Selected Answers
for
Core Connections Integrated II
Lesson 1.1.1


1-5. a: \( \frac{4}{3} \); \( y = \frac{4}{3}x + \frac{9}{2} \)
   
b: \( MU = \sqrt{41} \approx 6.40 \) units
   
c: One is a ratio (slope), while the other is a length (distance).

1-6. a: isosceles triangle  b: equilateral triangle  c: parallelogram

1-7. a: \( x = 6 \)  b: \( x = 16 \)  c: \( x = 1.5 \)  d: \( x = 8 \)

1-8. Perimeter: 74 cm
    Area: 231 cm\(^2\)

Lesson 1.1.2

1-16. C

1-17. isosceles: (a) and (c); scalene: (b)

1-18. Multiply the numbers on the sides to get the number on the top. Add the numbers on the sides to get the number on the bottom.

   a: \[
   \begin{array}{cc}
   15 & 3 \\
   5 & 8 \\
   \end{array}
   \]
   
b: \[
   \begin{array}{cc}
   2 & -2 \\
   -1 & -3 \\
   \end{array}
   \]
   
c: \[
   \begin{array}{cc}
   8 & 4 \\
   6 & 2 \\
   \end{array}
   \]
   
d: \[
   \begin{array}{cc}
   4 & \frac{1}{2} \\
   8 & \frac{1}{2} \\
   \end{array}
   \]
   
e: \[
   \begin{array}{cc}
   12 & -4 \\
   -3 & -7 \\
   \end{array}
   \]

1-19. It assumes that everyone who likes bananas is a monkey.

1-20. Carol: only inside circle #2
   Bob: outside both circles
   Pedro: only inside both circles
   Toby: intersection of both circles
Lesson 1.2.1

1-25. Yes, his plants will be dead. If his plants are indoors, they will be dead, because he has been gone for two weeks, so they have not been watered at least once a week. If he left them outdoors, they will still be dead, because it has not rained for two weeks, and they were not watered once a week.

1-26. a: \( x = -\frac{9}{33} = -\frac{3}{11} \) b: \( x = 1 \) c: \( x = \frac{12}{13} \)

1-27. a: possible
   b: Not possible, because the sum of the measures of an obtuse and right angle is more than 180°.
   c: Not possible, because a triangle with all sides of equal length obviously cannot have sides of different lengths.
   d: possible

1-28. a: b: c: d:
       \[ \begin{array}{c}
           -66 \\
           6 \\
           -5 \\
       \end{array} \quad \begin{array}{c}
           4 \\
           -1 \\
           -5 \\
       \end{array} \quad \begin{array}{c}
           -6 \\
           3 \\
           1 \\
       \end{array} \quad \begin{array}{c}
           -8 \\
           1 \\
           -7 \\
       \end{array} \]

1-29. a: \( \frac{1}{2} \) b: \( \frac{1}{3} \), parallelogram and square
Lesson 1.2.2

1-36. Part (c) is correct. \( x = 10 \) cm

1-37. a: 33 sq cm  
    b: 33x sq units

1-38. a: \( x = 8 \)
    b:
    \[
    \begin{array}{cccccccc}
    x & -2 & 0 & 2 & 4 & 6 & 8 & 10 \\
    y & -5 & -4 & -3 & -2 & -1 & 0 & 1 \\
    \end{array}
    \]
    c: It is the point where the line intersects the \( x \)-axis on the graph. It is the \( x \)-value when \( y = 0 \) in the table.

1-39. This reasoning is incorrect. Rewrite “it is raining” in the lower left oval, and “Andrea’s flowers must be closed up” in the right oval.

1-40. a: \( x = 18 \)  
    b: \( x = 3 \)  
    c: \( x = 6 \)  
    d: \( x = 2 \)

1-41. a: Sandy’s probability = \( \frac{2}{4} \), while Robert’s is \( \frac{3}{5} \); therefore, Robert has a greater chance.
    b: Sandy’s probability = 1 while Robert’s is 0; therefore Sandy has a greater chance.
    c: Sandy’s probability = \( \frac{3}{4} \), while Robert’s is \( \frac{3}{3} \); therefore, Sandy is more likely to select a shape with two sides that are parallel.
Lesson 1.2.3

1-50.  a: \(2x + 8\)  b: \(2x + 4y + 8\)

1-51.  a: \(77 + 56 + 33 + 24 = 190\) square units  
       b: \(33x^2 - 44x - 6x + 8 = 33x^2 - 50x + 8\) sq. units

1-52.  a: (3)  b: (5)  c: (6)  d: (2)

1-53.  a: isosceles triangle  b: regular pentagon  c: parallelogram  
       d: scalene triangle  e: isosceles right triangle  f: trapezoid

1-54.  a: 0.8  b: \(1200(0.8)^3 = 614.40\)  c: \(1200(0.8)^{-2} = 1875\)  
       d: \(y = 1200(0.8)^x\), where \(y\) is the cost and \(x\) is the time in years

1-55.  \(9x^2 - 2x - 1\)  
       a: 6, 3  b: –2

Lesson 1.2.4

1-62.  a: \((-6, -3)\)  b: The vertices are: (6, 2), (2, 3), (5, 6)  c: (8, –4)

1-63.  The graph is flat S-shaped and increasing everywhere (left to right); \(x\)-intercept is (8, 0); \(y\)-intercept is (0, –2); any value can be input, and any value can be the output; there is no maximum or minimum; (0, –2) is a special point, because that is where the “S” turns direction; it is a function; there are no lines of symmetry.

1-64.  a: Graph 3, continuous, decreasing  b: Graph 2, increasing in “steps”  c: Graph 4, increasing, not constant, more rapidly in the middle than beginning or end

1-65.  a: About 73% a year.
       b: \(y \approx 500(0.27)^x\); \(x\) is the number of years after the peak; \(y\) is the value \(x\) years after the peak, 500 is the peak value of the poster, and 0.271 is the multiplier for a yearly decrease of 73%.

1-66.  a: 420 square units  b: 80 square units

1-67.  a: \[
\begin{array}{c}
4 \\
3 \\
\end{array}
\]
       b: \[
\begin{array}{c}
16 \\
-4 \\
-4 \\
\end{array}
\]
       c: \[
\begin{array}{c}
-33 \\
11 \\
-3 \\
\end{array}
\]
       d: \[
\begin{array}{c}
-7 \\
-1 \\
6 \\
\end{array}
\]
Lesson 1.3.1

1-75.  a: linear pair or straight angle pair, supplementary  
       b: vertical angles, congruent  
       c: complementary  
       d: congruent

1-76.  No, this is not convincing. While the facts are each correct, the conclusion is not based on the facts. As stated in Fact #2, a square is a rectangle because it has four right angles. However, a rhombus does not have to have four right angles; therefore, there is not enough evidence that a rhombus is a rectangle.

1-77.  a: Vertical angles, equal measure;  \(3x + 5^\circ = 5x - 57^\circ, x = 31^\circ\);  \(3(31^\circ) + 5^\circ = 98^\circ\) and \(2(31^\circ) - 57^\circ = 98^\circ\)
       b: Straight angle pair, supplementary; \(2x + 4x + 150^\circ = 180^\circ, x = 5^\circ\); \(4(5^\circ) + 150^\circ = 170^\circ\) and \(2(5^\circ) = 10^\circ, 170^\circ + 10^\circ = 180^\circ\)

1-78.  \((4x + 5)(2x + 3) = 8x^2 + 22x + 15\)

1-79.  a: 0.85  
       b: \(f(t) = 27000(0.85)^t\)  
       c: \(\approx 11,980\)

1-80.  a: It should be a triangle with horizontal base of length 4 and vertical base of length 3.  
       b: \(-\frac{4}{3}\)  
       c: Any equation of the form \(y = -\frac{4}{3}x + b\).

Lesson 1.3.2

1-87.  See answers below.

1-88.  a: 238 square units  
       b: 112 square units

1-89.  a: square  
       b: \((-4, 5), (1, 5), (-4, 0), (1, 0)\)

1-90.  If \(x = \text{width}\), then \(2x + 2(2x + 5) = 88\); the width is 13 cm.

1-91.  a: If lines have the same slope, then they are parallel.  
       b: If a line is vertical, then its slope is undefined.  
       c: If lines have slopes \(\frac{2}{3}\) and \(-\frac{2}{3}\), then they are perpendicular.

1-92.  V-shaped graph, opening upward. As \(x\) increases, \(y\) decreases left to right until \(x = -2\), then \(y\) increases. \(x\)-intercepts: \((-3, 0)\) and \((-1, 0)\). \(y\)-intercept: \((0, 1)\). Minimum point at \((-2, -1)\).
Lesson 1.3.3

1-98.  a: alt. int. angles  
        b: vertical angles  
        c: corresponding angles  
        d: supplementary and straight angle pair or linear pair

1-99.  a: \[ \begin{array}{cccc}
        105° & 75° & 105° & 75° \\
        75° & 105° & 75° & 105° \\
        95° & 85° & 95° & 85° \\
        85° & 95° & 85° & 95° \\
        \end{array} \]

        b: \[ \begin{array}{cccc}
        30° & 70° & 80° & 30° \\
        80° & 70° & 80° & 70° \\
        100° & 80° & 70° & 110° \\
        80° & 100° & 110° & 70° \\
        \end{array} \]

1-100. a: If a shape is an equilateral triangle, then it has 120° rotation symmetry.  
        b: If a shape is a rectangle, then the shape is a parallelogram.  
        c: If a shape is a trapezoid, then the area of the shape is half the sum of its bases multiplied by its height.

1-101. \((2x + 4)(x + 2) = 2x^2 + 8x + 8\)

1-102. A

1-103. a: Let \(x\) = the number of votes for candidate B, \(x + (x - 15,000) = 109,000\).  
          62,000 votes  

        b: Let \(x\) = time (years); \(14(1.1)^x; \ 14(1.1)^{-2} \approx \$11.57\)

        c: Let \(x\) = time (years); \(29,000(0.89)^4 \approx \$18,195.25\)

        d: Let \(x\) = time (hours); \(6x + 10 = 10x\), after 2.5 hours, 25 problems each
Lesson 1.3.4

1-110. a: $x = 60^\circ$

b: $x = 24^\circ$

c: Calculate the angle measures using $x$ and check that the three angle measures sum to $180^\circ$. They are $48^\circ$ and $36^\circ$, $48^\circ + 36^\circ + 96^\circ = 180^\circ$.

1-111. a: Impossible: Can be rejected using Triangle Inequality or Pythagorean Theorem.

b: Possible

c: Impossible: The sum of the angles is $179^\circ$.

d: Possible (but diagram is very inaccurate)

e: Impossible: Third angle must be $59^\circ$ by Triangle Angle Sum, but side opposite $62^\circ$ must be larger than side opposite $59^\circ$ by Longest Side, Largest Angle.

1-112.

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1-113. $x = 10^\circ$, corresponding with $y$; $y = 61^\circ$, linear pair and supplementary with $119^\circ$

1-114. a: $(x + 1)(x + 3) = x^2 + 4x + 3$

b: $(2x + 1)(x + 2) = 2x^2 + 5x + 2$

1-115. a: $\sqrt{8} \approx 2.83$ units

b: $(2, -3)$

c: $(-1, 6), (x, y) \rightarrow (x, -y)$

d: $(-8, 5)$
Lesson 2.1.1

2-6.  a: $\triangle ABD \cong \triangle CBD$ by ASA  
       b: $\triangle ABC \cong \triangle DCB$ by SAS  
       c: Cannot be determined because “6” is not on corresponding sides.  
       d: $\triangle ABC \cong \triangle BAD$ by AAS  
       e: Cannot be determined because AAA is not a congruence condition.  
       f: $\triangle QRS \cong \triangle GKH$ by SSS

2-7.  a: heart  
       b: square  
       c: hexagon  
       d: Answers vary.

2-8.  a: Yes. It has four sides. Slope of $AB = \frac{1}{2}$ and slope of $BC = -2$ so each pair of consecutive sides is perpendicular and forms 90° angles.  
       b: $A'(4, 3), B'(6, -1), C'(-2, -5),$ and $D'(-4, -1)$

2-9.  A = 26 sq m, $P = 13 + \sqrt{20} + \sqrt{17} \approx 21.6$ m

2-10. See graph at right. ($-2, -1$)

2-11. In theory, $3 < x < 13$, but some of these lengths are not practical.
Lesson 2.1.2

2-17. a:  

\[\triangle YES \cong \triangle YEM\]

Given 
(Def. of isosceles)
Segment is \(\cong\) to itself 
Def. of midpoint

\[\angle S \cong \angle M\]

\(\cong\) \(\Delta s \rightarrow \cong\) parts

b: Yes; If a triangle is isosceles, then its base angles are congruent.

2-18. a: \(A = 31\) sq ft  
b: \(A = 41.5\) sq ft

2-19. This reasoning is correct.

2-20. a: \(x = 3\)  
b: no solution  
c: \(x = 6\)  
d: \(x = 0.5\)

2-21. a:  

\[
\begin{array}{c}
3 \\
15
\end{array}
\begin{array}{c}
5 \\
3
\end{array}
\begin{array}{c}
8 \\
4
\end{array}
\]

b:  

\[
\begin{array}{c}
3 \\
1
\end{array}
\begin{array}{c}
1 \\
2
\end{array}
\begin{array}{c}
2 \\
7
\end{array}
\]

c:  

\[
\begin{array}{c}
5 \\
10
\end{array}
\begin{array}{c}
2 \\
4
\end{array}
\begin{array}{c}
7 \\
9
\end{array}
\]

d:  

\[
\begin{array}{c}
1 \\
6
\end{array}
\begin{array}{c}
2 \\
5
\end{array}
\begin{array}{c}
3 \\
6
\end{array}
\]

2-22. a: \(x = 17.5^\circ\) (corresponding angles) \(5x + 7^\circ = 94.5^\circ, 9x - 63^\circ = 94.5^\circ\)

b: \(x = 5^\circ\) (multiple relationships possible) \(12x - 14^\circ = 46^\circ, 5x + 21^\circ = 46^\circ, 20x + 34^\circ = 134^\circ\)
Lesson 2.1.3

2-27.  a: Converse: If the ground is wet, then it is raining. Not true.

     b: Converse: If a polygon is a rectangle, then it is a square. Not true.

     c: Converse: If a polygon has four 90° angles, then it is a rectangle. Not true, it could have more than four angles.

     d: Converse: If a polygon is a triangle, then it has three angles. True.

     e: Converse: If vertical angles are congruent, then two lines intersect. True.

2-28.  a: 110°  b: 70°  c: 48°  d: 108°

2-29.  b: The measure of an exterior angle of a triangle equals the sum of the measures of its remote interior angles.

c: 

\[
\begin{align*}
&\text{Triangle Angle Sum Theorem} \\
&\quad \frac{a + b + c}{180°} \\
\Rightarrow &\quad \frac{a + b + c}{x + c} \\
\Rightarrow &\quad \frac{a + b}{x} \\
\Rightarrow &\quad \text{Linear pair} \rightarrow \text{supplementary} \\
\Rightarrow &\quad \text{Substitution} \\
\Rightarrow &\quad \text{Subtraction Property}
\end{align*}
\]

2-30.  a: (−2, 3)  b: (−2, 3); yes

2-31.  a: congruent (HL \equiv or SAS \equiv)  b: congruent (AAS \equiv)

     c: not necessarily congruent  d: congruent (SAS \equiv)

2-32.  a: 

\[
\begin{bmatrix}
28 \\
-4 \\
-7 \\
-11
\end{bmatrix}
\]

b: 

\[
\begin{bmatrix}
-12 \\
6 \\
-2 \\
4
\end{bmatrix}
\]

c: 

\[
\begin{bmatrix}
-8 \\
\frac{1}{2} \\
-16 \\
-15.5
\end{bmatrix}
\]

d: 

\[
\begin{bmatrix}
\frac{1}{10} \\
\frac{1}{2} \\
\frac{7}{5} \\
10
\end{bmatrix}
\]
Lesson 2.1.4

2-40. Describe a pair of parallel lines.

2-41. a: \(x = \frac{42}{5} = 8.4\)  
    b: \(m = 22\)  
    c: \(t = 12.5\)  
    d: \(x = \frac{3}{2} = 1.5\)

2-42. a: Yes because of AAS \(\cong\) or ASA \(\cong\). \(\triangle DEF \cong \triangle LJK\)
    
    b: One possible answer, a reflection across line segment \(EF\) and then a translation of \(\triangle DEF\) so that points \(J\) and \(E'\) coincide, followed by a rotation about point \(E'\).

2-43. Perimeter = 10 + 10 + 4 + 3 + 4 + 3 + 4 = 38 units, height of triangle = 8 units, area = 60 square units

2-44. The longer side of a triangle is opposite the larger angle: \(m\angle ADB > m\angle DAB\), so \(AB > DB\). And \(m\angle DCB > m\angle BDC\), so \(DB > BC\). \(AB > 10\) and \(BC < 10\), so \(AB > BC\).

2-45. a: There are 10 combinations: a & b, a & c, a & d, a & e, b & c, b & d, b & e, c & d, c & e, d & e
    
    b: Yes. If the outcomes are equally likely, we can use the theoretical probability computation described in the Math Notes box.
    
    c: \(\frac{3}{10}\)
    
    d: \(\frac{9}{10}\)
    
    e: The outcomes that satisfy part (d) include the outcomes that satisfy part (c), but there are others on the part (d) list as well.
Lesson 2.2.1

2-51.  
   a: \(AB = 5, \ BC = 4, \ AC = 3\)  
   b: \(A'B' = \sqrt{100} = 10\) units, \(B'C' = 8\) units, and \(A'C' = 6\) units  
   c: \(A = 24\) sq. units; \(P = 24\) units

2-52.  
   a: If a rectangle has base \(x\) and height \(2x\), then the area is \(2x^2\). True.
   b: If a rectangle has base \(x\) and height \(3y\), then the perimeter is \(3xy\). False. If a rectangle has base \(x\) and height \(3y\), then the perimeter is \(2x + 6y\).
   c: If a rectangle has base of 2 feet and a height of 3 feet, then the area is 864 square inches. True.

2-53. \(h = 5\) feet; \(P \approx 24.2\) feet

2-54.  
   \[ \begin{align*}
   AC &= DF \\
   m\angle A &= m\angle D \\
   AB &= DE
   \end{align*} \]
   Given  
   Given  
   Given

   \(\triangle ABC \cong \triangle DEF\)  
   SAS \cong

2-55.  
   a: \(x^2 + 8x + 15 = (x + 3)(x + 5)\)
   b: \(2x^2 + 13x + 15 = (2x + 3)(x + 5)\)

2-56.  
   a: \(x = 45^\circ\); isosceles right triangle
   b: \(71^\circ + y = 180^\circ, \ y = 109^\circ\); acute isosceles triangle
Lesson 2.2.2

2-61. Result should be 12 units tall and 16 units wide.

2-62. a: The 15 corresponds to the 6, while the 20 corresponds to the 8. Multiple equivalent ratios are possible. One possibility: \( \frac{15}{6} = \frac{20}{8} = 2.5 \)

b: 25 and 10; \( \frac{25}{10} = 2.5 \); yes

c: Possible response: Translate the figure on the right so that the right angle vertices coincide. Rotate the image about the right angle vertex so the legs coincide. Then dilate the image by 2.5 through the vertex.

2-63. a: Graph 2               b: Graph 3               c: Graph 1

2-64. a: triangle inequality   b: Pythagorean Theorem   c: base angles not equal

2-65. a: \begin{align*}
    7 & \quad -14 \\
-7 & \quad \end{align*} 

b: \begin{align*}
    \frac{9}{4} & \quad \frac{3}{2} \\
\frac{3}{2} & \quad \end{align*} 

c: \begin{align*}
    \frac{5}{4} & \quad \frac{5}{2} \\
\frac{5}{2} & \quad \end{align*} 

d: \begin{align*}
    -100 & \quad 10 \\
-10 & \quad 0 \\
\end{align*} 

2-66. a: yes               b: \( \frac{2}{5} \)               c: \( \frac{3}{5} \)               d: \( \frac{1}{5} \)               e: \( \frac{4}{5} \)
Lesson 2.3.1 Day 1

2-78.  a: Yes, AA ~. Dilate from right vertex.
       b: Yes, AA ~ since all angles are 60°. A dilation, or a dilation and translation.
       c: Not similar because the scale factor is not the same for all pairs of corresponding sides.
       d: No, since corresponding angles are not congruent. Note that you cannot apply scale factor to angles.

2-79.  a: \(2xy + 8y = 2y(x + 4)\)
       b: \((x + 8)(x + 5) = x^2 + 13x + 40\)
       c: \((x - 4)(2z - 3y + 5) = 2xz - 3xy + 5x - 8z + 12y - 20\)
       d: Multiple answers possible.

2-80.  a: Converse: If a triangle is isosceles, then its base angles are congruent. Converse is true.
       b: Converse: If the sum of the angles in a polygon is 180°, then the figure is a triangle. Converse is true.
       c: Converse: If my mom is happy, then I cleaned my room. Converse is false.

2-81.  Height = 12 feet; Using the Pythagorean Theorem, area = \(\frac{1}{2}(12)(12 + 23) = 210\) sq ft

2-82.  a: \(ABCD \sim EVOL\)  b: \(RIGHT \sim ESLAF\)  c: \(\Delta TAC \sim \Delta GDO\)

2-83.  a: The coordinates of the vertices of the image are \(A'(-6, -4), B'(10, -4), C'(10, 6), D'(2, 12), \) and \(E'(-6, 6)\).
       b: Each corresponding x-coordinate and y-coordinate are doubled in the image.
       c: perimeters = 28 and 56 units; areas = 52 and 208 sq. units
Lesson 2.3.1 Day 2

2-84.  a: Not similar, interior angles are different.
     b: Similar by AA ~.
     c: Similar by SSS ~.

2-85.  Sample responses: \( \frac{BC}{EF} = \frac{AB}{DE} \), \( \frac{AC}{DF} = \frac{AB}{DE} \), and \( \frac{AC}{AB} = \frac{DF}{DE} \)

2-86.  a: Reflection, rotation, and translation (Translation does not necessarily have to be included, since it can be avoided with a specially- chosen point of rotation).
     b: Not enough information to determine similarity.
     c: Rotation, translation to match centers, and dilation by factor of 2
     d: Rotation, reflection, and dilation by a scale factor of 0.5 (Another method is to use a translation, or multiple reflections, instead of rotation and reflection).

2-87.  The lines are parallel, so they do not intersect. Therefore, there is no solution.

2-88.  a: less than 45°  b: equal to 45°  c: more than 45°

2-89.  \(-x^2 + 3\)
Lesson 2.3.2

2-94.  a: SSS ~ and SAS ~ (if it is shown that the triangles are right triangles)
       b: AA ~ and SAS ~
       c: None since there is not enough information.

2-95.  y = 48° because of vertical angles;  z = 48° because ∠z is the reflection of ∠y, or because
       the light hits the mirror and bounces off the mirror at the same angle, so x = z = 48°.

2-96.  See flowchart at right.

2-97.  f(x) = 32(1/2)x

2-98.  5" < x < 21"

2-99.  a: 2/5
       b: Yes. If the first song is a country song, then there is only one country song left to play out
       of four songs. Therefore, the chance that the second song is a country song is 1/4.
       c: 1/2, because only two songs are left and only one is sung by Sapphire.
       d: 1/3; same
Lesson 2.3.3

2-103. a: \[ m\angle A = m\angle D \quad m\angle B = m\angle E \]
\[ \Delta ABC \sim \Delta DEF \]
AA ~

b: Yes, because the triangles are similar (AA ~) and the ratio of the corresponding side lengths is 1 (because \( AC = DF \)).

2-104. a: Converse: If the cat runs away frightened, then it knocked over the lamp. Converse is false.

b: Converse: If the probability of getting a 3 is \( \frac{1}{6} \), then a six-sided die was rolled. Converse is false (there could be a spinner or a random number generator).

c: Converse: If a triangle is a right triangle, then it has a 90º angle. Converse is true.

2-105. William is correct because the longest side is opposite the largest angle, which is the hypotenuse opposite the 90º angle in a right triangle.

2-106. a: \[ 2x^2 + 7x + 3 \]

b: \[ 2x^2 + 10x \]

c: \[ 2x^2 + xy \]

d: \[ 2x^2 + 2xy + 9x + 5y + 10 \]

2-107. a: \( A = 144 \text{ cm}^2, P = 52 \text{ cm} \)

b: \( A = 696.7 \text{ m}^2, P = 114.67 \text{ m} \)

c: \( A = 72 \text{ sq cm}, P = 48 \text{ cm} \)

d: \( A = 130 \text{ sq feet}, P = 58 \text{ feet} \)

2-108. a: \( n = 32 \)

b: \( m \approx 14.91 \)
Lesson 2.3.4

2-114. **a:** Similar (SSS ~)

**b:** Congruent (ASA ≅ or AAS ≡)

**c:** Congruent, because if the Pythagorean Theorem is used to solve for each unknown side, then three pairs of corresponding sides are congruent; thus, the triangles are congruent by SSS ≡).

**d:** Similar (AA ~) but not congruent. The two sides of length 12 are not corresponding and have different units of length (inches and feet).

2-115. Possible response: Translate one triangle so the vertices of the 20° angles coincide, then rotate about that vertex until the angle sides coincide.

2-116. **a:** Yes, since all trees are green and the oak is a tree.

**b:** No, only trees must be green according to the statement.

**c:** No, the second statement reverses the first.

2-117. **a:** \( x = 20 \text{ mm} \)  
**b:** \( w = 91 \text{ mm} \)

2-118. (a) and (d) are most likely independent.

2-119. **a:** \( 4x^2 + 4x + 1 \)  
**b:** \( 8x^2 \)  
**c:** \( 6x + 10 \)  
**d:** \( 2xy + y^2 + 3y \)
Lesson 3.1.1

3-6.  a: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12
   b: yes
   c: \( P(\text{even}) = \frac{18}{36}; \quad P(10) = \frac{3}{36}; \quad P(15) = 0 \)
   d: The sum of 7.  \( P(7) = \frac{6}{36} = \frac{1}{6} \)

3-7.  a: \( x = 26^\circ \); If lines are parallel and cut by a transversal, then alternate interior angles are equal.
   b: \( x = 33^\circ, n = 59^\circ \); If lines are parallel and cut by a transversal, then corresponding angles (b and m) are congruent.  \( m + n = 180^\circ \) so \( b + n = 180^\circ \) by substitution.

3-8.  a:  
    \[
    \begin{array}{c|c}
    81 & 9 \\
    0 & -9 \\
    \end{array}
    \]
   b:  
    \[
    \begin{array}{c|c}
    -36 & -6 \\
    0 & 6 \\
    \end{array}
    \]
   c:  
    \[
    \begin{array}{c|c}
    -20 & -5 \\
    -1 & 4 \\
    \end{array}
    \]
   d:  
    \[
    \begin{array}{c|c}
    -\frac{6}{25} & \frac{4}{5} \\
    \frac{3}{16} & \frac{1}{2} \\
    \end{array}
    \]

3-9.  a: \( x = 12 \) units  
   b: \( x = 13 \) units  
   c: \( x = 7 \) units

3-10.  Translate so that two corresponding vertices coincide, rotate by about 180° around that vertex so that the angle sides coincide, and then dilate it through that vertex by 0.75.

3-11.  a: \( A'(-2, -7), B'(-5, -8), C'(-3, -1) \)
   b: \( A''(2, 7), B''(5, 8), C''(3, 1) \)
   c: Reflection across the y-axis.
Lesson 3.1.2

3-17. a: \(\frac{10}{20} = \frac{1}{2}\)  
     b: \(\frac{9}{19}\)  
     c: No, they are not independent. The probability that the second contestant is a girl depends on whether the first contestant was a girl or not.

3-18. \(\frac{1}{335} \approx 0.0019\); No, this probability is very small.

3-19. a: Answer vary. A systematic list would work. A tree diagram works; a third dimension would be needed to represent the three coins with an area model.
     b: See tree diagram at right.  8
     c: i. \(\frac{1}{8}\)  
     ii. \(\frac{3}{8}\)  
     iii. \(\frac{7}{8}\)  
     iv. \(\frac{3}{8}\)  
     d: They are both the same probability of 50%.

3-20. a: Impossible because a leg is longer than the hypotenuse.
     b: Impossible because the sum of the angles is more than 180°.

3-21. a: \(3x^2 + 17x + 10\)  
     b: \(3y^2 + 2xy - 12x - 22y + 24\)

3-22: a: Similar because of AA ~.
     b: Neither because angles are not equal.
     c: Congruent because of ASA \(\cong\) or AAS \(\cong\). Sample flowchart below.

\[ m\angle B + m\angle A + m\angle C = 180^\circ \]
\[ m\angle B = 75^\circ \]

\[ m\angle B = m\angle P \]
\[ AB = PQ \]
\[ m\angle A = m\angle Q \]
\[ \triangle BAC \cong \triangle PQR \]

ASA \(\cong\)
Lesson 3.1.3

3-29. Both equal \(\frac{3}{8}\).

3-30. a: \(\frac{6}{36}\) \hspace{1cm} b: \(\frac{4}{36}\) \hspace{1cm} c: \(\frac{24}{36}\)

3-31. a: \(y = \frac{1}{2}x + 2\)
   
   b: \(x\)-intercept \((-4, 0)\) and \(y\)-intercept \((0, 2)\)
   
   c: \(A = 4\) sq. units; \(P = 6 + \sqrt{20} \approx 10.47\) units
   
   d: \(y = -2x + 7\)

3-32. a: See tree diagram at right.
   
   b: yes
   
   c: \(\frac{1}{6}, \frac{3}{6}\)
   
   d: \(\frac{1}{2}\); No—the spinners are independent.
   
   e: \(\frac{2}{6},\) because now the possible outcomes are \$100, \$200, \$1500, \$200, \$400, and \$3000.

3-33. They are congruent. Possible response: Reflect \(\triangle ADS\) across a vertical line, and then translate it.

3-34. a: \(3(4x - 12) = 180^\circ, x = 18^\circ\)
   
   b: \(4.9^2 - 3.1^2 = x^2, x \approx 3.8\)
   
   c: \(x + (180^\circ - 51^\circ - 103^\circ) + 82^\circ = 180^\circ, x = 72^\circ\)
   
   d: \(3x - 2 = 2x + 9, x = 11\)
Lesson 3.1.4

3-41.  a: \( P(K) = \frac{4}{52}, \ P(Q) = \frac{4}{52}, \ P(C) = \frac{13}{52} \)

b: \( \frac{16}{52} \); You can add the probabilities of king and club, but you need to subtract the number of cards that are both kings and clubs (1). \( P (K \ or \ C) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} \)

c: \( P(K \ or \ Q) = \frac{8}{52} = \frac{2}{13} \). There is no overlap in the events so you can just add the probabilities.

d: \( P(\text{not a face card}) = 1 - \frac{12}{52} = \frac{40}{52} \)

3-42.  a: \( \frac{1}{12} \)  \hspace{1cm}  b: \( \frac{1}{3} \)

3-43.  No. The Triangle Inequality prevents this because 7 + 10 < 20 and 20 − 10 > 7.

3-44.  a: \( 2x^3 + 17x + 30 \)  \hspace{1cm}  b: \( 3m^2 - 4m - 15 \)  \hspace{1cm}  c: \( 12x^3 + x^2 - 60x - 5 \)  \hspace{1cm}  d: \( 6 - 7y - 5y^2 \)

\begin{array}{cc|ccc|ccc|ccc|ccc}
& & +5 & & +5 & & +1 & & -5 & & -5y & & -10y & & -5y^2 \\
2x & 2x^2 & 12x & & 5x & 30 & & 5m & -15 & & 12x & & -60x & & 3 \\
+6 & x & & 3m & 3m^2 & -9m & & m & -3 & & x^2 & & -5 & & 2 \\
\end{array}

3-45.  a: \( x^2 + 18^2 = 30^2, \ x = 24 \)

b: \( 2x + 20^o + 3x + 20^o + x + 2x = 360^o, \ x = 40^o \)

c: \( \frac{5}{12} = \frac{3}{x}, \ x = \frac{36}{5} = 7.2 \)

3-46.  a: Graph 3  \hspace{1cm}  b: Graph 1  \hspace{1cm}  c: Graph 4
Lesson 3.1.5 Day 1

3-55.  a: \(\frac{1}{12}\)  
        b: Intersection  
        c: No, \(P(yellow) = \frac{1}{6}\)  
        d: \(\frac{2}{3}\)  
        e: You cannot move, and \(\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{2}{3}\), or you can move \(\frac{1}{3}\) of the time, and \(1 - \frac{1}{3} = \frac{2}{3}\).

3-56.  a: \(12x^2 - 7x - 10\)  
        b: \(16x^2 - 8x + 1\)  
        c: \(x = -\frac{5}{9}\)  
        d: \(x = 3\)

3-57.  a: \(5 + 2\sqrt{5} + \sqrt{37} \approx 15.55\) units  
        b: \(\approx 31.11\)  
        c: \((-2, 0)\)

3-58.  a: Yes, \(\Delta ABD \sim \Delta EBC\) by AA ~. See sample flowchart below.

b: Yes. Since \(DB = 9\) units (by the Pythagorean Thm.), the corresponding side ratio is 1.

3-59.  a: The sample space remains the same.

b: i. \(\frac{64}{125}\)  
    ii. \(\frac{12}{125}\)  
    iii. \(\frac{61}{125}\)  
    iv. \(\frac{12}{125}\)

3-60.  a: REFLECT  
        b: PRISM
Lesson 3.1.5  Day 2

3-61.  a: \( EV = 5 \cdot \frac{1}{4} + 0 \cdot \frac{135}{360} + 20 \cdot \frac{135}{360} = 8.75 \)  b: No, it is not a fair game.

3-62.  a:  
```
   1   3
   4   4
2  1/2
```
  b:  
```
   6   3
  2   5
```
  c:  
```
   5   -1
  -5   -6
```
  d:  
```
  -12   6
   4   -2
```

3-63.  a: \( x + x + 82^\circ = 180^\circ, x = 49^\circ \)  b: \( 2(71^\circ) + x = 180^\circ, x = 38^\circ \)

3-64.  \( f(x) = 7.68(2.5)^x \)

3-65.  a: No, because \( 3(2) = 6 \) and \( 5(2) = 10 \), but \( 4(2) \neq 7 \). The corresponding side lengths are not all multiplied by the same scale factor.
  b: \( x = 33 \) and \( y = 10 \)
  c: Translate any vertex to its corresponding vertex, rotate so that the angle sides of that vertex coincide, then dilate the image pentagon through the vertex with a scale factor of \( \frac{1}{3} \) to reduce it.

3-66.  a: 5 ways  b: 6 ways  c: 11  d: \( \frac{5}{11} \)
### Lesson 3.2.1

3-72.  a: \(x = 11^\circ\)  b: \(x = 45^\circ\)  c: \(x = 30^\circ; 30^\circ \) and \(60^\circ\)  d: \(x = 68^\circ\)

3-73.  a: \(\frac{22}{32}\) \; union  b: \(\frac{3}{52}\) \; intersection  c: \(1 - \frac{22}{32} = \frac{30}{32}\)

3-74.  a: \(f = 9\)  b: \(g = 18\)  c: \(h = \frac{70}{3}\)

3-75.  a: \(6x^2 - x - 2\)  b: \(6x^3 - x^2 - 12x - 5\)

3-76.  a: We do not know if the angle measures are equal, because we do not know if \(BD \parallel EG\).

3-77.  a: Vertical; they have equal measure.

3-81.  a: \((4, 18)\)  b: \((-13, 6)\)

3-82.  a: The triangles are similar by SSS \(\sim\).

### Lesson 3.2.2

3-83.  a: \(\theta = 11^\circ, \frac{x}{95} \approx \frac{1}{5}; x \approx 19\)

3-84.  \(3\left(\frac{135}{360}\right) + 5\left(\frac{135}{360}\right) + (-6)\left(\frac{90}{360}\right) = \$1.50\). It is not fair because the expected value is not zero.

3-85.  a:  b:  c:  d:

3-86.  B

3-87.  a: \((4, 18)\)  b: \((-13, 6)\)

3-88.  a: The triangles are similar by SSS \(\sim\).

b: The triangles are similar by AA \(\sim\).

c: Not enough information is provided.

d: The triangles are congruent by AAS \(\cong\) or ASA \(\cong\).
### Lesson 3.2.3

3-93. They both could be. It depends on which angle is used as the slope angle.

3-94. **a:** Yes, since the slope ratio is greater than 1, the angle must be greater than 45°.
   
   **b:** Isiah is correct. Since the angle is less than 45°, the slope ratio must be less than 1.
   
   **c:** Since the angle is greater than 45°, \( x \) must be less than 9.

3-95. **a:** \( \triangle ABC \sim \triangle DEF \) (AA ~)
   
   **b:** \( \triangle MON \cong \triangle PQR \) (AAS \( \cong \) or ASA \( \cong \)). Sample flowchart below.

   ![Flowchart](image)

   **c:** Cannot be determined

3-96. **a:** \( 6x^2 - 8x \)  
   **b:** \( 2x^3 + x - 15 \)  
   **c:** \( 4x^2 - 25 \)  
   **d:** \( 2x^3 - 5x^2 - 3x \)

3-97. **a:** \( (5, -2) \)  
   **b:** \( (-4, 2) \)  
   **c:** \( (3, 3) \); It is the center of the figure, or the midpoint of each diagonal.

3-98. \( P(\text{original}) = 18 \text{ units} \) and \( P(\text{new}) = 36 \text{ units} \); \( A(\text{original}) = 18 \text{ sq. units} \) and \( A(\text{new}) = 72 \text{ sq. units} \). The enlarged perimeter is 2 times greater. The enlarged area is not 2 times greater. Notice that the enlarged area is 4 times greater.
### Lesson 3.2.4

#### 3-105. a: $t \approx 11.524$  
   b: $p \approx 3.215$  
   c: $b \approx 148.505$

#### 3-106. $y = (\tan 25^\circ)x + 4$ or $y \approx 0.446x + 4$

#### 3-107. a: 
   ![Diagram]
   
   b: 
   ![Diagram]
   
   c: 
   ![Diagram]
   
   d: 
   ![Diagram]

#### 3-108. \(\frac{19}{4}\)

#### 3-109. a: A straight angle pair is supplementary; \(x = 26^\circ\)
   b: Vertical angles are congruent and corresponding angles are congruent; \(x = 5^\circ\)
   c: Triangle Angle Sum Theorem; \(x = 15^\circ\)
   d: Exterior angle equals sum of remote interior angles; \(x = 35^\circ\)

#### 3-110. a: Scale factor: 0.5; The sides are only half as long, so the side corresponding to the 16 will be 8, and the side corresponding to the 11 will be 5.5.
   b: It is 1:1 because it is congruent.
   c: She is not correct. Counterexamples may vary, but changing the angle measures will produce a figure that is neither similar nor congruent to the given figure.
Lesson 3.2.5

3-113. \( b: \approx 29.44 \text{ feet} \)

3-114. Since \( \tan(33.7^\circ) \approx \frac{2}{3} \), \( y \approx \frac{2}{3}x + 7 \).

3-115. See sample flowchart below. \( \triangle BCA \sim \triangle EDF \) by SAS ~

3-116. a: \( y = -4 \)
   b: \( y = 25 \)
   c: \( y = -2 \)

3-117. a: \( \frac{28}{7} = \frac{2}{\frac{7}{3}} \); There are 70 animals in the bin.
   b: \( \frac{13+17}{22+8+13+15+17} = \frac{30}{75} = 40\% \)
   c: \( \frac{3}{7} = 5\% \); You need a total of 60 animals in the bin.

3-118. It must be longer than 5 and shorter than 23 units.
Lesson 4.1.1

4-6.  a: \(8x^2 - 10x - 3\)  \(\quad\) b: \(16x^2 - 64x + 64\)

4-7.  \((2x - 1)(x + 3y - 5) = 2x^2 + 6xy - 11x - 3y + 5\)

4-8.  a: \(4(x + 2)\)  \(\quad\) b: \(5(2x + 5y + 1)\)
      c: \(2x(x - 4)\)  \(\quad\) d: \(3x(3xy + 4 + y)\)

4-9.  leg \(\approx 29.4\) cm, hypotenuse \(\approx 30.8\) cm, so the perimeter \(\approx 69.2\) cm

4-10.  a: yes  \(\quad\) b: no  \(\quad\) c: yes  \(\quad\) d: yes

4-11.  a: \(\frac{3}{4}\) or 75\%  \(\quad\) b: \(\frac{3}{20}\) or 15\%  \(\quad\) c: 1 or 100\%
      d: (b) is an intersection, and (c) is a union.

Lesson 4.1.2

4-18.  a: \((x - 6)(x + 2)\)  \(\quad\) b: \((2x + 1)^2\)
       c: \((x - 5)(2x + 1)\)  \(\quad\) d: \((x + 4)(3x - 2)\)

4-19.  Her father’s eyes were \(\approx 69\) inches high.

4-20.

\[
\begin{array}{c|cccccccc}
  x & -4 & -3 & -2 & -1 & 0 & \frac{1}{2} & 1 & 2 & 3 & 4 \\
  y & 16 & 9 & 4 & 1 & \frac{1}{4} & 0 & \frac{1}{4} & 1 & 4 & 9 & 16 \\
\end{array}
\]

a: See graph at right.  \(\quad\) b: \(0, 0\)

4-21.  a: \(\frac{63}{12}\) or \(\approx 4.42\)  \(\quad\) b: 12

4-22.  a: Yes, by AA \(\sim\).
      b: \(\frac{x}{20} = \frac{x+2}{24}, x = 10\)

4-23.  Answers vary. The left circle could be “equilateral”, and the right could be “quadrilateral”. Assuming this, you could add an equilateral hexagon to the left, a rhombus to the intersection, and a rectangle to the right circle.
Lesson 4.1.3

4-28.  a: \((k - 2)(k - 10)\)  
        b: \((2x + 7)(3x - 2)\)  
        c: \((x - 4)^2\)  
        d: \((3m + 1)(3m - 1)\)  
        e: All are quadratic expressions because they all can be written in the form \(ax^2 + bx + c\). In part (d), \(b = 0\).

4-29. See diagram at right. Total height \(= 330.4\) m

4-30. \(\frac{4}{10} = \frac{5}{x+5};\ x = 7.5\)

4-31. a: \(\frac{24}{40} = 60\%\)  
        b: \(\frac{18}{x} = \frac{3}{10};\ x = 60\)

4-32. a: \[
\begin{array}{ccc}
\frac{1}{2} & \frac{1}{2} & 1 \\
\frac{1}{2} & & \\
\end{array}
\]
        b: \[
\begin{array}{ccc}
\frac{1}{4} & \frac{3}{4} & \frac{12}{12} \\
\frac{1}{3} & \frac{1}{3} & \\
\end{array}
\]
        c: \[
\begin{array}{ccc}
x & x^2 \\
2x & \\
\end{array}
\]
        d: \[
\begin{array}{ccc}
ab & \\
a & b \\
\end{array}
\]

4-33. \(-7x^2 + 6\)  
        a: 2  
        b: 0

Lesson 4.1.4

4-39. a: \((2x + 5)(x - 1)\)  
        b: \((x - 3)(x + 2)\)  
        c: \((3x + 1)(x + 4)\)  
        d: It is not factorable because no integers have a product of 14 and a sum of 5.
        e: \(7(x - 3)(x + 2)\)  
        f: \(2(3x + 1)(x + 4)\)

4-40. Yes, for even numbers. On a number line, if you start at any multiple of two and add a multiple of two (an even number), you will always be stepping up the number line in multiples of two; you will always land on an even number. No for odd numbers. For example, \(3 + 5 = 8\); the sum of two odd numbers is not always odd. (In fact, the sum of two odd numbers is always even.)

4-41. a: 25 inches  
        b: 56 in\(^2\) and 350 in\(^2\)

4-42. a: \(x = 8.125\)  
        b: Not enough information.  
        c: \(x = 10\ \frac{2}{3}\)

4-43. a: 12  
        b: yes  
        c: \(\frac{6}{12} = \frac{1}{2};\ \frac{8}{12} = \frac{2}{3}\)

4-44.

\[
\begin{array}{cccccc}
x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\
y & 11 & 6 & 3 & 2 & 3 & 6 & 11 \\
\end{array}
\]

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Lesson 4.1.5

4-50.  a: \((x + 8)(x - 8)\)  b: \((x - 3)^2\)  c: \((2x + 1)^2\)  d: \((2x + 7)(2x - 7)\)

4-51.  They are not. A prime number added to a prime number is almost never prime number 
\((2 + 3 = 5\) is the only case). For example, \(11 + 17 = 28\).

4-52.  area \(\approx 294.6\) sq m, perimeter \(\approx 78.2\) m

4-53.  a:  b:
\[\text{c: The parabola in part (a) opens upward, while the parabola in part (b) opens downward.}\]
\[\text{d: } x \approx \pm 2.2\]
\[\text{e: } x \approx \pm 3.2\]

4-54.  a: \(1\)  b: \(\frac{20}{36}\)

4-55.  a: scalene triangle  b: non-equilateral isosceles triangle  
c: not possible  d: equilateral triangle
Lesson 4.2.1

4-62. \( x \approx 7.50 \) and \( y \approx 8.04 \) units; Use either sine or cosine to get the first leg, then any one of the trig ratios or the Pythagorean Theorem to get the other.

4-63. a: \( \sin \theta = \frac{b}{a} \)
   b: \( \tan \theta = \frac{a}{b} \)
   c: \( \cos \theta = \frac{a}{b} \)

4-64. a: \( (2x + 3)(3x - 2) \)
   b: \( 2(2x - 5)(2x + 5) \)
   c: \( 2x(x + 8)(x - 7) \)
   d: \( (3x - 4)^2 \)

4-65. a: They must have equal length. Since a side opposite a larger angle must be longer than a side opposite a smaller angle, sides opposite equal angles must be the same length.
   b: \( \approx 10.6 \) mm

4-66. a: See tree diagram at right.
   b: i. \( \frac{9}{12} \)
   ii. \( \frac{8}{12} \)
   iii. \( \frac{1}{12} \)
   iv. \( \frac{8}{12} \)
   c: No, each activity is equally likely regardless of which bus she takes.

4-67. a: See tree diagram below.
   b: \( \frac{2}{8} = \frac{1}{4} \)
**Lesson 4.2.2**

4-72.  a: \(\sin 22^\circ = \frac{14}{17}, x \approx 6.37\)  
       b: \(\tan 49^\circ = \frac{7}{x}, x \approx 6.09\)  
       c: \(\cos 60^\circ = \frac{1}{2}, x = 3\)  
       d: \(\sin 30^\circ = \frac{x}{6}, x = 3\)

4-73.  a: \(29^\circ; y\) is the adjacent side  
       b: \(\cos 29^\circ = \frac{y}{42}, y \approx 36.73\)

4-74.  a: \(m = 33\) m, \(n = 36\) m  
       b: Area (small) = 378 cm\(^2\), perimeter (small) = 80 cm, area (big) = 850.5 m\(^2\), and perimeter (big) = 120 m

4-75.  a: \((y - 6)(x + 3)\)  
       b: \((2x - 3)(y + 1)\)  
       c: \((-2x + 3)(4y - 7)\)  
       d: Answers vary, but each row and column need to have terms with a common factor.

4-76.  The graph is “U-shaped” (a parabola) with x-intercepts at \((-3, 0)\) and \((1, 0)\), and y-intercept at \((0, -3)\). It is a continuous function with line of symmetry \(x = -1\).

<table>
<thead>
<tr>
<th>(x)</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y)</td>
<td>5</td>
<td>0</td>
<td>-3</td>
<td>-4</td>
<td>-3</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

4-77.  a: Lose $1.50  
       b: Lose $12
Lesson 4.2.3

4-83.  a: Replace “slope ratio” with “tangent” or “tan”.
       b: If one angle of a right triangle has sine $\frac{a}{b}$, then the complementary angle has cosine $\frac{a}{b}$.

4-84.  Using $\cos A = \frac{5}{13}$, $\sin A = \frac{12}{13}$, or $\tan A = \frac{12}{5}, A \approx 67.4^\circ$

4-85.  a: difference of squares; $(2x + 7)(2x - 7)$
       b: $(2x + 3)(x + 4)$
       c: not factorable
       d: perfect square trinomial; $(3x + 1)^2$
       e: $(y + 2)(x - 4)$
       f: difference of squares; $(x^2 - 4)(x^2 + 4) = (x + 2)(x - 2)(x^2 + 4)$

4-86.  a: $y = \frac{13}{4}$  b: $y = -2$  c: $4 \frac{2}{3}$"  d: $x = 4$

4-87.  $P(A \text{or } B) = P(A) + P(B) - P(A \text{and } B) = 4\% + \frac{1}{2} \% - \frac{1}{2} \% = 4\%$. If a refrigerator has a dent it also always has a paint blemish.

4-88.  The even integers are a closed set under multiplication. Every even integer has a factor of 2, so a product of even integers will have a factor of 4, or $2 \cdot 2$, and will therefore be even.
Lesson 4.2.4

4-94.  a: See diagram at right.
      b: Ratio for $\tan 11^\circ \approx \frac{1}{5}$, so $\frac{170}{x} \approx \frac{1}{5}$, and $x \approx 850$ feet.
      Alternatively, a calculator could be used and
      $x = \frac{170}{\tan(11^\circ)} \approx 875$ feet.

4-95.  a: $\cos 23^\circ = \frac{18}{x}$ or $0.921 = \frac{18}{x}$
      b: Since $67^\circ$ is complementary to $23^\circ$, then $\sin 67^\circ = \cos 23^\circ$. So $\sin 67^\circ \approx 0.921$.

4-96.  a: $2(x - 2)(x + 1)$
      b: $4(x - 3)^2$

4-97.  a: $(0, -8)$; It is the constant term in the equation.
      b: $(-2, 0)$ and $(4, 0)$; Notice that the product of the $x$-intercepts equals the constant term.
      c: $(1, -9)$

4-98.  a: 12 boys
      b: 22 girls
      c: $\frac{2}{3}$
      d: 7 boys left, 23 students, so $\frac{7}{23}$.

4-99.  a: 

      b: 

      c: 

      d: 

      e: 

      f: 

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Lesson 5.1.1

5-4.  a: $x = 5$  
      b: $x = -6$  
      c: $x = 5$ or $-6$  
      d: $x = -\frac{1}{4}$  
      e: $x = 8$  
      f: $x = -\frac{1}{4}$ or $8$

5-5.  a: See table at right.  
      $y = (x + 1)^2 - 2 = x^2 + 2x - 1$  
      b: Method 1: $5^2 + 2(5) - 1 = 34$ tiles;  
      Method 2: The next term in the pattern is 34 because the terms of the sequence (2, 7, 14, 23) 
      increase by consecutive odd numbers.  
      Method 3: Figure 5 is a 6-by-6 square minus two corner squares, so $(6)^2 - 2 = 34$.

5-6.  a: $x = 10$  
      b: $x = 6$  
      c: $x = 20^\circ$  
      d: $x = 10^\circ$

5-7.  Jackie squared the binomials incorrectly.  
      It should be: $x^2 + 8x + 16 - 2x - 5 = x^2 - 2x + 1$, 
      $6x + 11 = -2x + 1$, $8x = -10$, and $x = -1.25$.

5-8.  a: Yes, AA ~.  
      b: No, side ratios not equal $\frac{12}{64} \neq \frac{18}{98}$.  
      c: Cannot tell, not enough angle values given.

5-9.  $LE = MS$ and $LI = ES = MI$

5-10. a: $x = 4$ or $-4$  
       b: $x = 4$  
       c: $x = 4$ or $-4$  
       d: $x = 1$  
       e: none  
       f: none

5-11. a: See possible area model at right.  
       b: $\frac{1}{4}$  
       c: $\frac{1}{9} + \frac{1}{6} + \frac{1}{6} + \frac{1}{4} = \frac{25}{36} = 69\%$

5-12. $\tan^{-1}\left(\frac{1}{4}\right) \approx 36.87^\circ$

5-13. Possible response: Translate $WXYZ$ to the left so that point $W'$ coincides with point $A$, then 
      rotate clockwise about $W'$ so that the corresponding angle sides coincide.  
      Then dilate it by a factor of 0.4 from point $W'$.  
      $y = 7.5$, $z = 9.6$

5-14. $m\angle ABC = 22^\circ$, $m\angle BAC = 68^\circ$; acute; complementary

5-15. a: $y = \frac{5}{2}x - 8$  
      b: $y = \frac{3}{2}x + 1$
Lesson 5.1.2

5-20. This is a parabola. It is a continuous function. Vertex: (4, –9),
x-intercepts: (1, 0) and (7, 0), y-intercept: (0, 7), opening upward,
line of symmetry x = 4

5-21. a: 3, –7, 6, –2
   b: …it does not change the value of the number.
   c: It tells us that \( a = 0 \).
   d: 0, 0, 0, 0
   e: …the result is always zero.
   f: It tells us that at least one of the numbers must be zero.

5-22. \( \approx 26.9 \) feet

5-23. a: Graph 1  
       b: Graph 2

5-24. a: \( A'(-3, -3), B'(9, -3), C'(-3, -6) \)
       b: \( A''(-3, 3), B''(-3, -9), C''(-6, 3) \)
       c: (9, 3)

5-25. \( \approx 103.8 \) meters
Lesson 5.1.3

5-32. a: Both are expressions equal to 0. One is a product and the other is a sum.
   b: i. \( x = -2 \) or \( x = 1 \); ii: \( x = -\frac{1}{2} \)

5-33. a: \( x = 2 \) or \( x = -8 \)  
   b: \( x = 3 \) or \( x = 1 \)  
   c: \( x = -10 \) or \( x = 2.5 \)  
   d: \( x = 7 \)

5-34. a: 4; Since the vertex lies on the line of symmetry, it must lie halfway between the \( x \)-intercepts.
   b: (4, −2)

5-35. a: \( \frac{3}{8} \)  
   b: \( \frac{1}{8} \)  
   c: \( \frac{3}{8} \)  
   d: \( \frac{1}{8} \); The sum must be equal to 1.

5-36. a: 2.5%
   b: \( f(t) = 500(1.025)^t \) where \( t \) represents time in months.
   c: $579.85
   d: \( (1.025)^{12} \approx 1.3448 \), effective rate is about 34.5% annually.

5-37. \( x = 7^\circ \)
Lesson 5.1.4

5-43.  a: x-intercepts (3, 0), (–5, 0), and (3, 0), y-intercept: (0, 16)  
b: x-intercepts (1, 0) and (2.5, 0), y-intercept: (0, –2.5)  
c: x-intercept (8, 0) and y-intercept (0, –16). For part (b), \(y = -(x - 1)(x - 2.5)\)

5-44.  a: \(x = 3\) or \(-\frac{2}{3}\)  
b: \(x = 2\) or 5  
c: \(x = -3\) or 2  
d: \(x = \frac{1}{2}\) or \(-\frac{1}{2}\)  
e: \(x = -3\) or 3  
f: \(x = 1\)

5-45.  a: \(x = 8\) or \(-8\)  
b: \(x = 7\) or \(-9\)  
c: \(x = 7\) or \(-9\)

5-46.  \(\approx 61^\circ\)

5-47.  \(x = (180^\circ - 28^\circ) \div 2 = 76^\circ\) because of the Triangle Angle Sum Theorem and because the base angles of an isosceles triangle are congruent; \(y = 76^\circ\) because corresponding angles are congruent when lines are parallel; \(z = 180^\circ - 76^\circ = 104^\circ\) because \(x\) and \(z\) form a straight angle

5-48.  Using the Addition Rule, \(0.11 = \frac{18}{200} + \frac{12}{200} - P(\text{long and lost})\), resulting in a probability of 4% that the food took too long and the rider got lost.

Lesson 5.1.5

5-53.  a: \(x = 1\) or 7  
b: \(x = 1\) or 7  
c: none  
d: \(x = 1\) or 7  
e: \(x = 1\) or 7  
f: none

5-54.  a: \(-1\)  
b: \(\approx 7.24\)  
c: \(\approx -4.24\)

5-55.  Possible equations given below.  
a: \(y = (x + 4)(x - 2) = x^2 + 2x - 8\)  
b: \(y = (x - 3)(x - 3) = x^2 - 6x + 9\)  
c: \(y = (x - 0)(x - 7) = x^2 - 7x\)  
d: \(y = -(x + 5)(x - 1) = -x^2 - 4x + 5\)

5-56.  Parabola with vertex (1, –9), x-intercepts (–2, 0) and (4, 0), y-intercept (0, –8), opening upward, line of symmetry \(x = 1\).

5-57.  a: \(\approx 71.56^\circ\)  
b: \(y = x + 3\)  
c: \((1, 4)\)

5-58.  a: \(\triangle SQR;\) HL \(\cong\)  
b: \(\triangle GFE;\) alternate interior angles equal; ASA \(\cong\)  
c: \(\triangle DEF;\) SSS \(\cong\)
Lesson 5.2.1

5-65. The x-intercepts are at \((-4 + \sqrt{7}, 0)\) and \((-4 - \sqrt{7}, 0)\).
   a: \(\approx (-1.35, 0)\) and \(\approx (-6.65, 0)\); See graph at right.
   b: Irrational because 7 is not a perfect square.
   c: The vertex is \((-4, -7)\). It is exact.

5-66. He needs to buy 15 more small square tiles to complete the design.

5-67. 6" < ML < 14"

5-68. a: \(3\sqrt{2}\)  b: 90  c: \(4\sqrt{5}\)

5-69. a: \(\sin \theta = \frac{5}{7}; \quad \theta \approx 42^\circ\)  b: \(\cos \alpha = \frac{5}{7}; \quad \alpha \approx 44^\circ\)  c: \(\tan \beta = \frac{7}{9}; \quad \beta \approx 38^\circ\)

5-70. a: It is a trapezoid. The slope of \(\overline{WZ}\) equals the slope of \(\overline{XY}\).
   b: \(\approx 18.3\) units  c: \((-9, 1)\)  d: 2

Lesson 5.2.2

5-77. a: 25  b: 9  c: 121

5-78. a: 2  b: -3  c: \(\approx -6.1\)

5-79. a: \(\approx (-1.4, 0)\) and \(\approx (0.4, 0)\)  b: The quadratic is not factorable.

5-80. no
   a: The parabola should have its vertex on the x-axis.
   b: Answers vary, but the parabola should not cross the x-axis.

5-81. See sample flowchart at right.

5-82. The expected value per throw is \(\frac{1}{4}(2) + \frac{1}{4}(3) + \frac{1}{2}(5) = \frac{15}{4} = 3.75\), so her expected winnings over 3 games are \(3(3.75) = 11.25\); so she is likely to win enough tickets to get the panda bear.
Lesson 5.2.3

5-89. a: \((x + 2)^2 = 1; x = -3\) or \(-1\)
   b: \((x - 4)^2 = 9; x = 1\) or \(7\)
   c: \((x + 2.5)^2 = 8.25; x \approx 0.37\) or \(-5.37\)

5-90. a: \(x = 4\) or \(-10\)
   b: \(x = -8\) or \(1.5\)

5-91. a: 4
   b: -10
   c: -8
   d: 1.5

5-92. a: \(x = 10\) or \(-16\)
   b: \(x = \frac{1}{3}\) or \(-\frac{11}{2}\)
   c: \(x = -\frac{2}{3}\) or \(6 \frac{1}{3}\)
   d: no solution

5-93. a: \(-\frac{5}{6}\)
   b: \(LD = \sqrt{61} \approx 7.81\) units
   c: Two possible answers: \(M(10, -9)\) or \(M(2, -\frac{7}{5})\)
   d: Calculate \(\Delta x\) and \(\Delta y\) by determining the difference in the corresponding coordinates.

5-94. a: \(P(\text{scalene}) = \frac{1}{4}\)
   b: \(P(\text{isosceles}) = \frac{3}{4}\)
   c: \(P(\text{side of the triangle is 6 cm}) = \frac{2}{4} = \frac{1}{2}\)

Lesson 5.2.4

5-100. a: \(x = 6\) or \(7\)
   b: \(x = \frac{2}{3}\) or \(-4\)
   c: \(x = 0\) or \(5\)
   d: \(x = 3\) or \(-5\)

5-101. a: The Zero Product Property only works when a product equals zero.
   b: Multiply the binomials and add six to both sides.
   The result: \(x^2 - 3x - 4 = 0\).
   c: \(x = 4\) or \(x = -1\); no

5-102. a: \(y = (x + 3)(x - 1) = x^2 + 2x - 3\)
   b: \(y = (x - 2)(x + 2) = x^2 - 4\)
   c: Neither, they both increase indefinitely.

5-103. See the area model at right.
   A tree diagram would have worked as well. \(\frac{3}{45} + \frac{4}{45} = \frac{7}{45} \approx 15.6\%\)

<table>
<thead>
<tr>
<th>Granite 1/5</th>
<th>Red oak 3/9</th>
<th>White oak 4/9</th>
<th>Maple 7/9</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{3}{45})</td>
<td>(\frac{4}{45})</td>
<td>(\frac{7}{45})</td>
<td></td>
</tr>
</tbody>
</table>

5-104. a: \(x = 13\) m, Pythagorean Theorem
   b: \(x = 80^\circ\), Alternate interior angles and the Triangle Angle Sum

5-105. a: \(\sqrt{6^2 - 3^2} = \sqrt{27}\) and \(\sqrt{9^2 - 3^2} = \sqrt{72}\), so the longest side is \(\sqrt{27} + \sqrt{72} = 3\sqrt{3} + 6\sqrt{2}\) cm.
   b: The area is \(\frac{3\sqrt{3} + 6\sqrt{2}}{2} = \frac{9\sqrt{3}}{2} + 9\sqrt{2} \approx 20.5\) sq. cm.
   c: The perimeter is \(3\sqrt{3} + 6\sqrt{2} + 15 \approx 28.7\) cm.
Lesson 5.2.5

5-112. Both result in no solution.

5-113. a: \(x = 12\) or \(-12\)  
b: \(x = 12\)  
c: \(x = 12\) or \(-12\)  
d: \(x = 13\)  
e: no real solution  
f: no real solution

5-114. a: \(x = 18\)  
b: \(w = 20\)  
c: \(n = \frac{48}{7}\)  
d: \(m = 7.7\)

5-115. a: \(y = 3 - \frac{3}{5}x\)  
b: \(x\)-intercept \((5, 0)\) and \(y\)-intercept \((0, 3)\)  
c: \(A = 7.5\) sq. units; \(P = 8 + \sqrt{34} \approx 13.8\) units  
d: \(y = 3 + \frac{5}{3}x\)

5-116. \(\approx 1469\) feet

5-117. a: \(-4\)  
b: 2  
c: \(-2\)  
d: 10

5-118. a: \(x = \pm 0.08\)  
b: \(x = \frac{2}{9}\) or \(-4\)  
c: no real solution  
d: \(x \approx 1.4\) or \(\approx -17.4\)

5-119. Methods vary: \(\theta = 68^\circ\) (could be found using corresponding and supplementary angles), \(\alpha = 85^\circ\) (could be found using corresponding angles) since lines are parallel.

5-120. a: \(x = -3\) or \(-7\)  
b: \(x = 15\)  
c: \(x = 53\)  
d: \(x = 5\) or \(11\)  
e: \(x = -15\) or \(-9\)  
f: \(x = 2\)

5-121. a: 3 feet per second  
b: He travels a net distance of 18 feet in the direction that the conveyor belt is moving.

5-122. a: \((1, 0)\) and \((\frac{4}{3}, 0)\)  
b: \((-5, 0)\) and \((\frac{3}{2}, 0)\)  
c: \((0, 0)\) and \((-6, 0)\)  
d: \((5, 0)\) and \((-\frac{3}{2}, 0)\)

5-123. a: false (a 30°- 60°- 90° triangle is a counterexample)  
b: false (this is only true for rectangles and parallelograms)  
c: true
Lesson 5.2.6

5-131. a: $7i$  
   b: $i\sqrt{2}$  
   c: $-16$  
   d: $5i - 5$

5-132. a: $x = -2$ or $-16$  
   b: $x = -6$

5-133. a: See tree diagram below.

```
   Bread       Protein       Condiment
   white 1/2  salami 2/3       mayo 2/18
   1/3  1/4  turkey 2/3       plain 1/18
   2/3  1/4  ham 2/3         mayo 2/36
   grain 1/2  salami 2/3       plain 2/36
   1/3  1/4  turkey 2/3       mayo 4/18
   2/3  1/4  ham 2/3         plain 4/36
```

b: \{WSM, WSP, WTM, WHM, GSM, GSP, GCM, GHM\}
\[
\frac{2}{18} + \frac{1}{18} + \frac{2}{36} + \frac{2}{36} + \frac{4}{18} + \frac{1}{18} + \frac{4}{36} + \frac{4}{36} = \frac{30}{36} \approx 83.3\%
\]
c: \{WTP, WHP, GTP, GHP\}; \[
\frac{2}{36} + \frac{2}{36} + \frac{1}{36} + \frac{1}{36} = \frac{6}{36} \approx 16.7\%
\]
d: $100\% - 83.3\% = 16.7\%$

e: \{WSM, GSM\}

5-134. a: $\left(\frac{5\sqrt{13}}{2}, 0\right) \approx (0.7, 0)$ and $\approx (4.3, 0)$
   b: $(-1 \pm \sqrt{7}, 0) \approx (-3.6, 0)$ and $\approx (1.6, 0)$

5-135. y-intercept: $(0, 6)$; x-intercept: $(4, 0)$

5-136. a: $x^4y^3$  
   b: $xy$  
   c: $-6x^6$  
   d: $8x^3$
Lesson 6.1.1

6-6.  a: $A = 1 \text{ m}^2$, $P = 2 + 2\sqrt{2} \text{ m}$  
      b: $A = \frac{25\sqrt{3}}{3} \approx 21.7 \text{ ft}^2$, $P = 15 + 5\sqrt{3} \approx 23.66 \text{ ft}$

6-7.  a: false (a rhombus and square are counterexamples)  
      b: true  
      c: false (it does not mention that the lines must be parallel)

6-8.  a: $-20a^3b$  
      b: $9x^8y^2$  
      c: $2z^7$

6-9.  $x = 9$ or $x = 0.5$

6-10. a: $t = \sqrt{\frac{2a}{g}}$  
       b: $r = \sqrt{\frac{a}{x}}$

6-11. a: similar  
       b: similar

6-12. [Diagrams showing similar triangles]

Lesson 6.1.2

6-19. a: 16 inches  
       c: 24 feet  
       d: 10 and $10\sqrt{3}$ meters

6-20. a: $x = 2$  
       b: $x = 1.5$  
       c: $x = -1$

6-21. a: $-15x$  
       b: $64p^6q^3$  
       c: $3m^8$

6-22. a: $11 - 5i$  
       b: $-2 \pm 3i$  
       c: $8 + i\sqrt{3}$

6-23. See graphs at right.

6-24. a: $x = 8.5^\circ$  
       b: $x = 11$  
       c: $x = 14^\circ$
Lesson 6.1.3

6-30. \( \frac{15}{17} \); Use the Pythagorean Theorem or the Pythagorean Identity.

6-31. a: true
   b: false (counterexample is a quadrilateral without parallel sides)
   c: true

6-32. a: \( 15x^3y \)  
   b: \( y \)  
   c: \( x^5 \)  
   d: \( \frac{8}{x^3} \)

6-33. a: \( y = 111^\circ; \ x = 53^\circ \) vertical angles and Triangle Angle Sum Theorem
   b: \( y = 79^\circ; \ x = 47^\circ \) Triangle Angle Sum Theorem linear pair \( \rightarrow \) supplementary alternate interior angles are \( \equiv \)
   c: \( y = 83^\circ; \ x = 53^\circ \) corresponding angles are \( \equiv \) and vertical angles are \( \equiv \)
   d: \( y = 3; \ x = 3\sqrt{2} \) units 45°-45°-90° triangle

6-34. \( x = \frac{5}{3} \) or \( x = -\frac{5}{2} \)

6-35. a: \( \mathbb{R} \)  
   b: \( I \)  
   c: \( I \)  
   d: \( \mathbb{R} \)

Lesson 6.1.4

6-42. Possibilities: 4, \( 2^2 \), \((8^2)^{1/3}\), \((8^{1/3})^2\), \(3\sqrt{2}\), etc.

6-43. a: \( 7, 24, 25; \ x = 48 \)  
   b: \( 5, 12, 13; \ x = 26 \)  
   c: \( 3, 4, 5; \ x = 15 \)

6-44. Area = \( 8 + 8\sqrt{3} \approx 21.86 \) sq. units, perimeter = \( 12 + 4\sqrt{2} + 4\sqrt{3} \approx 24.59 \) units

6-45. a: \( 3 + 2i \)  
   b: \( 1 + 4i \)  
   c: \( 5 + i \)

6-46. a: \( x = \frac{23 \pm \sqrt{9}}{3} \); irrational  
   b: \( x = \frac{5}{6}, \frac{1}{2} \); rational

6-47. a: It is possible.
   b: Not possible. Same-side interior angles should add up to 180° or, the sides are not parallel.
   c: Not possible. One pair of alternate interior angles are equal, but the other is not for the same pair of lines cut by a transversal; or, the vertical angles are not equal.
Lesson 6.2.1

6-53. a: R  b: l  c: I  d: R

6-54. D

6-55. a: $12 + 13i$  b: $21 - 10i$  c: $-80$  d: 2

6-56. $x = 8\sqrt{2} \approx 11.3$ units; Methods include using the Pythagorean Theorem to set up the equation $x^2 + x^2 = 16^2$, using the 45°-45°-90° triangle pattern to divide 16 by $\sqrt{2}$, or using sine or cosine to solve.

6-57. a: $x = 8, -13$  b: $x = \frac{14}{3}, -\frac{10}{3}$  c: $x = \frac{17}{2}, -11$

6-58. a: See diagram at right.

   b: Since corresponding parts of congruent triangles are congruent, $2y + 7 = 21$ and $y = 7$.

Lesson 6.2.2

6-62. a: $(5^{1/2})^6 = 5^3 = 125$  b: $7^5 = 16807$  c: $(81^{3/4})^4 = 81^{3/4} = (81^{1/4})^3 = 3^3 = 27$

6-63. a: $P = 2\sqrt{10} + 34 \approx 40.3$ mm, $A = 72$ sq mm

   b: $P = 30$ feet, $A = 36$ square feet

6-64. 10.1% by using the Addition Rule.

6-65. a: $y = ax(x - 5)$

   b: $y = a(x - 6)(x + 6)$

   c: $y = a(x + 0.25)(x - 0.75)$

6-66. $x = 11^\circ; \ m\angle ABC = 114^\circ$

6-67. A(2, 4), B(6, 2), C(4, 5)
6-73. \(\approx 36.4\) feet from the point on the street closest to the art museum.

6-74. a: \(w = \pm \sqrt{\frac{17}{3}} \approx \pm 1.84\)
    b: \(w = \frac{3\sqrt{39}}{10} \approx 2.17\) and \(-1.57\)
    c: \(w = \pm i\sqrt{3} \approx \pm 1.73i\)

6-75. a: real  
    b: complex  
    c: complex  
    d: real  
    e: real  
    f: complex

6-76. a: \(P = 23.4\) m; \(A = 10.5\) m\(^2\)  
    b: \(P = 70.2\) m; \(A = 94.5\) m\(^2\)  
    c: yes  
    d: The perimeter triples, but the area increases by a factor of 9.

6-77. \(\sin^{-1} \frac{7}{8} = 61^\circ\)

6-78. See tree diagram at right (an area model is not practical). \(P(\text{three yogurts}) = 12.5\%\).  
   \(100\% - 12.5\% = 87.5\%\) chance of not getting three yogurts.
Lesson 6.2.4

6-84. a: $x = \frac{1}{5}$ or $-3$  
   b: $x = \frac{1}{2}$ or $-3$  
   c: $x = -1 \pm 2i$  
   d: $x = -7$ or 2

6-85. a: 16  
   b: 3125  
   c: 2187

6-86. a: $(0, -9)$; It is the constant term in the equation.  
   b: $(3, 0)$ and $(-3, 0)$; Notice that the product of the x-intercepts equals the constant term.

6-87. $AB \approx 11.47$ units, $A \approx 97.47$ sq. units

6-88. The triangles described in (a), (b), and (d) are isosceles.

6-89. E

Lesson 6.2.5

6-91. area $\approx 100.6$ sq. yards; perimeter $\approx 43.4$ yards

6-92. a: $x = \frac{1}{4}$  
   b: $x = \frac{-1+\sqrt{5}}{2}$

6-93. No, there are several problems with her diagram. The sum of the lengths of the two shorter sides of the triangle is less than 15, so the three sides would not form a triangle. Also, $22^\circ > 18^\circ$, but 5 ft < 8 ft, so the larger angle is not opposite the longer side.

6-94. a: It is a parallelogram, because $\overline{MN} \parallel \overline{PQ}$ and $\overline{NP} \parallel \overline{MQ}$.
   b: $(1, -5)$, a reflection across the x-axis.

6-95. a: $f(t) = 135000(1.04)^t$, 135000 is the initial value at time 0 and 1.04 is the multiplier for an increase of 4% each year. (100% + 4% = 104%, or 1.04.)
   b: $\approx \$199,833$

6-96. C
Lesson 6.2.6

6-101. a: $1$  
    b: $\frac{20}{x}$  
    c: $\frac{5}{t^3}$  
    d: $x^2y$

6-102. a: $(i - 3)^2 = i^2 - 6i + 9 = -1 - 6i + 9 = 8 - 6i$
    b: $(2i - 1)(3i + 1) = 6i^2 - 3i + 2i - 1 = -6 - i - 1 = -7 - i$
    c: $(3 - 2i)(2i + 3) = 6i - 4i^2 - 6i + 9 = 4 + 9 = 13$

6-103. a: $\angle A = 35^\circ$, $\angle B = 35^\circ$, $\angle ACB = 110^\circ$, $\angle D = 35^\circ$, $\angle E = 35^\circ$, $\angle DCE = 110^\circ$
    b: Answers vary. Once all the angles have been solved for, state that two pairs of corresponding angles have equal measure, such as $\angle A = \angle D$ and $\angle B = \angle E$, to reach the conclusion that $\triangle ABC \sim \triangle DEC$ by AA ~ or $AC = BC$ and $DC = EC$, so $\frac{AC}{CE} = \frac{BC}{CE}$, and $\angle ACB = \angle DCE$, therefore $\triangle ABC \sim \triangle DEC$ by SAS ~.
    c: They are both correct. Since both triangles are isosceles, we cannot tell if one is the reflection or the rotation of the other (after dilation).

6-104. A

6-105. a: No, there may be red marbles that she has not selected in her draws.
    b: No, it is less likely that there are red marbles, but no number of trials will ever assure that there are no red ones.
    c: This is not possible, no number of draws will assure this.

6-106. C
Lesson 7.1.1 Day 1

7-9. See sample flowchart below. Congruent (SAS \( \cong \)) and \( x = 2 \)

\[
\begin{align*}
\overline{AD} & \cong \overline{CB} & \text{Given} \\
\angle ADB & \cong \angle CBD & \text{Given} \\
\overline{DB} & \cong \overline{BD} & \text{Segment is} \equiv \text{to itself} \\
\triangle ADB & \cong \triangle CBD & \text{SAS} \equiv
\end{align*}
\]

7-10.

\[
\begin{align*}
WXYZ & \text{ is a parallelogram} & \text{Given} \\
\overline{WX} & \parallel \overline{ZY} & \text{Def. of a parallelogram} \\
\angle WXY & \equiv \angle ZYW & \parallel \text{lines} \rightarrow \text{alt.} \int. \angle \equiv \\
\angle WMX & \equiv \angle YMZ & \text{Vertical angles are} \equiv \\
\overline{WX} & \equiv \overline{YZ} & \text{Opp. sides of a parallelogram are} \equiv \\
\triangle XWM & \equiv \triangle ZYM & \text{AAS} \equiv \\
\overline{WM} & \equiv \overline{YM} & \equiv \Delta s \rightarrow \equiv \text{parts} \\
\overline{ZM} & \equiv \overline{XM} & \equiv \Delta s \rightarrow \equiv \text{parts}
\end{align*}
\]

7-11. \( a: 12 \) \( b: 15 \) \( c: 15.5 \)

7-12. \( a: I \) \( b: R \)
\( c: I \) \( d: I \)

7-13. Equations may vary, but each should be equivalent to \( y = x^2 + 4x + 3 \).

7-14. \( a: \) See tree diagram at right.
\( b: \frac{8}{240} + \frac{16}{240} = \frac{24}{240} = 10\% \)

7-15. \( A = 40.5 \text{ sq units}, \)  
\( P = 10 + 6\sqrt{5} + 3\sqrt{2} \approx 27.7 \text{ units} \)
Lesson 7.1.1 Day 2

7-16.  
\(a: \ x = 6 \) (Pythagorean Theorem and SAS \(\cong\))  
\(b: \ x = 10 \) (ASA \(\cong\))  
\(c: \ x \approx 15.7 \) units (tangent and HL \(\cong\))  
\(d: \) Cannot be determined (although triangles are similar by AA ~)

7-17.

7-18.  
\(a: \ 3(5x - 2)(x + 3) \)  
\(b: \ 2(3t - 1)(t - 4) \)  
\(c: \ 6(x - 2)(x + 2) \)

7-19.  
\(x = 6\sqrt{3} \approx 10.4, \ y \approx 12 \)

7-20.  
\(a: \ \sqrt{125}^2 = 25 \)  
\(b: \ \sqrt{16} = 4 \)  
\(c: \ \frac{1}{\sqrt{16}} = \frac{1}{4} \)  
\(d: \ \frac{4}{\sqrt{81}} = \frac{4}{9} \)

7-21.  
\(y = 35,000(0.85)^x; \ y \) represents the value of the car in year \(x; \) 35,000 is the initial value of the car, 0.85 is the annual multiplier, which means the car is worth 85% of its value from the previous year. Annual rate of depreciation is 15%.

7-22.  
She should construct an arc centered at \(P\) with radius \(a\) so that it intersects \(n\) and \(m\) each once (call these intersections \(R\) and \(S\)). Then she can construct \(\overline{RS}\) to complete \(\triangle PRS\).
Lesson 7.1.2

7-26. \( M(0, 7) \)

7-27. \( a: x = 5 \quad b: x = -6 \text{ or } \frac{1}{3} \quad c: x = -1 \text{ or } \frac{5}{3} \quad d: x = \pm \frac{3}{4} \)

7-28. \( x = \frac{1}{3} \text{ or } x = -6; \text{ yes; Answers vary.} \)

7-29. \( a: 5 + i \quad b: -1 + 9i \quad c: 26 + 7i \)

7-30. \( a: (0.8)(0.8) = 0.64 = 64\% \quad b: (0.8)(0.2) = 0.16 = 16\% \)

7-31. \( a: \text{It is a parallelogram; opposite sides are parallel.} \)
   \( b: \approx 63.4^\circ; \text{ They are equal.} \)
   \( c: \overline{AC}: y = \frac{1}{2}x + \frac{1}{2}, \overline{BD}: y = -x + 5; \text{ no} \)
   \( d: (3, 2) \)

7-32. \( 36\sqrt{3} \approx 62.4 \text{ square units} \)
Lesson 7.1.3

7-39. | Statements | Reasons |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( AD \parallel EH )</td>
<td>Given</td>
</tr>
<tr>
<td>2. ( a = b )</td>
<td>If lines are parallel, alternate interior angle measures are equal.</td>
</tr>
<tr>
<td>3. ( BF \parallel CG )</td>
<td>Given</td>
</tr>
<tr>
<td>4. ( b = c )</td>
<td>If lines are parallel, corresponding angle measures are equal.</td>
</tr>
<tr>
<td>5. ( a = c )</td>
<td>Substitution</td>
</tr>
<tr>
<td>6. ( c = d )</td>
<td>Vertical angles have equal measure.</td>
</tr>
<tr>
<td>7. ( a = d )</td>
<td>Substitution</td>
</tr>
</tbody>
</table>

7-40.  

a: \((0, 0), (6, 0), (6, 4.5)\)

b: \(i. \frac{6}{8} = \frac{3}{4} \)  
\(ii. \frac{7.5}{10} = \frac{3}{4}\)

c: Methods may vary quite a bit. \((12.5, 9)\)

7-41. B

7-42. Roots: \( x = 2 \pm \sqrt{7} \), \( x \)-intercepts: \((\approx -0.65, 0)\) and \((\approx 4.65, 0)\); vertex: \((2, -7)\); \( y \)-intercept \((0, -3)\)

7-43.  
a: \( x = \frac{3}{2} \)  
b: \( x = \frac{1}{2} \)  
c: \( x = 1 \)  
d: \( x = -2 \)

7-44. Side length = \( \sqrt{50} \) units; diagonal is \( \sqrt{50} \cdot \sqrt{2} = \sqrt{100} = 10 \) units.

7-45.  
a: \( x + 4x - 2^\circ = 90^\circ, x = 18.4^\circ \) (complementary angles)

b: \(2m + 3^\circ + m - 1^\circ + m + 9^\circ = 180^\circ, m = 42.25^\circ \) (Triangle Angle Sum Theorem)

c: \(7k - 6^\circ = 3k + 18^\circ, k = 6^\circ \) (vertical angles are equal)

d: \( \frac{x}{16} = \frac{8}{13} \) \( x \approx 9.8 \) (AA ~, corresponding parts of similar \( \triangle \)s are proportional)
Lesson 7.1.4

7-49. No. Her conclusion in Statement #3 depends on Statements #2 and #5, and thus must follow them.

7-50. Multiple answers are possible. The statement \( a = d \) must be last. The statement \( c = d \) is independent and can fall anywhere else. The statement \( a = b \) must follow \( AD \parallel EH \), \( b = c \) must follow \( BF \parallel CG \), and \( a = c \) must follow all of these.

7-51. a: \( \triangle SHR \sim \triangle SAK \) because \( \triangle SHR \) can be dilated by a factor of 2 through point \( S \).

b: \( 2HR = AK, 2SH = SA, SH = HA \)

c: 6 units

7-52. a: False, it could be an isosceles trapezoid.

b: True. The quadrilateral can be divided by a diagonal into two triangles, so the sum of the angle measures is \( 2(180^\circ) = 360^\circ \). Thus each angle measures \( 90^\circ \) and the quadrilateral is a rectangle.

c: True; the opposite sides of a rhombus are parallel, so every rhombus is a parallelogram.

d: False, if the parallelogram is not a rhombus, the diagonals will not bisect the angles.

7-53. If \( h \) represents the number of hours and \( t \) represents the temperature, then \( t = 77 + 3h \) and \( t = 92 - 2h; h = 3 \) hours and the temperature will be \( 86^\circ \)F.

7-54. See graph at right. The parabola has \( y \)-intercept \((0, 2)\), \( x \)-intercepts \((-1, 0) \) and \((-2, 0) \), opens upward, line of symmetry \( x = -1.5 \), vertex \((-1.5, -0.25)\).

7-55. D
Lesson 7.1.5

7-60. See sample proof below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \overline{AB} \parallel \overline{CD} )</td>
<td>Given</td>
</tr>
<tr>
<td>2. ( \overline{AB} \cong \overline{CD} )</td>
<td>Given</td>
</tr>
<tr>
<td>3. ( \angle BAC \cong \angle DCA )</td>
<td>Parallel ( \rightarrow ) alt. int. angles ( \cong )</td>
</tr>
<tr>
<td>4. ( \overline{AC} \cong \overline{CA} )</td>
<td>Segment is congruent to itself</td>
</tr>
<tr>
<td>5. ( \triangle ABC \cong \triangle CDA )</td>
<td>SAS ( \cong )</td>
</tr>
<tr>
<td>6. ( \angle BCA \cong \angle DAC )</td>
<td>( \cong ) ( \Delta )s ( \rightarrow ) ( \cong ) parts</td>
</tr>
<tr>
<td>7. ( \overline{BC} \parallel \overline{AD} )</td>
<td>Alt. int. angles ( \cong ) ( \rightarrow ) parallel</td>
</tr>
<tr>
<td>8. ( \triangle ABCD ) is a parallelogram</td>
<td>Two pairs of parallel sides (def. of parallelogram)</td>
</tr>
</tbody>
</table>

7-61. a: \((3x - 2)(2x + 5) = 0\), \(x = \frac{2}{3}\) or \(-\frac{5}{2}\)

b: \(x = \frac{2}{3}\) or \(-\frac{5}{2}\)

c: Yes, although you might get a decimal answer for one and not the other, and not initially recognize them as equal.

7-62. \(26 + i\)

7-63. a: \((0.7)(0.7) = 0.49 = 49\%\)

b: \((0.3)(0.7) = 0.21 = 21\%\)

7-64. a: See diagram at right.

b: \(x = \frac{10\sqrt{3}}{3} \approx 5.77\) ft

7-65. C

7-66. a: \((2x - 5)^2\) b: not factorable

c: \(3x(x - 4)\) d: \(5(x - 4)(2x + 1)\)
Lesson 7.2.1

7-72.  a: \(\frac{4}{20} = \frac{1}{5}\)

b: \(\frac{4}{5}\); Since the sum of the probabilities of finding the ring and not finding the ring is 1, you can subtract \(1 - \frac{1}{5} = \frac{4}{5}\).

c: No, his probability is still \(\frac{4}{20} = \frac{1}{5}\) because the ratio of the shaded region to the whole sandbox is unchanged.

7-73.  See answers in bold below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (BC \parallel EF)</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. (m\angle BCF = m\angle EFC)</td>
<td>2. Parallel lines (\rightarrow) alt. int. angles =</td>
</tr>
<tr>
<td>3. (AB \parallel DE)</td>
<td>3. Given</td>
</tr>
<tr>
<td>4. (m\angle BAC = m\angle EDF)</td>
<td>4. Parallel lines (\rightarrow) alt. int. angles =</td>
</tr>
<tr>
<td>5. (AF = DC)</td>
<td>5. Given</td>
</tr>
<tr>
<td>6. ([FC = FC])</td>
<td>6. Reflexive Property</td>
</tr>
<tr>
<td>7. (AF + FC = FC + DC)</td>
<td>7. Addition Property of Equality (adding the same amount to both sides of an equation keeps the equation true)</td>
</tr>
<tr>
<td>8. (AC = DF)</td>
<td>8. Segment addition</td>
</tr>
<tr>
<td>9. (\Delta ABC \cong \Delta DEF)</td>
<td>9. ASA (\cong)</td>
</tr>
<tr>
<td>10. ([BC \cong EF])</td>
<td>10. (\cong)s (\rightarrow) (\cong) parts</td>
</tr>
</tbody>
</table>

7-74.  a: \((6.5, 5)\)

b: \(\frac{3}{8}\)

c: Using the strategy developed in Lesson 7.1.5, \(\Delta x = 14 - 2 = 12\) and \(\Delta y = 10 - 2 = 8\). Then the \(x\)-coordinate is \(2 + \frac{3}{8}(12) = 6.5\) and the \(y\)-coordinate is \(2 + \frac{3}{8}(8) = 5\).

7-75.  a: \(y = (4x - 3)(x + 2) = 4x^2 + 5x - 6\)

b: \(y = (x + \sqrt{5})(x - \sqrt{5}) = x^2 - 5\)

7-76.  a: false (isosceles trapezoid)  b: true

c: true  d: false (parallelogram)

7-77.  a: \(A = 36\) sq. ft, \(P = 28\) ft

b: \(A = 600\) sq. cm, \(P = 80 + 20\sqrt{2} \approx 108\) cm

7-78.  a: \(y = 2(0.83)^x\)  b: \(\approx 0.83\) or a 17% decrease  c: about 2.90 grams
Lesson 7.2.2  Day 1

7-84.  a: \( P(\text{on campus given Engr}) = \frac{120}{800 + 120} \approx 13.0\% \)

b: \( P(\text{on campus}) = 0.6 = 60\% \)

c: Yes. The probability of living on campus given that the student is an engineer is much smaller than the probability of living on campus.

7-85.  b: \( \frac{14}{22} = \frac{10}{DE} \), \( DE \approx 15.71 \)

7-86.  D

7-87.  a: \((6x + a)(6x - a)\)  \hspace{1cm} b: \((2x - 3)(2x + 3)(4x^2 + 9)\)

7-88.  It must be a rhombus and it could be a square.

7-89.  a: 3 \hspace{1cm} b: 2 \hspace{1cm} c: 7 \hspace{1cm} d: 10

7-90.  a: For example, domain is from 0 to 1 hour (or 60 minutes), range is from 0 to 1 mile. Piecewise-defined function with linear pieces, continuous. Increasing, then approximately constant, then decreasing at a steeper slope. See graph at right.

b: If \( n \) is the number of gym memberships sold, the domain is whole numbers, range is \{135, 145, 155, \ldots\} dollars. Discrete, linear, increasing. See graph at right.

c: Linear and piecewise for four months, then exponential and piecewise. Increasing and discrete, but easiest to model with a continuous graph. The domain is \( t \geq 0 \) months, the range is balance \( \geq \$500 \). See graph at right.
Lesson 7.2.2 Day 2

7-91.  a: \( P(\text{laptop given business trip}) = \frac{236}{236+274} = 46.3\% \)

b: \( P(\text{laptop}) \neq P(\text{laptop given business trip}) \) so they are associated.

7-92.  a: \((x - 7)(x - 1)\)  
b: \((y - 5)(y + 3)\)  
c: \(7(x + 3)(x - 3)\)  
d: \((3x + 4)(x + 2)\)

7-93.  16

7-94.  a: \(x = 15^\circ\), Triangle Angle Sum

b: \(k = 5\), isosceles triangle

c: \(t = 9^\circ\) and \(w = 131^\circ\), parallel lines

d: \(x \approx 49.9\), Triangle Angle Sum, isosceles triangle, trigonometry

7-95.  a: \( r = \sqrt{\frac{GM}{F}} \)  
b: \( \theta = \sin^{-1} \left( \frac{x}{r} \right) \)

7-96.  a: \( \sqrt{32} = 4\sqrt{2} \) units; Use the Pythagorean Theorem or use the fact that \(\overline{AB}\) is the hypotenuse of a 45°-45°-90° triangle.

b: It is an isosceles trapezoid; 24 square units

7-97.  a: \(x = 3\) or \(-11\)  
b: \(x = 14\)  
c: \(x = 2\)  
d: \(x = 2\)
7-107. a: See table below. Entries not in bold are given in problem statement, and entries in bold are computed from given information.

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>Not Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly local</td>
<td>25%</td>
<td>12%</td>
</tr>
<tr>
<td>Not weekly</td>
<td>40%</td>
<td>23%</td>
</tr>
<tr>
<td>local</td>
<td>65%</td>
<td>35%</td>
</tr>
</tbody>
</table>

b: \( P(\text{subscribes to at least one}) = 25\% + 12\% + 40\% = 77\% \)

c: \( P(\text{daily paper given subscribe to at least one}) = \frac{25 \times 40}{77} = 84.4\% \)

7-108. No, Dr. G does not have anything to worry about. Since \( P(\text{academic}) \cdot P(\text{arts}) = P(\text{academic and arts}) \) the events are independent. There is no association between winning an academic award and a Fine Arts award. It could also have been determined that \( P(\text{arts given academic}) = P(\text{arts}), \) or that \( P(\text{academic given arts}) = P(\text{academic}). \)

7-109. \( x \approx -0.3 \) or \(-6.7\); vertex: \((-3.5, -10.25)\); \( y \)-intercept: \((0, 2)\); the vertex is a minimum

7-110. B is correct; If two sides of a triangle are congruent, the angles opposite them must be congruent.

7-111. a: \( z = 1.5 \)  
    b: \( z = \frac{6}{7} \)  
    c: \( z = 8 \)  
    d: \( z = \frac{1}{5} \)

7-112. Possible response: Construct a circle of any radius. Then mark two points on the circumference of the circle. Connect the center point to each of the points on the circle. Since the radii of the circle are congruent, the sides of the triangle are congruent.

7-113. a: Isosceles right triangle, because \( AC = BC \) and \( \overline{AC} \perp \overline{BC} \).
    b: \( 45^\circ \); methods vary
Lesson 7.2.3 Day 2

7-114. a: \( P(\text{memorize}) = \frac{12}{60} = 20\% \)
   b: \( P(\text{music and memorize}) = \frac{1}{36} = 7.7\% \)
   c: no

7-115. See possible flowchart at right. \( x = 32 \)

7-116. D

7-117. \( y = -x^2 + 5x + 6 \)

7-118. a: \( x = 3 \) or \( x = -11 \)
   b: \( x = 1 \pm 2i \)
   c: \( x \approx 7.4 \) or \( x \approx -0.4 \)

7-119. See answers in bold in the table below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sqrt{m} \cdot \sqrt{n} )</td>
<td>Given</td>
</tr>
<tr>
<td>( = m^{1/2} \cdot n^{1/2} )</td>
<td>Rewrite with fractional exponents</td>
</tr>
<tr>
<td>( = (mn)^{1/2} )</td>
<td>Law of exponents</td>
</tr>
<tr>
<td>( = \sqrt{mn} )</td>
<td>Rewrite in radical form</td>
</tr>
</tbody>
</table>

7-120. \((-2, 4)\)
Lesson 8.1.1 Day 1

8-7. She is constructing an angle bisector.

8-8. a: Yes; see flowchart below.

\[ \overline{AB} \cong \overline{CD} \]
\[ \angle ABC \cong \angle DCB \]
\[ \overline{BC} \cong \overline{CB} \]

Given

\[ \Delta ABC \cong \Delta DCB \]

SAS \cong

\[ \overline{AC} \cong \overline{DB} \]

\[ \cong \Delta s \rightarrow \cong \text{parts} \]

b: No; the other relationships in the figure are true as long as the two angles remain congruent.

8-9. Because alternate interior angles are congruent, the angle of depression equals the angle formed by the line of sight and the ground. Then \( \tan \theta = \frac{38}{52} \), \( \theta \approx 53.8^\circ \).

8-10. a: (1.5, 5)
   b: (3, 7)
   c: \( y = \frac{4}{3} x + 3 \)
   d: \( \sqrt{2^2 + 1.5^2} = \sqrt{6.25} = 2.5 \text{ units} \)

8-11. a: Yes, she used the Pythagorean Theorem.
   b: \( x = 24; \) perimeter = 56 unit

8-12. a: \((8x + y)(8x - y)\)
   b: \((4x - 3y)(3x + 2y)\)
   c: \((2x + 3)^2\)
   d: not factorable

8-13. a: Yes; \( \text{HL} \cong \)
   b: \( 18^\circ, 4 \)
   c: \( \tan 18^\circ = \frac{4}{AD}, AD \approx 12.3 \text{ units} \)
   d: \( \approx 49.2 \text{ square units} \)
Lesson 8.1.1 Day 2

8-14.  \( a = 132^\circ, b = 108^\circ, \text{ and } c = 120^\circ; \ a + b + c = 360^\circ \)

8-15.  
\( a: \) One strategy: Translate one so that the centers coincide. Then dilate so that the radius is the same as the other circle.
\( b: \) Equilateral triangles, which are all similar by AA \( \sim \). Squares and other regular polygons are also always similar.

8-16.  
\( a: \approx 48.25 \) units \( b: \approx 32.9^\circ \) and \( \approx 57.1^\circ \)

8-17.  
\( a: (3x)^{3/2} \) \( b: 81^{1/x} \) \( c: 17^{3/3} \)

8-18.  
\( a: x = 0 \) or \( x = \frac{\sqrt{3}}{2} \approx 2.34 \) \( b: x = \frac{2}{3} \approx 0.67 \)
\( c: x = 1.5 \) or \(-5 \) \( d: x = \frac{1 + \sqrt{3}}{3} \)

8-19.  
\( a: -18 \) \( b: 11 + 3i \) \( c: 13 + 39i \)

8-20.  
\( a: \) Circles
\( b: \frac{1}{9} \) \( c: \frac{1}{9} + \frac{1}{18} = 66.7\% \)

<table>
<thead>
<tr>
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<th>red</th>
<th>yellow</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>( \frac{1}{6} )</td>
<td>( \frac{2}{6} )</td>
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<td>( \frac{2}{9} )</td>
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<td>( \frac{2}{6} )</td>
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<td></td>
<td>( \frac{1}{9} )</td>
<td>( \frac{1}{18} )</td>
<td>( \frac{1}{6} )</td>
</tr>
<tr>
<td></td>
<td>( \frac{2}{3} )</td>
<td>( \frac{1}{3} )</td>
<td>1</td>
</tr>
</tbody>
</table>
8-26.  \( x = 72^\circ \) and \( y = 54^\circ \); regular pentagon

8-27.  a: The central vertex must be \( 360^\circ ÷ 10 = 36^\circ \). The other two angles must be equal since the triangle is isosceles. Therefore, \( (180^\circ - 36^\circ) ÷ 2 = 72^\circ \).

b: \( 10 \cdot 14.5 = 145 \) square inches

8-28.  One method, fold the triangle through one vertex so that the angle sides coincide. This creates an angle bisector. Repeat with another vertex. The intersection of the two angle bisectors is the center of the inscribed circle, which is called the incenter.

8-29.

8-30.  Side length = 4, so height of triangle is \( 2\sqrt{3} \). Thus, the \( y \)-coordinate of point \( C \) could be \( 2 \pm 2\sqrt{3} \); \((5, \approx 5.46)\) or \((5, \approx -1.46)\).

8-31.  \( A = 100\sqrt{3} = 173.2 \text{ mm}^2 \)

8-32.  All of the triangles are similar. They are all equilateral triangles.
Lesson 8.2.2 Day 1

8-39. It must have eight sides. One method: solve the equation \( \frac{180°(n-2)}{n} = 135° \). Another method: Determine the exterior angle (45°) and divide into 360°. Answers vary.

8-40. \( \frac{AB}{AC} \quad \frac{BC}{AB} \quad \frac{BC}{AC} \quad \frac{AB}{AC} \quad \frac{BC}{AC} \)

8-41. Ben used the intersection of an angle bisector and the triangle side to set his compass radius. Instead, he needs to construct a perpendicular line from point \( I \) through one of the triangle sides, and use that intersection point to set his compass radius.

8-42. \( \triangle D B G \) is isosceles. See sample flowchart proof.

8-43. a: 10 + 11i  
b: 13  
c: 29  
d: \( a^2 + b^2 \)

8-44. Jamila’s product does not equal zero. She cannot assume that if the product of two quantities is 8, then one of the quantities must be 8. Correct solution: \( x = -6 \) or 3

8-45. a: \[ \begin{array}{cccc}
-3 & 0 & 3 & x
\end{array} \]  
b: \[ \begin{array}{cccc}
-3 & 0 & 3 & x
\end{array} \]  
c: \[ \begin{array}{cccc}
-4 & 0 & 4 & x
\end{array} \]  
d: \[ \begin{array}{cccc}
-5 & 0 & 5 & x
\end{array} \]  
e: \[ \begin{array}{cccc}
0 & 3 & 7
\end{array} \]  
f: \[ \begin{array}{cccc}
-10 & 0 & 4 & x
\end{array} \]
Lesson 8.2.2  Day 2

8-46.  a: $A = 192 \text{ cm}^2$, $P = 70 \text{ cm}$

b: The length of each side is 5 times the corresponding side in the floor plan.
$A = 4,800 \text{ cm}^2$ and $P = 350 \text{ cm}$.

c: The ratio is $\frac{5}{1} = 5$; the ratio of the perimeters equals the scale factor.

d: The ratio of the areas is $\frac{25}{1} = 25$. The ratio of the areas equals the square of the scale factor ($5^2$).

8-47.  a: $\approx 403.1 \text{ cm}^2$          b: $\approx 100.8 \text{ cm}^2$

8-48.  a: 10          b: $(8.5, 7)$          c: $\tan \theta = \frac{8}{6}$; $m \angle CAB \approx 53.13^\circ$

8-49.  a: 30%          b: 42%          c: No, 22% had both.

d: $P(\text{Green Fang}) \cdot P(\text{alarm}) \neq P(\text{Green Fang and alarm})$, $0.64 \cdot 0.28 \neq 0.22$ so they are
associated.

8-50.  Central angle $= 36^\circ$, distance from center to midpoint of side $\approx 30.777$ units,
$A = \frac{1}{2} (20)(30.777) \cdot 10 \approx 3077.7$ square units

8-51.  a: 4          b: $\frac{1}{16} x^4 y^{10}$          c: $6xy^2$

8-52.  a:  

b:  

c:  

Distance from centerfielder (ft)  

# of shoppers  

Time after pouring (minutes)  

Temperature (ºF)  

Time of day
Lesson 8.3.1

8-57.  a: \( A = 34 \text{ units}^2; \ P = 20 + 4\sqrt{2} \approx 25.7 \text{ units} \)

   b: \( A = 306 \text{ units}^2; \ P = 60 + 12\sqrt{2} \approx 77 \text{ units} \)

   c: ratio of the perimeters = 3:1; ratio of the areas = 9:1

8-58.  a: The interior and exterior angles must be supplementary. Therefore, \( 180^\circ - 20^\circ = 160^\circ \).

       b: Use \( 360^\circ / 20^\circ = 18 \) sides, or solve the equation \( \frac{180^\circ (n-2)}{n} = 160^\circ \) to get \( n = 18 \).

8-59.  The area of the hexagon is \( 24\sqrt{3} \) square units, so the side length of the square is \( \sqrt{24\sqrt{3}} \approx 6.45 \) units.

8-60.  a: See diagram right.

       Entries not bolded are given in the problem statement, while bold entries are computed.

       b: \( P(\text{senior|OceanView}) = \frac{0.06}{0.24} = 25\% \)

       c: They are associated because \( P(\text{senior}) \cdot P(\text{OceanView}) \neq P(\text{senior and OceanView}) \),

       that is \( (0.10)(0.24) \neq (0.06) \).

8-61.  a: \( 5 + 1 = 6 \), so two sides will collapse on the third side.

       b: Answers vary. One solution is 2, 5, and 6.

8-62.  \( 4 \div 21 \approx 19.05\% \); \( k = 0, 6, 10, 12 \) are factorable.

8-63.  a: \( x = 0 \)       b: \( x = 1 \)       c: \( x = -7 \)
Lesson 8.3.2

8-70.  a: $\frac{3}{4}$  b: $rp$  c: $ar^2$

8-71.  a: The area of the wildflower garden will be $1.5\sqrt{3}$ square yards.
   
   b: Using dimensional analysis:
   
   \[
   \frac{1 \text{ packet}}{10 \text{ sq ft}} \times \frac{9 \text{ sq ft}}{1 \text{ sq yd}} \times \frac{1.5\sqrt{3} \text{ sq yd}}{1 \text{ garden}} \times \frac{10 \text{ garden}}{1 \text{ packet}} \approx 2.34 \text{ packets/garden}
   \]

8-72.  From problem 8-15, all circles are similar. Or use similarity transformations to justify the similarity.

8-73.  a: $x + x + 125^\circ + 125^\circ + 90^\circ = 540^\circ$, $x = 100^\circ$  
   
   b: $6x + 18^\circ = 2x + 30^\circ$, $x = 3^\circ$

8-74.  a: $16\sqrt{3} \approx 27.7$ sq. cm
   
   b: 36 sq. cm; larger
   
   c: $24\sqrt{3} \approx 41.6$ square cm; its area is greater than the areas of the square and the equilateral triangle.
   
   d: A circle

8-75.  a: The spinner on the left has an expected value of 5. The spinner on the right has an expected value of 7.5, so the class should choose the spinner on the right.
   
   b: Now the left spinner has an expected value of 25, so it is the better choice.

8-76.  a: $x = 57$ or $-43$  
   
   b: $x = 43$ or $-57$  
   
   c: $x = -2$ or 22
   
   d: no solution
   
   e: Subtraction; $117 - 42$
   
   f: $|x - 47| = 21$ or $|47 - x| = 21$
   
   g: $i. |x - 4| = 12$ or $|4 - x| = 12$, $x = 16$ or $-8$
   
   $ii. |x + 9| = 15$ or $|9 - x| = 15$, $x = 6$ or $-24$
Lesson 8.4.1

8-81.  a: \(100\pi \text{ units}^2\)        b: \(7\pi \text{ units}\)
      c: 22 units          d: \(100\pi \text{ units}^2\)

8-82.  B

8-83.  168°

8-84.  a: 20        b: \(\approx 126.3 \text{ units}^2\)

8-85.  See bold answers within table below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (AB \perp DE) and (DE) is a diameter of (\odot C).</td>
<td>1. [Given]</td>
</tr>
<tr>
<td>2. (\angle AFC) and (\angle BFC) are right angles.</td>
<td>2. [Definition of perpendicular]</td>
</tr>
<tr>
<td>3. (FC \cong FC)</td>
<td>3. [Reflexive Property]</td>
</tr>
<tr>
<td>4. (AC \cong BC)</td>
<td>4. Definition of a circle (radii must be equal)</td>
</tr>
<tr>
<td>5. [(\Delta AFC \cong \Delta BFC)]</td>
<td>5. HL (\cong)</td>
</tr>
<tr>
<td>6. (AF \cong FB)</td>
<td>6. [(\cong \triangle \rightarrow \cong \text{ parts})]</td>
</tr>
</tbody>
</table>

8-86.  D

8-87.  a: \(x = 0\)        b: \(x = -2\)        c: \(x = 5\)
Lesson 8.4.2

8-93.  a: Arc length = $\frac{10\pi}{3}$ cm, area = $\frac{25\pi}{3}$ sq cm  
       b: Arc length = $3\pi$ in, area = $\frac{9\pi}{2}$ sq in

8-94.  a: 60°       b: 82°       c: 14°       d: 117°

8-95.  a: $2\pi r = 24; r = \frac{12}{\pi}; A = \frac{144}{\pi} \approx 45.8$ square cm  
       b: $2\pi r = 18\pi; r = 9; A = 81\pi \approx 254.5$ square cm

8-96.  a: C = 28\pi units; A = 196\pi units$^2$  
       b: C = 10\pi units; A = 25\pi units$^2$  
       c: $r = 50$ unit; area = 2500\pi units$^2$  
       d: $A = C^2/4\pi$ units$^2$

8-97.  a: 50%; The sum must be 100%.  
       b: central angle for red = 0.4(360°) = 144°, white = 0.1(360°) = 36°,  
           blue = 0.5(360°) = 180°  
       c: Yes; there could be more than three sections to the spinner, but the ratio of the areas  
           for each color must match the ratios for the spinner in part (b).

8-98.  a: $\cos 58.5^\circ = \frac{x}{7}$  
       b: Using $\sin 31.5^\circ = \frac{4}{7}$ or $\cos 58.5^\circ \approx 0.522, x \approx 3.6575.$

8-99.  a: The quadratic equation $(x - 11)^2 = -4$ has no real solutions because when a real  
       number is squared, it must be positive or 0.  
       b: $x = 11 \pm 2i; \text{ There are no real solutions, but there are complex solutions.}$
Lesson 8.4.3

8-105. a: \((55)(60) + 900\pi \approx 6127.4\) square feet 
   b: \(110 + 60\pi \approx 299\) feet; \(299 \cdot 8 = 2392\) 
   c: Area is four times as large \(\approx 24,509.7\) sq ft; perimeter is twice as long \(\approx 597\) ft

8-106. a: \(m = 133^\circ\) 
   b: \(k = 144^\circ\) 
   c: The two unmarked angles sum to \(180^\circ\) (same-side interior angles), so \(y = 45^\circ\).

8-107. a: \(P = 18 + \sqrt{34} \approx 23.8\) feet 
   b: \(x \approx 7\) yards 
   c: \(x = 60^\circ\) 
   d: \(x = 5\sqrt{2} \approx 7.1\) cm 
   e: \(\approx 334.6\) feet above Juanito’s hand

8-108. The minimum or maximum is the opposite of the value added or subtracted to the variable \(x\). It is a maximum if there is a negative sign in front of the parentheses, otherwise it is a minimum value. 
   a: \(\text{min}, x = -4\) 
   b: \(\text{max}, x = -27\) 
   c: \(\text{max}, x = 40\) 
   d: \(\text{min}, x = -32\)

8-109. a: \(\frac{1}{8}\) 
   b: \(\frac{5}{8}\)

8-110. a: \(360^\circ\) 
   b: \(30^\circ\) 
   c: \(60^\circ\) 
   d: \(45^\circ\)
Lesson 9.1.1

9-5. Smallest: a: 1; b: 0; c: –2; d: none.
Largest: a: none; b: none; c: none; d: 0; e: At the vertex.

9-6. Graph consists of three parabolas: one standard, and two opening downward; one appears “fatter” and one appears “skinnier” than standard. The negative coefficient causes parabolas to open downward, without changing the vertex. See graph at right.

9-7. a: parabola with vertex (2, 0); See graph at right.
b: shifted to the right two units

9-8. a: $x < 2$

b: $x \geq 6$

c: $x > 4$

d: $x \geq 18$

9-9. a: 3 b: 15 c: 4 d: 9

9-10. a: (6, –6); See graph at right.
b: They are perpendicular because the slopes are opposite reciprocals.

9-11. a: Not similar, $\frac{15}{10} \neq \frac{17}{11}$.
b: SAS $\sim$; Possible sequence: Translate so that $H'$ lies on $K$, rotate about $H'$ so that the angle sides coincide, dilate by a scale factor of $\frac{8}{5}$.
c: SSS $\sim$; Possible sequence: Translate so that $P'$ lies on $S$. Rotate clockwise about $P'$ until $P'M'$ lies on $SR$. Dilate by a scale factor of $\frac{85}{5}$.
d: SSS $\sim$ or SAS $\sim$; Possible sequence: Translate so that $U'$ lies on $X$. Rotate about $U'$ so that $U'V'$ lies on $XW$. Dilate by a scale factor of 2.
Lesson 9.1.2

9-16.  a: \( f(x) = (x - 7)^2 - 4 \)  
       b: \( f(x) = 2(x + 3)^2 \)  
       c: \( f(x) = -0.5(x + 5)^2 + 2 \)

9-17.  a: 3  
       b: 27  
       c: 153.29

9-18.  a: \( x \geq 3 \)  
       b: \( x < -\frac{7}{2} \)  
       c: \( x < 28 \)  
       d: \( x > \frac{5}{2} \)

9-19.  \( y = (x + 2)(x - 5) \) or \( y = x^2 - 3x - 10 \); See graph at right.

9-20.  a: \((1, 2)\)  
       b: \((-3, 2)\)

9-21.  \( 102.6 \div \pi \approx 32.7 \) feet

9-22.  Methods vary, but a variety of relationships can be used, such as parallel line angle relationships, vertical angles, and the sum of the angles in a polygon; \( x = 109^\circ, \ y = 71^\circ, \ z = 99^\circ \)

Lesson 9.1.3

9-29.  \( f(x) = x^2 - 1 \)

9-30.  a: vertex at \((3, 2)\), opens down, vertically stretched by a factor of 2  
       b: \( x \)-intercepts \((2, 0)\) and \((4, 0)\); \( y \)-intercept \((0, -16)\)

9-31.  a: \( f(x) = 7x^2 - 5 \)  
       b: \( f(x) = -\frac{1}{2} (x - 1)^2 + 4 \)

9-32.  \( K^2 + 1 < 65, -8 < K < 8\);  
       Negative values do not make sense, so Kayla is less than 8 years old.

9-33.  a: \((3)\)  
       b: \((1)\)  
       c: \((4)\)  
       d: \((2)\)

9-34.  a: 2  
       b: \( \frac{1}{xy^3} \)  
       c: \( 5x^2 \)

9-35.  D
Lesson 9.1.4

9-42. See graph at right. The vertex is at (3, –1);
x-intercepts (4, 0) and (2, 0); y-intercept (0, 2)

9-43. a: domain: all real numbers; range: $y \geq 0$

b: $g(x) = 2(x - 6)^2 + 3$ and $h(x) = -\frac{1}{2}(x - 6)^2 + 3$

c: domain: all real numbers; range: $y \geq 3$

9-44. See graph at right. $f(x) = (x - 1)^2 - 49$; x-intercepts: (–6, 0), (8, 0);
y-intercept: (0, –48); vertex: (1, –49)

9-45. a: Answers vary. She ran about 2 miles to the park, rested for about ten minutes, then ran home more quickly.

b: She ran 2 miles in 20 minutes, which is equivalent to 0.1 mi/min, or 6 mi/h.

c: 0 mi/h, the slope of the graph is 0 from 20 min to 30 min.

d: Answers vary. The last interval of the graph contains points (30, 2) and (≈ 48, 4).

The slope is $\frac{4 - 2}{48 - 30} = \frac{2}{18} \approx 0.11$, so her speed was about 0.11 mi/min, or about 6.67 mi/h.

9-46. Area of shaded region $= 54\sqrt{3} - 27\pi \approx 93.53 - 84.82 \approx 8.7$ in$^2$

9-47. a: $A = 42$ square units, $P = 26 + \sqrt{20} \approx 30.5$ units

b: $A = 4 \frac{1}{2}$ sq. units, $P \approx 10.2$ units

9-48. The area of the hexagon $\approx 23.4$ ft$^2$. Adding the rectangles makes the total area $\approx 41.4$ ft$^2$. 
Lesson 9.2.1

9-54.  a: \(x \geq 4\)  

\[\begin{array}{c}
0 & 5 \\
-5 & 0 & 5
\end{array}\]

\[\begin{array}{c}
0 & 5 & 10 & 15 & 20
\end{array}\]

b: \(x > 20.5\)

\[\begin{array}{c}
-5 & 0 & 5 \\
0 & 5 & 10 & 15 & 20
\end{array}\]

c: \(-5 \leq x \leq 1\)

9-55.  a: exponential  
b: linear  
c: quadratic

9-56.  There is no difference. It does not matter which one you use.

9-57.  a: \(y = (x + 3)^2 + 6\); vertex \((-3, 6)\) y-intercept: \((0, 15)\)

\[\begin{array}{c}
0 & 5 \\
-5 & 0 & 5
\end{array}\]

b: \(y = (x - 1.5)^2 + 6.75\); vertex: \((1.5, 6.75)\); y-intercept: \((0, 9)\)

9-58.  Point B; The circumcenter is the center of the circle that passes through all three vertices of the triangle. The other points are not equidistant from all three vertices, so they cannot be the circumcenter.

9-59.  a: \((4, -2)\)  
b: \((-6, -4)\)  
c: \((\frac{1}{2}, 12)\)

9-60.  a: \(D(0, 4)\) and \(E(4, 7)\)

b: \(DE = 5\) units, so \(AC\) is 10 units long.

c: \(AC = \sqrt{6^2 + 8^2} = 10\) units

d: \(F(0.5, 6.5)\) and \(G(2.5, 8)\); \(FG\) is parallel to \(AC\) and \(FG = \frac{1}{4}(AC) = 2.5\) units;

Side Splitter Converse and Midsegment Theorem or similar triangle side ratios.
Lesson 9.2.2

9-66. a: 

b: 

c: not possible 

d: 

e: 

f: 

g: 

9-67. See graph at right. The solutions are (−1, 4) and (−3, 2).

9-68. a: From 10 to 20 minutes, she only ran 0.4 miles, so that was her slowest interval. The greatest distance was 1.2 miles from 30 minutes to 40 minutes, so that is when she was running the fastest.

b: \[
\frac{4.8-1.2}{30-40} = \frac{1.1}{10} = 0.11 \text{ mi/m or 6.6 mi/h}
\]

9-69. a: vertex: (−3.5, −10.25) 

b: vertex: (−1, 1) 

c: vertex: (2.5, 0.75)

9-70. \[
m_\angle ECB = m_\angle EAD \\

E is the midpoint of AC \\

AE \equiv CE \\

\Delta AED \equiv \Delta CEB \\

\text{Given} \\

\text{Vertical angles are } \equiv \\

\text{ASA } \equiv \\

\equiv \Delta s \rightarrow \equiv \text{ parts}
\]

9-71. height = \(6\sqrt{3}\), area (15)(6\sqrt{3}) + \frac{1}{2}(144\pi) = 90\sqrt{3} + 24\pi \approx 231.3\ \text{in}^2

perimeter = 15 + 12 + 12 + 15 + \frac{1}{6}(24\pi) = 54 + 4\pi \approx 66.6\ \text{in}

9-72. a: \[
\frac{371}{1000} + \frac{250}{1000} - \frac{152}{1000} = \frac{469}{1000} = 46.9\%
\]

b: \[
1 - \frac{469}{1000} = \frac{531}{1000} = 53.1\%
\]

c: \[
1 - \frac{250}{1000} = \frac{750}{1000} = 75\%
\]

d: \[
P(A \text{ given under } 20) = \frac{152}{152+54+44} = 60.8\%
\]
Lesson 9.3.1 Day 1

9-78.  a: \( v = \frac{12 - 7}{0.5 - 0.25} = 20 \text{ ft/s} \)

\[ b: v = \frac{16 - 12}{1 - 0.5} = 8 \text{ ft/s} \]

c: The acrobat slows down. When she reaches her maximum height of 16 feet, she changes direction and her velocity is 0 ft/sec at that moment. The parabola is steeper at first, representing a greater velocity, and decreases in steepness until the change of direction at the vertex.

9-79.  a: yes  b: no  c: yes  d: no

e: Part (a) shows the constant function \( y = 2 \). While part (d) shows a constant relationship, the vertical line is not a function, so it does not meet the criteria. None of the other relationships are constant.

9-80.  a: \((-1, -2)\)  b: \((4, -4)\)  c: \((3, 4)\)

9-81.  a: \( a(x) = x^2 - 2, \) shifted down 2 units

\[ b: b(x) = -2x^2, \text{ reflected over } x\text{-axis, stretched vertically} \]

c: \( c(x) = (x - 2)^2, \text{ shifted right 2 units} \)

\[ d: d(x) = (2x)^2 \text{ or } 4x^2, \text{ compressed horizontally or stretched vertically} \]

9-82.  a: The vertex is \((2, 6)\). The coefficient of \(-2\) means the graph opens down, so the vertex is a maximum.

\[ b: \text{See graph at right.} \]

9-83.  a: 151°

\[ b: \text{Yes; a regular 36-gon has interior angles of 170°.} \]

c: \( 27 \cdot 180° = 4860° \)

9-84.  Region A is \( \frac{1}{4} \) of the circle, so the spinner should land in region A about \( \frac{1}{4} \times 80 = 20 \) times. Regions B and C have equal weight (which can be confirmed with arc measures), so they should each be the result about \( (80 - 20) ÷ 2 = 30 \) times.
Lesson 9.3.1 Day 2

9-85.  a: \( t = 5 \) seconds  \hspace{1cm} b: 100 feet  \hspace{1cm} c: 0 \leq t \leq 5

9-86.  See graph at right.  They intersect only once, at (3, 5).

9-87.  a: \( 4 - 2\sqrt{3} < b < 4 + 2\sqrt{3} \) or \( 0.54 < b < 7.46 \)

\hspace{1cm} b: x < -5 or x > -1

\hspace{1cm} c: x > 5

9-88.  a: \( f(x) = (x + 2)^2 + 1; \ ( -2, 1 ) \)

\hspace{1cm} b: \( f(x) = (x - 3.5)^2 - 12.25; \ (3.5, -12.25) \)

\hspace{1cm} c: minimum value for both

9-89.  a: \( A = 1,459,379.5 \) square feet

\hspace{1cm} b: \( A = 0.052 \) square miles

9-90.  \( A = 74 \) sq ft;  \( P = 42 + 4\sqrt{2} \approx 48 \) ft

9-91.  a: \( x^2 + y^2 = r^2 \)

\hspace{1cm} b: \( \sin(\theta) = \frac{y}{r}; \ y \)

\hspace{1cm} c: \( \cos(\theta) = \frac{x}{r}; \ x \)
Lesson 9.3.2

9-95. a: See table at right.
   
   b: Mateo: \[ \frac{1400 - 1000}{2 - 0} = \frac{400}{2} = 200/\text{yr} \]
   Marcy: \[ \frac{1343.20 - 1000}{2 - 0} = \frac{343.20}{2} = 171.60/\text{yr} \]
   
   c: Mateo: \[ \frac{2000 - 1600}{2 - 0} = \frac{400}{2} = 200/\text{yr} \]
   Marcy: \[ \frac{1967.99 - 1535.66}{2 - 0} \approx \frac{432.33}{2} \approx 216.16/\text{yr} \]
   
   d: Marcy’s investment will exceed Mateo’s in the long run because her growth rate is increasing, while his growth rate is constant. Exponential growth always exceeds linear growth eventually.

9-96. (0.5, 2) and (–1.1, –1.2); See graph at right.

9-97. a: The platform is 11 meters off the ground.
   
   b: \( h = 0 \) at \( t \approx 10.4 \) seconds.
   
   c: The maximum height is \( \approx 138.6 \) meters and occurs when \( t \approx 5.1 \) seconds.

9-98. a: 

   b: 

   c: 

9-99. a: \[ 2x + 4x - 3 + 7x - 6 + 3x + 12 + x + 10 = 540, x = 31^\circ \]
   
   b: \[ 4x + 20^\circ + 5x - 2^\circ = 180^\circ x = 18^\circ \]

9-100. a: \[ \theta = \frac{360A}{\pi r^2} \]
   
   b: \[ r = \sqrt{\frac{360A}{\pi \theta}} \]

9-101. a: \[ \frac{4}{25} \]
   
   b: 196:1
   
   c: 9:1
Lesson 9.3.3

9-107. a: See graph at right.

b: \( f(x) = \begin{cases} -x & x < 0 \\ x & x \geq 0 \end{cases} \)

9-108. Solve \((x - 1)^2 + 2 = 6; x = -1 \) or 3

9-109. a: The vertex is \((-1, -5)\) and the point is a minimum.

b: -5

9-110. Area of the entire pentagon \( \approx 172.05 \) square units, so the shaded area \( \approx \frac{3}{5}(173.05) \approx 103.23 \) square units.

9-111. 36%

9-112. a: Either 300 or \( \frac{1}{300} \).

b: Either 90,000 or \( \frac{1}{900,000} \).

9-113. a: \( g(10) = 1000, h(10) = 1.1046, m(10) = 10.24; \) so \( g(x) \) will be in first place at \( x = 10 \).

b: \( g(x): \frac{40-0}{2-0} = 20; \ h(x): \frac{1.0201-1}{2-0} = 0.01005; \ m(x): \frac{0.04-0.01}{2-0} = \frac{0.03}{2} = 0.015 \)

c: Assuming it continues the same growth pattern, it is an increasing exponential function, with a growth factor of 2. It doubles for each increase of \( x \) by 1.

\( m(x) = 0.01(2)^x \)

d: The mystery function, \( m(x) \), will win the race. It will take the lead between \( x = 18 \) and \( x = 19 \).
Lesson 9.3.4

9-118. a: (0, –6)
   b: (–3, 0) and (2, 0)
   c: \( g(x) = x^2 + x \)
   d: \( g(x) \) has x-intercepts at (0, 0) and (–1, 0) and y-intercept at (0, 0); the graph of \( g(x) \) is 6 units higher than the graph of \( f(x) \).

9-119. \( f(x) = \begin{cases} 
  x + 1 & x \geq 2 \\
  2x - 3 & x < 2 
\end{cases} \)

9-120. \( \frac{3}{12} (3) + \frac{7}{12} (–1) + \frac{2}{12} (10) = \frac{11}{6} \approx $1.83 \). The game is not fair because the expected value is not zero. The player will come out ahead over time, so students may want to play the game!

9-121. a: When \( h = 0 \), the time is \( t = 5.75 \) seconds.
   b: \(-16t^2 + 92t \geq 76; \ 1 \leq t \leq 4.75 \) seconds
   c: No. Chad’s rocket is above 76 feet for only 3.75 seconds.
   d: \( 0 \leq t \leq 5.75 \)

9-122. a: \( y = -0.25(x - 5)(x + 9) \)
   b: \( y = 2(x + 4)(x + 7) \)
   c: \( y = \frac{1}{3} (x + 6)^2 \)

9-123. D

9-124. a: \( CD = 14, BC = 3, \) and \( ED = 5; \) the perimeter is \( 14 + 6 + 10 = 30 \) units
   b: \( 6.5(4) = 26 \) units^2
Lesson 9.4.1  Day 1

9-132. One method: Make a table for both the original equation and the inverse and make sure the input and output values are reversed.

\[ f^{-1}(x) = \frac{x^3}{2} \] \hspace{1cm} \[ g^{-1}(x) = 4x + 5 \]

9-133. a: \(a(x)\) is an increasing exponential function with a growth rate of 5% or a multiplier of 1.05. The equation is \(a(x) = 10(1.05)^x\). \(b(x)\) is a quadratic function with vertex \((-2, 4)\) and a vertical stretch factor of 5. It is increasing for \(x > -2\) and has \(y\)-intercept (0, 24).

b: Eventually \(a(x)\) will intersect \(b(x)\) and then exceed it.

9-134. a:

<table>
<thead>
<tr>
<th>(x)</th>
<th>(y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
</tr>
<tr>
<td>2</td>
<td>-3</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

b: \(y = (x - 2)(x - 5) = x^2 - 7x + 10\)

c: See graph at right.

d: 4 seconds, 256 feet

9-135. a: \(s(x) = x^2 + 3x - 2\)

b: \(m(x) = x^2 + x + 4\)

c: \(v(x) = 2x^2 + 4x + 2\)

d: \(d(x) = -x^2 - x - 4\)

9-136. a: \(x - 2\) \hspace{1cm} b: \(5 - x\)

9-137. \((36 - 9\pi) \div 2 \approx 3.86\) units²

9-138. See graph at right.

Perimeter = 44.9 units
Area = 94 square units
Lesson 9.4.1 Day 2

9-139. a: $f^{-1}(x) = \frac{x + 3}{2}$

   b: $h^{-1}(x) = \sqrt{x - 2} + 3$

   c: The domain of $h(x)$ is $x \geq 3$.

9-140. a: Two solutions: (1, 2) and (3, 2). There are two points of intersection.

   b: One solution: (−1, 0). There is only one point of intersection.

9-141. a:  

   b:  

   c:  

9-142. a: Example equation: $M(x) = \begin{cases} 50 & 1 \leq x \leq 6 \\ 5x + 20 & 6 < x \end{cases}$

   The overall domain should be restricted to positive integer values.

   b: $E(x) = 3x$

   c: $N(x) = M(x) - E(x)$

   d: For example, for a party with three children, Jill will earn $50 and have $15 in expenses for a net income of $35. For a party with 10 children, she will earn $70 and have $30 in expenses for a net income of $40.

   $N(x) = \begin{cases} 50 - 3x & 1 \leq x \leq 6 \\ 3x + 20 & 6 < x \end{cases}$

9-143. $y = (x + 4)^2 - 16$; vertex: (−4, −16); x-intercepts: (0, 0) and (−8, 0)

   See graph at right.

9-144. a: equilateral triangle  

   b: rectangle  

   c: nonagon  

   d: rhombus

9-145. Because they are independent,

   $P(\text{coffee and dairy}) = P(\text{coffee}) \cdot P(\text{dairy}) = \left(\frac{42}{63}\right)\left(\frac{21}{63}\right) \approx 22.2\%$.

   $P(\text{no caffeine and no dairy}) = P(\text{no caffeine}) \cdot P(\text{no dairy}) = \left(\frac{\frac{63-42}{63}}{63}\right)\left(\frac{\frac{63-21}{63}}{63}\right) \approx 22.2\%$.

   Avoid the common mistake of computing

   $P(\text{no caffeine and no dairy}) = 1 - P(\text{coffee and dairy})$, because the expression on the right includes all the drinks that have either coffee or dairy but not both.
10-6.  a: Each layer has 7 cubes, so the volume is 42 cubic units.
     b: $14 \cdot 6 + 2 \cdot 7 = 98$ square units
     c: (1) $V = 20$ units$^3$, $SA = 58$ units$^2$
        (2) $V = 24$ units$^3$, $SA = 60$ units$^2$
        (3) $V = 60$ units$^3$, $SA = 94$ units$^2$

10-7.  a: $x^2 + y^2 = 9$       b: 9

10-8.  $y = 2(x + 3)^2 - 25$; vertex: $(-3, -25)$; $x$-ints: approx. $(0.54, 0)$ and $(-6.54, 0)$;
     y-int: $(0, -7)$

10-9.  a: Step function and/or piecewise-defined function.
     b: See graph at right.
     c: It will be much cheaper ($13.38 \text{ vs } 22.42$) to mail them in one package.

10-10. No. For example, $f(0) = 3$, but $f^{-1}(3) \neq 0$.
        Kent did not follow the order of operations when undoing.
        The correct inverse is $f^{-1}(x) = \frac{x - 3}{2}$, or $f^{-1}(x) = \frac{1}{2} x - \frac{3}{2}$.

10-11. D

10-12. The angles, from smallest to largest, measure $64^\circ$, $90^\circ$, $116^\circ$, $130^\circ$, and $140^\circ$, so the
        probability is $\frac{4}{5}$.

10-13.  a: $64$ units$^2$       b: $\approx 27.0$ units$^2$       c: $8\sqrt{3} \approx 13.9$ units$^2$
Lesson 10.1.2

10-18. \((x - 4)^2 + (y + 3)^2 = 16\), the center is \((4, -3)\) and the radius is 4 units.

10-19. See graph at right. The graph should include a circle with radius 5, center \((0, 0)\), and a line with slope 1 and \(y\)-intercept \((0, 1)\). Intersection points are \((3, 4)\) and \((-4, -3)\).

10-20. \(a: -1 \leq x \leq 3 \quad b: x = -2 \pm \sqrt{7} \approx 0.65 \text{ or } -4.65 \)
\(c: x < -9 \text{ or } x > 4 \quad d: x = -2.5 \text{ or } 5.5 \)

10-21. See graph at right.
\(a: (-2.5, 0) \text{ and } (3, 0) \)
\(b: \text{The graph of } y = -(2x^2 - x - 15) \text{ is a reflection of } y = 2x^2 - x - 15 \text{ across the } x\)-axis because each } y\text{-value has the opposite sign. The } x\text{-intercepts are the same.} \)

10-22. \(a: -2 - 5i \quad b: 16 + 10i \quad c: 20 + 10i \)

10-23. \(V = (16)(16)(16) = 4096 \text{ units}^3; \quad SA = (6)(16)(16) = 1536 \text{ units}^2 \)

10-24. \(a: \text{See diagram at right.} \)
\(b: P(\text{both blue}) = \frac{5}{6} \cdot \frac{5}{6} = \frac{25}{36} = 69.4\% \)
\(c: \frac{5}{6} (49\pi) \approx 128.3 \text{ square cm} \)
\(d: 1 - \frac{1}{4} - \frac{2}{3} = \frac{1}{12} \cdot \frac{1}{12} (360\degree) = 30\degree \)

10-25. \(a: 4x(x - 3) \quad b: 3(y + 1)^2 \)
\(c: m(2m + 1)(m + 3) \quad d: (3x - 2)(x + 2) \)
**Lesson 10.1.3 Day 1**

10-32. a: $x = -3$  
   b: $m = 10$  
   c: $p = -4$ or $\frac{4}{3}$  
   d: $x = 23$

10-33. Possible function below, where $f(t) =$ value of the account after $t$ years.

$$f(t) = \begin{cases} 
200 & 0 < t \leq 0.25 \\
200(1.02)^t & 0.25 < t \leq 5.25 
\end{cases}$$

10-34. A slice of circular pizza has area $0.107 \text{ ft}^2$ (or a slice of square pizza has area $18 \text{ in}^2$) so you should order a slice of the square pizza.

10-35. $36^\circ$

10-36. a: 1: exponential; 2: quadratic; 3: linear  
   b: The linear model does not fit the data well, as shown by a pattern in the residual plots. The linear model is predicting values too low at the ends of the data and too high in the middle. Both the exponential and quadratic look reasonable for this range of data however the exponential makes more sense if you wish to extrapolate the data. Notice the vertex of the quadratic model has been reached so the parabola will begin rising, meaning that training beyond that distance would predict slower (longer) 5K times using the quadratic model.
   c: 1: $\approx 21.99 \text{ min}$; 2: $\approx 19.59 \text{ min}$; 3: $\approx 18.15 \text{ min}$  
   d: There is a strong association between the distances run in training and 5K race times. However, this study cannot show cause and effect. Perhaps people who are natural runners enjoy running more so they run more in training. It is not possible to tell which is causing which. There are also many other variables that could be a source of the faster 5K race times tied to training distance like age, experience, equipment, and gender.

10-37. a: $x^2 + 1$  
   b: $x^2 + 4$  
   c: $(x + 5i)(x - 5i)$

10-38. a: $30^\circ$  
   b: 5 cm  
   c: 0.5  
   d: $5\sqrt{3}$

10-39. C
Lesson 10.1.3 Day 2

10-40. a: $\sqrt{x^2 + y^2}$  b: $y = (-6)$ or $y + 6$

c: $x^2 + y^2 = (y + 6)^2$ or $y = \frac{1}{12} x^2 - 3$

10-41. a: $(2, -3); \ r = 5$  b: $(x + 1)^2 + (y + 3)^2 = 16; (-1, -3); \ r = 4$

10-42. a: $f^{-1}(x) = 3(x + 2)$  b: $g^{-1}(x) = 2(x - 5)$

10-43. a: 1 is the starting area of bacteria. Bailey’s expression shows that the area is multiplied by 2 (every 20 minutes), and because there are six 20-minute periods in two hours, the multiplier needs to be applied 6 times. Carmen’s expression shows that the area of bacteria will multiply by $2^{1/20}$ per minute, and there are 120 minutes in two hours. Demetri’s expression shows that the area of bacteria will multiply by $2^{3}$ every hour during the two-hour period. There will be 64 sq. cm of bacteria after two hours (assuming that the dish is not completely covered before that time).

b: Possible expressions: $1(2^{1/2})^{-1}$ or $1(2^{1/20})^{-10}$ or $1(2)^{-1/2} \approx 0.707$ sq. cm

10-44. a: $y = f(x); \ f(0) = -3$ and $f(1) = -2$, both function values are smaller than the minimum value of $g(0) = 9$.

b: $(x + 3i)(x - 3i)$

10-45. a: one solution; Explanations will vary.

b: no real solutions; $x^2$ must be positive or zero.

c: two solutions; Explanations will vary.

d: no solution; Absolute value must be positive or zero.

10-46. a: $a = 120^\circ, b = 108^\circ$, so $a$ is greater.

b: Not enough information is given since it is not known if the lines are parallel.

c: Third side is approximately 8.9 units, so $b$ is opposite the greater side and must be greater than $a$.

d: $a$ is three more than $b$, so $a$ must be greater.

e: $\sin 23^\circ = \cos 67^\circ$, so $\frac{a}{b} = \frac{b}{a}$ and $a = b$.

10-47. C
Lesson 10.2.1

10-53. a: 70°  b: 50°  c: 2x

10-54. See solution graph at right.
   a: C: (0, 0); r = 4.5  b: C: (0, 0); r = 5\sqrt{3} ≈ 8.7
   c: C: (3, 0); r = 1  d: C: (2, 1); r = \sqrt{19} ≈ 4.4

10-55. 312 ÷ 13 = 24, so the tower is 24 blocks tall.

10-56. (4, 3) and (–4, –3). Solving algebraically involves working with fractions (or decimals). If you graph the line precisely using the slope starting from the y-intercept at the origin, you may notice that moving up 3 units and right 4 units yields an exact intersection point, as does moving down 3 units and left 4 units.

10-57. a: Investment A: linear, growing $10/month; Investment B: exponential, growth rate of 1%; Investment C: quadratic, growing by $1, $3, $5, $7, $9, …
   b: A: \frac{1060–1040}{6–4} = $10/mo; B: \frac{1061.5–1040.60}{6–4} = $10.45/mo; C: \frac{1036–1016}{6–4} = $10/mo
   c: Answers vary. Investment C will surpass Investment B before the end of the year. Investment B will eventually grow larger than Investment C, but only after 588 months, or about 49 years.

10-58. a: x = \frac{45}{5} = 11.25  b: x = –10 or x = 10
   c: x = 1.3  d: x = 2 ± i\sqrt{2}

10-59. a: See diagram at right.
   b: 2(3w – 2) + 2w = 100 and w(3w – 2) = 481
   c: width is 13 feet, length is 37 feet

10-60.

\[ M \text{ is a midpoint of } KL \]
\[ \angle P \equiv \angle L \]
\[ KM \equiv QM \]
\[ \angle KML \equiv \angle QMP \]
\[ \triangle KLM \equiv \triangle QPM \]
\[ KL \equiv OP \]
\[ \equiv \triangle s \to \equiv \text{ parts} \]
Lesson 10.2.2

10-66. a: 64°  b: 128°  c: 64°  d: 180°  e: 128°  f: 52°

10-67. a: See diagram at right.  
   b: 108°; interior angle of a regular polygon  
   c: 72°; central angle  
   d: 216°; This measure can be calculated as 
2(\angle EDC) or as 3(\angle BOC).

10-68. a: C: (−5, 0), r = \sqrt{10}  
   b: C: (3, 1), r = \sqrt{15}

10-69. a: \(x = \frac{10}{y}\)  
   b: no soln.  
   c: \(x = −11\) or 3  
   d: \(x = 288\)

10-70. a: \(f^{-1}(x) = \frac{x+2}{7}\)  
   b: Yes, it should be.

10-71. See graph at right.  
   a: \(\sqrt{x^2 + y^2}\)  
   b: \(4 − y\)  
   c: \(x^2 + y^2 = (4 − y)^2\) or \(y = −\frac{1}{8} x^2 + 2\)

10-72. Original: A = 135 sq. units, P = 48 units  
New: A = 15 sq. units, P = 16 units

10-73. a: If \(x\) is the number of guests, \(f(x) = 300 + 7x\)  
   b: \(p(x) = 50x − (300 + 7x)\), or \(p(x) = 43x − 300\)  
   c: \(43x − 300 > 100\); at least 10 guests
Lesson 10.2.3

10-80. a: 124°    b: 25π units²    c: ≈ 12.3 units

10-81. a: 3    b: 6    c: 2    d: 1    e: 4    f: 5

10-82. Point X is the circumcenter of ΔTRA. It is equidistant from the vertices of ΔTRA and is the center of the circumscribed circle of the triangle. It is the point of concurrency of the perpendicular bisectors of the sides of ΔTRA.

10-83. 240 cm³

10-84. a: x = y    b: y = 2x or x = \( \frac{1}{2} y \)    c: 3y = 5x    d: x + y = 180°

10-85. a: −2 ≤ x ≤ 3    b: x = 4 or −2    c: −5 < x < 4    d: x = \( \frac{3}{2} \pm \frac{1}{2} i \)

10-86. a: no intersection points    b: (1, −4) and (−2, −7)

10-87. a: See graph at right.

b: x ≤ −4

c: \( f(−4) = 1 \)
Lesson 10.2.4

10-94. \( MA = 14 \times 17 + 8 = 39 \) feet, \( MB = 6 \) feet, so \( AB = ER \) and \( ER = \sqrt{1485} \approx 38.5 \) feet

10-95. See graph at right. \( x \)-intercepts: \((4, 0)\) and \((-4, 0)\); 
\( y \)-intercepts: \((0, -2)\) and \((0, 8)\)

10-96. a: Using properties of isosceles triangles and trigonometry, \( AC \approx 12.9 \).

b: 18

10-97. a: \( \frac{360^\circ}{9} = 40^\circ \)

b: \( m \overarc{AD} = 2(97^\circ) = 194^\circ \); \( m \angle C = 0.5(194^\circ) = 97^\circ \)

c: \( m \overarc{AB} = 125^\circ \) and the length of \( \overarc{AB} = \frac{125^\circ}{360^\circ} (16\pi) = 17.5 \) units; 
area = \( \frac{125^\circ}{360^\circ} (64\pi) = 69.8 \) sq units

10-98. \( 10^2 + (x + 3)^2 = 26^2; \ x = 21 \)

10-99. a: 2 b: 3 c: 1

10-100. \( \frac{45}{360} (\pi(3)^2(2)) \approx 7.07 \) in\(^3\)

10-101. \( 2x + 3x + 4x + 5x = 360^\circ; \ x \approx 25.7^\circ \)
Lesson 10.2.5

10-108.  a: \( x = 270^\circ \)  \hspace{1cm}  b: \( x = 132^\circ, y \approx 15.7 \)  \hspace{1cm}  c: \( 3(x + 2) = 6x, x = 2 \)

10-109.  \( (x - 4)^2 + (y - 2)^2 = 9 \)

10-110.  a: 50°  \hspace{1cm}  b: 50°  \hspace{1cm}  c: 67°  \hspace{1cm}  d: 126°  \hspace{1cm}  e: 54°  \hspace{1cm}  f: 63°

10-111.  a: 13  \hspace{1cm}  b: 6.5  \hspace{1cm}  c: \approx 67.4^\circ  \hspace{1cm}  d: \approx 134.8^\circ

10-112.  a: \( x = -2 \) or 5  
           \hspace{1cm}  b: \( x = \frac{2}{3} \pm \frac{i\sqrt{26}}{3} \)
           \hspace{1cm}  c: \( x = \frac{8 \pm 2\sqrt{7}}{2} = 4 \pm \sqrt{7} \)  \( x \approx 1.35 \) or 6.65
           \hspace{1cm}  d: \( y = -3 \) or 5

10-113.  If \( t \) = hours, \( 2 + \frac{1}{4}t = 12 \); 40 hours

10-114.  Since the perimeter is 100, each side is 10. The central angle is \( 360 \div 10 = 36^\circ \). The right triangle has acute angles 18° and 72°. Area = 769.4 units²

10-115.  65°; One method: The sum of the angles in \( \triangle PSR \) is 180°, so \( m\angle SPR + \angle SRP = 40^\circ \). Then add the 40° and 35° of \( \angle QPS \) and \( \angle QRS \) to get \( m\angle QPR + \angle QRP = 115^\circ \). Thus, \( m\angle Q = 180^\circ - 115^\circ = 65^\circ \).
Lesson 11.1.1

11-7.  height ≈ 5 cm;  SA ≈ 1438.4 cm²

11-8.  24 square units; Since $\overline{DE}$ is a midsegment, $DE = \frac{1}{2} BC$. If the ratio of side lengths is 0.5, then the ratio of areas is $(0.5)^2 = 0.25$.

11-9.  9.5

11-10. a: They are both intercepted by $\angle CPD$. Dilate $\overline{AB}$ from $P$ to get $\overline{CD}$.
        b: They have the same measure because they have the same central angle. However, $\overline{CD}$ is longer; it is part of a circle with a greater circumference.
        c: $\frac{60}{360} (28\pi) \approx 14.7$ units

11-11. See graph at right. The points of intersection are $(–4, 3)$ and $(–4, –3)$.

11-12. B

11-13. a: $x = \frac{1}{3}$        b: $x = \frac{35}{8}$        c: $x = 7$ or $–3$        d: $x = –1$

11-14. $\approx 29^o$
Lesson 11.1.2

11-19. If she needs the balloon to double in width, then the volume will increase by a factor of 8. That means the balloon requires 24 breaths to blow it up. Since she has already used 3 breaths, she needs 21 more to fill the balloon.

11-20. a: \(SA = 180\pi \approx 565.5\text{ in}^2\)  
   b: \(V = 324\pi \approx 1017.9\text{ in}^3\)  
   c: \(V = 324\pi \cdot 27 \approx 27,482.7\text{ in}^3\)

11-21. \(\frac{180\pi}{1} \cdot \frac{1\text{ ft}}{12\text{ in}} \times \frac{1\text{ ft}}{12\text{ in}} = \frac{180\pi}{1} \cdot \frac{1\text{ ft}^3}{144\text{ in}^2} = \frac{5\pi}{4} \approx 1.25\pi \approx 3.9\text{ ft}^2\)

11-22. a: It has 8 sides. \((n - 2)180^\circ = 135^\circ n\)
   b: \(V \approx 30,177.7\text{ ft}^3\)

11-23. a: \(A = 175\pi \approx 549.8\text{ sq cm}\)  
   b: \(A \approx 74.2\text{ sq cm}\)  
   c: \(A \approx 25.0\text{ sq cm}\)

11-24. \(y = (x + 1.5)^2 + 1.75\); When you set \(y = 0\) and solve for \(x\), you get the square root of a negative number, meaning that there are no real solutions. The graph of the parabola does not cross the \(x\)-axis (where \(y = 0\)), so there are no real solutions to the equation \(0 = x^2 + 3x + 4\).

11-25. a: \(P \approx 23.9\text{ mm}\)  
   b: \(P = 66\text{ m}\)  
   c: \(P \approx 32.9\text{ in}\)

11-26. See graph at right.
   a: \((1, -3)\)
   b: \(\sqrt{(x - 1)^2 + (y + 2)^2}\)
   c: \(y - (-4)\) or \(y + 4\)
   d: \(y = \frac{1}{4}(x - 1)^2 - 3\); the vertex matches the answer from part (a). Check another point on the parabola to confirm that it is equidistant from the focus and directrix, such as \((-1, -2)\).
Lesson 11.1.3

11-30. a: 2
   b: 24 units² and 96 units²; ratio = 4 = 2²; It is the square of the linear scale factor.
   c: 6 units³ and 48 units³; ratio = 8 = 2³; It is the cube of the linear scale factor.

11-31. 1000 ⋅ 180° = 180,000°

11-32. \( \pi (2)^2 (4) \left( \frac{45}{360} \right) = 2\pi \approx 6.3 \text{ ft}^3 \)

11-33. IG = 12

11-34. a: The point is not on the circle. This can be shown using the fact that all of the points on the circle are 3 units away from the origin and then computing the distance from the origin to the point \((1, \sqrt{5})\): \(1^2 + \sqrt{5}^2 \neq 3^2\).
   b: \(x = -2 \) or \(2\)
   c: Possible answers will satisfy the equation \(x^2 + y^2 = 9\).

11-35. D

11-36. a: See graph at right. \(y\)-intercept: (0, 1.5); \(x\)-intercepts: (3, 0) and (−1, 0). Annie launched her balloon from 1 yard behind the goal line and the balloon was 1.5 yards high directly above the goal line. Her balloon landed 3 yards past the goal line.
   b: The vertex is at (1, 2), so Annie’s balloon reaches a maximum height of 2 yards.

11-37. a: If \(n\) is the number of participants, \(f(n) = 45n\); whole numbers
   b: \(p(n) = 45n − 1200\); She needs at least 27 participants.
Lesson 11.2.1

11-45. The surface area is $\approx 43,234$ square meters. This does not include the area of the base, which is 9216 square meters. Therefore, $\approx 173$ gallons of cleaning solution are needed.

11-46. a: Height of the tank = $6\sqrt{3} \approx 10.4$ in, so $V = 7 \cdot 13 \cdot 6\sqrt{3} = 546\sqrt{3} = 945.7$ cubic inches
b: $945.7 \text{ in}^3 \cdot \frac{1 \text{ foot}}{12 \text{ inch}} \cdot \frac{1 \text{ foot}}{12 \text{ inch}} \cdot \frac{7.48 \text{ gallon}}{1 \text{ ft}^3} \approx 4.1$ gallons

11-47. The ratio of the volumes is $\frac{4\pi}{500\pi} = \frac{1}{125}$, which is the scale factor cubed. So the ratio of the heights is the cube root of the volume ratio, or $(\frac{1}{125})^{\frac{1}{3}} = \frac{1}{5}$.

11-48. a: $m\angle PCQ = 46^\circ$, $\tan 46^\circ = \frac{5}{CP}$, $CP = CQ \approx 4.83$, $\sin 46^\circ = \frac{5}{CR}$, $CR \approx 6.95$, so $QR \approx 6.95 - 4.83 \approx 2.12$
   b: $x = 2(7 \cdot \sin 51^\circ), x \approx 10.88$ units

11-49. a: $-3$ b: $-4$
c: $\approx 2.8$ and $\approx -2.8$ d: $2$ and $-2$

11-50. See graph at right.
   a: Parallelogram because the opposite sides are parallel.
   b: $\overline{AC}: y = \frac{3}{4}x$; $\overline{BD}: y = -\frac{3}{2}x + 9$

11-51. a: $x = 13$ b: $x = 3$
c: $-5 \leq x \leq 5$ d: $x < -\frac{2}{3}$ or $x > 2$

11-52. a: $\frac{3V}{\pi r^2} = h$ b: $v = \pm \sqrt{\frac{2k}{m}}$
Lesson 11.2.1 Day 2

11-53. \( V = \frac{1}{3} (6^2)(4) = 48 \) cubic units; slant height is \( \sqrt{3^2 + 4^2} = 5; \)
\[ SA = 4\left(\frac{1}{2} \cdot 6 \cdot 5\right) + 6^2 = 96 \text{ square units} \]

11-54. Central angle \( = 3.6^\circ; \ A \approx 795.5 \text{ square units}\)

11-55. D

11-56. \( 36\pi \approx 113.1 \text{ ft}^3 \)

11-57. a: \( a = 44^\circ, b = 28^\circ, c = 56^\circ \)

b: Notice that the measure of each vertical angle \( (72^\circ) \) is the average of measures of the two arcs they intercept.

c: See scatterplot at right.

Exponential: \( y = 0.172847(1.12408)^x \)

Quadratic: \( y = 0.0027866x^2 + 0.042524x + 0.098083 \)

d: \( \approx 20.2 \text{ inches} \) (using the quadratic model)

e: Diagonal measurement is not a completely reliable way to calculate screen area if the screens are not similar rectangles. A square with a diagonal of 3.5 inches would have more area than a thin rectangle with the same 3.5-inch diagonal measurement. Also, pixel density can vary from screen to screen. Some manufacturers are able to put more pixels per square inch than others.

11-59. There are two points of intersection.

11-60. a: See graph at right.

b: The domain for the function is all real numbers; but for this context, a reasonable domain is approximately \(-3.7 \text{ yd} \leq x \leq -0.3 \text{ yd} \).

c: \( y = 3; \) The balloon reaches a maximum height of 3 yards.

d: The balloon is launched from 0.3 yards behind the goal line, it rises to a maximum height of 3 yards when it is 2 yards from the goal line and then falls to hit the ground 3.7 yards behind the goal line.
Lesson 11.2.2

11-66. **a:** \(BA = \frac{1}{2}(7)(24) = 84 \text{ in}^2, V = (84)(12) = 1008 \text{ in}^3,\)
\(\text{SA} = (2)(84) + (12)(7 + 24 + 25) = 840 \text{ in}^2\)

**b:** \(BA = 25\pi \text{ m}^2, V = \frac{1}{3}(25\pi)(12) = 100\pi \approx 314 \text{ m}^3,\) lateral \(\text{SA} = \pi(5)(13) = 65\pi \text{ m}^2,\)
total \(\text{SA} = 25\pi + 65\pi = 90\pi \approx 282.7 \text{ m}^2\)

11-67. **a:** \(14\pi \approx 44 \text{ cm}^3\)

**b:** \(BA \approx 19.3 \text{ ft}^2, \text{ so } V \approx (19.3)(7) \approx 135.1 \text{ ft}^3\)

11-68. **a:** \(V = (12)(12)(12) = 1728 \text{ inches}^3; \text{ SA} = (6)(12)(12) = 864 \text{ inches}^2\)

**b:** \(V = (1)(1)(1) = 1 \text{ feet}^3; \text{ SA} = (6)(1)(1) = 6 \text{ feet}^2\)

11-69. 12 inches

11-70. \(21^\circ + x = 2(62^\circ), \ x = 103^\circ\)

11-71. **a:** \((2, -2), (-2, 2)\)

**b:** See graph at right.

11-72.

11-73. **a:** 1.05  
**b:** \(\approx \$130,588\)  
**c:** \(f(t) = 130588(1.05)^t\)
Lesson 11.2.3

11-80. \( r = 4 \text{ cm}; \ SA = 4\pi(4^2) = 64\pi \approx 201 \text{ cm}^2; \ V = \frac{4}{3} \pi (4)^3 = \frac{256}{3} \pi \approx 268 \text{ cm}^3 \)

11-81. \( a: 162^\circ \quad b: 16 \text{ sides} \quad c: \approx 120.7 \text{ cm}^2 \)

11-82. C

11-83. \( \pi(6)^2(14.5) = 522\pi \text{ in}^3; \ \frac{522\pi \text{ in}^3}{\frac{1 \text{ gallon}}{231 \text{ in}^3}} \approx 7.1 \text{ gal} \)

11-84. \( a: x^2 - 2ix - 1 \quad b: x^2 - 4ix - 4 \quad c: (x - 3i)(x - 3i) \)

11-85. \( a: \) The slant height of the cone is \( \approx 9.2 \text{ m}, \ LA(\text{cone}) = 6\pi(9.22) \approx 173.8 \text{ m}^2, \) and \( \text{LA(cylinder)} = 12\pi(11) = 132\pi \approx 414.7 \text{ m}^2, \) so total surface area is \( \approx 173.8 + 414.7 = 588.5 \text{ m}^2 \)

\( b: \ V(\text{cylinder}) = 36\pi(11) = 396\pi \approx 1244.1 \text{ m}^3 \) and \( V(\text{cone}) = \frac{1}{3}(36\pi)(7) = 84\pi \approx 263.9 \text{ m}^3, \) so the total volume is \( 480\pi \approx 1508 \text{ m}^3. \)

11-86. \( y = (x + 4)^2 - 6 \)

See graph at right.
vertex \((-4, -6), \ y\)-intercept \((0, 10)\)

11-87. \( \overline{OY} \equiv \overline{KY} \equiv \overline{PY} \equiv \overline{EY} \) (all radii are congruent), \( \angle PYO \equiv \angle EYK \) (arc measures are equal), so \( \triangle POY \equiv \triangle EKY \) (SAS \( \equiv \)). Therefore, \( \overline{PO} \equiv \overline{EK} \) because \( \equiv \)s \( \rightarrow \equiv \) parts.
Lesson 12.1.1

12-7. a: 24; four choices for the first letter, three for the next, two for the next, and one last one, 4(3)(2)(1) = 24.
   
   b: The decision chart tells how many branches there are at each stage.
   
   c: \( \frac{4}{24} = \frac{1}{6} \); span, naps, snap, and pans

12-8. 5! = 120

12-9. a: \( k^2 = (8)(18) = 144, k = 12 \)  
   
   b: \( r = \frac{5}{\sin 25°} \approx 11.8, z = 310° \)

12-10. A

12-11. a: Since \( 2\pi r = 40 \) feet, then \( r = \frac{20}{\pi} \approx 6.4 \) feet; \( SA \approx 4\pi \left( \frac{20}{\pi} \right)^2 = 509.3 \) square feet;
   
   \[ V = \frac{4}{3} \pi \left( \frac{20}{\pi} \right)^3 \approx 1080.8 \text{ ft}^3 \]
   
   b: If the volume is increased by 2 times, the circumference will be increased by \( 2^{1/3} \): \( 40(2^{1/3}) \approx 50.4 \) feet.

12-12. (6, 20) and (−1, 6)

12-13. a: The residual plot shows a clear U-shape. A curved regression model would have been better.
   
   b: See graph at right. Since the graph is U-shaped, a quadratic model might be better.
   
   c: \( a = -0.083r^2 + 14.2t - 579 \), where \( a \) is the attendance (in 1000s of people) and \( t \) is the high temperature (°F) that day. 20,900 people, rounded to the nearest 100 people.
Lesson 12.1.2

12-20. a: \(7! = 5040\)  
   b: \(\frac{1}{50400}\)

12-21. a: \(12 \binom{3}{3} = \frac{12!}{(12-3)!} = \frac{12!}{9!} = 12 \cdot 11 \cdot 10 = 1320\)

12-22. \(AD = 3\) feet, so \(BD = 5\) feet. His arm needs to be at least 2 feet long.

12-23. B

12-24. a: \(f(x) = (x + 3)^2 + 2\)  
   b: \((-3, 2)\); See graph at right.
   c: The parabola has no \(x\)-intercepts so the equation has no real solutions.

12-25. a: It is a square. Demonstrate that each side is the same length and that two adjacent sides are perpendicular (slopes are opposite reciprocals).
   b: \(C'\) is at \((-5, -8)\) and \(D''\) is at \((-7, 4)\).

12-26. a: \(y = -x^2\); reflected over the \(x\)-axis  
   b: \(y = (x - 3)^2\); translated right 3 units
   c: \(y = x^2 - 3\); translated down 3 units  
   d: \(y = (2x)^2\) or \(y = 4x^2\); vertically stretched by a factor of 4

12-27. Sample answers given below.
   a: The amount of money, \(y\), in an account after \(x\) years if the starting balance is \$2000 and the monthly interest is 4\%. exponential growth
   b: The value of a car, \(y\), purchased for \$25,000 after \(x\) years if it depreciates 17\% per year. exponential decay
Lesson 12.1.3

12-34. a: 1

b: 8 things taken 8 at a time. \(8P_8\) should equal 8!.
\[8P_8 = \frac{8!}{(8-8)!} = \frac{8!}{0!} = \frac{8!}{1!} = 8!\]
If 0! = 0, you would be dividing by 0.

c: \(\frac{3!}{3} = 2!\), \(\frac{2!}{2} = 1!\), \(\frac{1!}{1} = 0!\)

12-35. a: \(10P_8 = \frac{10!}{2!} = 1,814,400\)

b: \(10C_8 = \frac{10P_8}{8!} = \frac{10!}{8!2!} = 45\)

c: \(6C_1 = \frac{6!}{1!5!} = 6\)

12-36. a: They might be. The ratio of the weights is 125:1, and the ratio of the surface areas is 25:1. However, it isn’t clear that both nuggets are shaped identically.

b: Since the ratio of the areas is 25:1, the ratio of the lengths is 5:1.

12-37. a: two x-intercepts; two real roots

b: one x-intercept; one double root

c: zero x-intercepts; two complex roots

d: one x-intercept; one double root

12-38. \(V \approx 64.2 \text{ mm}^3\), \(SA = 102.7 \text{ mm}^2\)

12-39. a: \(5m + 1 = 3m + 9, m = 4\)

b: \(2(x + 4^\circ) = 3x - 9^\circ, x = 17^\circ\)

c: \((p - 2)^2 + 6^2 = p^2, p = 10\)

d: \(18t = 360^\circ, t = 20^\circ\)

12-40. D

12-41. a: \(y = f(x - 3)\)

b: \(y = f(x - 2)\)
Lesson 12.1.4

12.47. \(8C_3 \cdot 10C_3 = 6720\)

12.48. \(3 \cdot 7 \cdot 2 \cdot 1 \cdot 4 = 168\) choices

12.49. a: \(22P_3 = 9240\)

b: This is really a permutation lock. In this case the common use of the word “combination” conflicts with the mathematical meaning.

c: \(22C_3 = 1540\), but this does not make sense for a mechanical lock because it would imply dialing the numbers in any order to open the lock.

d: \(22 \cdot 21 \cdot 21 = 9702\)

12.50. a: \(77^\circ\)  
b: \(49\pi\) un\(^2\)  
c: \(\sqrt{30}\)

12.51. a: \(= 436,000\) miles

b: The Sun’s radius is almost double the distance between Earth and the Moon. That means that if the sun were placed next to Earth, its center would be farther away than the Moon!

c: \(1,295,029\) if the Earths completely filled the space without gaps, less than this if the Earths stay “intact”.

12.52. See graph at right.

a: \((3, -4)\)

b: D: all real numbers, R: \(y \geq -4\)

c: The parabola opens upward, so it is a minimum.

d: \(x < 1\) and \(x > 5\)

12.53. a: \((1 \pm 2i, 2 \pm 4i)\)  
b: The graphs do not intersect.

12.54. a: \(1\)  
b: \(\frac{1}{\sqrt{2}}\) or \(\frac{\sqrt{2}}{2}\)  
c: \(\frac{1}{\sqrt{2}}\) or \(\frac{\sqrt{2}}{2}\)
Lesson 12.2.1 Day 1

12-58. \(2(5!)(3!) = 1440\)

12-59. Francis: \(d = t + 2\), John: \(d = \frac{3}{4} t + 5\); 12 seconds

12-60. a: It is 80 feet above ground because \(y = 80\) when \(x = 0\).
   b: \(-16(3)^2 + 64(3) + 80 = 128\) feet; \(-16(\frac{1}{2})^2 + 64(\frac{1}{2}) + 80 = 108\) feet
   c: \(y = -16x^2 + 64x + 80 = 0; x = 5\) seconds
   d: The domain for this context is \(0 \leq x \leq 5\) seconds.

12-61. a: \(b\) is larger, even though we are not told that \(b\) is a central angle.
   b: The missing angle is \(180^\circ - 62^\circ - 70^\circ = 48^\circ\), and since the angle opposite side \(a\) is bigger, \(a\) must be larger than \(b\).
   c: \(a = 9\sqrt{3} \approx 15.6\) units\(^2\) and \(b = 16\) units\(^2\), so \(b\) is larger than \(a\).

12-62. The \(x\)-coordinate must lie on the perpendicular bisector of segment \(\overline{AB}\). Thus, since the midpoint \(M\) of segment \(AB\) is \((6, 0)\), the \(x\)-coordinate of point \(C\) must be 6. \(\Delta AMC\) is a right triangle, and the hypotenuse must have a length of 12 units for \(\Delta ABC\) to be equilateral. Therefore, \(MC = \sqrt{12^2 - 6^2} = 6\sqrt{3}\) because of the Pythagorean Theorem. So the \(y\)-coordinate of point \(C\) could be \(6\sqrt{3}\) or \(-6\sqrt{3}\).

12-63. a: \(\frac{1}{\sqrt{3}}\) or \(\frac{\sqrt{3}}{3}\)
   b: \(\frac{1}{2}\)
   c: \(\frac{\sqrt{3}}{2}\)
   d: \(\sin 60^\circ = \cos 30^\circ\); Yes, the sine of an angle equals the cosine of the complement. This is because the side opposite an angle is the side adjacent to its complement, and vice versa.

12-64. The First Equations Bank is a better choice. The yearly multiplier for You Figure Bank is \(\left(1 + \frac{0.039}{365}\right)^{365} \approx 1.0397\), which is less than 4% interest.

12-65. C
Lesson 12.2.1 Day 2

12-66. This is similar to rearranging letters. \( \frac{10!}{3!2!} = 302,400 \) ways to layer the dip.

12-67. a: 3  
   b: 1  
   c: 2

12-68. a: \( V = (2)(5)(6) - \pi(0.5^2)(6) \approx 55.3 \text{ cm}^3 \)  
   b: Answers vary. One possibility: it could represent a pencil sharpener.

12-69. a: The triangles should be \( \cong \) by SSS \( \cong \) but \( 80^\circ \neq 50^\circ \).  
   b: The triangles should be \( \cong \) by SAS \( \cong \) but \( 80^\circ \neq 90^\circ \) and \( 40^\circ \neq 50^\circ \).  
   c: The triangles should be \( \cong \) by SAS \( \cong \) but \( 10 \neq 12 \).  
   d: Triangle is isosceles but the base angles are not equal.  
   e: The triangles should be \( \cong \) by SAS \( \cong \) but sides \( 13 \neq 14 \).

12-70. \( x = 3 \pm i\sqrt{2} \)

12-71. The surface area of the moon \( \approx 4\pi(1080)^2 \approx 14,657,414.7 \) which makes it larger than Africa and smaller than Asia.

12-72. \((-\sqrt{5}, 2)\) and \((\sqrt{5}, 2)\); The graphs intersect in two points.

12-73. \(|x - 3| = 2\); \( x = 1 \) or \( 5 \)
Lesson 12.2.2  Day 1

12-78. a: $8C_3 = 56$
   
   b: There are 6 choices left for the third filling.
   
   c: $\frac{7C_2}{8C_3} = \frac{21}{56} = 37.5\%$

12-79. a: $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$
   
   b: $\frac{5!}{2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = 60$
   
   c: $\frac{5!}{2!2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1 \cdot 2 \cdot 1} = 30$
   
   d: Because you cannot tell the repeated letters apart, there are fewer arrangements when there are repeated letters.

12-80. 14

12-81. C

12-82. a: $x = -2$ or $x = -4$
   
   b: $x = 1$ or $x = \frac{4}{3}$
   
   c: $x = -5$ or $x = \frac{3}{2}$

12-83. If the circle’s center is C and if the midpoint of $\overline{AB}$ is D, then $\triangle ADC$ is a 30°-60°-90° triangle. Then the radius, $AC$, is 10 units long and the area of the circle is $100\pi \approx 314.16$ square units.

12-84. $\frac{1}{3}(9^2)(12) = 324$ cm$^3$

12-85. 4 cm
Lesson 12.2.2 Day 2

12-86. a: The second throw; it lands after more than 1.25 seconds.
   
   b: First throw: \( \frac{4.5-1.5}{0.25} = 12 \) ft/s; second throw: \( \frac{5.5-1.5}{0.25} = 16 \) ft/s
   
   c: The second throw. The first throw is in the air for less time and has a lower initial velocity. Therefore, it reaches its peak sooner and does not fly as high as the second ball.

12-87. \( 9! = 362,880 \); Think of this as being similar to rearranging letters.

12-88. a: \( 9(27) = 243 \)  
   b: \( 243(15) = 3645 \) ways; 9.98 years

12-89. a: See graph at right.
   
   b: Anything with initial value of 20 and increasing by 6%.

12-90. Possible solution. Place the sprinkler at the circumcenter of the triangle. She can find the perpendicular bisectors of two sides of the triangle and the intersection point is where the sprinkler should be.

12-91. \((-2, 5)\) and \((6, 21)\)

12-92. a: \(36^\circ\)
   
   b: \( b = c = 108^\circ, d = 72^\circ \)

12-93. a: See diagram at right.
   
   b: \(1.4\) ft\(^3\)

12-94. a: \( A = 144\) square units, \( P = 84\) units
   
   b: \( A = 16\) square units, \( P = 28\) units
12-102. $158,184,000 - 17,576,000 = 140,608,000; \frac{1}{175760}$

12-103. a: $\binom{12}{4} + \binom{12}{3} = 715$

b: If raspberry and custard are known fillings, then there are two fewer fillings to choose from, so $\frac{\binom{10}{2} + \binom{10}{1}}{715} = \frac{55}{715} = 7.7\%$.

12-104. $V = 324 - 12 = 312 \text{ cm}^3$

12-105. Answers may vary, but given the centers and radii of the circles you should predict that there will be 2 points of intersection.

a: The system has intersection points at (2, 4) and (2, -4).

b: See graph at right.

12-106. A

12-107. $b \geq 20$ or $b \leq -20$

12-108. $A = 16\pi$ square units; $C = 8\pi$ units

12-109. a: $f(x) = 4(\frac{3}{2})^x$

b: The $b$ represents the multiplier. This is an increasing exponential function with a growth rate of 50%.

c: Answers vary. Starting value should be 4, with a growth rate of 50%.
Lesson 12.2.3  Day 2

12-110. This is similar to rearranging letters. \( \frac{8!}{2!5!} = 168 \) arrangements of cars.

12-111. \( a: \) If \( x \) is the number of miles, \( f(x) = \begin{cases} 5 & 0 < x < 3 \\ 5 + 1.5x & 3 \leq x \end{cases} \)

\( b: \) \( f(x) = \left( \frac{3.00}{28} + 0.6 \right) x \approx 0.71x \)

\( c: \) \( f(x) = \begin{cases} 5 - 0.71x & 0 < x < 3 \\ 5 + 0.79x & 3 \leq x \end{cases} \)

2.5 miles: \$3.23; 10 miles: \$12.90

12-112. \( a: \approx 986 \) square mm

\( b: \) 400\% is 4 times as large. Therefore, its area increases by a factor of \( 4^2; 986.16 \cdot 16 \approx 15,778.6 \) square mm. (Or \( 986 \cdot 16 \approx 15776 \) sq mm.)

12-113. \( V(\text{prism}) = (34)(84)(99) = 282,744 \) units\(^3; \) \( V(\text{cylinder}) = \pi(38)^2(71) = 322,088.6 \) units\(^3, \)

so the cylinder has more volume.

12-114. Equations may vary.

\( a: \) \( 2x = 180 - 106, x = 37^\circ \)  \( b: \) \( x + 67 = 180, x = 113^\circ, 5y + 3y - 16 = 180, y = 24.5^\circ \)

12-115. \( a: \) \( x = 14\sqrt{3}, 30^\circ\ - 60^\circ\ - 90^\circ \) pattern

\( b: \) No solution, hypotenuse must be longest side.

\( c: \) 24 units, triangle area formula

12-116. B

12-117. Possible answers: \( a: y = x^2 + x - 6 \)  \( b: y = 2x^2 + 5x - 3 \)
Lesson 12.2.4 Day 1

12-131.  \(a: 900C_{12} \approx 5.48 \times 10^{26} \quad b: 899C_{11} \approx 7.30 \times 10^{24} \quad c: \approx 1.3\%

12-132. No, they should not charge a higher premium. \(P(\text{ticket given red}) = \frac{9}{348} = 0.025\) and \(P(\text{ticket}) = \frac{507}{20,000} = 0.025\). Since they are approximately the same, they are most likely independent.

12-133. B

12-134.  \(a: 10^{1/3} \quad b: 15^{1/2} \quad c: 18^{3/4} \quad d: 5^{-1/2}\)

12-135.  \(r = \frac{4.5}{\sin 16^\circ} \approx 16.3\) mm; \(C \approx 102.6\), so \(\overline{mAB} \approx \frac{32}{360} (102.6) \approx 9.1\) mm

12-136. The parabola has vertex \((1, -3)\) and opens downward. The line has \(y\)-intercept at \((0, -5)\) and decreases. There are two points of intersection because the parabola continues down forever, so the line will cross both branches. Therefore, there are two solutions to the system.

12-137. 8.83

12-138.  \(\sqrt{x^2 + y^2}\)
Lesson 12.2.4 Day 2

12-139. \[ 12C_5 + 12C_4 + 12C_3 + 12C_2 + 12C_1 + 12C_0 = 1586 \]

12-140. a: It is a rhombus. It has four sides of length 5 units.
   b: \( \overline{HJ} : y = -2x + 8 \) and \( \overline{GI} : y = \frac{1}{2}x + 3 \)
   c: They are perpendicular.
   d: (6, -1)
   e: 20 square units

12-141. \( 2L + 2W = 100; \ L^2 + W^2 = 40^2; \) About 38.2 m by 11.8 m

12-142. small cone: \( \frac{2}{5} = \frac{r}{6}, \ r = 2.4''; \ V = \frac{1}{3} \pi (2.4)^2 (2) \approx 12.06 \text{ in}^3; \)
   large cone: \( V = \frac{1}{3} \pi (6)^2 (5) \approx 188.50 \text{ in}^3; \) new volume \( \approx 188.50 - 2(12.06) \approx 164.4 \text{ in}^3 \)

12-143. D

12-144. a: \( \Delta ABC \sim \Delta FED \) (AA~)
   b: \( \Delta ABC \sim \Delta MKL \) (SSS~)
   c: Not similar because the scale factor for corresponding sides are not equal.

12-145. a: 288 feet by 256 feet
   b: area of shape = 59.5 square units; area of island = 60,928 square feet

12-146. a: [Graph of a line]
   b: [Graph of a line]