Unit 1: Foundations of Geometry

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<td>Point</td>
<td>a location</td>
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<tr>
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<tr>
<td>Collinear Points</td>
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</tr>
<tr>
<td>Plane</td>
<td></td>
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</tr>
<tr>
<td>Coplanar</td>
<td>an accepted statement of fact</td>
<td></td>
</tr>
</tbody>
</table>

**Postulate 1-1**
Through any two points there is \( \overrightarrow{AB} \).

Line \( \overrightarrow{t} \) is the only line that passes through points \( A \) and \( B \).

**Postulate 1-2**
If two lines intersect, then they intersect in \( \overrightarrow{AE} \) and \( \overrightarrow{BD} \) intersect at \( E \).

**Postulate 1-3**
If two planes intersect, then they intersect in \( \overrightarrow{RST} \) and plane \( STW \) intersect in \( T \).

**Postulate 1-4**
Through any three noncollinear points there is \( \overrightarrow{RST} \).
NAMING A PLANE

Name a plane using at least three noncollinear points in the plane.

- Name the front plane 3 ways: plane _____, plane _____, plane _____
- Name the right plane 3 ways: plane _____, plane _____, plane _____

FINDING THE INTERSECTION OF TWO PLANES

The intersection of two planes is a line

- The back face and left faces of the cube intersect at _______.
- Planes ABF and BCG intersect vertically at _______.
- Planes HGC and AED intersect vertically at _______.

TRY IT!

1. Are points W, Y, and X collinear?    _________

2. Name line m in three different ways: _____, _____, _____

3. List three different names for plane Z: _____, _____, _____

4. Name two planes that intersect in BF: Planes _______ and _______

5. Shade plane VWX.

6. Name a point that is coplanar with points V, W, and X.
POINTS, LINES, & PLANES

1. What are two other ways to name \( \overrightarrow{QT} \)?

2. What are two other ways to name plane \( P \)?

3. What are the names of three collinear points?

4. What are the names of four coplanar points?

TRY IT!

1. What are two other ways to name \( \overrightarrow{RS} \)?

2. What are two more ways to name plane \( P \)?

3. What are the names of three other collinear points?

4. What are two points that are NOT coplanar points with \( R, S, \) and \( V \)?

SEGMENTS, RAYS, AND OPPOSITE RAYS

1. What are the names of the segments in the figure below?

2. What are the names of the rays in the figure below?

3. Which of the rays in question 2 are opposite rays?

TRY IT!

1. Do the names \( \overline{DE} \) and \( \overline{ED} \) represent different segments? Explain.

2. Can the three points shown be used to name a plane? Explain.

3. How are segments \( \overline{DE}, \overline{EF}, \) and \( \overline{DF} \) related to each other?
POSTULATE/AXIOMS

accepted statements of facts that are used as the basic building blocks of geometric logic.

Postulate 1-1
Through any two points there is ____________________________________________________________________

[Image 425x222 to 523x325]

Line \( t \) is the only line that passes through points \( A \) and \( \square \).

Postulate 1-2
If two lines intersect, then they intersect in ____________________________________________________________________

[Image 36x349 to 557x687]

\( \overrightarrow{AE} \) and \( \overrightarrow{BD} \) intersect at \( \square \).

Postulate 1-3
If two planes intersect, then they intersect in ____________________________________________________________________

[Image 442x54 to 540x157]

Plane \( RST \) and plane \( STW \) intersect in \( \square \).

Postulate 1-4
Through any three noncollinear points there is ____________________________________________________________________

FINDING THE INTERSECTION OF TWO PLANES

The intersection of two planes is a line.

1. What is the intersection of plane \( EHG \) and \( FBC \)?

2. What are the names of two planes that intersect at \( \overrightarrow{BF} \)?

3. Why do you only need to find two common points to name the intersection of two planes?

TRY IT!

6. What is another name for plane \( EHG \)? Plane \( FBC \)?

7. Why is \( F\overline{G} \) not a correct way to represent the intersection of the two planes?

8. Is it possible for a third plane to intersect in \( \overline{FG} \)? Explain.

9. What are two planes that do not share any points in common?
MORE ON PLANES


2. What plane contains points $L, M,$ and $Q$? Shade the plane.

3. What is the name of a line that is coplanar with $\overrightarrow{JK}$ and $\overrightarrow{KL}$?

TRY IT!

1. What other point is in the same plane as $N, P,$ and $Q$?

2. What other point is in the same plane as points $J, M,$ and $Q$?

3. What lines contain two of the four points: $J, K, L,$ and $M$?

4. What is the intersection of plane $JMQP$ and $JKLM$? Do you need a diagram to answer the question?
Define the following terms in your own words:

Colinear:

Coplanar:
Lesson 1 Review

1. Name each of the following items in both words and symbols:

   (i) \( \overline{PQ} \)

   (ii) \( O \)

   (iii) \( \overline{RS} \)

   (iv) \( \overline{AB} \)

   (v) \( \triangle ABC \)

PRACTICE

Decide whether the statement is true (T) or false (F)

1. Points A, B and C are collinear.
2. Points A, B and C are coplanar.
3. Point F lies on DE.
4. DE lies on plane DEF.
5. BD and DE intersect.
6. BD is the intersection of plane ABC and plane DEF.

PRACTICE

Name a point that is coplanar with the given points

1. A, B, and C
2. D, C, and F
3. G, A, and D
4. E, F, and G
5. A, B and H
2. Highlight in different colors each set of opposite rays. Using correct notation, write each pair of opposite rays.

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<thead>
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<th>a.</th>
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<tbody>
<tr>
<td>A</td>
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<td>B</td>
<td>C</td>
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<tr>
<td>D</td>
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<tr>
<td>E</td>
<td>F</td>
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<tr>
<th>c.</th>
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<tbody>
<tr>
<td>G</td>
<td>H</td>
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</table>

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<tr>
<th>d.</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>J</td>
<td>K</td>
</tr>
<tr>
<td>K</td>
<td>L</td>
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</tbody>
</table>

7. Answer the following questions based on the diagram:

a) What point is coplanar to plane \( WQX \)?

b) What point is collinear to point \( Z \)?

c) What two planes intersect at \( RS \)?

d) The planes \( XYT \) and \( QRS \) intersect at which line?

e) What is a point that is not coplanar to plane \( QRS \)?

f) Where do lines \( WZ \) and \( YW \) intersect?
Refer to the Figure for questions 1 - 5.

1. Name a line that is not contained in plane $\mathcal{N}$. (2 pt)

2. Name two different ways to name a plane that contains point B. (2 pt)

3. Name three collinear points. (2 pt)

4. Name two lines that intersect and the point where they intersect. (3 pt)

5. Name a set of opposite rays. (2 pt)

---

Refer to the Figure for questions 6 - 11.

6. Name ALL the planes. (6 pt)

7. Name three collinear points. (2 pt)


9. What is another way to name Plane $\mathcal{A}$? (2 pt)

10. Where do $\overline{QR}$ and $\overline{SR}$ intersect? (2 pt)

11. Name two lines or segments and their intersections (other than question 10). (3 pt)

---

For questions 12-17, determine whether each statement is always, sometimes, or never true. (2 pt)

12. $\overline{PQ}$ and $\overline{QD}$ are the same line.
13. $\overrightarrow{KR}$ and $\overrightarrow{LJ}$ are the same ray.
14. Intersecting lines are coplanar.
15. Four points are coplanar.
16. A plane containing two points of a line contains the entire line.
17. Two distinct lines intersect in more than one point.
Intro to Solving Equations - Review

Solve each equation.

1) \( r + 11 = 3 \)  
2) \( n - 20 = -5 \)

3) \( \frac{p}{5} = \frac{-3}{5} \)  
4) \( -4p = 8 \)

5) \( -5r - 2 + 3r = -6 \)  
6) \( 4 = v - 4 + 7v \)

7) \( -12 + 3v = 8v - 2 \)  
8) \( 5 - 7(4r + 3) = 152 \)
Solve each equation.

1) \(-6 = x - 7\)

2) \(-13 = 2 - b\)

3) \(-9 = \frac{b}{16}\)

4) \(-18 + k = -11\)

5) \(11r = -99\)

6) \(17 = \frac{x}{10}\)
9) \(-8k - 4k = -12\)  

10) \(6n - 1 + n = -1\)  

11) \(-11 = 5n - 8 - 6n\)  

12) \(6 = 8 + 8n - 2\)  

13) \(-24 = -5x - x\)  

14) \(0 = 5n - 8 - n\)
POSTULATE 1-5: Ruler Postulate

\[ AB = |a - b| \]

MEASURING SEGMENT LENGTHS

\[ ST = \]

TRY IT! Use the number line above.

Find \( UV \)   Find \( SV \)

POSTULATE 1-6: Segment Addition Postulate

If three points \( A, B, \) and \( C \) are collinear and \( B \) is between \( A \) and \( C \), then \( AB + BC = AC \).

If \( EG = 59 \), what are \( EF \) and \( FG \)?

TRY IT!

In the diagram, \( JL = 120 \). What are \( JK \) and \( KL \)?
CONGRUENT SEGMENTS

- **Congruent Segments** (\(\cong\)): two _______________ with the same ______________.

Are \(\overline{AC}\) and \(\overline{BD}\) congruent?

TRY IT!
Use the diagram above. Is \(\overline{AB}\) congruent to \(\overline{DE}\)?

USING MIDPOINTS

- **Midpoint**: a _______________ that divides a segment into _______ congruent segments.

- **Segment bisector**: a point, ____________, ray, or _______________ that ______________ a segment at its midpoint.

Algebra  \(Q\) is the midpoint of \(\overline{PR}\).
What are \(PQ, QR, \) and \(PR\)?

**Step 1**

**Step 2**

**Step 3**
1. Name two opposite rays (1 point):

![Diagram of a line with points D, E, and F]

2. Why can’t we name this plane DEF? (1 point):

![Diagram of a plane with points D, E, and F]

3. Name each of the following items in both how you read it *in words* and how you notate it *in symbols* (5 points):

<table>
<thead>
<tr>
<th>How you read it:</th>
<th>How you notate it:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>(i)</td>
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<td>(ii)</td>
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<td>(iii)</td>
<td>(iii)</td>
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<td>(iv)</td>
<td>(iv)</td>
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<tr>
<td>(v)</td>
<td>(v)</td>
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</tbody>
</table>

4. Solve each equation (4 and 6-1 point each, 5- 2 points):

4. $3x = 6$

5. $2x - 2 = 8$

6. $x - 6 = 10$
Use the number line to find each segment length (1 point each):

7. \( BC = \)_____
8. \( AD = \)_____

9. Suppose \( EG = 40\), what are \( EF \) and \( FG\)? (3 points)

10. Point \( Q \) is the midpoint of \( PR \). What are \( PQ, QR \) and \( PR\)? (4 points)
1. Use the figure to write the segment addition postulate, write an equation and solve for $x$. Then find, $AB$, $BC$, and $AC$.
   a. 
   ![Diagram](image)

2. Using the diagram, find each value indicated.
   a. 
   
   
   
   
   
   
   TU = 2x, UB = 3x + 1, TB = 21
   
   
   
   
   
   
   $x =$ _______  
   
   
   
   
   
   
   TU = _______  
   
   
   
   
   
   
   UB = _______  
   
   
   
   
   
   
   TB = _______  
   
   
   b. 
   
   
   
   
   
   
   TU = 4x - 1, UB = 2x - 1, TB = 5x
   
   
   
   
   
   
   $x =$ _______  
   
   
   
   
   
   
   TU = _______  
   
   
   
   
   
   
   UB = _______  
   
   
   
   
   
   
   TB = _______
3. \( O \) is the midpoint of segment \( FG \). Using the picture to the right, write an equation and solve. Find the length of each segment.

a. \( FO = 3x + 17, \ OG = 7x - 15 \)

\[
x = \underline{\hspace{2cm}}
\]
\[
FO = \underline{\hspace{2cm}}
\]
\[
OG = \underline{\hspace{2cm}}
\]
\[
FG = \underline{\hspace{2cm}}
\]

b. \( FO = x + 10, \ FG = 3x + 10 \)

\[
x = \underline{\hspace{2cm}}
\]
\[
FO = \underline{\hspace{2cm}}
\]
\[
OG = \underline{\hspace{2cm}}
\]
\[
FG = \underline{\hspace{2cm}}
\]
<table>
<thead>
<tr>
<th>Symbol/Picture</th>
<th>Definition</th>
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</table>

### Naming Angles

There are 3 ways to name angles. The name can be:

1. The **number** between the sides of the angle: __________
2. The **vertex** of the angle: __________
3. A point, the vertex, and a point: __________ or __________

### Measuring & Classifying Angles

Find the measure of each $\angle AOC$. Classify each angle as **acute**, **right**, **obtuse**, or **straight**.

a. 

b. 
Use the diagram below. Complete each statement.

18. \( \angle CBJ \equiv \square \)

19. \( \angle FJH \equiv \square \)

20. If \( m\angle EFD = 75 \), then \( m\angle JAB = \square \).

21. If \( m\angle GHF = 130 \), then \( m\angle JBC = \square \).

**Postulate 1-8  Angle Addition Postulate**

If point \( B \) is in the interior of \( \angle AOC \), then \( m\angle AOB + m\angle BOC = m\angle AOC \).

**ANGLE ADDITION POSTULATE**

If \( m\angle RQT = 155 \), what are \( m\angle RQS \) and \( m\angle TQS \)?

\( \angle DEF \) is a straight angle. What are \( m\angle DEC \) and \( m\angle CEF \)?
Lesson 3 Review - Determining Angles with Protractors

Find the measure of each angle in degrees.

\[ \angle \text{CAB} \quad \angle \text{DAB} \quad \angle \text{EAB} \quad \angle \text{CAF} \quad \angle \text{DAF} \quad \angle \text{EIF} \]
Find the missing angle measurement using the angle addition postulate.

1) \angle LMO = ******
\angle LOM = 46°
\angle LMN = 100°

2) \angle LDEG = 76°
\angle LGEF = ******
\angle LDEF = 135°
\angle LDEF = 115°

3) \angle LPQ = ******
\angle SQ = ******
\angle SQ = ******
\angle SQ = ******

4) \angle RST = ******
\angle UST = 56°
\angle RST = 110°

5) \angle QRT = 95°
\angle TRS = ******
\angle QRS = 120°
\angle QRS = ******

6) \angle MNP = 48°
\angle PNO = 57°
\angle MNP = ******
\angle MNP = ******

7) \angle HJL = 77°
\angle LJK = 63°
\angle HJK = ******

8) \angle CDF = 107°
\angle FDE = 23°
\angle CDE = ******

9) \angle OPR = 96°
\angle RPQ = 62°
\angle OPQ = ******
Lesson 3 Review- Naming Angles

Name the vertex and sides of each angle.

1) 
   
   
   

2) 
   
   
   

3) 
   
   
   

4) 
   
   
   

Name each angle in four ways.

5) 
   
   
   

6) 
   
   
   

7) 
   
   
   

8) 
   
   
   

Lesson 3 Review - Finding Missing Angles

<table>
<thead>
<tr>
<th>Determine the value of 'A'.</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 88°, 58°</td>
<td>1.</td>
</tr>
<tr>
<td>2) 36°, 125°</td>
<td>2.</td>
</tr>
<tr>
<td>3) 62°, 86°</td>
<td>3.</td>
</tr>
<tr>
<td>4) 64°, 98°</td>
<td>4.</td>
</tr>
<tr>
<td>5) 111°, 78°</td>
<td>5.</td>
</tr>
<tr>
<td>6) 120°, 89°</td>
<td>6.</td>
</tr>
<tr>
<td>7) 133°, 36°</td>
<td>7.</td>
</tr>
<tr>
<td>8) 114°, 51°</td>
<td>8.</td>
</tr>
<tr>
<td>9) 95°, 63°</td>
<td>9.</td>
</tr>
<tr>
<td>10) 135°, 43°</td>
<td>10.</td>
</tr>
<tr>
<td>11) 130°, 45°</td>
<td>11.</td>
</tr>
<tr>
<td>12) 140°, 94°</td>
<td>12.</td>
</tr>
</tbody>
</table>
Lesson 3 Review - Classifying Angles

Classify each angle as acute, obtuse, right, or straight.

1) \[ \quad \]  6) \[ \quad \]

2) \[ \quad \]  7) \[ \quad \]

3) \[ \quad \]  8) \[ \quad \]

4) \[ \quad \]  9) \[ \quad \]

5) \[ \quad \]  10) \[ \quad \]

11) \( 50^\circ \)  16) \( 7^\circ \)  

12) \( 180^\circ \)  17) \( 31^\circ \)  

13) \( 113^\circ \)  18) \( 160^\circ \)  

14) \( 110^\circ \)  19) \( 156^\circ \)  

15) \( 40^\circ \)  20) \( 90^\circ \)  
IDENTIFYING ANGLE PAIRS

<table>
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<tr>
<th>Name</th>
<th>Symbol/Picture</th>
<th>Definition</th>
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<tbody>
<tr>
<td></td>
<td><img src="image1.png" alt="Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

In the diagram, identify pairs of numbered angles that are related as follows:

- a. Complementary:
- b. Supplementary
- c. Vertical:
- d. Adjacent:

Determine if each statement is true. Use the diagram at the right.

\[ \angle BFD \text{ and } \angle CFD \text{ are adjacent angles.} \]

\[ \angle AFB \text{ and } \angle EFD \text{ are vertical angles.} \]

\[ \angle AFE \text{ and } \angle BFC \text{ are complementary.} \]
FINDING INFORMATION FROM A DIAGRAM

There are some relationships you can assume to be true from a diagram that has no marks or measures. There are other relationships you cannot assume directly. For example, you can conclude the following from an unmarked diagram.

- Angles are adjacent.
- Angles are adjacent and supplementary.
- Angles are vertical angles.

You cannot conclude the following from an unmarked diagram.

- Angles or segments are congruent.
- An angle is a right angle.
- Angles are complementary.

**Postulate 1-9 Linear Pair Postulate**

If two angles form a linear pair, then they are supplementary.

\[ \angle KPL \text{ and } \angle JPL \text{ are a linear pair, } m\angle KPL = 2x + 24, \text{ and } m\angle JPL = 4x + 36. \text{ What are the measures of } \angle KPL \text{ and } \angle JPL? \]

**ANGLE BISECTORS**

Angle Bisector: a _______ that divides an angle into two ________________ angles.

**Multiple Choice** \( \overline{AC} \) bisects \( \angle DAB \). If \( m\angle DAC = 58 \), what is \( m\angle DAB? \)

\[ \begin{align*}
A & : 29 \\
B & : 58 \\
C & : 87 \\
D & : 116
\end{align*} \]

**TRY IT!**

\( \overline{KM} \) bisects \( \angle JKL \). If \( m\angle JKL = 72 \), what is \( m\angle JKM? \)
1. Suppose $\anglePRS$ is bisected by $\overline{RQ}$. Find the $m\angle PRQ$ and $m\angle QRS$.

For each set of complementary angles, find the value of $x$. Then, find the angle measure of each angle.

2. 

3.
For each set of supplementary angles, find the value of $x$. Then, find the angle measure of each angle.

4.

\[ (3x - 20)^\circ \]

\[ x^\circ \]

5.

\[ (4x + 45)^\circ \]

\[ (5x - 18)^\circ \]

Use the diagram at the right to determine $x$ and $y$. $\overline{AB}$ and $\overline{CD}$ are straight lines.

$x = \underline{\hspace{2cm}}$

$y = \underline{\hspace{2cm}}$

Name a pair of vertical angles:

\[ \underline{\hspace{2cm}} \]

Find the measure of $\angle BOF$. Justify your calculation.

\[ \underline{\hspace{2cm}} \]
### Finding Complementary Angles

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</thead>
<tbody>
<tr>
<td><strong>Find the value of 'A' in the set of complementary angles.</strong></td>
<td><strong>Answers</strong></td>
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<tr>
<td>1)</td>
<td>A</td>
<td>34°</td>
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<td>2)</td>
<td>A</td>
<td>39°</td>
<td>2.</td>
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<tr>
<td>3)</td>
<td>A</td>
<td>47°</td>
<td>3.</td>
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**Lesson 4 Review - Complementary Angles**
Lesson 4 Review - Supplementary Angles

Finding Supplementary Angles

Find the value of 'A' in the set of supplementary angles.

1) \[\text{39}^\circ\]

2) \[157^\circ\]

3) \[92^\circ\]

4) \[60^\circ\]

5) \[61^\circ\]

6) \[28^\circ\]

7) \[52^\circ\]

8) \[-121^\circ\]

9) \[151^\circ\]

10) \[128^\circ\]

Answers

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.
Lesson 4 Review- Naming Types of Angle Pairs

Name the relationship: complementary, linear pair, vertical, or adjacent.

1) \( \angle L_d \) \( \angle L_p \)

2) \( \angle L_e \) \( \angle L_k \)

3) \( \angle L_m \) \( \angle L_g \)

4) \( \angle L_a \) \( \angle L_r \)

5) \( \angle L_q \) \( \angle L_s \)

6) \( \angle L_j \) \( \angle L_t \)

7) \( \angle L_h \) \( \angle L_b \)

8) \( \angle L_n \) \( \angle L_c \)
FINDING THE MIDPOINT

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Diagram</th>
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</table>
| ON A NUMBER LINE | The coordinate of the midpoint \( M \) of \( \overline{AB} \) is \( \frac{a+b}{2} \). | ![Diagram](image1)
| IN THE COORDINATE PLANE | Given \( \overline{AB} \) where \( A(x_1, y_1) \) and \( B(x_2, y_2) \), the coordinates of the midpoint of \( \overline{AB} \) are \( M \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \). | ![Diagram](image2)

\( \overline{AB} \) has endpoints \(-4 \) and \( 9 \). What is the coordinate of its midpoint?

\( \overline{QS} \) has endpoints \( Q(3, 5) \) and \( S(7, -9) \). Find the coordinates of its midpoint, \( M \).

Find the coordinates of the midpoint of \( \overline{XY} \) with endpoints \( X(2, -5) \) and \( Y(6, 13) \).
FINDING AN ENDPOINT

The midpoint of $\overline{AB}$ is $M(3, 4)$. One endpoint is $A(-3, -2)$. Find the coordinates of the other endpoint $B$.

THE DISTANCE FORMULA

The distance $d$ between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$ 

Find the distance between $T(5, 2)$ and $R(-4, -1)$ to the nearest tenth.

REAL WORLD! Each morning Juanita takes the “Blue Line” subway from Oak Station to Jackson Station. As the map at the left shows, Oak Station is 1 mile west and 2 miles south of City Plaza. Jackson Station is 2 miles east and 4 miles north of City Plaza. Find the distance Juanita travels between Oak Station and Jackson Station.
U1L5 Review: Midpoint and Distance Worksheet

**Formula**

**The Distance Formula**

The distance \( d \) between two points \( A(x_1, y_1) \) and \( B(x_2, y_2) \) is

\[
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.
\]

**Midpoint Formula**

\[
M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)
\]

---

**Part 1: Graphing**

1) Graph the points \( C (2, -4) \) and \( D (6, 2) \). Find the midpoint of \( \overline{CD} \).

Find the length of \( \overline{CD} \).

<Graph>

2) Graph the points \( E (-10, -9) \) and \( F (4, -3) \). Find the midpoint of \( \overline{EF} \).

Find the length of \( \overline{EF} \).

<Graph>

---

**Part 2: Midpoint Using Formula Only**

Find the midpoint for each line segment using the formula (no graphing needed). Show the formula and all work.

3) \( G (6, 5) \) and \( H (9, 2) \)

4) \( I (1, 1) \) and \( J (-3, -3) \)
5) Given the midpoint of segment KL is M (1, -1) and L (8, -7). What are the coordinates of the other endpoint K?

Part 3: Distance Using Formula Only

Find the distance between each set of points. Show the formula and all work.

6) (0, 0) and (4, 3)

7) (3, -3) and (2, 7)

8) Determine the coordinates of the points needed. Then find the distance of each line segment.

a) GH  G ( , )  H ( , )

b) KL  K ( , )  L ( , )

**The Distance Formula**

The distance $d$ between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$
Lesson 5- Practice with Midpoint Formula

Find the midpoint of the line segment with the given endpoints.

1) \((5, 0), (1, 4)\)  
2) \((-9, 3), (7, -8)\)

3) \((-2, 9), (-7, 7)\)  
4) \((5, 10), (-3, 6)\)

5) \((-1, -6), (3, 0)\)  
6) \((8, 1), (-2, -5)\)

Find the other endpoint of the line segment with the given endpoint and midpoint.

1) Endpoint: \((-6, -9)\), midpoint: \((2, -4)\)  
2) Endpoint: \((-7, 8)\), midpoint: \((0, 0)\)

3) Endpoint: \((1, 3)\), midpoint: \((-2, 5)\)  
4) Endpoint: \((6, -4)\), midpoint: \((5, -1)\)

5) Endpoint: \((0, -11)\), midpoint: \((-3, -1)\)  
6) Endpoint: \((3, -8)\), midpoint: \((1, -6)\)

7) Endpoint: \((7, 10)\), midpoint: \((0, 6)\)  
8) Endpoint: \((-2, 12)\), midpoint: \((-4, 11)\)
Find the distance between the points. Round the answer to two decimal places.

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<tr>
<td>1)</td>
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<td>2)</td>
<td>(-8, -9), (-4, -10)</td>
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<td>7)</td>
<td>(-7, -2), (6, 9)</td>
<td>8)</td>
<td>(-6, 5), (8, -3)</td>
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<tr>
<td>9)</td>
<td>(-5, -6), (-9, -4)</td>
<td>10)</td>
<td>(2, 0), (-7, 1)</td>
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Match the definition with the word. Write the letter in the blank.

a. Having the same shape or size 1. Supplementary Angle ____
b. Next to or side by side 2. Space ____
c. A point’s distance & direction from 0 on a number line 3. Obtuse Angle ____
d. A pair of angles that have a sum of 90 degrees 4. Collinear ____
e. On the same plane 5. Opposite Rays ____
f. On the same line 6. Parallel Lines ____
g. A statement accepted to be true without proof 7. Straight Lines ____
h. A pair of angles with a sum of 180 degrees 8. Congruent ____
i. Lines that are coplanar but do not intersect 9. Segment Addition Post. ____
j. An angle whose measure is $90 < x < 180$ 10. Midpoint ____
k. An angle whose measure is 180 degrees 11. Coplanar ____
l. An angle whose measure is $0 < x < 90$ 12. Adjacent ____
m. The middle of a segment 13. Coordinate ____
n. The set of all points 14. Acute Angle ____
o. Collinear rays with the same endpoint 15. Postulate ____
p. If $A$, $B$, and $C$ are collinear, then $AB + BC = AC$ 16. Complementary ____

Draw and label a figure for each exercise:

17. Point $P$ 19. Plane $XYZ$ 20. $\overline{TQ}$ 21. $\overline{AB}$
Use the figure to answer questions 22-28.

22. Name the plane with 3 letters: _______
23. \( \overrightarrow{AC} \) intersects the plane at what point? _______
24. Where do \( \overrightarrow{HG} \) and \( \overrightarrow{GE} \) intersect? _______
25. Name 3 collinear points: _______ _______ _______
26. Name 3 noncollinear points: _______ _______ _______
27. Name a point NOT on the plane: _______
28. Are points \( F, D, E, \) and \( B \) coplanar? _______

Use the figure at the right to answer questions.

29. Name the top plane: _______
30. What is the intersection of \( ADC \) and \( SRC \)? _______
31. Name the planes that intersect at \( QA \): _______ _______

Use your knowledge of the Segment Addition Postulate to answer the questions below.

32. Find the length of \( AC \).

33. If \( JK = 48 \), find the values of \( x, JH, \) and \( HK \).

\[
x = \quad JH = \quad HK =
\]

Use the picture at the right to answer the following questions.

34. Name a pair of supplementary angles (sum of 180°).
35. Name a pair of **complementary** angles.

36. Name two **congruent** angles.

**Use the picture at the right to answer the following questions.**

37. If $\overline{XZ} = 31$, find the following:
   
   a. $x = \underline{\phantom{000}}$
   
   b. $\overline{XM} = \underline{\phantom{000}}$
   
   c. $\overline{MZ} = \underline{\phantom{000}}$

**Use the picture at the right to answer the following questions.**

38. $m\angle ABC =$

   $m\angle ABC = 17x + 8$, $m\angle ABK = 42^\circ$, and $m\angle KBC = 12x - 4$. Find $m\angle ABC$.

39. $m\angle KBC =$

40. Find the **midpoint** and **distance** for the following endpoints. Round to the nearest tenth when necessary.

   $(-3, 1)$ and $(7, -4)$

**Midpoint:**

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

**Distance:**

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$
41. Find the **midpoint** and **distance** for the following **endpoints**. Round to the nearest tenth when necessary.

   \((8, -2)\) and \((-10, -6)\)

   **Midpoint:**
   \[
   M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)
   \]

   **Distance:**
   \[
   d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.
   \]

42. The coordinates of the midpoint of \(\overline{SB}\) are \((4, 1)\). The coordinates of endpoint \(S\) are \((10, -5)\). Find the coordinates of endpoint \(B\). (Hint: sketch the line first)
1. Suppose \( \angle LMN \) is bisected by \( \overrightarrow{MO} \). Find the value of \( x \).

2. Suppose \( \angle DAC \) is bisected by \( \overrightarrow{AB} \). Find \( m\angle CAB \) and \( m\angle DAC \)

For each set of complementary angles, find the value of \( x \). Then, find the angle measure of each angle.

3.

4.
For each set of supplementary angles, find the value of $x$. Then, find the angle measure of each angle.

5.

![Diagram of supplementary angles](image1)

6.

![Diagram of supplementary angles](image2)

C is collinear with & between A and E. For each problem, draw a picture representing the three points and the information given. Solve for indicated.

7. If $AC = 24$ in. and $CE = 13$ in., $AE = \underline{\hspace{2cm}}$.

8. If $CE = 7$ in. and $AE = 23$ in., $AC = \underline{\hspace{2cm}}$. 
Find the missing segment length in the following problems. \( R \) is collinear with and between \( Q \) and \( S \).

9. If \( RS = 44.6 \) and \( SQ = 68.4 \), find \( QR \).
10. If \( RS = 33.5 \) and \( RQ = 80 \), find \( SQ \).

Refer to the figure and the given information to find each measure.

11. Given: \( AC = 39 \) m

\[ \begin{align*}
A & \quad 2x - 8 \quad B \quad x + 17 \quad C \\
\end{align*} \]

\( x = \) ________

\( AB = \) ________

\( BC = \) ________

12. Given the figure and \( DG = 60 \) ft.

\[ \begin{align*}
D & \quad O \quad G \\
4x - 3 & \quad 2x + 21 \\
\end{align*} \]

\( x = \) ________

\( DO = \) ________

\( OG = \) ________
**Mid point of the line segment** \(P(x_1, y_1)\) **and** \(Q(x_2, y_2)\) **is** \(\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)\)

Find the missing end point of the following line segments whose midpoint and one of the endpoint is given:

<table>
<thead>
<tr>
<th>Endpoint: ((2, 5)), midpoint: ((3, 4))</th>
<th>Endpoint: ((7, 9)), midpoint: ((6, 7))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing endpoint: _________________________</td>
<td>Missing endpoint: _________________________</td>
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<tr>
<td>Endpoint: ((-4, 8)), midpoint: ((0, 8))</td>
<td>Endpoint: ((-1, -1)), midpoint: ((-1, -1))</td>
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<tr>
<td>Missing endpoint: _________________________</td>
<td>Missing endpoint: _________________________</td>
</tr>
<tr>
<td>Endpoint: ((3, 10)), midpoint: ((-2, -3))</td>
<td>Endpoint: ((0, 4)), midpoint: ((5, 3.5))</td>
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<tr>
<td>Missing endpoint: _________________________</td>
<td>Missing endpoint: _________________________</td>
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<tr>
<td>Endpoint: ((6, -2)), midpoint: ((4.5, -2.5))</td>
<td>Endpoint: ((4, 4)), midpoint: ((0, 0))</td>
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<tr>
<td>Missing endpoint: _________________________</td>
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