Mini-Lesson 10.1
Points, Lines, Planes, and Angles

Learning Objectives:
1. Understand points, lines, and planes as the basis of geometry.
2. Solve problems involving angle measures.
3. Solve problems involving angles formed by parallel lines and transversals.

Examples:
1. Find the missing degree.
   a. \[ 19^\circ \]
   b. \[ 105^\circ \]

2. Find the measure of the complement and the supplement of each angle:
   a. \( 45.5^\circ \)  b. \( 87^\circ \)  c. \( 21.5^\circ \)  d. \( 5^\circ \)

3. Find the measure of the angle described by the following: the measure of the angle is \( 26^\circ \) greater than its complement.

4. Find the measures of the angles 1, 2, and 3:
   a. \[ 140^\circ \]
   b. \[ 66^\circ \]

5. Find the measures of the missing angles:
6. Find the measures of the missing angles.

\[ \begin{align*}
\angle 1 & = 34^\circ \\
\angle 3 & = \ ? \\
\angle 4 & = \ ? \\
\angle 5 & = \ ? \\
\angle 6 & = \ ? \\
\angle 7 & = \ ? 
\end{align*} \]

7. Use an algebraic equation to find the measure of each angle that is represented in terms of \( x \).

\[ \begin{align*}
\text{a.} & \quad 5x + 3 \\
\text{b.} & \quad 3x - 1 \\
\text{c.} & \quad 2x - 2 \\
\text{d.} & \quad 3x + 7 \\
\end{align*} \]

8. Find the union or intersection of the following:

\[ \begin{align*}
\text{a.} & \quad \overline{AD} \cap \overline{AC} \\
\text{b.} & \quad \overline{AB} \cap \overline{BD} \\
\text{c.} & \quad \overline{CD} \cup \overline{BC} \\
\text{d.} & \quad \overline{BA} \cap \overline{BD} \\
\end{align*} \]

**Student Pitfalls:**
1. Point out the connection of intersection and union from set theory.
2. Students switch the definitions for supplemental and complementary angles.

**Answers:**
1. a) 71°; b) 75°
2. a) 44.5°, 134.5°; b) 3°, 93°; c) 68.5°, 158.5°, d) 85°, 175°
3. 32°
4. a) \( m\angle 1 = m\angle 3 = 40^\circ \); b) \( m\angle 1 = 24^\circ, m\angle 2 = 66^\circ, m\angle 3 = 90^\circ \)
5. \( m\angle 1 = m\angle 2 = m\angle 5 = m\angle 6 = 43^\circ, m\angle 3 = m\angle 4 = m\angle 7 = 137^\circ \)
6. \( m\angle 1 = 124^\circ, m\angle 2 = m\angle 4 = m\angle 7 = 56^\circ, m\angle 3 = 146^\circ, m\angle 5 = m\angle 6 = 34^\circ \)
7. a) \( x = 11^\circ, 5x + 3 = 58^\circ, 3x - 1 = 32^\circ \); b) \( x = 35^\circ, 3x + 7 = 112^\circ, 2x - 2 = 68^\circ \)
8. a) \( \overline{AC} \); b) \( \overline{B} \); c) \( \overline{BD} \); d) \( \overline{DA} \)
Mini-Lesson 10.2
Triangles

Learning Objectives:
1. Solve problems involving angle relationships in triangles.
2. Solve problems involving similar triangles.
3. Solve problems using the Pythagorean Theorem.

Examples:
1. Find the measure of the angle A for the triangle shown.

   ![Diagram of a triangle with angles 55° and 21°]

2. Find the measure of angles 1 through 5 in the figure shown.

   ![Diagram of angles 125° and 35°]

3. Find the measure of each numbered angle.

   ![Diagram of angles labeled 2 ft and 105°]
4. Lines $l$ and $m$ are parallel. Find the measure of each numbered angle.

5. Use similar triangles to find the missing length, $x$.

6. Find the missing length, $x$.

**Student Pitfalls:**
1. When calculating similar triangles, students set up the ratios incorrectly.
2. When finding the measure of angles, students forget about the total measure inside a triangle to find the remaining angles.

**Answers:**
1. $m\angle A = 104^\circ$
2. $m\angle 1 = 35^\circ, m\angle 2 = 55^\circ, m\angle 3 = 90^\circ, m\angle 4 = 145^\circ$
3. $m\angle 1 = m\angle 4 = 105^\circ, m\angle 2 = m\angle 3 = 75^\circ, m\angle 6 = 150^\circ, m\angle 7 = 30^\circ$
4. $m\angle 1 = m\angle 3 = m\angle 6 = 53^\circ, m\angle 2 = 127^\circ, m\angle 4 = m\angle 6 = 105^\circ, m\angle 5 = 75^\circ$,
5. 15 ft.
6. $10\sqrt{5}$ in.
Mini-Lesson 10.3
Polygons, Perimeter, and Tessellations

Learning Objectives:
1. Name certain polygons according to the number of sides.
2. Recognize the characteristics of certain quadrilaterals.
3. Solve problems involving a polygon’s perimeter.
4. Find the sum of the measures of a polygon’s angles.
5. Understand tessellations and their angle requirements.

Examples:
1. Name the number of sides and the sum of the measure of the angles of the following polygons:
   a. Pentagon  b. Dodecagon  c. Nonagon  d. trapezoid

2. Find the perimeter of the figure named and shown.
   a. Rectangle:
      \[
      \begin{array}{c}
      \text{11 ft} \\
      \text{15 ft}
      \end{array}
      \]
   b. Triangle:
      \[
      \begin{array}{c}
      \text{10 cm} \\
      \text{8 cm}
      \end{array}
      \]
   c. Regular pentagon:
      \[
      \begin{array}{c}
      \text{12 in.}
      \end{array}
      \]
   d. Trapezoid:
      \[
      \begin{array}{c}
      \text{5 in.} \\
      \text{22 in.} \\
      \text{3 in.} \\
      \text{2 in.}
      \end{array}
      \]
3. A rectangular farm is 6 times as long as it is wide. If the perimeter of the farm is 28 miles, what are the farm’s dimensions?
4. A rectangular garden is 18 ft wide and 30 ft long. If decorative fencing costs $0.20 per inch, how much will it cost to enclose the garden?
5. You need to install gutters around your house. If gutters cost $10 per yard, how much would it cost to install? See figure below.

**Student Pitfalls:**
1. Students forget to figure the length of the sides that are missing measurements.

**Answers:**
1. a) 5, 540°, b) 12, 1800°, c) 9, 1260°, d) 4, 360°
2. a) 52 ft, b) 24 cm; c) 60 in.; d) 64 in.; e) 140 m
3. 2 miles by 12 miles
4. $230.40
5. $2,840
Mini-Lesson 10.4
Area and Circumference

Learning Objectives:
1. Use area formulas to compute the areas of plane regions and solve applied problems.
2. Use formulas for a circle’s circumference and area.

Examples:
1. Use the formulas developed in this section to find the area of each figure.
   a. ![Figure a](image)
   b. ![Figure b](image)
   c. ![Figure c](image)
   d. ![Figure d](image)

2. Find the circumference and area of the circle. Express it in terms of $\pi$.
   a. ![Figure a](image)
   b. ![Figure b](image)

3. Find the area of the figure:
   ![Figure](image)
4. Find the area of the shaded region:

![Diagram of a circle with a shaded region]

5. Look at the diagram to figure out the following questions:

![House diagram]

a. If construction costs $110 per square foot, find the cost of building the home.

b. If carpet costs $21.25 per square yard and is available in whole square yards only, find the cost of carpeting the three bedrooms and living room.

c. If ceramic tile costs $25.60 per square yard and is available in whole square yards only, find the cost of tiling the remainder of the home.

6. Taxpayers with an office in their home may deduct a percentage of their home-related expenses. This percentage is based on the ratio of the office’s area to the area of the home. A taxpayer with an office in a 3205-square-foot home maintains a 21 foot by 23 foot office. If the yearly electric bills for the home come to $7260, how much of this is deductible?
7. The lot in the figure shown below, except for the house, deck, driveway, and shed, is the lawn. Lawn Company A charges $.10 per square yard and Company B charges $0.01 a square foot to mow and fertilize the lawn. Which is the better deal and how much would it cost to mow and fertilize the lawn?

Student Pitfalls:
1. When figuring out the area, students have a hard time visualizing the different shapes within a figure.

Answers:
1. a) 40 m\(^2\); b) 7 in.\(^2\); c) 126 cm\(^2\); d) 30 km\(^2\)
2. a) \(6 \pi \) ft, \(9 \pi \) ft\(^2\), b) \(15 \pi \) in., \(56.25 \pi \) in\(^2\)
3. 678.43 ft\(^2\)
4. \(36 \pi \) cm\(^2\)
5. a) $178,200.00; b) $1,933.75; c) $2,304.00
6. $1094.10
7. Company A charges $858.06; Company B charges $772.25
Mini-Lesson 10.5
Volume

Learning Objectives:
1. Use volume formulas to compute the volumes of three-dimensional figures and solve applied problems.
2. Compute the surface area of a three-dimensional figure.

Examples:
1. Find the volume of the following solids:
   a. \[ \text{5 in.} \]
   \[ \text{14 in.} \]
   b. \[ \text{3 cm} \]
   \[ \text{18 cm} \]
   \[ \text{2 cm} \]
   c. \[ \text{10 cm} \]
   \[ \text{12 cm} \]
   \[ \text{20 cm} \]
   d. \[ \text{3 in.} \]
   \[ \text{14 in.} \]

2. A cylinder with radius 4 inches and height 8 inches has its radius doubled. How many times greater is the volume of the larger cylinder than the smaller cylinder?

3. A spherical premium balloon has a diameter of 9 inches. If a store charges $.01 per cubic inch of helium, determine the cost to fill up 10 premium balloons.

4. A rectangular pool has a length of 20 feet, width of 14 feet, and depth of 6 feet. If water costs $1.50 per thousand gallons, how much will it cost to fill the pool?

5. A machine produces open boxes using square sheets of metal measuring 20 inches on each side. The machine cuts equal-sized squares whose sides measure 3 inches from each corner. Then it shapes the metal into an open box by turning up the sides. Find the volume of the box.
**Student Pitfalls:**

1. When working on applications, students may not remember to convert measurements in different units to the correct unit.

2. When looking at a solid, students have a hard time picking out the base and whether it is a pyramid or prism.

**Answers:**

1. a) 350π in³; b) 108 cm³; c) 800 cm³; d) 4.5π yd³
2. The volume of the larger cylinder is 4 times the smaller
3. $38.17
4. $18.85
5. 588 in³
Mini-Lesson 10.6
Right Triangle Trigonometry

Learning Objectives:
1. Use the lengths of the sides of a right triangle to find trigonometric ratios.
2. Use trigonometric ratios to find missing parts of right triangles.
3. Use trigonometric ratios to solve applied problems.

Examples:
1. Use the given right triangles to find ratios, for \( \sin A, \cos A, \) and \( \tan A. \)

\[
\begin{align*}
a. \quad & \text{A} \quad \text{7 in.} \\
& \text{B} \quad \text{2 in.} \\
& \text{C} \quad \text{2 in.}
\end{align*}
\]

\[
\begin{align*}
b. \quad & \text{A} \quad \text{25 ft} \\
& \text{B} \quad \text{4 ft} \\
& \text{C}
\end{align*}
\]

2. Find the measure of the side of the right triangle whose length is designated by a lowercase letter.

\[
\begin{align*}
a. \quad & \text{A} \quad \text{4 ft} \\
& \text{B} \quad \text{30°} \\
& \text{C} \quad \text{b}
\end{align*}
\]

\[
\begin{align*}
b. \quad & \text{A} \quad \text{13 cm} \\
& \text{B} \quad \text{10°} \\
& \text{C} \quad \text{a}
\end{align*}
\]

3. Find the measures of the parts of the right triangle that are not given.

\[
\begin{align*}
a. \quad & \text{A} \quad \text{c} \quad \text{60°} \\
& \text{B} \quad \text{15 in.} \\
& \text{C} \quad \text{a}
\end{align*}
\]

\[
\begin{align*}
b. \quad & \text{A} \quad \text{30 m} \\
& \text{B} \quad \text{70°} \\
& \text{C} \quad \text{b}
\end{align*}
\]

4. Find the length \( x. \)
5. A helicopter hovers 750 feet above a small island. The angle of depression from the helicopter to the landing pad is 15°. How far away, to the nearest foot, is the small island to the landing pad?
6. From a point on level ground 50 yards from the base of a building, the angle of elevation to the top of the building is 54°. Approximate the height of the building to the nearest foot.

Student Pitfalls:
1. Students think \( \sin \) is a variable and will divide by it. So, if they have \( \frac{4}{\sin A} = \frac{4}{5} \), they will try to solve it like this: \( A = \frac{5}{\sin} \). What does this mean?
2. They also confuse the difference between angle of elevation and angle of depression.

Answers:
1. a) \( \sin A = \frac{7}{\sqrt{53}} \), \( \cos A = \frac{2}{\sqrt{53}} \), \( \tan A = \frac{7}{2} \); b) \( \sin A = \frac{4}{25} \), \( \cos A = \frac{\sqrt{609}}{25} \), \( \tan A = \frac{4}{\sqrt{609}} \)
2. a) 8 ft; b) 12.8 cm
3. a) \( a = 25.98 \) in, \( c = 30 \) in, \( \angle B = 30^\circ \); b) \( a = 10.92 \) m, \( b = 31.93 \) m; \( \angle A = 20^\circ \)
4. \( x = 50.43 \) in.
5. 2.799 ft.
6. 206 ft. or 207 if rounded up to for 0.45 ft
Mini-Lesson 10.7
Beyond Euclidean Geometry

Learning Objectives:
1. Gain an understanding of some of the general ideas of other kinds of geometries.

Examples:
1. Is the graph traversable? If it is, describe a path that will traverse it.

   a.  
   b.  
   c.  

2. Give the genus of the following objects:

   a.  
   b.  
   c.  
   d.  

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Student Pitfalls:
1. Seeing a cup with a hole at the top fools a lot of students into thinking that would be a true hole toward the genus.

Answers:
1. a) yes, AECBEDCDABA ; b) yes, FABCDEFBEC; c) Non transversable
2. a) 1; b) 2; c) 8; d) 0;