x=0.75$

18. $\frac{-x}{3}=1$

$-3\left(\frac{-x}{3}\right)=-3(1)$

$x=-3$

19. $-3x+1=19$

$-3x+1-1=19-1$

$-3x=18$

$\frac{-3x}{-3}=\frac{18}{-3}$

$x=-6$

20. $5x+25=20$

$5x+25-25=20-25$

$5x=-5$

$\frac{5x}{5}=\frac{-5}{5}$

$x=-1$

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21. $7(x-1)+9=5x$
$7x-7+9=5x$
$7x+2=5x$
$-7x+7x+2=-7x+5x$
$2=-2x$
$\frac{2}{-2}=\frac{-2x}{-2}$
$-1=x$

22. $7x-6=5x-3$
$7x-6-5x=5x-3-5x$
$2x-6=-3$
$2x-6+6=-3+6$
$2x=3$
$\frac{2x}{2}=\frac{3}{2}$
$x=\frac{3}{2}$ or $1\frac{1}{2}$

23. $-5x+\frac{3}{7}=\frac{10}{7}$
$7\left(-5x+\frac{3}{7}\right)=7\cdot\frac{10}{7}$
$-35x+3=10$
$-35x+3-3=10-3$
$-35x=7$
$\frac{-35x}{-35}=\frac{7}{-35}$
$x=-\frac{1}{5}$

24. $5x+x=9+4x-1+6$
$6x=4x+14$
$6x-4x=4x+14-4x$
$2x=14$
$\frac{2x}{2}=\frac{14}{2}$
$x=7$

25. Let x be the first integer. Then $x + 1$ and $x + 2$ are the next two consecutive integers. Their sum is $x + x + 1 + x + 2 = 3x + 3$.

26. Let x be the first even integer. Then $x + 2$, $x + 4$, and $x + 6$ are the 2nd, 3rd, and 4th consecutive even integers. The sum of the first and fourth is $x + x + 6 = 2x + 6$.

27. $\frac{5}{3}x+4=\frac{2}{3}x$
$3\left(\frac{5}{3}x+4\right)=3\left(\frac{2}{3}x\right)$
$5x+12=2x$
$5x+12-5x=2x-5x$
$12=-3x$
$\frac{12}{-3}=\frac{-3x}{-3}$
$-4=x$

28. $\frac{7}{8}x+1=\frac{5}{8}x$
$8\left(\frac{7}{8}x+1\right)=8\left(\frac{5}{8}x\right)$
$7x+8=5x$
$7x+8-7x=5x-7x$
$8=-2x$
$\frac{8}{-2}=\frac{-2x}{-2}$
$-4=x$

29. $-(5x+1)=-7x+3$
$-5x-1=-7x+3$
$-5x-1+7x=-7x+3+7x$
$2x-1=3$
$2x-1+1=3+1$
$2x=4$
$\frac{2x}{2}=\frac{4}{2}$
$x=2$

30. $-4(2x+1)=-5x+5$
$-8x-4=-5x+5$
$-8x-4+8x=-5x+5+8x$
$-4=3x+5$
$-4-5=3x+5-5$
$-9=3x$
$\frac{-9}{3}=\frac{3x}{3}$
$-3=x$

31. $-6(2x-5)=-3(9+4x)$
$-12x+30=-27-12x$
$12x-12x+30=12x-27-12x$
$30=-27$
Since the statement $30 = -27$ is false, the equation has no solution.

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32.
$$\begin{aligned} 3(8y-1) &= 6(5+4y) \\ 24y-3 &= 30+24y \\ 24y-3-24y &= 30+24y-24y \\ -3 &= 30 \end{aligned}$$
Since the statement $-3 = 30$ is false, the equation has no solution.

33.
$$\begin{aligned} \frac{3(2-z)}{5} &= z \\ 5\left[\frac{3(2-z)}{5}\right] &= 5\cdot z \\ 3(2-z) &= 5z \\ 6-3z &= 5z \\ 6-3z+3z &= 5z+3z \\ 6 &= 8z \\ \frac{6}{8} &= \frac{8z}{8} \\ \frac{3}{4} &= z \end{aligned}$$

34.
$$\begin{aligned} \frac{4(n+2)}{5} &= -n \\ 5\left[\frac{4(n+2)}{5}\right] &= 5(-n) \\ 4(n+2) &= -5n \\ 4n+8 &= -5n \\ 4n+8-4n &= -5n-4n \\ 8 &= -9n \\ \frac{8}{-9} &= \frac{-9n}{-9} \\ -\frac{8}{9} &= n \end{aligned}$$

35.
$$\begin{aligned} 0.5(2n-3)-0.1 &= 0.4(6+2n) \\ 5(2n-3)-1 &= 4(6+2n) \\ 10n-15-1 &= 24+8n \\ 10n-16 &= 24+8n \\ 10n-16-8n &= 24+8n-8n \\ 2n-16 &= 24 \\ 2n-16+16 &= 24+16 \\ 2n &= 40 \\ \frac{2n}{2} &= \frac{40}{2} \\ n &= 20 \end{aligned}$$

36.
$$\begin{aligned} -9-5a &= 3(6a-1) \\ -9-5a &= 18a-3 \\ 9-5a+5a &= 18a-3+5a \\ -9 &= 23a-3 \\ -9+3 &= 23a-3+3 \\ -6 &= 23a \\ \frac{-6}{23} &= \frac{23a}{23} \\ -\frac{6}{23} &= a \end{aligned}$$

37.
$$\begin{aligned} \frac{5(c+1)}{6} &= 2c-3 \\ 6\left[\frac{5(c+1)}{6}\right] &= 6(2c-3) \\ 5(c+1) &= 6(2c-3) \\ 5c+5 &= 12c-18 \\ 5c+5-5c &= 12c-18-5c \\ 5 &= 7c-18 \\ 5+18 &= 7c-18+18 \\ 23 &= 7c \\ \frac{23}{7} &= \frac{7c}{7} \\ \frac{23}{7} &= c \end{aligned}$$

38.
$$\begin{aligned} \frac{2(8-a)}{3} &= 4-4a \\ 3\left[\frac{2(8-a)}{3}\right] &= 3(4-4a) \\ 2(8-a) &= 3(4-4a) \\ 16-2a &= 12-12a \\ 16-2a+12a &= 12-12a+12a \\ 16+10a &= 12 \\ 16+10a-16 &= 12-16 \\ 10a &= -4 \\ \frac{10a}{10} &= \frac{-4}{10} \\ a &= -\frac{2}{5} \end{aligned}$$

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39.
$$\begin{aligned}
200(70x-3560) &= -179(150x-19,300)\\
14,000x-712,000 &= -26,850x+3,454,700\\
14,000x-712,000+26,850x &= -26,850x+3,454,700+26,850x\\
40,850x-712,000 &= 3,454,700\\
40,850x-712,000+712,000 &= 3,454,700+712,000\\
40,850x &= 4,166,700\\
\frac{40,850x}{40,850} &= \frac{4,166,700}{40,850}\\
x &= 102
\end{aligned}$$

40.
$$\begin{aligned}
1.72y-0.04y &= 0.42\\
172y-4y &= 42\\
168y &= 42\\
\frac{168y}{168} &= \frac{42}{168}\\
y &= 0.25
\end{aligned}$$

41. Let x be the length of the side of the square base. Then the height is $10x + 50.5$. The sum is 7327.
$$\begin{aligned}
x+10x+50.5 &= 7327\\
11x+50.5 &= 7327\\
11x+50.5-50.5 &= 7327-50.5\\
11x &= 7276.5\\
\frac{11x}{11} &= \frac{7276.5}{11}\\
x &= 661.5
\end{aligned}$$
$$\begin{aligned}
10x+50.5 &= 10(661.5)+50.5\\
&= 6615+50.5\\
&= 6665.5
\end{aligned}$$
The height is 6665.5 inches.

42. Let x be the length of the short piece. Then $2x$ is the length of the long piece. The lengths sum to 12.
$$\begin{aligned}
x+2x &= 12\\
3x &= 12\\
\frac{3x}{3} &= \frac{12}{3}\\
x &= 4
\end{aligned}$$
$2x = 2(4) = 8$
The short piece is 4 feet and the long piece is 8 feet.

43. Let x be the number of Keebler plants. Then $2x - 1$ is the number of Kellogg plants. The total number of plants is 53.
$$\begin{aligned}
x+2x-1 &= 53\\
3x-1 &= 53\\
3x-1+1 &= 53+1\\
3x &= 54\\
\frac{3x}{3} &= \frac{54}{3}\\
x &= 18
\end{aligned}$$
$2x - 1 = 2(18) - 1 = 36 - 1 = 35$
Keebler has 18 plants and Kellogg has 35 plants.

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44. Let x be the first integer. Then $x + 1$ and $x + 2$ are the next two consecutive integers. Their sum is -114.

$$\begin{aligned} x+x+1+x+2 &= -114 \\ 3x+3 &= -114 \\ 3x+3-3 &= -114-3 \\ 3x &= -117 \\ \frac{3x}{3} &= \frac{-117}{3} \\ x &= -39 \end{aligned}$$

$x + 1 = -39 + 1 = -38$

$x + 2 = -39 + 2 = -37$

The integers are -39, -38, and -37.

45.

$$\begin{aligned} \frac{x}{3} &= x-2 \\ 3\cdot\frac{x}{3} &= 3(x-2) \\ x &= 3x-6 \\ x-3x &= 3x-6-3x \\ -2x &= -6 \\ \frac{-2x}{-2} &= \frac{-6}{-2} \\ x &= 3 \end{aligned}$$

The number is 3.

46.

$$\begin{aligned} 2(x+6) &= -x \\ 2x+12 &= -x \\ -2x+2x+12 &= -2x-x \\ 12 &= -3x \\ \frac{12}{-3} &= \frac{-3x}{-3} \\ -4 &= x \end{aligned}$$

The number is -4.

47. Use $P = 2l + 2w$ when $P = 46$ and $l = 14$.

$$\begin{aligned} P &= 2l+2w \\ 46 &= 2(14)+2w \\ 46 &= 28+2w \\ 46-28 &= 28+2w-28 \\ 18 &= 2w \\ \frac{18}{2} &= \frac{2w}{2} \\ 9 &= w \end{aligned}$$

48. Use $V = lwh$ when $V = 192$, $l = 8$, and $w = 6$.

$$\begin{aligned} V &= lwh \\ 192 &= 8\cdot 6\cdot h \\ 192 &= 48h \\ \frac{192}{48} &= \frac{48h}{48} \\ 4 &= h \end{aligned}$$

49.

$$\begin{aligned} y &= mx+b \\ y-b &= mx+b-b \\ y-b &= mx \\ \frac{y-b}{x} &= \frac{mx}{x} \\ \frac{y-b}{x} &= m \end{aligned}$$

50.

$$\begin{aligned} r &= vst-5 \\ r+5 &= vst-5+5 \\ r+5 &= vst \\ \frac{r+5}{vt} &= \frac{vst}{vt} \\ \frac{r+5}{vt} &= s \end{aligned}$$

51.

$$\begin{aligned} 2y-5x &= 7 \\ -2y+2y-5x &= -2y+7 \\ -5x &= -2y+7 \\ \frac{-5x}{-5} &= \frac{-2y+7}{-5} \\ x &= \frac{2y-7}{5} \end{aligned}$$

52.

$$\begin{aligned} 3x-6y &= -2 \\ -3x+3x-6y &= -3x-2 \\ -6y &= -3x-2 \\ \frac{-6y}{-6} &= \frac{-3x-2}{-6} \\ y &= \frac{3x+2}{6} \end{aligned}$$

53.

$$\begin{aligned} C &= \pi D \\ \frac{C}{D} &= \frac{\pi D}{D} \\ \frac{C}{D} &= \pi \end{aligned}$$

54.

$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2r} &= \frac{2\pi r}{2r} \\ \frac{C}{2r} &= \pi \end{aligned}$$

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55. Use $V = lwh$ when $V = 900$, $l = 20$ and $h = 3$.

$$V = lwh$$
$$900 = 20 \cdot w \cdot 3$$
$$900 = 60w$$
$$\frac{900}{60} = \frac{60w}{60}$$
$$15 = w$$

The width is 15 meters.

56. Let x be the width. Then the length is $x + 6$. Use $P = 2 \cdot \text{length} + 2 \cdot \text{width}$ when $P = 60$.

$$P = 2 \cdot \text{length} + 2 \cdot \text{width}$$
$$60 = 2(x + 6) + 2x$$
$$60 = 2x + 12 + 2x$$
$$60 = 4x + 12$$
$$60 - 12 = 4x + 12 - 12$$
$$48 = 4x$$
$$\frac{48}{4} = \frac{4x}{4}$$
$$12 = x$$

$x + 6 = 12 + 6 = 18$

The dimensions of the billboard are 12 feet by 18 feet.

57. Use $d = rt$ when $d = 10\text{K}$ or 10,000 m and $r = 125$.

$$d = rt$$
$$10{,}000 = 125t$$
$$\frac{10{,}000}{125} = \frac{125t}{125}$$
$$80 = t$$

The time is 80 minutes or $\frac{80}{60} = 1\frac{1}{3}$ hours or 1 hour and 20 minutes.

58. Use $F = \frac{9}{5}C + 32$ when $F = 104$.

$$F = \frac{9}{5}C + 32$$
$$104 = \frac{9}{5}C + 32$$
$$104 - 32 = \frac{9}{5}C + 32 - 32$$
$$72 = \frac{9}{5}C$$
$$\frac{5}{9} \cdot 72 = \frac{5}{9} \cdot \frac{9}{5}C$$
$$40 = C$$

Thus, 104°F is equivalent to 40°C.

59. Let x be the unknown percent.

$$9 = x \cdot 45$$
$$\frac{9}{45} = \frac{45x}{45}$$
$$0.2 = x$$
$$20\% = x$$

9 is 20% of 45.

60. Let x be the unknown percent.

$$59.5 = x \cdot 85$$
$$\frac{59.5}{85} = \frac{85x}{85}$$
$$0.7 = x$$
$$70\% = x$$

59.5 is 70% of 85.

61. Let x be the unknown number.

$$137.5 = 125\% \cdot x$$
$$137.5 = 1.25x$$
$$\frac{137.5}{1.25} = \frac{1.25x}{1.25}$$
$$110 = x$$

137.5 is 125% of 110.

62. Let x be the unknown number.

$$768 = 60\% \cdot x$$
$$768 = 0.6x$$
$$\frac{768}{0.6} = \frac{0.6x}{0.6}$$
$$1280 = x$$

768 is 60% of 1280.

63. increase = $11\% \cdot 1900 = 0.11 \cdot 1900 = 209$
new price = $1900 + 209 = 2109$
The mark-up is \$209 and the new price is \$2109.

64. Find 66.9% of 76,000.
$66.9\% \cdot 76{,}000 = 0.669 \cdot 76{,}000 = 50{,}844$
You would expect 50,844 to use the Internet.

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65. Let x be the number of gallons of 40% solution. Then $30 - x$ is the number of gallons of 10% solution.

	gallons	concentration	amount
40% solution	x	40%	$0.4x$
10% solution	$30 - x$	10%	$0.1(30 - x)$
20% solution	30	20%	$0.2(30)$

The amount of acid in the combined solutions must be the same as in the mixture.

$$0.4x + 0.1(30 - x) = 0.2(30)$$
$$0.4x + 3 - 0.1x = 6$$
$$3 + 0.3x = 6$$
$$3 + 0.3x - 3 = 6 - 3$$
$$0.3x = 3$$
$$\frac{0.3x}{0.3} = \frac{3}{0.3}$$
$$x = 10$$

$30 - x = 30 - 10 = 20$

Mix 10 gallons of 40% solution with 20 gallons of 10% solution.

66.
$$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{21.0 - 20.7}{20.7}$$
$$= \frac{0.3}{20.7}$$
$$\approx 0.0145$$

The percent increase is 1.45%.

67. From the graph, 18% of motorists who use a cell phone while driving have almost hit another car.

68. The tallest bar represents the most common effect. Therefore, swerving is the most common effect of cell phone use on driving.

69. 21% of drivers cut off someone. Find 21% of 4600.

$21\% \cdot 4600 = 0.21 \cdot 4600 = 966$

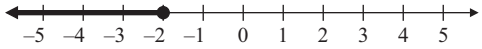
You expect 966 customers to cut someone off while driving and talking on their cell phones.

70. $46\% + 41\% + 21\% + 18\% = 126\%$

No, the percents do not sum to 100%.

Answers may vary.

71.



72.

73.
$$x - 5 \le -4$$
$$x - 5 + 5 \le -4 + 5$$
$$x \le 1$$

$\{x | x \le 1\}$

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74. $x+7>2$
$x+7-7>2-7$
$x>-5$
$\{x|x>-5\}$

75. $-2x\geq -20$
$\frac{-2x}{-2}\leq\frac{-20}{-2}$
$x\leq 10$
$\{x|x\leq 10\}$

76. $-3x>12$
$\frac{-3x}{-3}<\frac{12}{-3}$
$x<-4$
$\{x|x<-4\}$

77. $5x-7>8x+5$
$5x-7-8x>8x+5-8x$
$-3x-7>5$
$-3x-7+7>5+7$
$-3x>12$
$\frac{-3x}{-3}<\frac{12}{-3}$
$x<-4$
$\{x|x<-4\}$

78. $x+4\geq 6x-16$
$x+4-6x\geq 6x-16-6x$
$-5x+4\geq -16$
$-5x+4-4\geq -16-4$
$-5x\geq -20$
$\frac{-5x}{-5}\leq\frac{-20}{-5}$
$x\leq 4$
$\{x|x\leq 4\}$

79. $\frac{2}{3}y>6$
$\frac{3}{2}\cdot\frac{2}{3}y>\frac{3}{2}\cdot 6$
$y>9$
$\{y|y>9\}$

80. $-0.5y\leq 7.5$
$\frac{-0.5y}{-0.5}\geq\frac{7.5}{-0.5}$
$y\geq -15$
$\{y|y\geq -15\}$

81. $-2(x-5)>2(3x-2)$
$-2x+10>6x-4$
$-2x+10-6x>6x-4-6x$
$-8x+10>-4$
$-8x+10-10>-4-10$
$-8x>-14$
$\frac{-8x}{-8}<\frac{-14}{-8}$
$x<\frac{7}{4}$
$\left\{x\middle|x<\frac{7}{4}\right\}$

82. $4(2x-5)\leq 5x-1$
$8x-20\leq 5x-1$
$8x-20-5x\leq 5x-1-5x$
$3x-20\leq -1$
$3x-20+20\leq -1+20$
$3x\leq 19$
$\frac{3x}{3}\leq\frac{19}{3}$
$x\leq\frac{19}{3}$
$\left\{x\middle|x\leq\frac{19}{3}\right\}$

83. Let x be the sales. Her weekly earnings are $175 + 0.05x$.
$175+0.05x\geq 300$
$175+0.05x-175\geq 300-175$
$0.05x\geq 125$
$\frac{0.05x}{0.05}\geq\frac{125}{0.05}$
$x\geq 2500$
She must have weekly sales of at least \$2500.

84. Let x be his score on the fourth round.
$\frac{76+82+79+x}{4}<80$
$\frac{237+x}{4}<80$
$4\cdot\frac{237+x}{4}<4\cdot 80$
$237+x<320$
$237+x-237<320-237$
$x<83$
His score must be less than 83.

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85. $6x+2x-1=5x+11$
$8x-1=5x+11$
$8x-1-5x=5x+11-5x$
$3x-1=11$
$3x-1+1=11+1$
$3x=12$
$\frac{3x}{3}=\frac{12}{3}$
$x=4$

86. $2(3y-4)=6+7y$
$6y-8=6+7y$
$6y-8-6y=6+7y-6y$
$-8=6+y$
$-8-6=6+y-6$
$-14=y$

87. $4(3-a)-(6a+9)=-12a$
$12-4a-6a-9=-12a$
$3-10a=-12a$
$3-10a+10a=-12a+10a$
$3=-2a$
$\frac{3}{-2}=\frac{-2a}{-2}$
$-\frac{3}{2}=a$

88. $\frac{x}{3}-2=5$
$\frac{x}{3}-2+2=5+2$
$\frac{x}{3}=7$
$3\cdot\frac{x}{3}=3\cdot 7$
$x=21$

89. $2(y+5)=2y+10$
$2y+10=2y+10$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

90. $7x-3x+2=2(2x-1)$
$4x+2=4x-2$
$4x+2-4x=4x-2-4x$
$2=-2$
Since the statement $2=-2$ is false, there is no solution.

91. Let x be the number.
$6+2x=x-7$
$6+2x-x=x-7-x$
$6+x=-7$
$6+x-6=-7-6$
$x=-13$
The number is −13.

92. Let x be the length of the shorter piece. Then $4x + 3$ is the length of the longer piece. The lengths sum to 23.
$x+4x+3=23$
$5x+3=23$
$5x+3-3=23-3$
$5x=20$
$\frac{5x}{5}=\frac{20}{5}$
$x=4$
$4x + 3 = 4(4) + 3 = 16 + 3 = 19$
The shorter piece is 4 inches and the longer piece is 19 inches.

93. $V=\frac{1}{3}Ah$
$3V=3\cdot\frac{1}{3}Ah$
$3V=Ah$
$\frac{3V}{A}=\frac{Ah}{A}$
$\frac{3V}{A}=h$

94. Let x be the number.
$x = 26\% \cdot 85$
$x = 0.26 \cdot 85$
$x = 22.1$
22.1 is 26% of 85.

95. Let x be the unknown number.
$72 = 45\% \cdot x$
$72 = 0.45x$
$\frac{72}{0.45}=\frac{0.45x}{0.45}$
$160 = x$
72 is 45% of 160.

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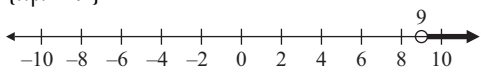
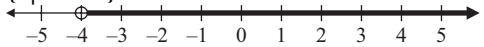
96. $$\text{percent increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{282-235}{235}$$
$$= \frac{47}{235}$$
$$= 0.2$$
The percent increase is 20%.

97. $$4x-7>3x+2$$
$$4x-7-3x>3x+2-3x$$
$$x-7>2$$
$$x-7+7>2+7$$
$$x>9$$
$$\{x|x>9\}$$



98. $$-5x<20$$
$$\frac{-5x}{5}>\frac{20}{-5}$$
$$x>-4$$
$$\{x|x>-4\}$$



99. $$-3(1+2x)+x\ge-(3-x)$$
$$-3-6x+x\ge-3+x$$
$$-3-5x\ge-3+x$$
$$-3-5x-x\ge-3+x-x$$
$$-3-6x\ge-3$$
$$-3-6x+3\ge-3+3$$
$$-6x\ge0$$
$$\frac{-6x}{-6}\le\frac{0}{-6}$$
$$x\le0$$
$$\{x|x\le0\}$$

Chapter 2 Test

1. $$-\frac{4}{5}x=4$$
$$-\frac{5}{4}\left(-\frac{4}{5}x\right)=-\frac{5}{4}(4)$$
$$x=-5$$

2. $$4(n-5)=-(4-2n)$$
$$4n-20=-4+2n$$
$$4n-20-2n=-4+2n-2n$$
$$2n-20=-4$$
$$2n-20+20=-4+20$$
$$2n=16$$
$$\frac{2n}{2}=\frac{16}{2}$$
$$n=8$$

3. $$5y-7+y=-(y+3y)$$
$$6y-7=-y-3y$$
$$6y-7=-4y$$
$$6y-7-6y=-4y-6y$$
$$-7=-10y$$
$$\frac{-7}{-10}=\frac{-10y}{-10}$$
$$\frac{7}{10}=y$$

4. $$4z+1-z=1+z$$
$$3z+1=1+z$$
$$3z+1-z=1+z-z$$
$$2z+1=1$$
$$2z+1-1=1-1$$
$$2z=0$$
$$\frac{2z}{2}=\frac{0}{2}$$
$$z=0$$

5. $$\frac{2(x+6)}{3}=x-5$$
$$3\left(\frac{2(x+6)}{3}\right)=3(x-5)$$
$$2(x+6)=3(x-5)$$
$$2x+12=3x-15$$
$$2x+12-2x=3x-15-2x$$
$$12=x-15$$
$$12+15=x-15+15$$
$$27=x$$

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6. $\dfrac{4(y-1)}{5} = 2y+3$

$5\left[\dfrac{4(y-1)}{5}\right] = 5(2y+3)$

$4(y-1) = 5(2y+3)$

$4y-4 = 10y+15$

$4y-4-10y = 10y+15-10y$

$-6y-4 = 15$

$-6y-4+4 = 15+4$

$-6y = 19$

$\dfrac{-6y}{-6} = \dfrac{19}{-6}$

$y = -\dfrac{19}{6}$

7. $\dfrac{1}{2} - x + \dfrac{3}{2} = x-4$

$-x + \dfrac{4}{2} = x-4$

$-x+2 = x-4$

$-x+2+x = x-4+x$

$2 = 2x-4$

$2+4 = 2x-4+4$

$6 = 2x$

$\dfrac{6}{2} = \dfrac{2x}{2}$

$3 = x$

8. $\dfrac{1}{3}(y+3) = 4y$

$3\cdot\dfrac{1}{3}(y+3) = 3\cdot 4y$

$y+3 = 12y$

$y+3-y = 12y-y$

$3 = 11y$

$\dfrac{3}{11} = \dfrac{11y}{11}$

$\dfrac{3}{11} = y$

9. $-0.3(x-4)+x = 0.5(3-x)$

$-0.3(x-4)+1.0x = 0.5(3-x)$

$-3(x-4)+10x = 5(3-x)$

$-3x+12+10x = 15-5x$

$7x+12 = 15-5x$

$7x+12+5x = 15-5x+5x$

$12x+12 = 15$

$12x+12-12 = 15-12$

$12x = 3$

$\dfrac{12x}{12} = \dfrac{3}{12}$

$x = \dfrac{1}{4} = 0.25$

10. $-4(a+1)-3a = -7(2a-3)$

$-4a-4-3a = -14a+21$

$-4-7a = -14a+21$

$-4-7a+14a = -14a+21+14a$

$-4+7a = 21$

$-4+7a+4 = 21+4$

$7a = 25$

$\dfrac{7a}{7} = \dfrac{25}{7}$

$a = \dfrac{25}{7}$

11. $-2(x-3) = x+5-3x$

$-2x+6 = -2x+5$

$2x-2x+6 = 2x-2x+5$

$6 = 5$

Since the statement 6 = 5 is false, there is no solution.

12. Let x be the number.

$x + \dfrac{2}{3}x = 35$

$\dfrac{3}{3}x + \dfrac{2}{3}x = 35$

$\dfrac{5}{3}x = 35$

$\dfrac{3}{5}\cdot\dfrac{5}{3}x = \dfrac{3}{5}\cdot 35$

$x = 21$

The number is 21.

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13. $A = lw = (35)(20) = 700$
The area of the deck is 700 square feet. To paint two coats of water seal means covering $2 \cdot 700 = 1400$ square feet.

$$1400 \text{ sq ft} \cdot \frac{1 \text{ gal}}{200 \text{ sq ft}} = 7 \text{ gal}$$

7 gallons of water seal are needed.

14. Use $y = mx + b$ when $y = -14$, $m = -2$, and $b = -2$.

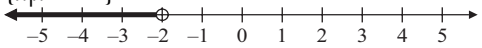
$$\begin{aligned} y &= mx + b \\ -14 &= -2x + (-2) \\ -14 + 2 &= -2x + (-2) + 2 \\ -12 &= -2x \\ \frac{-12}{-2} &= \frac{-2x}{-2} \\ 6 &= x \end{aligned}$$

15.
$$\begin{aligned} V &= \pi r^2 h \\ \frac{V}{\pi r^2} &= \frac{\pi r^2 h}{\pi r^2} \\ \frac{V}{\pi r^2} &= h \end{aligned}$$

16.
$$\begin{aligned} 3x - 4y &= 10 \\ 3x - 4y - 3x &= 10 - 3x \\ -4y &= 10 - 3x \\ \frac{-4y}{-4} &= \frac{10 - 3x}{-4} \\ y &= \frac{3x - 10}{4} \end{aligned}$$

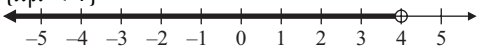
17.
$$\begin{aligned} 3x - 5 &> 7x + 3 \\ 3x - 5 - 3x &> 7x + 3 - 3x \\ -5 &> 4x + 3 \\ -5 - 3 &> 4x + 3 - 3 \\ -8 &> 4x \\ \frac{-8}{4} &> \frac{4x}{4} \\ -2 &> x \end{aligned}$$

$\{x | x < -2\}$



18.
$$\begin{aligned} x + 6 &> 4x - 6 \\ x + 6 - 4x &> 4x - 6 - 4x \\ -3x + 6 &> -6 \\ -3x + 6 - 6 &> -6 - 6 \\ -3x &> -12 \\ \frac{-3x}{-3} &< \frac{-12}{-3} \\ x &< 4 \end{aligned}$$

$\{x | x < 4\}$



19.
$$\begin{aligned} -0.3x &\geq 2.4 \\ \frac{-0.3x}{-0.3} &\leq \frac{2.4}{-0.3} \\ x &\leq -8 \end{aligned}$$

$\{x | x \leq -8\}$

20.
$$\begin{aligned} -5(x-1) + 6 &\leq -3(x+4) + 1 \\ -5x + 5 + 6 &\leq -3x - 12 + 1 \\ -5x + 11 &\leq -3x - 11 \\ -5x + 11 + 3x &\leq -3x - 11 + 3x \\ -2x + 11 &\leq -11 \\ -2x + 11 - 11 &\leq -11 - 11 \\ -2x &\leq -22 \\ \frac{-2x}{-2} &\geq \frac{-22}{-2} \\ x &\geq 11 \end{aligned}$$

$\{x | x \geq 11\}$

21.
$$\begin{aligned} \frac{2(5x+1)}{3} &> 2 \\ 3 \cdot \frac{2(5x+1)}{3} &> 3(2) \\ 2(5x+1) &> 6 \\ 10x + 2 &> 6 \\ 10x + 2 - 2 &> 6 - 2 \\ 10x &> 4 \\ \frac{10x}{10} &> \frac{4}{10} \\ x &> \frac{2}{5} \end{aligned}$$

$\left\{x \middle| x > \frac{2}{5}\right\}$

22. From the graph, 29% of tornadoes occurring in the U.S. are classified as strong, that is F2 or F3.

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23. From the graph, 69% are classified as weak.
Find 69% of 800.
$69\% \cdot 800 = 0.69 \cdot 800 = 552$
You would expect 552 of the 800 to be classified as weak.

24. Let x be the unknown percent.
$$72 = x \cdot 180$$
$$\frac{72}{180} = \frac{180x}{180}$$
$$0.4 = x$$
72 is 40% of 180.

25. Let x represent the number of public libraries in Indiana. Then there are $x + 650$ public libraries in New York.
$$x + x + 650 = 1504$$
$$2x + 650 = 1504$$
$$2x + 650 - 650 = 1504 - 650$$
$$2x = 854$$
$$\frac{2x}{2} = \frac{854}{2}$$
$$x = 427$$
$x + 650 = 427 + 650 = 1077$
Indiana has 427 public libraries and New York has 1077.

Cumulative Review Chapters 1–2

1. Since 8 = 8, the statement $8 \geq 8$ is true.

2. Since −4 is to the right of −6 on the number line, the statement $-4 < -6$ is false.

3. Since 8 = 8, the statement $8 \leq 8$ is true.

4. Since 3 is to the right of −3 on the number line, the statement $3 > -3$ is true.

5. Since neither $23 < 0$ nor $23 = 0$ is true, the statement $23 \leq 0$ is false.

6. Since −8 = −8, the statement $-8 \geq -8$ is true.

7. Since $0 < 23$ is true, the statement $0 \leq 23$ is true.

8. Since −8 = −8, the statement $-8 \leq -8$ is true.

9. a. $|0| < 2$ since $|0| = 0$ and $0 < 2$.

b. $|-5| = 5$

c. $|-3| > |-2|$ since $3 > 2$.

d. $|-9| < |-9.7|$ since $9 < 9.7$.

e. $\left|-7\frac{1}{6}\right| > |7|$ since $7\frac{1}{6} > 7$.

10. a. $|5| = 5$ since 5 is 5 units from 0 on the number line.

b. $|-8| = 8$ since −8 is 8 units from 0 on the number line.

c. $\left|-\frac{2}{3}\right| = \frac{2}{3}$ since $-\frac{2}{3}$ is $\frac{2}{3}$ unit from 0 on the number line.

11.
$$\frac{3 + |4-3| + 2^2}{6-3} = \frac{3 + |1| + 2^2}{6-3}$$
$$= \frac{3+1+2^2}{3}$$
$$= \frac{3+1+4}{3}$$
$$= \frac{8}{3}$$

12.
$$1 + 2(9-7)^3 + 4^2 = 1 + 2(2)^3 + 4^2$$
$$= 1 + 2(8) + 16$$
$$= 1 + 16 + 16$$
$$= 33$$

13. $(-8) + (-11) = -19$

14. $-2 + (-8) = -10$

15. $(-2) + 10 = 8$

16. $-10 + 20 = 10$

17. $0.2 + (-0.5) = -0.3$

18. $1.2 + (-1.2) = 0$

19. a.
$$-3 + [(-2-5) - 2] = -3 + [(-2 + (-5)) - 2]$$
$$= -3 + [(-7) - 2]$$
$$= -3 + [-7 + (-2)]$$
$$= -3 + [-9]$$
$$= -12$$

b.
$$2^3 - 10 + [-6 - (-5)] = 2^3 - 10 + [-6 + 5]$$
$$= 2^3 - 10 + [-1]$$
$$= 8 - 10 + (-1)$$
$$= 8 + (-10) + (-1)$$
$$= -2 + (-1)$$
$$= -3$$

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20. a. $-(-5) = 5$

b. $-\left(-\frac{2}{3}\right) = \frac{2}{3}$

c. $-(-a) = a$

d. $-|-3| = -3$

21. a. $7(0)(-6) = 0(-6) = 0$

b. $(-2)(-3)(-4) = (6)(-4) = -24$

c. $(-1)(5)(-9) = (-5)(-9) = 45$

22. a. $-2.7 - 8.4 = -2.7 + (-8.4) = -11.1$

b. $-\frac{4}{5} - \left(-\frac{3}{5}\right) = -\frac{4}{5} + \frac{3}{5} = -\frac{1}{5}$

c. $\frac{1}{4} - \left(-\frac{1}{2}\right) = \frac{1}{4} + \frac{1}{2} = \frac{1}{4} + \frac{2}{4} = \frac{3}{4}$

23. a. $-18 \div 3 = -18 \cdot \frac{1}{3} = -6$

b. $\frac{-14}{-2} = -14 \cdot -\frac{1}{2} = 7$

c. $\frac{20}{-4} = 20 \cdot -\frac{1}{4} = -5$

24. a. $(4.5)(-0.08) = -0.36$

b. $-\frac{3}{4} \cdot -\frac{8}{17} = \frac{3 \cdot 8}{4 \cdot 17} = \frac{6}{17}$

25. $-5(-3 + 2z) = -5(-3) + (-5)(2z) = 15 - 10z$

26. $2x(x^2 - 3x + 4) = 2x(x^2) - 2x(3x) + 2x(4)$
$= 2x^3 - 6x^2 + 8x$

27. $\frac{1}{2}(6x + 14) + 10 = \frac{1}{2}(6x) + \frac{1}{2}(14) + 10$
$= 3x + 7 + 10$
$= 3x + 17$

28. $-(x + 4) + 3(x + 4) = -1(x + 4) + 3(x + 4)$
$= -1 \cdot x + (-1)(4) + 3 \cdot x + 3 \cdot 4$
$= -x - 4 + 3x + 12$
$= -x + 3x - 4 + 12$
$= 2x + 8$

29. a. $2x$ and $3x^2$ are unlike terms, since the exponents on x are not the same.

b. $4x^2y$, xy^2, and $-2x^2y$ are like terms, since each variable and its exponent match.

c. $-2yz$ and $-3zy$ are like terms, since $zy = yz$ by the commutative property.

d. $-x^4$ and x^4 are like terms. The variable and its exponent match.

e. $-8a^5$ and $8a^5$ are like terms. The variable and its exponent match.

30. a. $\frac{-32}{8} = -4$

b. $\frac{-108}{-12} = 9$

c. $\frac{-5}{7} \div \left(\frac{-9}{2}\right) = \frac{-5}{7} \cdot \left(\frac{2}{-9}\right) = \frac{5 \cdot 2}{7 \cdot 9} = \frac{10}{63}$

31. $(2x - 3) - (4x - 2) = 2x - 3 - 4x + 2 = -2x - 1$

32. $(-5x + 1) - (10x + 3) = -5x + 1 - 10x - 3$
$= -15x - 2$

33. $x - 7 = 10$
$x - 7 + 7 = 10 + 7$
$x = 17$

34. $\frac{5}{6} + x = \frac{2}{3}$
$\frac{5}{6} + x - \frac{5}{6} = \frac{2}{3} - \frac{5}{6}$
$x = \frac{4}{6} - \frac{5}{6}$
$x = -\frac{1}{6}$

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35.
$$\begin{aligned} -z-4 &= 6 \\ -z-4+4 &= 6+4 \\ -z &= 10 \\ \frac{-z}{-1} &= \frac{10}{-1} \\ z &= -10 \end{aligned}$$

36.
$$\begin{aligned} -3x+1-(-4x-6) &= 10 \\ -3x+1+4x+6 &= 10 \\ x+7 &= 10 \\ x+7-7 &= 10-7 \\ x &= 3 \end{aligned}$$

37.
$$\begin{aligned} \frac{2(a+3)}{3} &= 6a+2 \\ 3\cdot\frac{2(a+3)}{3} &= 3(6a+2) \\ 2(a+3) &= 3(6a+2) \\ 2a+6 &= 18a+6 \\ 2a+6-18a &= 18a+6-18a \\ -16a+6 &= 6 \\ -16a+6-6 &= 6-6 \\ -16a &= 0 \\ \frac{-16a}{-16} &= \frac{0}{-16} \\ a &= 0 \end{aligned}$$

38.
$$\begin{aligned} \frac{x}{4} &= 18 \\ 4\cdot\frac{x}{4} &= 4\cdot 18 \\ x &= 72 \end{aligned}$$

39. Let x be the number of Democrats. Then $x + 15$ is the number of Republicans. The total number is 431.
$$\begin{aligned} x+x+15 &= 431 \\ 2x+15 &= 431 \\ 2x+15-15 &= 431-15 \\ 2x &= 416 \\ \frac{2x}{2} &= \frac{416}{2} \\ x &= 208 \end{aligned}$$
$x + 15 = 208 + 15 = 223$
There are 208 Democrats and 223 Republicans.

40.
$$\begin{aligned} 6x+5 &= 4(x+4)-1 \\ 6x+5 &= 4x+16-1 \\ 6x+5 &= 4x+15 \\ 6x+5-4x &= 4x+15-4x \\ 2x+5 &= 15 \\ 2x+5-5 &= 15-5 \\ 2x &= 10 \\ \frac{2x}{2} &= \frac{10}{2} \\ x &= 5 \end{aligned}$$

41. Use $d = rt$ when $d = 31{,}680$ and $r = 400$.
$$\begin{aligned} d &= rt \\ 31{,}680 &= 400t \\ \frac{31{,}680}{400} &= \frac{400t}{400} \\ 79.2 &= t \end{aligned}$$
It will take the ice 79.2 years to reach the lake.

42.
$$\begin{aligned} x+4 &= 3x-8 \\ x+4-3x &= 3x-8-3x \\ -2x+4 &= -8 \\ -2x+4-4 &= -8-4 \\ -2x &= -12 \\ \frac{-2x}{-2} &= \frac{-12}{-2} \\ x &= 6 \end{aligned}$$
The number is 6.

43. Let x be the unknown percent.
$$\begin{aligned} 63 &= x\cdot 72 \\ \frac{63}{72} &= \frac{72x}{72} \\ 0.875 &= x \\ 87.5\% &= x \end{aligned}$$
63 is 87.5% of 72.

44.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\ \frac{C}{2\pi} &= r \text{ or } r = \frac{C}{2\pi} \end{aligned}$$

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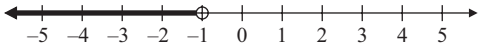
45. $5(2x+3) = -1+7$
$5(2x)+5(3) = -1+7$
$10x+15 = 6$
$10x+15-15 = 6-15$
$10x = -9$
$\frac{10x}{10} = \frac{-9}{10}$
$x = -\frac{9}{10}$

46. $x-3 > 2$
$x-3+3 > 2+3$
$x > 5$
$\{x|x > 5\}$

47. $-1 > x$ or $x < -1$



48. $3x-4 \le 2x-14$
$3x-4-2x \le 2x-14-2x$
$x-4 \le -14$
$x-4+4 \le -14+4$
$x \le -10$
$\{x|x \le -10\}$

49. $2(x-3)-5 \le 3(x+2)-18$
$2x-6-5 \le 3x+6-18$
$2x-11 \le 3x-12$
$-x-11 \le -12$
$-x \le -1$
$\frac{-x}{-1} \ge \frac{-1}{-1}$
$x \ge 1$
$\{x|x \ge 1\}$

50. $-3x \ge 9$
$\frac{-3x}{-3} \le \frac{9}{-3}$
$x \le -3$
$\{x|x \le -3\}$

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