INSTRUCTOR'S SOLUTIONS MANUAL

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ELEMENTARY ALGEBRA

FOURTH EDITION

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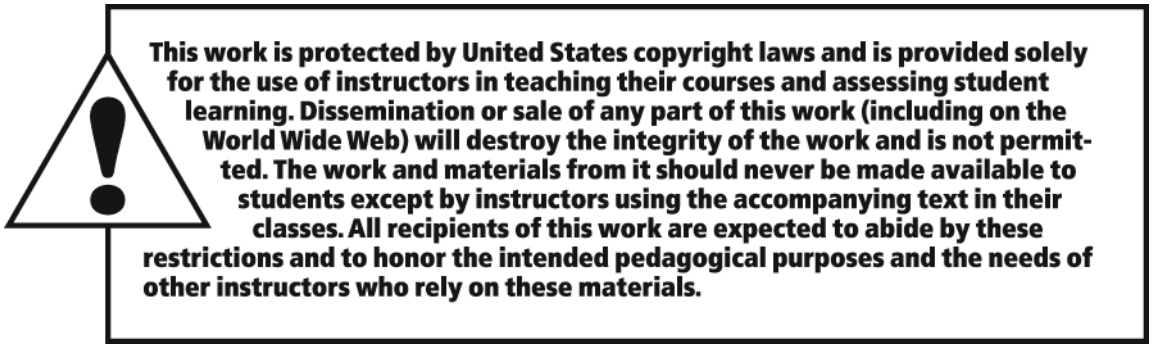

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Chapter 1
Foundations of Algebra

Exercise Set 1.1

2. $\{q, r, s, t, u, v, w, x, y, z\}$

4. $\{\text{Alaska, Hawaii}\}$

6. $\{2, 4, 6, 8, \ldots\}$

8. $\{16, 18, 20, 22, \ldots\}$

10. $\{-2, -1, 0\}$

12. Rational because 1 and 4 are integers.

14. Rational because -12 is an integer and all integers are rational numbers.

16. Irrational because $\frac{\pi}{4}$ cannot be written as a ratio of integers.

18. Rational because -0.8 can be expressed as $-\frac{8}{10}$, the ratio of two integers.

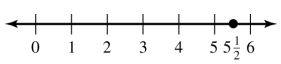
20. Rational because $0.\overline{13}$ can be expressed as the fraction $\frac{13}{99}$, the ratio of two integers.

22. False. There are real numbers that are not rational (irrational numbers).

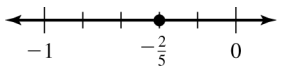
24. False. There are real numbers that are not natural numbers, such as 0, –2, $\frac{3}{4}$, $0.\overline{6}$, and π.

26. True

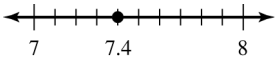
28. The number $5\frac{1}{2}$ is located $\frac{1}{2}$ of the way between 5 and 6, so we divide the space between 5 and 6 into 2 equal divisions and place a dot on the 1st mark to the right of 5.



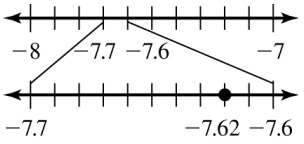
30. The number $-\frac{2}{5}$ is located $\frac{2}{5}$ of the way between 0 and -1, so we divide the space between 0 and -1 into 5 equal divisions and place a dot on the 2nd mark to the left of 0.



32. The number 7.4 is located $0.4 = \frac{4}{10}$ of the way between 7 and 8, so we divide the space between 7 and 8 into 10 equal divisions and place a dot on the 4th mark to the right of 7.



34. First divide the number line between -7 and -8 into tenths. The number -7.62 falls between -7.6 and -7.7 on the number line. Subdivide this section into hundredths and place a dot on the 2nd mark to the left of -7.6.



36. $|6| = 6$ because 6 is 6 units from 0 on a number line.

38. $|-8| = 8$ because -8 is 8 units from 0 on a number line.

40. $|-4.5| = 4.5$ because -4.5 is 4.5 units from 0 on a number line.

42. $\left|2\frac{3}{5}\right| = 2\frac{3}{5}$ because $2\frac{3}{5}$ is $2\frac{3}{5}$ units from 0 on a number line.

44. $|-67.8| = 67.8$ because -67.8 is 67.8 units from 0 on a number line.

46. $2 < 7$ because 2 is farther to the left on a number line than 7.

48. $-6 < 5$ because -6 is farther to the left on a number line than 5.

50. $-19 < -7$ because -19 is farther to the left on a number line than -7.

52. $0 > -5$ because 0 is farther to the right on a number line than -5.

54. $2.63 < 3.75$ because 2.63 is farther to the left on a number line than 3.75.

56. $-3.5 < -3.1$ because -3.5 is farther to the left on a number line than -3.1.

58. $3\frac{5}{6} > 3\frac{1}{4}$ because $3\frac{5}{6}$ is farther to the right on a number line than $3\frac{1}{4}$.

60. $|-4.1| = 4.1$ because the absolute value of -4.1 is equal to 4.1.

62. $|-10.4| > 3.2$ because the absolute value of -10.4 is equal to 10.4, which is farther to the right on a number line than 3.2.

64. $|-0.59| = |0.59|$ because the absolute value of -0.59 and the absolute value of 0.59 are both equal to 0.59.

66. $4\frac{2}{9} < \left|4\frac{5}{9}\right|$ because $4\frac{2}{9}$ is farther to the left on a number line than the absolute value of $4\frac{5}{9}$, which is equal to $4\frac{5}{9}$.

68. $|-10| > |-8|$ because the absolute value of -10 is 10, the absolute value of -8 is 8, and 10 is farther to the right on a number line than 8.

70. $|-5.36| < |5.76|$ because the absolute value of -5.36 is 5.36, the absolute value of 5.76 is 5.76, and 5.36 is farther to the left on a number line than 5.76.

72. $\left|-\frac{9}{11}\right| > \left|-\frac{7}{11}\right|$ because the absolute value of $-\frac{9}{11}$ is $\frac{9}{11}$, the absolute value of $-\frac{7}{11}$ is $\frac{7}{11}$, and $\frac{9}{11}$ is farther to the right on a number line than $\frac{7}{11}$.

74. $-12.6, -9.6, 1, |-1.3|, \left|-2\frac{3}{4}\right|, 2.9$

76. $-4\frac{1}{8}, -2\frac{1}{4}, -2, -0.13, |0.1|, 1.02, |-1.06|$

Exercise Set 1.2

2. $\frac{5}{8}$ 4. $\frac{7}{20}$ 6. $\frac{1}{4}$ 8. $\frac{5}{8}$ 10. $\frac{9}{16}$

12. $\frac{5}{8} = \frac{?}{16} \Rightarrow \frac{5\cdot 2}{8\cdot 2} = \frac{10}{16}$
The missing number is 10.

14. $\frac{2}{5} = \frac{6}{?} \Rightarrow \frac{2\cdot 3}{5\cdot 3} = \frac{6}{15}$
The missing number is 15.

16. $\frac{6}{8} = \frac{?}{4} \Rightarrow \frac{6\div 2}{8\div 2} = \frac{3}{4}$
The missing number is 3.

18. $\frac{27}{30} = \frac{9}{?} \Rightarrow \frac{27\div 3}{30\div 3} = \frac{9}{10}$
The missing number is 10.

20. The LCD of 7 and 11 is 77.
$\frac{5\cdot 11}{7\cdot 11} = \frac{55}{77}$ and $\frac{3\cdot 7}{11\cdot 7} = \frac{21}{77}$

22. The LCD of 8 and 12 is 24.
$\frac{5\cdot 3}{8\cdot 3} = \frac{15}{24}$ and $\frac{7\cdot 2}{12\cdot 2} = \frac{14}{24}$

24. The LCD of 20 and 15 is 60.
$-\frac{9\cdot 3}{20\cdot 3} = -\frac{27}{60}$ and $-\frac{7\cdot 4}{15\cdot 4} = -\frac{28}{60}$

26. The LCD of 21 and 14 is 42.
$-\frac{13\cdot 2}{21\cdot 2} = -\frac{26}{42}$ and $-\frac{9\cdot 3}{14\cdot 3} = -\frac{27}{42}$

28. $33 = 3\cdot 11$

30. $42 = 2\cdot 21 = 2\cdot 3\cdot 7$

32. $48 = 2\cdot 24$
$= 2\cdot 8\cdot 3$
$= 2\cdot 2\cdot 4\cdot 3$
$= 2\cdot 2\cdot 2\cdot 2\cdot 3$

34. $810 = 2\cdot 405$
$= 2\cdot 81\cdot 5$
$= 2\cdot 9\cdot 9\cdot 5$
$= 2\cdot 3\cdot 3\cdot 3\cdot 3\cdot 5$

36. $\frac{48}{84} = \frac{2\cdot 2\cdot \cancel{2}\cdot \cancel{2}\cdot \cancel{3}}{\cancel{2}\cdot \cancel{2}\cdot \cancel{3}\cdot 7} = \frac{4}{7}$

38. $\frac{42}{91} = \frac{2\cdot 3\cdot \cancel{7}}{\cancel{7}\cdot 13} = \frac{6}{13}$

40. $-\frac{30}{54} = -\frac{\cancel{2}\cdot\cancel{3}\cdot 5}{\cancel{2}\cdot\cancel{3}\cdot 3\cdot 3} = -\frac{5}{9}$

42. $-\frac{24}{162} = -\frac{\cancel{2}\cdot 2\cdot 2\cdot\cancel{3}}{\cancel{2}\cdot 3\cdot 3\cdot 3\cdot\cancel{3}} = -\frac{4}{27}$

44. Incorrect. 2 is not a factor of the numerator.

46. Incorrect. The prime factorization of 108 should be $2\cdot 2\cdot 3\cdot 3\cdot 3$.

48. If 130 of the 250 calories come from fat, the fraction of calories in a serving that comes from fat is $\frac{130}{250}$.
$\frac{130}{250} = \frac{\cancel{2}\cdot\cancel{5}\cdot 13}{\cancel{2}\cdot 5\cdot\cancel{5}\cdot 5} = \frac{13}{25}$

50. If 120 square feet of the 1830 square feet are used as a home office, the fraction of her home that is used as an office is $\frac{120}{1830}$.
$\frac{120}{1830} = \frac{\cancel{2}\cdot 2\cdot 2\cdot\cancel{3}\cdot\cancel{5}}{\cancel{2}\cdot\cancel{3}\cdot\cancel{5}\cdot 61} = \frac{4}{61}$

52. There are $7\cdot 24 = 168$ hours in one week.
$\frac{50}{168} = \frac{\cancel{2}\cdot 5\cdot 5}{\cancel{2}\cdot 2\cdot 2\cdot 3\cdot 7} = \frac{25}{84}$
Carla spends $\frac{25}{84}$ of her week sleeping.

54. $50+40+18+4 = 112$ hours for the listed activities. The non-listed activities take $168-112 = 56$ hours.
$\frac{56}{168} = \frac{\cancel{2}\cdot\cancel{2}\cdot\cancel{2}\cdot\cancel{7}}{\cancel{2}\cdot\cancel{2}\cdot\cancel{2}\cdot 3\cdot\cancel{7}} = \frac{1}{3}$
Carla spends $\frac{1}{3}$ of her week away from all of the listed activities.

56. $\frac{310}{1000} = \frac{\cancel{2}\cdot\cancel{5}\cdot 31}{\cancel{2}\cdot 2\cdot 2\cdot\cancel{5}\cdot 5\cdot 5} = \frac{31}{100}$

58. $1000-310 = 690$ non-victims;
$\frac{690}{1000} = \frac{69}{100}$

60. a) 2008
b) $\frac{26}{1000} = \frac{\cancel{2}\cdot 13}{\cancel{2}\cdot 2\cdot 2\cdot 5\cdot 5\cdot 5} = \frac{13}{500}$

62. $\frac{9}{159} = \frac{\cancel{3}\cdot 3}{\cancel{3}\cdot 53} = \frac{3}{53}$

64. $\frac{8}{60} = \frac{\cancel{2}\cdot\cancel{2}\cdot 2}{\cancel{2}\cdot\cancel{2}\cdot 3\cdot 5} = \frac{2}{15}$

66. $\frac{4}{12} = \frac{\cancel{2}\cdot\cancel{2}}{\cancel{2}\cdot\cancel{2}\cdot 3} = \frac{1}{3}$

68. 47 Republicans + 2 Independents = 49 Not Democrats; $\frac{49}{100}$ of the Senate was not Democrat.

70. $6+12+6 = 24$ atoms total
$12+6 = 18$ not-carbon atoms
$\frac{18}{24} = \frac{\cancel{2}\cdot\cancel{3}\cdot 3}{\cancel{2}\cdot 2\cdot 2\cdot\cancel{3}} = \frac{3}{4}$

Exercise Set 1.3

2. Commutative Property of Addition because the order of the addends is changed.

4. Additive identity because the sum of a number and 0 is that number.

6. Additive inverse because the sum of these opposites is 0.

8. Associative Property of Addition because the grouping is changed.

10. Commutative Property of Addition because the order of the addends is changed.

12. Additive inverse because the sum of the opposites -4.6 and 4.6 is 0.

14. $15+7 = 22$

16. $-5+(-7) = -12$

18. $-5+16 = 11$

20. $-17+8 = -9$

22. $29+(-7) = 22$

24. $-16+13 = -3$

26. $\frac{9}{16}+\frac{5}{16} = \frac{9+5}{16}$
$= \frac{14}{16}$
$= \frac{\cancel{2}\cdot 7}{\cancel{2}\cdot 2\cdot 2\cdot 2}$
$= \frac{7}{8}$

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

30. $-\frac{9}{14}+\frac{3}{14}=\frac{-9+3}{14}$
$=-\frac{6}{14}$
$=-\frac{\cancel{2}\cdot 3}{\cancel{2}\cdot 7}$
$=-\frac{3}{7}$

32. The LCD of 4 and 8 is 8.
$\frac{1}{4}+\frac{7}{8}=\frac{1(2)}{4(2)}+\frac{7}{8}$
$=\frac{2}{8}+\frac{7}{8}$
$=\frac{2+7}{8}$
$=\frac{9}{8}$

34. The LCD of 5 and 20 is 20.
$-\frac{2}{5}+\left(-\frac{3}{20}\right)=-\frac{2(4)}{5(4)}+\left(-\frac{3}{20}\right)$
$=-\frac{8}{20}+\left(-\frac{3}{20}\right)$
$=-\frac{11}{20}$

36. The LCD of 16 and 12 is 48.
$-\frac{5}{16}+\frac{3}{12}=-\frac{5(3)}{16(3)}+\frac{3(4)}{12(4)}$
$=-\frac{15}{48}+\frac{12}{48}$
$=\frac{-15+12}{48}$
$=-\frac{3}{48}$
$=-\frac{\cancel{3}}{\cancel{3}\cdot 16}$
$=-\frac{1}{16}$

38. $0.06+0.17=0.23$

40. $-15.81+4.28=-11.53$

42. $-7.8+(-9.16)=-16.96$

44. $-31+|-54|=-31+54=23$

46. $|-0.6|+|-9.1|=0.6+9.1=9.7$

48. The LCD of 5 and 4 is 20.
$\left|-\frac{4}{5}\right|+\left|\frac{3}{4}\right|=\frac{4}{5}+\frac{3}{4}$
$=\frac{4(4)}{5(4)}+\frac{3(5)}{4(5)}$
$=\frac{16}{20}+\frac{15}{20}$
$=\frac{31}{20}$

50. -7 because $7+(-7)=0$

52. 6 because $-6+6=0$

54. 9 because $-9+9=0$

56. $\frac{6}{17}$ because $-\frac{6}{17}+\frac{6}{17}=0$

58. –2.8 because $2.8+(-2.8)=0$

60. $-b$ because $b+(-b)=0$

62. $\frac{a}{b}$ because $-\frac{a}{b}+\frac{a}{b}=0$

64. $-(-15)=15$

66. $-(-(-1))=-(1)=-1$

68. $-|10|=-10$

70. $-|-5|=-(5)=-5$

72. $8-20=8+(-20)=-12$

74. $-7-15=-7+(-15)=-22$

76. $6-(-7)=6+7=13$

78. $-13-(-6)=-13+6=-7$

80. $-\frac{3}{4}-\left(-\frac{3}{4}\right)=-\frac{3}{4}+\frac{3}{4}$
$=0$

82. The LCD of 6 and 8 is 24.

$$\frac{3}{8}-\left(-\frac{5}{6}\right)=\frac{3}{8}+\frac{5}{6}$$
$$=\frac{3(3)}{8(3)}+\frac{5(4)}{6(4)}$$
$$=\frac{9}{24}+\frac{20}{24}$$
$$=\frac{29}{24}$$

84. The LCD of 2 and 3 is 6.

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

86. $8.1-4.76=3.34$

88. $0.107-5.802=0.107+(-5.802)$
$=-5.695$

90. $-7.1-(-2.3)=-7.1+2.3$
$=-4.8$

92. $-|-9|-|-12|=-(9)-(12)$
$=-9+(-12)$
$=-21$

94. $|4.6|-|-7.3|=4.6-7.3$
$=4.6+(-7.3)$
$=-2.7$

96. $24,572.88+1284.56+(-1545.75)+(-2700)$
$+(-865.45)+(-21,580.50)=-\$834.26,$ which indicates a loss

98. $31,672.88+32,284.56+124.75+2400$
$+(-6545.75)+(-1200)+(-165.45)$
$+(-10,800)=\$47,770.99$

100. $29.15-28.83=29.15+(-28.83)$
$=\$0.32$

102. $2887.98-(-14.35)=2887.98+14.35$
$=\$2902.33$

104. $-256.5-(-273.15)$;
$-256.5-(-273.15)=-256.5+273.15$
$=16.65$

106. a) $21.0-18.8$

b) $21.0-18.8=2.2$

c) The positive difference indicates that the mean composite score in 2010 was greater than the score in 1986.

108. \$94,207 – \$67,790 = \$26,417

110. Masters;
\$111,149 – \$94,207 = \$16,942

Puzzle Problem

2	9	4
7	5	3
6	1	8

Exercise Set 1.4

2. Distributive Property of Multiplication over addition.

4. Multiplicative Identity because the product of a number and 1 is the number.

6. Multiplicative Property of 0 because the product of a number and 0 is 0.

8. Commutative Property of Multiplication because the order of the factors is different.

10. Associative Property of Multiplication because the grouping of factors is different.

12. Commutative Property of Multiplication because the order of the factors is different.

14. $4(-7)=-28$

16. $(-8)(5)=-40$

18. $(12)(-4)=-48$

20. $(-4)(-3)=12$

22. $(-8)(-12)=96$

24. $-\frac{4}{5}\cdot\left(\frac{20}{3}\right)=-\frac{2\cdot 2}{\cancel{5}}\cdot\frac{2\cdot 2\cdot\cancel{5}}{3}=-\frac{16}{3}$

26. $\left(-\frac{5}{6}\right)\left(-\frac{6}{5}\right)=\frac{\cancel{5}\cdot\cancel{6}}{\cancel{6}\cdot\cancel{5}}=1$

28. $\left(\frac{2}{9}\right)\left(-\frac{21}{26}\right)=\frac{\cancel{2}}{\cancel{3}\cdot 3}\cdot\left(-\frac{\cancel{3}\cdot 7}{\cancel{2}\cdot 13}\right)=-\frac{7}{39}$

30. $8(-2.5)=-20$

32. $-7.1(-0.5)=3.55$

34. $8.1(-2.75)=-22.275$

36. $-4(5)(-3)=-20(-3)=60$

38. $3(7)(-8)=21(-8)=-168$

40. $(-5)(-3)(-2)=(15)(-2)=-30$

42. $-5(3)(-4)(-2)=-15(-4)(-2)$
$=60(-2)$
$=-120$

44. $(-2)(-4)(-30)(-1)=(8)(-30)(-1)$
$=(-240)(-1)$
$=240$

46. $(-1)(-1)(4)(-5)(-3)=(1)(4)(-5)(-3)$
$=4(-5)(-3)$
$=-20(-3)$
$=60$

48. $\frac{3}{20}$ is the multiplicative inverse of $\frac{20}{3}$ because $\frac{20}{3}\cdot\frac{3}{20}=1$.

50. $-\frac{7}{6}$ is the multiplicative inverse of $-\frac{6}{7}$ because $-\frac{6}{7}\cdot\left(-\frac{7}{6}\right)=1$.

52. $\frac{1}{17}$ is the multiplicative inverse of 17 because $17\cdot\frac{1}{17}=1$.

54. –1 is the multiplicative inverse of -1 because $-1\cdot(-1)=1$.

56. $42\div(-7)=-6$

58. $-12\div(-4)=3$

60. $\frac{75}{-3}=-25$

62. $\frac{-48}{-6}=8$

64. $\frac{0}{5}=0$

66. $-21\div 0$ is undefined.

68. $0\div 0$ is indeterminate.

70. $-8\div\frac{3}{4}=\frac{-8}{1}\cdot\frac{4}{3}$
$=-\frac{32}{3}$

72. $-\frac{4}{5}\div\frac{4}{5}=-\frac{\cancel{4}}{\cancel{5}}\cdot\frac{\cancel{5}}{\cancel{4}}$
$=-1$

74. $-\frac{1}{3}\div\left(-\frac{3}{2}\right)=-\frac{1}{3}\cdot\left(-\frac{2}{3}\right)$
$=\frac{2}{9}$

76. $\frac{7}{15}\div\left(-\frac{35}{24}\right)=\frac{7}{15}\cdot\left(-\frac{24}{35}\right)$
$=\frac{\cancel{7}}{\cancel{3}\cdot 5}\cdot\left(-\frac{2\cdot 2\cdot 2\cdot\cancel{3}}{5\cdot\cancel{7}}\right)$
$=-\frac{8}{25}$

78. $8.1\div 0.6=13.5$

80. $-10.65\div(-7.1)=1.5$

82. $19\div(-0.06)=-316.\overline{6}$

84. $25\frac{1}{2}\div 2=\frac{51}{2}\cdot\frac{1}{2}$
$=\frac{51}{4}$
$=12\frac{3}{4}$

The 12th fret should be placed $12\frac{3}{4}$ in. from the saddle or nut.

86. $(-858)\frac{2}{3}=-\$572$

88. $4\left(-\frac{3}{8}\right)=-\$1\frac{1}{2}$

90. $70.4(-9.8)=-689.92$ N

92. $\dfrac{-2080}{-32.2} \approx 64.6$ slugs

94. $-15 \div (-8) = 1.875\ \Omega$

96. $400 = (-6.5)^2 r$

$\dfrac{400}{(-6.5)^2} = r$

$9.47\Omega \approx r$

Exercise Set 1.5

2. Base: 9; Exponent: 4; "nine to the fourth power"

4. Base: –8; Exponent: 2; "negative eight squared"

6. Base: 3; Exponent: 8; "additive inverse of three to the eighth power"

8. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

10. $(-2)^4 = (-2)(-2)(-2)(-2) = 16$

12. $-2^4 = -2 \cdot 2 \cdot 2 \cdot 2 = -16$

14. $(-3)^5 = (-3)(-3)(-3)(-3)(-3) = -243$

16. $-3^5 = -3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = -243$

18. $-(-3)^3 = -(-3)(-3)(-3)$
$= -(-27)$
$= 27$

20. $-(-1)^4 = -(-1)(-1)(-1)(-1)$
$= -(1)$
$= -1$

22. $\left(-\dfrac{2}{7}\right)^2 = \left(-\dfrac{2}{7}\right)\left(-\dfrac{2}{7}\right) = \dfrac{4}{49}$

24. $\left(-\dfrac{1}{3}\right)^5 = \left(-\dfrac{1}{3}\right)\left(-\dfrac{1}{3}\right)\left(-\dfrac{1}{3}\right)\left(-\dfrac{1}{3}\right)\left(-\dfrac{1}{3}\right)$
$= -\dfrac{1}{243}$

26. $(0.3)^4 = (0.3)(0.3)(0.3)(0.3)$
$= 0.0081$

28. $(-0.2)^4 = (-0.2)(-0.2)(-0.2)(-0.2)$
$= 0.0016$

30. ± 7

32. No real-number square root exists.

34. ± 13

36. ± 15

38. $\sqrt{36} = 6$

40. $\sqrt{289} = 17$

42. $\sqrt{0.01} = 0.1$

44. $\sqrt{-25}$ is not a real number.

46. $\sqrt{\dfrac{9}{100}} = \dfrac{\sqrt{9}}{\sqrt{100}}$
$= \dfrac{3}{10}$

48. $\sqrt{\dfrac{48}{3}} = \sqrt{16} = 4$

50. $4 \cdot 6 - 5 = 24 - 5$
$= 19$

52. $18 \div 2 + 3 = 9 + 3$
$= 12$

54. $9 + 6 \div 3 = 9 + 2$
$= 11$

56. $-3 \cdot 4 - 2 \cdot 7 = -12 - 14$
$= -26$

58. $8 - 3^2 = 8 - 9$
$= -1$

60. $16 - 5(-2)^2 = 16 - 5(4)$
$= 16 - 20$
$= -4$

62. $3^2 - 18 \div 3(6 - 3) = 3^2 - 18 \div 3 \cdot 3$
$= 9 - 18 \div 3 \cdot 3$
$= 9 - 6 \cdot 3$
$= 9 - 18$
$= -9$

64. $12 - 2(-2)^3 - 64 \div 4 \cdot 2 = 12 - 2(-8) - 64 \div 4 \cdot 2$
$= 12 - (-16) - 16 \cdot 2$
$= 12 + 16 - 32$
$= 28 - 32$
$= -4$

66. $(-3)^3 - 16 - 5(7-2) = (-3)^3 - 16 - 5(5)$
$= -27 - 16 - 5(5)$
$= -27 - 16 - 25$
$= -43 - 25$
$= -68$

68. $18 \div (-6+3)(4+1) = 18 \div (-3)(5)$
$= -6(5)$
$= -30$

70. $-15.54 \div 3.7 + (-2)^4 + \sqrt{49}$
$= -15.54 \div 3.7 + 16 + 7$
$= -4.2 + 16 + 7$
$= 11.8 + 7$
$= 18.8$

72. $16.3 + 2.8\left[(8+7) \div 5 - 4^2\right]$
$= 16.3 + 2.8\left(15 \div 5 - 4^2\right)$
$= 16.3 + 2.8(15 \div 5 - 16)$
$= 16.3 + 2.8(3 - 16)$
$= 16.3 + 2.8(-13)$
$= 16.3 + (-36.4)$
$= -20.1$

74. $-2|9-15| + 5^2 - 3^2 = -2|-6| + 5^2 - 3^2$
$= -2(6) + 5^2 - 3^2$
$= -2(6) + 25 - 9$
$= -12 + 25 - 9$
$= 4$

76. $\frac{5}{6} \div \left(-\frac{2}{3}\right) + \left(-\frac{2}{7}\right)(5)(-14)$
$= \frac{5}{2 \cdot \cancel{3}} \cdot \left(-\frac{\cancel{3}}{2}\right) + \left(-\frac{2}{\cancel{7}}\right)\left(\frac{5}{1}\right)\left(-\frac{2 \cdot \cancel{7}}{1}\right)$
$= -\frac{5}{4} + \frac{20}{1}$
$= -\frac{5}{4} + \frac{80}{4}$
$= \frac{75}{4}$
$= 18\frac{3}{4}$

78. $\sqrt{100-64} + 18 \div (-3)(-2)$
$= \sqrt{36} + 18 \div (-3)(-2)$
$= 6 + 18 \div (-3)(-2)$
$= 6 + (-6)(-2)$
$= 6 + 12$
$= 18$

80. $4 - 8\left[3 - (9+3)\right] + \sqrt{64}$
$= 4 - 8(3-12) + \sqrt{64}$
$= 4 - 8(-9) + \sqrt{64}$
$= 4 - 8(-9) + 8$
$= 4 + 72 + 8$
$= 84$

82. $\sqrt{83-58} - 2^2\left[9 - (3-8)\right] + 3^4$
$= \sqrt{25} - 2^2\left[9 - (-5)\right] + 3^4$
$= \sqrt{25} - 2^2(9+5) + 3^4$
$= \sqrt{25} - 2^2(14) + 3^4$
$= 5 - 4(14) + 81$
$= 5 - 56 + 81$
$= -51 + 81$
$= 30$

84. $\left(\frac{3}{4} - \frac{2}{3}\right) \div \sqrt{\frac{9}{81}} - \left(\frac{16}{27}\right) \div \left(\frac{4}{9}\right)$
$= \left(\frac{9}{12} - \frac{8}{12}\right) \div \sqrt{\frac{9}{81}} - \left(\frac{16}{27}\right) \div \left(\frac{4}{9}\right)$
$= \left(\frac{1}{12}\right) \div \frac{\sqrt{9}}{\sqrt{81}} - \left(\frac{16}{27}\right) \div \left(\frac{4}{9}\right)$
$= \left(\frac{1}{12}\right) \div \frac{3}{9} - \left(\frac{16}{27}\right) \div \left(\frac{4}{9}\right)$
$= \frac{1}{12} \div \frac{1}{3} - \frac{16}{27} \div \frac{4}{9}$
$= \frac{1}{12} \cdot \frac{3}{1} - \frac{{}^{4}\cancel{16}}{{}_{3}\cancel{27}} \cdot \frac{\cancel{9}^{1}}{\cancel{4}_{1}}$
$= \frac{3}{12} - \frac{4}{3}$
$= \frac{3}{12} - \frac{16}{12}$
$= -\frac{13}{12}$

86. $\frac{5}{6}(-18)\div\left(\frac{3}{2}\right)-\sqrt{9+16}$

$=\frac{5}{6}(-18)\div\left(\frac{3}{2}\right)-\sqrt{25}$

$=\frac{5}{6}(-18)\div\left(\frac{3}{2}\right)-5$

$=-15\div\left(\frac{3}{2}\right)-5$

$=-\frac{\overset{5}{\cancel{15}}}{1}\cdot\frac{2}{\underset{1}{\cancel{3}}}-5$

$=-10-5$

$=-15$

88. $18\cdot\left(-\frac{5}{6}\right)\div(-3)+2\left|4+2(7-3)\right|$

$=18\cdot\left(-\frac{5}{6}\right)\div(-3)+2\left|4+2(4)\right|$

$=18\cdot\left(-\frac{5}{6}\right)\div(-3)+2\left|4+8\right|$

$=18\cdot\left(-\frac{5}{6}\right)\div(-3)+2\left|12\right|$

$=\overset{3}{\cancel{18}}\cdot\left(-\frac{5}{\underset{1}{\cancel{6}}}\right)\div(-3)+2(12)$

$=-15\div(-3)+2(12)$

$=5+2(12)$

$=5+24$

$=29$

90. $\frac{\left|6(-3)+7\right|-11}{5^3-2(6-12)}=\frac{\left|-18+7\right|-11}{5^3-2(-6)}$

$=\frac{\left|-11\right|-11}{125-2(-6)}$

$=\frac{11-11}{125+12}$

$=\frac{0}{137}$

$=0$

92. $\frac{3\left[24-4(6-2)\right]}{-3^3+4^2+3}=\frac{3\left[24-4(4)\right]}{-27+16+3}$

$=\frac{3(24-16)}{-11+3}$

$=\frac{3(8)}{-8}$

$=\frac{24}{-8}$

$=-3$

94. $\frac{6^2-3\left(4+2^5\right)}{4+20-(2+4)^2}=\frac{6^2-3(4+32)}{4+20-6^2}$

$=\frac{6^2-3(36)}{4+20-36}$

$=\frac{36-3(36)}{24-36}$

$=\frac{36-108}{-12}$

$=\frac{-72}{-12}$

$=6$

96. $\frac{5(4-9)+1}{2^3-\sqrt{100-36}}=\frac{5(-5)+1}{2^3-\sqrt{64}}$

$=\frac{-25+1}{8-8}$

$=\frac{-24}{0}$

Because the divisor is 0, the answer is undefined.

98. Distributive Property. The parentheses were not simplified first.

100. Commutative Property of Addition. The addition was not performed from left to right.

102. Mistake: Subtracted before multiplying.

Correct: $19-6(10-8)=19-6\cdot 2$

$=19-12$

$=7$

104. Mistake: Treated -3^4 as $(-3)^4$.

Correct:

$-3^4+20\div 5-(16-24)=-3^4+20\div 5-(-8)$

$=-81+20\div 5-(-8)$

$=-81+4+8$

$=-69$

106. Since the instructor drops one quiz, the 4, there is a total of 8 quizzes. Add the quiz scores and divide by 8.

$$\frac{9+8+8+7+7+6+9+8}{8}=\frac{62}{8}=7.75$$

108. Assume that Lisa will not make lower than 68 and that score will be dropped. Add the test scores (268) and subtract from the lowest possible points for an A (4 tests multiplied by a score of 90 = 360 points). 360 – 268 = 92.

110. Add the unemployment figures for each month and divide by 12, the number of months in a year.

$$\frac{\left(\begin{array}{l}14,937+14,542+14,060+13,237\\+13,421+14,409+14,428+14,008\\+13,520+13,102+12,613+12,692\end{array}\right)}{12}$$

$$=\frac{164,969}{12}$$

$$\approx 13,747 \text{ thousand people}$$

$$=13,747,000 \text{ people}$$

112. Add the ending averages and divide by 5, the number of days.

$$\frac{\left(\begin{array}{l}13,075.35+13,071.72+13,007.47\\+12,969.70+12,885.82\end{array}\right)}{5}$$

$$=\frac{65,010.06}{5}$$

$$\approx 13,002.01$$

Exercise Set 1.6

2. $4n$

4. $5+y$

6. $T-6$

8. $\dfrac{7}{m^2}$

10. $2y-13$

12. $r\div 6$ or $\dfrac{r}{6}$

14. b^3+7

16. $4x+\dfrac{2}{3}$

18. $3(n+4)$

20. $(2-l)^3$

22. $3a+5$

24. $x\div y+7$ or $\dfrac{x}{y}+7$

26. $-8-(m-n)$

28. $0.81+8(x+0.3)$

30. $(c-d)-(a+b)$

32. $ab-\sqrt{x}$

34. $5n-(n+2)$

36. Mistake: Order is incorrect.
Correct: m^2-4

38. Mistake: Wrote 19 as a dividend instead of a divisor.
Correct: $\dfrac{hk}{19}$ or $hk\div 19$

40. $l-4$

42. $\dfrac{1}{4}l$

44. $2r$

46. $60-n$

48. $t+\dfrac{1}{3}$

50. πr^2

52. $\dfrac{4}{3}\pi r^3$

54. $\dfrac{v^2}{r}$

56. $\sqrt{1-\dfrac{v^2}{c^2}}$

58. Mistake: Could be translated as $2(a-7)$.
Correct: Seven less than two times a.

60. Mistake: Could be translated as $4y+6$.
Correct: Four times the sum of y and six.

62. Mistake: Could be translated as $(m-3)(m+2)$.
Correct: m minus the product of three and the sum of m and two.

64. The product of one-half the height and the sum of a and b.

66. The product of π, the radius squared, and the height.

68. Twice the product of π, the radius, and the sum of the radius and the height.

70. The product of a and x squared added to the product of b and x added to c.

Puzzle Problem

a) $n+1, n+2$
b) $n+2, n+4$
c) $n+2, n+4$

Exercise Set 1.7

2. Let $m = 5, n = 3$.

$$\begin{aligned} 8n - 2(m+1) &= 8(3) - 2(5+1) \\ &= 8(3) - 2(6) \\ &= 24 - 12 \\ &= 12 \end{aligned}$$

4. Let $y = 5$.

$$\begin{aligned} 6 - 0.4(y-2) &= 6 - 0.4(5-2) \\ &= 6 - 0.4(3) \\ &= 6 - 1.2 \\ &= 4.8 \end{aligned}$$

6. Let $n = -1$.

$$\begin{aligned} n^2 - 8n + 1 &= (-1)^2 - 8(-1) + 1 \\ &= 1 - 8(-1) + 1 \\ &= 1 + 8 + 1 \\ &= 10 \end{aligned}$$

8. Let $r = -\frac{1}{3}$.

$$\begin{aligned} 3r^2 - 9r + 6 &= 3\left(-\frac{1}{3}\right)^2 - 9\left(-\frac{1}{3}\right) + 6 \\ &= 3\left(\frac{1}{9}\right) - 9\left(-\frac{1}{3}\right) + 6 \\ &= \frac{1}{3} + 3 + 6 \\ &= 9\frac{1}{3} = \frac{28}{3} \end{aligned}$$

10. Let $l = -0.4$.

$$\begin{aligned} -6 - 2(l-5) &= -6 - 2(-0.4 - 5) \\ &= -6 - 2(-5.4) \\ &= -6 + 10.8 \\ &= 4.8 \end{aligned}$$

12. Let $m = 3$, $n = -2$.

$$\begin{aligned} -\left|2m^2\right| - |4n| &= -\left|2(3)^2\right| - |4(-2)| \\ &= -|2(9)| - |-8| \\ &= -|18| - 8 \\ &= -18 - 8 \\ &= -26 \end{aligned}$$

14. Let $m = -4$, $n = -5$.

$$\begin{aligned} \left|2m^2 + 2n\right| &= \left|2(-4)^2 + 2(-5)\right| \\ &= |2(16) + 2(-5)| \\ &= |32 + (-10)| \\ &= |22| \\ &= 22 \end{aligned}$$

16. Let $x = -2$, $y = -3$, $z = 4$.

$$\begin{aligned} -2x^3 y + \sqrt{z} &= -2(-2)^3(-3) + \sqrt{4} \\ &= -2(-8)(-3) + 2 \\ &= -48 + 2 \\ &= -46 \end{aligned}$$

18. Let $h = 16$, $k = 9$.

$$\begin{aligned} -3\sqrt{h} + 3\sqrt{k} &= -3\sqrt{16} + 3\sqrt{9} \\ &= -3(4) + 3(3) \\ &= -12 + 9 \\ &= -3 \end{aligned}$$

20. Let $m = 2, n = 4$.

$$\begin{aligned} \frac{4m^2}{n+4} &= \frac{4(2)^2}{4+4} \\ &= \frac{4(4)}{8} \\ &= \frac{16}{8} \\ &= 2 \end{aligned}$$

22. Let $a = 1, x = 64, y = 36$.

$$\begin{aligned} \frac{5 - a^2}{3\sqrt{x+y}} &= \frac{5 - 1^2}{3\sqrt{64+36}} \\ &= \frac{5-1}{3\sqrt{100}} \\ &= \frac{4}{3 \cdot 10} \\ &= \frac{4}{30} \\ &= \frac{2}{15} \end{aligned}$$

24. a) Let $a=1, b=0.5, c=-4, d=6$.

$$\begin{aligned} ad-bc &= 1(6)-0.5(-4) \\ &= 6+2 \\ &= 8 \end{aligned}$$

b) Let $a=-3, b=\frac{4}{5}, c=2, d=\frac{1}{2}$.

$$\begin{aligned} ad-bc &= -3\left(\frac{1}{2}\right)-\frac{4}{5}(2) \\ &= -\frac{3}{2}-\frac{8}{5} \\ &= -\frac{3(5)}{2(5)}-\frac{8(2)}{5(2)} \\ &= -\frac{15}{10}-\frac{16}{10} \\ &= -\frac{31}{10} \end{aligned}$$

26. a) Let $x_1=2, y_1=1, x_2=5, y_2=7$.

$$\begin{aligned} \sqrt{(x_2-x_1)^2+(y_2-y_1)^2} &= \sqrt{(5-2)^2+(7-1)^2} \\ &= \sqrt{3^2+6^2} \\ &= \sqrt{9+36} \\ &= \sqrt{45} \\ &\approx 6.7 \end{aligned}$$

b) Let $x_1=-1, y_1=2, x_2=-7, y_2=-2$

$$\begin{aligned} &\sqrt{(x_2-x_1)^2+(y_2-y_1)^2} \\ &= \sqrt{\left(-7-(-1)\right)^2+(-2-2)^2} \\ &= \sqrt{(-6)^2+(-4)^2} \\ &= \sqrt{36+16} \\ &= \sqrt{52} \\ &\approx 7.2 \end{aligned}$$

28. If $x=-3$, we have $\frac{8}{-3+3}=\frac{8}{0}$, which is undefined because the denominator is 0.

30. If $a=4$, we have $\frac{-5(4)}{(4-4)(4-2)}=\frac{-20}{(0)(2)}=\frac{-20}{0}$, which is undefined. If $a=2$, we have $\frac{-5(2)}{(2-4)(2-2)}=\frac{-10}{(-2)(0)}=\frac{-10}{0}$, which is undefined.

32. If $y=0$, we have $\frac{7-0}{0}=\frac{7}{0}$, which is undefined because the denominator is 0.

34. If $y=-\frac{1}{2}$, we have $\frac{3\left(-\frac{1}{2}\right)}{2\left(-\frac{1}{2}\right)+1}=\frac{-\frac{3}{2}}{-1+1}=\frac{-\frac{3}{2}}{0}$, which is undefined because the denominator is 0.

36. $$\begin{aligned} 4(b-5) &= 4\cdot b-4\cdot 5 \\ &= 4b-20 \end{aligned}$$

38. $$\begin{aligned} -7(3-2m) &= -7\cdot 3-(-7)\cdot 2m \\ &= -21-(-14m) \\ &= -21+14m \end{aligned}$$

40. $$\begin{aligned} \frac{4}{5}\left(-10h+\frac{2}{9}\right) &= \frac{4}{5}(-10h)+\frac{4}{5}\cdot\frac{2}{9} \\ &= -8h+\frac{8}{45} \end{aligned}$$

42. $$\begin{aligned} -1.5(6x+7) &= -1.5\cdot 6x+(-1.5)\cdot 7 \\ &= -9x-10.5 \end{aligned}$$

44. -14 46. 1 48. -1

50. $\frac{5}{8}$ 52. $-\frac{1}{3}$

54. $6m+7m=13m$

56. $5b-13b=-8b$

58. $-5y+12y=7y$

60. $-7m-6m=-13m$

62. $-5.1x^4+3.4x^4=-1.7x^4$

64. $$\begin{aligned} \frac{3}{4}z-\frac{7}{5}z &= \frac{3(5)}{4(5)}z-\frac{7(4)}{5(4)}z \\ &= \frac{15}{20}z-\frac{28}{20}z \\ &= -\frac{13}{20}z \end{aligned}$$

66. $$\begin{aligned} -15w-6w-11w &= -21w-11w \\ &= -32w \end{aligned}$$

68. $$\begin{aligned} 5y^2+6+3y^2-8 &= 5y^2+3y^2+6-8 \\ &= 8y^2-2 \end{aligned}$$

70. $-4a+9b-a+5+2b-8$
$=-4a-a+9b+2b+5-8$
$=-5a+11b-3$

72. $-3h+7k-5-8h-7k+19+x$
$=-3h-8h+7k-7k+x-5+19$
$=-11h+x+14$

74. $0.4t^2+t-2.8-t^2+0.9t-4$
$=0.4t^2-t^2+t+0.9t-2.8-4$
$=-0.6t^2+1.9t-6.8$

76. $\frac{5}{8}y+4-\frac{3}{4}x+\frac{2}{3}-\frac{1}{4}y$
$=-\frac{3}{4}x+\frac{5}{8}y-\frac{1}{4}y+4+\frac{2}{3}$
$=-\frac{3}{4}x+\frac{5}{8}y-\frac{1(2)}{4(2)}y+\frac{4(3)}{1(3)}+\frac{2}{3}$
$=-\frac{3}{4}x+\frac{5}{8}y-\frac{2}{8}y+\frac{12}{3}+\frac{2}{3}$
$=-\frac{3}{4}x+\frac{3}{8}y+\frac{14}{3}$

78. $\frac{1}{2}m-3n+14-\frac{3}{8}m-\frac{9}{10}n-5$
$=\frac{1}{2}m-\frac{3}{8}m-3n-\frac{9}{10}n+14-5$
$=\frac{1(4)}{2(4)}m-\frac{3}{8}m-\frac{3(10)}{1(10)}n-\frac{9}{10}n+14-5$
$=\frac{4}{8}m-\frac{3}{8}m-\frac{30}{10}n-\frac{9}{10}n+14-5$
$=\frac{1}{8}m-\frac{39}{10}n+9$

80. a) $-5n+(8-2n)$
b) $8-7n$
c) Let $n=0.2$
$8-7n=8-7(0.2)$
$=8-1.4$
$=6.6$

Puzzle Problem

F = 2, O = 9, R = 7, T = 8, Y = 6, E = 5, N = 0,
S = 3, I = 1, X = 4

$$\begin{array}{r} 29786 \\ 850 \\ +\ 850 \\ \hline 31486 \end{array}$$