Section 1

1) Classify each statement as true or false, and explain your reasoning in each false case.
   a) Two planes intersect in only one point. **False—they intersect in a line, which has infinitely many points.**
   b) A ray starts at one point on a line and goes on forever. **True**
   c) The intersection of 2 planes is one line. **True**
   d) Any four points are collinear. **False—any two points are collinear**

2) Use the figure below for #6-14. Note that \( \overline{RN} \) pierces the plane at \( N \). It is not coplanar with \( V \).
   a) Name two segments shown in the figure. **Sample answer:** \( \overline{MN} \) and \( \overline{MX} \)
   b) What is the intersection of \( \overline{CM} \) and \( \overline{RN} \)? Point \( N \)
   c) Name three collinear points. **Sample answer:** Points \( A, N, \) and \( X \)
   d) What are two other ways to name plane \( V \)? **Sample answer:** \( \overline{ANC} \) and \( \overline{MNX} \)
   e) Are points \( R, N, M, \) and \( X \) coplanar? **No**
   f) Name two rays shown in the figure. **Sample answer:** \( \overline{AX} \) and \( \overline{NC} \)
   g) Name a pair of opposite rays with endpoint \( N \). **Sample answer:** \( \overline{NX} \) and \( \overline{NA} \)
   h) \( \overline{AN} \) is the same as \( \overline{NA} \). True or False? **True**, they are the same line. (But, \( \overline{AN} \) and \( \overline{NA} \) are NOT the same ray.)
   i) \( \overline{ANX} \) names a plane. True or False? **False**, you can't use 3 collinear points when naming a plane.

3) Below each figure write the name of the kind of rigid transformation shown.
   a. **Reflection**
   b. **Rotation**
   c. **Translation**
Section 2

Complete the following statements:

1) \( \angle ABC \) and \( \angle BCD \) are complementary. \( m\angle ABC = 6x^\circ \) and \( m\angle BCD = 12x^\circ \). Find \( x \).

\[
6x + 12x = 90
18x = 90
x = 5
\]

2) \( \angle ABC \) and \( \angle BCD \) are supplementary. \( m\angle ABC = 40x^\circ \) and \( m\angle BCD = 20^\circ \). Find \( x \).

\[
40x + 20 = 180
40x = 160
x = 4
\]

3) \( AB = 2x + 1 \), \( BC = 16 \) inches, \( AC = 5x - 4 \). Use the diagram to solve for \( x \):

\[
2x + 1 + 16 = 5x - 4
2x + 17 = 5x - 4
17 = 3x - 4
3x = 21
x = 7
\]

4) Solve for \( y \): \( m\angle DGE = 12y - 5 \), \( m\angle EGF = 24^\circ \), \( m\angle DGE = 5y + 6 \)

\[
5y + 6 + 24 = 12y - 5
5y + 30 = 12y - 5
35 = 7y
y = 5
\]

5) \( \overline{WS} \) bisects \( \angle BWV \). \( m\angle BWS = 32^\circ \). What is \( m\angle BWV \)?

\[
64^\circ
\]

6) Determine the value of \( x \):

a)

b)

\[
55^\circ + x + 74 \]

55 + 4 + x + 74 = 180
133 + x = 180
x = 47

7) Use the following steps to determine whether the given statement is a definition.

Linear pairs are supplementary, adjacent angles.

a) Conditional statement: If something is a linear pair, then it is a figure with supplementary and adjacent angles.

b) Converse: If two angles are supplementary and adjacent, then they are a linear pair.

c) Biconditional statement: Something is a linear pair if and only if it is a figure with supplementary adjacent angles.

d) Decide whether the statement is a definition. Explain your reasoning.

Yes, because both the conditional and its converse are true.
8) Write the conditional statement that corresponds to the Venn diagram below:

If someone is a pediatrician,
then they are a doctor.

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Section 3

1) For the following exercises, refer to the diagram below. Lines m and n are parallel. Name all angles congruent to the given angle and give the theorems or postulates that justify your answer.

a) \( \angle 6 \equiv \angle 7 \) (vertical angles theorem)
   \( \angle 2 \equiv \angle 5 \) (alt. int. \& \ alt. \ ext. \ thm.
   \( \angle 1 \equiv \angle 8 \) (corr. \ thm.)
   \( \angle 4 \equiv \angle 3 \) (corr. \ post.)

b) \( \angle 3 \equiv \angle 4 \) (alt. int. \& \ alt. \ ext. \ thm.
   \( \angle 1 \equiv \angle 8 \) (corr. \ thm.)

2) For the figure to the right m\( \angle \)BCD = 160 - 3\( x \)°, and m\( \angle \)CFH = 35°. What is \( x \)?
   
   What Theorem or Postulate supports your answer?

   
   Sample answers:
   
   - \( \angle \)BCA and \( \angle \)CFH are corresponding and therefore congruent.
   - \( \angle \)BCA and \( \angle \)BCD form a linear pair and are therefore supplementary.

3) For the figure to the right m\( \angle \)BCA = 68°, and m\( \angle \)CFH = 92 - 8\( x \)°. What value of \( x \) makes \( \overline{AD} \parallel \overline{EH} \)?
   
   What Theorem or Postulate supports your answer?

   \( 68 = 92 - 8x \)
   \( -24 = -8x \)
   \( x = 3 \)
4) Fill in the blanks so that the sentences are true.

a) The sum of angles in any quadrilateral is **360°**.

b) In a parallelogram diagonals **bisect each other** and opposite angles are **congruent**.

c) A **rhombus** and a **square** have perpendicular diagonals. (Kite too)

d) A **trapezoid** is a quadrilateral with only one pair of parallel sides.

e) A square is a quadrilateral with **four (all)** congruent sides and **four (all)** right angles.

f) A rhombus is a **parallelogram** with four **congruent** sides.

h) A **parallelogram** is a quadrilateral with 2 pairs of parallel sides.

i) Any four-sided polygon is a **quadrilateral**.

j) A rectangle is a quadrilateral with **4** right angles. (It also has 2 pairs of parallel sides, 2 pairs of congruent sides, and congruent, bisecting diagonals... but these are not part of the definition.)

5) Polygon DEFG is a parallelogram. GF = 3 in, DG = 2 in, m∠GDE = 110°

![Diagram of parallelogram DEFG]

a) m∠DGF = **70°**

b) m∠GFE = **110°**

c) **EF = 2 in**

d) **DE = 3 in**

6) MNOP is a rhombus. If m∠MNO = 88°, find each of the following:

a) m∠NOP = **92°**

b) m∠OPG = **44°** (in a rhombus, diagonals bisect the opposite angles)

c) m∠OGN = **90°** (in a rhombus, diagonals are ⊥)

7) Parallelogram RUST

![Diagram of parallelogram RUST]

m∠RUS = **58°**

m∠UST = **122°**

m∠STR = **58°**

m∠TRU = **122°**

RU = **30 cm**

US = **28 cm**

ST = **30 cm**

TR = **28 cm**

RS = **18 cm**

RQ = **9 cm**

QS = **9 cm**

TQ = about 28.6 cm

OU = about 28.6 cm

UT = **57.4 cm**

9 cm + 9 cm = 30² → TQ ≈ 28.6 cm
8) Polygon $ABCD$ is a rhombus. $AB = 4x + 2$ and $AD = 30$. What is $x$? Give a reason for your equation.

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

All sides of a rhombus are congruent.

9) Polygon $ABCD$ is a rectangle. $AC$ and $BD$ intersect to $E$. $AE = 12$ ft. What is $BD$?

If $AE = 12$, then $AC = 24$,
If $AC = 24$, then $BD = 24$ because in a rectangle, diagonals are always congruent.

10) Use trapezoid TRAP to the right to answer the following:

If $m \angle T = 60^\circ$ find the measures of the other angles.

$$m \angle R = 180^\circ$$
$$m \angle A = 120^\circ$$
$$m \angle P = 60^\circ$$

11) Find the following.

a) $NM = \frac {25}{G}$

b) $x = -4$

$$2(120) = 3x - 52x$$
$$240 = 3x - 52x$$
$$208 = -52x$$
$$x = -4$$

c) What is $\overline{NM}$ called? **Midsegment**

12) Find the **slope**, **midpoint**, and **length** of each of the following segments whose endpoints are given.

a) $(-1, 4)$ and $(4, 10)$

Slope: $\frac{4-10}{-1-4} = \frac{-6}{-5} = \frac{6}{5}$

Midpoint: $\left(\frac{-1 + 4}{2}, \frac{4 + 10}{2}\right) = \left(\frac{3}{2}, 7\right)$

Length: $\sqrt{(-1-4)^2 + (4-10)^2} = \sqrt{(-5)^2 + (-6)^2} = \sqrt{25 + 36} = \sqrt{61} \approx 7.81$

b) $(8, 0)$ and $(10, 6)$

Slope: $\frac{0-6}{8-10} = \frac{-6}{-2} = 3$

Midpoint: $\left(\frac{8+10}{2}, \frac{0+6}{2}\right) = \left(9, 3\right)$

Length: $\sqrt{(8-10)^2 + (0-6)^2} = \sqrt{(-2)^2 + (-6)^2} = \sqrt{4 + 36} = \sqrt{40} \approx 6.32$

13) Lines that are parallel have **same** slopes and lines that are perpendicular have **opposite reciprocal** slopes.
14) Triangle TRI has vertices T(5,6), R(5,1), and I(3,11). Use coordinate geometry to determine if triangle TRI is scalene, isosceles, or equilateral.

\[ \text{Do distance formula 3 times:} \]
\[ \sqrt{(15-5)^2 + (6-1)^2} = \sqrt{100 + 25} = \sqrt{125} \]
\[ \sqrt{(5-5)^2 + (1-11)^2} = \sqrt{100} \]
\[ \sqrt{(5-5)^2 + (6-11)^2} = \sqrt{125} \]

2 match so it's isosceles.

Section 4

1) Write a congruency statement for the following polygons. Why are they congruent?

\[ \text{ABCD} \cong \text{HEFG} \]
\[ \text{All sides are } \cong \]
\[ \text{and} \]
\[ \text{All corr. } \angle \text{s are } \cong \]

2) Determine whether each pair of triangles can be proven congruent by using the SSS, SAS, ASA or AAS congruence postulates. If so, identify what postulate is used.

a)

b) Cannot be proven (SAS is not a shortcut)

3) Determine whether each pair of triangle scans can be proven congruent by using the SSS, SAS, ASA, AAS or HL congruence postulates. If so, identify what postulate is used and write a congruency statement.

a)

b) \[ \Delta \text{ABC} \cong \Delta \text{DEF} \]

\[ \text{by AAS} \]

\[ \text{by HL} \]

\[ \text{by HL} \]

\[ \text{by SSS} \]

\[ \Delta \text{ABC} \cong \Delta \text{DEF} \]
4) Label and state what additional information is required in order to know that the triangles are congruent for the reason given.

a) ASA \( \angle DUT \cong \angle SUT \)

b) ASA \( \angle L \cong \angle T \)

c) SAS \( \overline{UV} \cong \overline{MV} \)

5) Determine whether or not the triangles below are similar (you may need to do a little work to figure it out) by AA, SSS, or SAS, or none of them. If they are similar, complete the similarity statement.

a) \( \triangle ABC \sim \triangle DEF \)

b) \( \triangle ABC \sim \triangle DEF \)

c) \( \triangle CBA \sim \triangle FGH \)

d) \( \triangle LVM \sim \triangle UVT \)

6) Determine whether the polygons are similar, not similar, or not enough information given. If they are similar, determine the scale factor comparing the first to second figure.

a) Yes, similar. Scale factor: \( \frac{3}{4} \)

b) \( \frac{10}{3} \)

c) Not enough info.

7) The following polygons are similar; find \( x \) and \( y \).

a) \( 5x + y = 180 \)

b) \( \frac{5x}{5} = \frac{10}{3} \)

\( 5x = 10x - 3 \)

\( 5x = 10 \)

\( x = 2 \)

\( y = 75 \)

\( y = 15 \)
8) \( \triangle AFN \sim \triangle DPG \), \( AF = 2 \text{ cm} \), \( FN = 3 \text{ cm} \), \( DG = 10 \text{ cm} \), and \( PD = 8 \text{ cm} \). Find \( AN \). If \( \text{m} \angle A = 36^\circ \), what is \( \text{m} \angle D \)?

\[
\frac{2}{x} = \frac{x}{10} \\
x = \frac{2}{10} \times 10 \\
x = 2 \times \frac{2}{10} \\
x = 0.4 \times \frac{2}{10} \\
x = 0.8 \\
x = 3.5
\]

9) Use the following image to explain why the two triangles are similar, then estimate the length of the lake.

They're similar because the segments are parallel, creating congruent corresponding angles. Also, both have the third angle, so that angle is congruent to itself. However the shortcut AA only requires 2 pairs of angles to be congruent.

10) Solve for \( x \).

\[ \frac{5}{x} = \frac{15}{18} \rightarrow \frac{5x}{18} = 90 \rightarrow x = 36 \]

11) Use the diagram to find the height of each building.

\[ \frac{40}{30} = \frac{36}{x} \rightarrow \frac{40x}{30} = \frac{36}{x} \rightarrow x = 63 \text{ ft} \]

Section 5

1) For #1-3 two lengths of the right triangle are given. Find the missing length.

a) \( a = 13 \)
   \[ 13^2 + b^2 = 14^2 \]
   \[ 169 + b^2 = 196 \rightarrow b = 27 \rightarrow b = 5.20 \]

b) \( a = 12 \)
   \[ 12^2 + 16^2 = c^2 \]
   \[ \text{c} = 20 \]

c) \( a = 7 \)
   \[ a^2 + 7^2 = 13^2 \]
   \[ \text{c} = 13 \]
2) A triangle has side lengths given below. Determine what type of triangle each set is (acute, obtuse, or right). Show work to support your answer.

a. 24, 40, and 32
   \[40^2 = 24^2 + 32^2\]
   \[1600 = 576 + 1024\]
   \[1600 = 1600\] (right)

b. 30, 24, and 19
   \[30^2 = 24^2 + 19^2\]
   \[900 = 576 + 361\]
   \[900 < 937\] (acute)

c. 6, 14, and 11
   \[14^2 = 6^2 + 11^2\]
   \[196 = 36 + 121\]
   \[196 > 15.7\] (obtuse)

3) Find the missing side lengths. Leave your answers in radical form.

<table>
<thead>
<tr>
<th>Diagram</th>
<th>Side Length</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td>[9]</td>
</tr>
<tr>
<td><img src="image2.png" alt="Diagram" /></td>
<td>[10]</td>
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<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td>[\sqrt{2}]</td>
</tr>
<tr>
<td><img src="image4.png" alt="Diagram" /></td>
<td>[14]</td>
</tr>
</tbody>
</table>

4) For the following, \(\triangle PQR\), \(m \angle PQR = 90^\circ\), \(PQ = 6\), \(m \angle QPS = 60^\circ\), and \(PR = 12\).

a) Find \(QR = \frac{6 \sqrt{3}}{2} \approx 10.39\)

b) Find \(QS = \frac{3 \sqrt{3}}{2} \approx 5.20\)

c) Find \(SR = 9\)

d) Find the area of \(\triangle PQR = \frac{bh}{2} = \frac{18 \cdot 3 \sqrt{3}}{2} = 27 \sqrt{3} \text{ units}^2 \approx 31.18 \text{ units}^2\)

5) Find the area of each figure. Round your answers to the nearest tenth.

a) \(\text{Area} = \frac{4 \cdot 4}{2} = 8 \text{ m}^2\)

b) \(3.5^2 + h^2 = 7^2\)

   - \(h = \sqrt{36.75} \approx 6.06\)

   - \(\text{Area} = \frac{3.5 \cdot (\sqrt{36.75})}{2} = 10.61 \text{ ft}^2\)
6) Find the area of the following figures.

a) \[ \frac{20.8}{2} = 10.4 \text{ ft}^2 \]

b) \[ 8 \text{ mm} \times 20 \text{ mm} = 160 \text{ mm}^2 \]

c) \[ 8 \text{ mi} \times 12 \text{ mi} = 96 \text{ mi}^2 \]

d) \[ 6.8 \times 5 \times 8 = 272 \text{ in}^2 \]

e) \[ 9 \text{ m} \times 5 = 45 \text{ m}^2 \]

7) Find the circumference AND area of each figure. Leave your answer in terms of \( \pi \).

a) \[ r = 8 \text{ mm} \]
\[ C = 2\pi r = 16\pi \text{ mm} \]
\[ A = \pi r^2 = 64\pi \text{ mm}^2 \]

b) \[ d = 26 \text{ cm} \]
\[ r = \frac{d}{2} = 13 \text{ cm} \]
\[ C = \pi d = 26\pi \text{ cm} \]
\[ A = \frac{1}{4} \pi d^2 = 26\pi \text{ cm}^2 \]

c) \[ r = \frac{26}{2} = 13 \text{ ft} \]
\[ C = 2\pi r = 26\pi \text{ ft} \]
\[ A = \pi r^2 = 169\pi \text{ ft}^2 \]

8) Round your answers to \( \frac{1}{100} \) to the nearest hundredth.

\[ C = 50.21 \text{ mm} \]
\[ A = 201.06 \text{ mm}^2 \]

9) Find the radius of each circle from the given information. Round to the nearest tenth if necessary.

a) \[ \text{Area} = 256\pi \text{ in}^2 \]
\[ \pi r^2 = 256\pi \]
\[ r^2 = 256 \]
\[ r = 16 \text{ in} \]

b) \[ \text{Circumference} = 120 \text{ ft} \]
\[ 2\pi r = 120 \]
\[ r = 19.1 \text{ ft} \]

10) If the area of a parallelogram is 100 cm\(^2\) and the length of the base is 25 cm, what is the height?
\[ A = bh \rightarrow 25h = 100 \]
\[ h = 4 \text{ cm} \]

11) If the area of a parallelogram is 45 ft\(^2\) and the height is 3 ft, what is the length of the base?
\[ A = bh \rightarrow 45 = b(3) \]
\[ b = 15 \text{ ft} \]

12) If the area of a trapezoid is 250 in\(^2\), the lengths of the bases are 23 in and 27 in, what is the height?
\[ A = \frac{1}{2}h(b_1 + b_2) \rightarrow 250 = \frac{1}{2}h(23 + 27) \]
\[ 250 = \frac{1}{2}h(50) \]
\[ 250 = 25h \]
\[ h = 10 \text{ in} \]
13) If the area of a triangle is 343 $u^2$ and the height is 14 $u$, what is the length of the base?

$$A = \frac{1}{2}bh \Rightarrow 343 = \frac{1}{2}b(14)$$

$$2b = 343 \Rightarrow b = 49 \, u$$

14) Find the area of the shaded region.

$$300 - 200\pi = 176.8 \, u^2$$

15) Find the area of the composite figures below.

a)

$$24 + 2\pi \approx 30.28 \, cm^2$$

b)

$$30 + \frac{1}{2}(6)(3) = 39 \, cm^2$$

Section 6

1) For the following, refer to the solid below.

a) Name the solid. **Triangular prism**

b) Name a pair of parallel planes. $\overline{AB}$ and $\overline{EF}$

c) Name two segments skew to $\overline{BF}$. $\overline{AC}$ and $\overline{ED}$

d) Name two segments $\perp$ to plane BFD. $\overline{AC}$ and $\overline{ED}$

e) What is the volume of the solid if $BC = 4$, $AC = 3$, and $DC = 2$.

$$V = \left(\frac{1}{2} \times 3 \times 4\right) \times 2 \approx 12 \, u^3$$

2) What is the slant height of a right cone with a radius of 8 in. and a height of 14 in. $\sqrt{8^2 + 14^2} = \sqrt{260} \approx 16.12 \, inches$
Find the Surface Area and Volume of each right prism. Round to the hundredth if necessary.

3) Find the Surface Area, Lateral Area, and Volume for the following solids. Give an exact answer.

a. \[ A = 4 \times 3 \times 2 = 24 \text{ cm}^2 \]
\[ V = 2 \times 3 \times 2 = 12 \text{ cm}^3 \]

b. \[ A = 6 \times 4 + 2 \times 3 \times 4 = 48 \text{ cm}^2 \]
\[ V = 3 \times 4 \times 2 = 24 \text{ cm}^3 \]

c. \[ BC = 12, \ CH = 5, \ apothem = 6.2 \]
\[ SA = 5 \times (2 \times 5) + 2 \times (5 \times 5) = 67.2 \text{ cm}^2 \]
\[ LA = 300 \text{ cm}^2 \]
\[ V = 930 \text{ cm}^3 \]

d. \[ V = \frac{4\pi \times 5^2}{3} \text{ cm}^3 \]
\[ V = \frac{4\pi \times 6^2}{3} \text{ cm}^3 \]

(continued)

\[ V = \frac{4\pi \times r^2}{3} \text{ cm}^3 \]
\[ V = \frac{4\pi \times r^2}{3} \text{ cm}^3 \]

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4) The surface area of a square pyramid is given by $540 \text{ cm}^2$ and the side of the square is $10 \text{ cm}$. Find the slant height of the square pyramid.

$S_A = \frac{1}{2}Pl + B \rightarrow 540 = \frac{1}{2} \cdot 4 \cdot 10 \cdot h + 10^2$

$S_A = \frac{200 + 100}{2} = 150 \text{ cm}$

5) The volume of a cylinder is $960 \pi \text{ cubic inches}$. The height of the cylinder is $15 \text{ inches}$. Find the radius.

$V = \pi r^2 h \rightarrow 960 \pi = \pi r^2 \cdot 15 \rightarrow \frac{960 \pi}{15} = r^2 \pi \rightarrow r^2 = 64 \text{ in}^2 \rightarrow r = 8 \text{ in}$

6) If a cylinder has surface area of $128 \pi \text{ sq ft}$, and the height of the cylinder is $12 \text{ feet}$, find the radius and the volume.

$128 \pi = 2\pi r^2 + 2\pi r h$ \rightarrow $64 = r^2 + 6r$ \rightarrow $r^2 + 6r - 64 = 0$ \rightarrow $(r - 8)(r + 8) = 0$ \rightarrow $r = 8$ \text{ ft}

$V = \pi r^2 h = \pi \cdot 8^2 \cdot 12 = 768 \pi \text{ ft}^3$

7) The volume of a spherical ball is $5,000 \pi \text{ cm}^3$. What is the radius of the ball?

$V = \frac{4}{3} \pi r^3 \rightarrow 5000 \pi = \frac{4}{3} \pi r^3 \rightarrow 15000 = 4r^3 \rightarrow \frac{15000}{4} = r^3 \rightarrow r^3 = 3750 \rightarrow r = \sqrt[3]{3750} \approx 15.54 \text{ cm}$

**Section 7**

1) Find the degree measures of each arc or angle by using the central angle measures given.

- a) $m\widehat{AC} = 154^\circ$
- b) $m\widehat{FA} = 86^\circ$
- c) $m\widehat{CBF} = 240^\circ$
- d) $m\widehat{DB} = 170^\circ$
- e) $m\widehat{ADC} = 206^\circ$
- f) $m\widehat{DCA} = 240^\circ$
- g) $m\widehat{DMC} = 86^\circ$

2) Determine arc with length $L$ of a circle with radius $8.5 \text{ in}$ and degree measure $240^\circ$.

$\frac{240}{360} = \frac{L}{2\pi r} \rightarrow \frac{240}{360} = \frac{L}{2\pi \cdot 8.5} \rightarrow 360L = 240 \cdot 2\pi \cdot 8.5 \rightarrow \frac{360L}{360} = \frac{240 \cdot 2\pi \cdot 8.5}{360} \rightarrow L \approx 11.5 \pi \text{ in} \approx 35.6 \text{ in}$

3) Each polygon circumscribes a circle. What is the perimeter of each polygon?

a.

$16 + 16 + 2 + 2 + 15 + 15 + 3 + 3 \approx 72 \text{ in}$

b.

$9 + 9 + 15 + 15 + 2 + 2 + 22 \approx 96 \text{ cm}$

c.

$12 + 12 + 19 + 19 + 39 + 39 \approx 140 \text{ ft}$
4) Using circle \( O \) below, name the following:
   a. Diameter \( \overline{AB} \)
   b. Central Angle Sample answer: \( \angle FDE \)
   c. Minor Arc Sample answer: \( \widehat{AB} \)
   d. Major Arc Sample answer: \( \widehat{FLA} \)
   e. Semicircle Sample answer: \( \widehat{BD} \)
   f. Radius Sample answer: \( \overline{OF} \)
   g. Tangent \( \overline{OF} \)
   h. Point of Tangency \( P \)

5) For the following, in \( \odot M \), \( \overline{AC} \) is the diameter, \( \overline{DC} \) is tangent to the circle at point \( C \), and \( m\overline{BC} = 78^\circ \).
   a) \( m\angle BAC \) \( 39^\circ \)
   b) \( m\angle BEC \) \( 39^\circ \)
   c) \( m\overline{AB} \) \( 102^\circ \)
   d) \( m\angle ACB \) \( 51^\circ \)
   e) \( m\angle ABC \) \( 90^\circ \)
   f) \( m\angle ACD \) \( 90^\circ \)
   g) \( \overline{AB} \) is a minor arc, \( \widehat{CEB} \) is a major arc
   h) \( \overline{AB} \) is a radius, \( \overline{AC} \) is a diameter
   i) \( \overline{CD} \) is a tangent line

Find the measure of the arc or angle in \( \odot M \).
7. \( m\angle QMP \) \( 40^\circ \)
8. \( m\angle NMO \) \( 110^\circ \)
9. \( m\angle PNO \) \( 35^\circ \)
10. \( m\angle QNP \) \( 30^\circ \)
11. \( m\angle QO \) \( 180^\circ \)
12. \( m\angle NOP \) \( 180^\circ \)
13. \( m\angle PO \) \( 15^\circ \)
14. \( m\angle OQN \) \( 25^\circ \)

15) What is the value of \( x \)? Lines that appear to be tangent are tangent. Round to the nearest hundredth if necessary.
   a) \( (n-2)180 = \text{sum of interior} \)
   \( 4x = 360 \)
   \( 90 \), \( x+90+90+60 = 360 \)
   \( x = 140^\circ \)
   b) \( 90+70+x = 180 \)
   \( x = 20^\circ \)
   c) \( x^2+4= (x+6)^2 \)
   \( x^2+81 = x^2+12x+36 \)
   \( 81 = 12x+36 \)
   \( 45 = 12x \)
   \( x = 45 \)
   d) \( 9x+40 = (x+4)^2 \)
   \( 40 = 2x+16 \)
   \( 24 = 2x \)
   \( x = 12 \)
16) Write the equation for the circle with center $(2, 4)$ and radius $= 7$ in
\[(x-2)^2 + (y-4)^2 = 49\]

17) Write the equation for the circle with center $(-3, 1)$ and diameter $= 18$ in
\[(x+3)^2 + (y-1)^2 = 81\]  \(\text{Remember: if } d=18, \text{ then } r=9\)

18) Find the center and radius of the circle: $(x-7)^2 + (y+12)^2 = 144$
Center: $(7, -12)$, radius: 12

19) Find the center and radius of the circle: $(x + 5)^2 + (y + 8)^2 = 225$
Center: $(-5, -8)$, radius: 15

20) Graph the circle on the coordinate plane.

a. $(x + 2)^2 + (y - 4)^2 = 16$

b. $(x - 7)^2 + (y - 8)^2 = 1$

c. $(x - 2)^2 + (y + 3)^2 = 36$

---

Find the center and radius of the following equations by completing the square:

\[y^2 + 4x - 20 - 2y = -x^2\]
\[2x^2 + 4x + y^2 - 2y = 20 = 0\]
\[x^2 + 4x + 4 + y^2 - 2y + 1 = 20 + 4 + 1\]
\[(x+2)^2 + (y-1)^2 = 25, \quad \text{Center: } (-2, 1), \quad \text{Radius: } 5\]

\[16 + x^2 + y^2 - 8x - 6y = 0\]
\[x^2 - 8x + y^2 - 6y = -16\]
\[x^2 - 8x + 16 + y^2 - 6y + 9 = -16 + 16 + 9\]
\[(x-4)^2 + (y-3)^2 = 9, \quad \text{Center: } (4, 3), \quad \text{Radius: } 3\]
Section 8

1) Using the triangles below, determine the trigonometric ratio. Leave your answers as simplified fractions.
   a) $\tan B = \frac{3}{3\sqrt{10}}$  
   b) $\cos A = \frac{\sqrt{5}}{2}$  
   c) $\sin F = \frac{\sqrt{29}}{5}$  
   d) $\tan G = \frac{\sqrt{29}}{5}$

2) Find the marked side of each of the following triangles.
   a) $\cos 56^\circ \approx 0.56$  
   b) $\cos 30^\circ = \frac{\sqrt{3}}{2}$

3) Find the value for each of the marked angles.
   a) $\tan^{-1} 3.6 \approx 70^\circ$  
   b) $\cos^{-1} 0.56 \approx 54^\circ$

4) A skateboarding ramp is 12 in. high and rises at an angle of 17°. How long is the base of the ramp? Round your answer to the nearest inch.
   $\frac{\tan 17^\circ}{x} = \frac{12}{x}$

5) Joey is walking home from the library. He can walk for 1 mile along the street, then turn right and walk 1.5 miles along another street; or he can cut across a large field straight to his house. At what angle, $\theta$, should he head off from the library, and how far, $d$, should he cut across the field?
   $\theta = \text{about 56}^\circ = \tan^{-1} (\frac{5}{7})$
   $d = \text{about 1.79 m}$
Proofs

1) Given: \( \angle B \) and \( \angle D \) are right angles, \( AB \equiv CD \)

Prove: \( \triangle DAC \equiv \triangle BCA \)

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \angle B ) and ( \angle D ) are right angles, ( AB \equiv CD )</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. ( \angle B \equiv \angle D )</td>
<td>3. All right angles are congruent</td>
</tr>
<tr>
<td>3. ( AC \equiv CA )</td>
<td>4. Reflexive Property of Congruence</td>
</tr>
<tr>
<td>4. ( \triangle ABC \equiv \triangle CDA )</td>
<td>5. HL</td>
</tr>
<tr>
<td>5. ( \angle DAC \equiv \angle BCA )</td>
<td>5. CPCTC</td>
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Given: \( AC \equiv EC, BC \equiv DC \)

Prove: \( \triangle CBA \equiv \triangle CDE \)

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<td>1. ( AC \equiv EC; BC \equiv DC )</td>
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</tr>
<tr>
<td>2. ( \angle ACB ) and ( \angle ECD ) are vertical angles</td>
<td>2. Definition of Vertical Angles</td>
</tr>
<tr>
<td>3. ( \angle ACB \equiv \angle ECD )</td>
<td>3. Vertical Angles Theorem</td>
</tr>
<tr>
<td>4. ( \triangle CBA \equiv \triangle CDE )</td>
<td>4. SAS</td>
</tr>
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<td>5. ( \triangle CBA \equiv \triangle CDE )</td>
<td>5. CPCTC</td>
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Given: \( Q \) is the midpoint of \( PR \), \( P \equiv Q \)

Prove: \( \triangle SQP \equiv \triangle TQR \)

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<td>1. ( Q ) is the midpoint of ( PR ); ( \angle PQ \equiv \angle QRT )</td>
<td>1. Given</td>
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<tr>
<td>2. ( PQ \equiv QR )</td>
<td>2. Definition of midpoint</td>
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