G7-3 Measuring and Drawing Angles and Triangles

1. Without using a protractor, identify each angle as acute or obtuse.
   a)  
   b)  
   c)  
   d)  

2. Practise choosing the correct scale to measure an angle.

   **Step 1:** Is the angle acute or obtuse? Circle your answer.
   **Step 2:** Circle the 2 numbers that the arm of the angle passes through.
   **Step 3:** Choose the correct angle measure. Example: if the angle is acute, the measure is less than 90°.

   a)  
   b)  
   c)  
   d)  

   The angle is acute / obtuse.
   The angle measures ______ °.

   The angle is acute / obtuse.
   The angle measures ______ °.
3. Measure each angle. Hint: For parts d) and e), you will have to extend the arms.
   a)  
   b)  
   c)  

4. In each polygon, circle angle $\angle XYZ$. Then measure the angle.
   a)  
   b)  
   c)  

5. $\angle ABC$ is 90°. $\angle ABD$ is 50°.
   a) What is the measure of $\angle DBC$? 
      How do you know?  
   b) Measure $\angle DBC$ with a protractor to check your answer in a).
Drawing an Angle

**Step 1:** Draw a line segment.

**Step 2:** Place the protractor with the origin on one endpoint. This point will be the vertex of the angle.

**Step 3:** Hold the protractor in place and mark a point at the angle measure you want.

**Step 4:** Draw a line from the vertex through the angle mark.

6. Draw the angles shown.
   a)
   b)

30°  120°

Drawing Lines That Intersect at an Angle

**Step 1:** Draw a line. Mark a point $P$ on the line.

**Step 2:** Place the protractor on the line with the origin at $P$.

**Step 3:** Mark a point at the angle measure you want.

**Step 4:** Draw a line that passes through the angle mark and point $P$.

7. Draw each angle.
   a) 30°  b) 45°  c) 60°  d) 150°  e) 10°

8. Construct two lines that intersect at...
   a) 45°  b) 30°  c) 60°  d) 90°

9. Draw the triangles with the side and two angles shown. (Lines are not drawn to scale.)
   a) [Diagram with side 8 cm and angles 40° and 60°]
   b) [Diagram with side 6 cm and angles 25° and 110°]
   c) [Diagram with side 7 cm and angles 90° and 30°]
   d) [Diagram with side 9 cm and angles 45° and 45°]
G7-4 Perpendicular Lines

Perpendicular lines meet at a right angle (90°). The \( \perp \) symbol means “is perpendicular to.”

1. Name the perpendicular lines.
   a) \( \perp \)  b) \( \perp \)  c) \( \perp \)  d) \( \perp \)

2. Are the pairs of lines below perpendicular? Measure the angle where they meet to check.

   Draw a square corner (\( \square \)) to show any perpendicular lines.
   a) \( \perp \) b) \( \perp \) c) \( \perp \) d) \( \perp \) e) \( \perp \)

3. Match the diagrams to the descriptions.

   A. \( \perp \)  B. \( \perp \)  C. \( \perp \)  D. \( \perp \)
   point \( P \) on line segment \( AB \)
   lines perpendicular to \( AB \)
   lines that pass through point \( P \) on \( AB \)
   the line perpendicular to \( AB \) that passes through point \( P \)
Drawing a Line Segment Perpendicular to $AB$ Through Point $P$

4. Use a set square. Draw a line segment perpendicular to $AB$ that passes through $P$.
   a) 
   
   Using a Set Square
   
   
   Here point $P$ is on $AB$.

   b) 
   
   Using a Protractor
   
   
   Here point $P$ is outside $AB$.

5. Use a set square or a protractor.
   a) Draw a line segment $AB$.
   b) Draw a line segment $CD$ perpendicular to $AB$.
   c) Explain why the two lines are perpendicular.

6. Draw any line $CD$. Draw a point $P$ not on $CD$. Draw any line $LM$ that is perpendicular to $CD$ and passes through $P$.

7. Use a protractor. Draw a line segment perpendicular to $AB$ that passes through $P$.
   a) 
   
   b) 

8. a) A rectangle has 4 right angles. Draw the missing sides to complete rectangle $ABCD$.
   b) Name all the pairs of sides of $ABCD$ that are perpendicular to one another.

   $\underline{\hphantom{1}} \perp \underline{\hphantom{1}}, \quad \underline{\hphantom{1}} \perp \underline{\hphantom{1}}, \quad \underline{\hphantom{1}} \perp \underline{\hphantom{1}}, \quad \underline{\hphantom{1}} \perp \underline{\hphantom{1}}$
1. Fill in the blanks to find the midpoint of this line segment.

\[ A \quad M \quad B \]

\( M \) is the midpoint of \( AB \).

Length of line segment = ____ cm

Length \( \div 2 = \) ____ cm

Mark the midpoint on the line.

2. Determine the midpoint of each line segment. Use a ruler.

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a) Total length = ____ cm

Length \( \div 2 = \) ____ cm

Mark the midpoint on the line.
Label the midpoint \( M \).

b) Total length = ____ cm

Length \( \div 2 = \) ____ cm

Mark the midpoint on the line.
Label the midpoint \( M \).

3. Draw a line segment 8 cm in length. Mark the midpoint.

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4. a) Name each midpoint shown in the figure and the line segment it is the midpoint of.

___ is the midpoint of _______

___ is the midpoint of _______

b) Can you tell from the diagram whether \( E \) is the midpoint of \( FD \)? Why or why not?

**BONUS** Any line segment has a midpoint. But can a line have a midpoint? Explain.

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5. a) Mark the midpoint of the line segment.

Then draw 3 bisectors.

b) Draw another line segment with 3 bisectors.
6. Use a set square or a protractor to draw the perpendicular bisector of each line segment. The midpoint is marked.
   a) 
   b) 

7. Draw the perpendicular bisector of each line segment.
   a) 
   b) 

8. Use the diagram to fill in the blanks.
   a) $D$ is the midpoint of ____.
   b) $BH$ is perpendicular to ____.
   c) The intersection point of $CE$ and $FG$ is ____.
   d) $FG$ is the perpendicular bisector of ____.
   e) $CE$ is a bisector of ____.
   f) Can you tell for sure from the diagram whether $CB = BA$? Why or why not? 

9. a) Circle the capital letters in the set below that contain perpendicular bisectors.
   
   A E F H I K L M N T V W X Y Z

   b) Perpendicular bisectors are seen in window frames, bookshelves, the letter E, and so on. Describe other examples of perpendicular bisectors seen in the world around you.
**G7-6 Parallel Lines**

**Parallel lines** never intersect, no matter how far they are extended in either direction.

1. Extend both lines. Use a ruler. Do the lines intersect or are they parallel? ________________

2. Match the descriptions to the lines.
   
   A. The lines intersect.
   B. If the lines were extended far enough, they would intersect.
   C. The lines are parallel.

   __________  __________  __________

3. Give two examples of parallel lines in the world around you.

   __________________________________________________________

4. Use arrow symbols to mark the sides or edges of these shapes that look like they are parallel.

   a)  b)  c)  d)

5. State which lines are parallel.

   a)  b)  c)

   \[ \overline{AB} \parallel \overline{_______} \]

   \[ \overline{_______} \parallel \overline{_______} \]

   \[ \overline{_______} \parallel \overline{_______} \]
6. Mark any parallel lines. State which lines are parallel.

   a) \( EF \parallel \) ________
   b) ________ \( || \) ________
   c) ________ \( || \) ________
   d) ________ \( || \) ________

7. Complete the statements.
   a) \( AB \) is parallel to ________ and
      \( KL \) is perpendicular to \( CD \), so
      \( KL \) is also perpendicular to ________.
   b) \( AB \parallel \) ________ and \( QR \perp \) ________, so, \( QR \perp \) ________.

8. a) All the angles in a rectangle are right angles.
    Mark the right angles on this rectangle.
   b) \( AD \perp AB \) and \( AD \perp \) ________, so \( AB \parallel \) ________
      \( DC \perp AD \) and \( DC \perp \) ________, so \( AD \parallel \) ________
   c) Explain how you know that these pairs of sides are parallel.

9. Circle the flags that contain parallel lines (not counting the edges of the flags).
Drawing a Line Segment Parallel to $AB$ Through Point $P$

**Using a Protractor**

**Step 1:** Line up the $90^\circ$ line on the protractor with $AB$. Use the base of the protractor to draw a line segment perpendicular to $AB$.

**Step 2:** Line up the $90^\circ$ line on the protractor with the line segment drawn in step 1, and the base of the protractor with point $P$. Draw a line parallel to $AB$. Erase the first perpendicular you drew.

10. Draw a line through $P$ parallel to $AB$.

a)

b)

11. A **regular** polygon has sides that are all the same length and angles that are all the same size.

a) Write the number of sides of each regular polygon below.

b) Mark all the pairs of parallel sides. Then write the number of pairs of parallel sides.

- Triangle
- Square
- Pentagon
- Hexagon
- Heptagon
- Octagon

Number of sides

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Square</th>
<th>Pentagon</th>
<th>Hexagon</th>
<th>Heptagon</th>
<th>Octagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pairs of parallel sides

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Square</th>
<th>Pentagon</th>
<th>Hexagon</th>
<th>Heptagon</th>
<th>Octagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

(c) Predict when a regular polygon will have parallel sides. How do you know?

**BONUS** How many parallel sides could a non-regular quadrilateral (shape with 4 sides) have?

12. Use parallel and perpendicular lines to draw a rectangle.
G7-7 Angle Relationships

1. Match the diagrams to the names. Hint: The angles in a linear pair are also adjacent angles.
   straight angle: _____  adjacent angles: _____  linear pair: _____
   A.  
   B.  
   C.  

2. Calculate these angle sums.
   a) $10^\circ + 25^\circ = \underline{___}$  b) $30^\circ + 40^\circ = \underline{___}$  c) $12^\circ + 28^\circ = \underline{___}$  d) $20^\circ + 30^\circ + 40^\circ = \underline{___}$

3. $\angle 1$ and $\angle 2$ are a linear pair. Identify the three other linear pairs in the diagram.
   $\angle \underline{____}$ and $\angle \underline{____}  \quad \angle \underline{____}$ and $\angle \underline{____}  \quad \angle \underline{____}$ and $\angle \underline{____}$

4. Determine the sum of the angles formed by two lines that intersect at a right angle.
   $\angle 1 + \angle 2 = 90^\circ + 90^\circ = \underline{___}^\circ \quad \angle 3 + \angle 4 = 90^\circ + 90^\circ = \underline{___}^\circ$
   So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = \underline{___}^\circ + \underline{___}^\circ = \underline{___}^\circ$

5. Determine the sum of the angles formed by any two intersecting lines.
   The sum of the angles in a linear pair is $\underline{___}^\circ$.
   So, $\angle 1 + \angle 2 = \underline{___}^\circ$ and $\angle 3 + \angle 4 = \underline{___}^\circ$
   So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = \underline{___}^\circ$

6. Predict the sum of the four angles around any point $P$. $\underline{___}^\circ$
   Calculate these angle sums to check your prediction.
   $30^\circ + 150^\circ + 30^\circ + 150^\circ = \underline{___}$  $95^\circ + 85^\circ + 95^\circ + 85^\circ = \underline{___}$
7. Determine the measure of $\angle XZY$.
   The sum of the angles in a triangle is $\_\_\_\_^\circ$.
   So, $\angle XZY = \_\_\_\_^\circ - (60^\circ + 90^\circ)$
   $\hspace{2cm} = \_\_\_\_^\circ - \_\_\_\_^\circ$
   $\hspace{2cm} = \_\_\_\_^\circ$

8. Determine the measure of $\angle A$ in each triangle.
   a) $\hspace{1cm} B$
   $\angle A = 180^\circ - (80^\circ + 30^\circ)$
   $\hspace{2cm} = \_\_\_\_^\circ$
   b) $\hspace{1cm} B$
   $\angle A = 180^\circ - (\_\_\_^\circ + \_\_\_^\circ)$
   $\hspace{2cm} = \_\_\_\_^\circ$
   c) $\hspace{1cm} C$
   $\angle A = \_\_\_\_^\circ - (\_\_\_\_^\circ + \_\_\_\_^\circ)$

9. Determine the measure of $\angle F$ in $\triangle DEF$ without doing any calculations. ______

10. a) A triangle has a $30^\circ$ angle and a $60^\circ$ angle. What is the third angle in the triangle? _____
    b) A triangle has two $45^\circ$ angles. What is the third angle in the triangle? _____
    c) A triangle has all angles equal. What is the measure of each angle? _____

11. a) Could a triangle ever have more than one obtuse angle? Use a sketch to help you explain.
    b) Could a triangle ever have more than one right angle? Use a sketch to help you explain.

12. a) Measure and mark the angles on each set square.
    b) Use set squares to draw two lines that intersect at a
       i) $30^\circ$ angle  ii) $45^\circ$ angle  iii) $60^\circ$ angle

13. a) A triangle has two equal angles. One of the angles in this triangle measures $20^\circ$.
   What are the other angles? (Hint: There are two solutions. Try sketching the possibilities.)
   b) A triangle has two equal angles. One of the angles in this triangle measures $100^\circ$.
   What are the other angles?
   c) How are problems a) and b) different? Why do they have a different number of solutions?