3.1 Angles and Their Measures

- **Angle**: The union of two rays that have the same endpoint.
- **Sides**: (of an angle) the rays that form it.
- **Vertex**: (of an angle) the common endpoint of the two rays.

**Names of angles**

- \(<A\) or \(<BAC\) or \(<CAB\) Not \(<ABC\) (why not?)

**Can you call this \(<BP\)?**

**What is another name for \(<1\)?**

**What is another name for \(<2\)?**
3.1 Angles and Their Measures

- Measure of Angle
  - \( m\angle ABC \) = measured in degrees.
  - Full circle is 360°
  - Straight angle is 180°

- Tool used to measure degrees is half of a circle commonly called a \( \text{__________} \).

3.1 Angles and Their Measures

- Angle Addition Property
  - If \( (\text{except for point V}) \) is in the interior of \( \angle AVB \), then \( m\angle AVC = m\angle CVB = m\angle AVB \)

3.1 Angles and Their Measures

- \( m\angle DEC? \)
- \( m\angle CEA? \)
- \( m\angle AED? \)

3.1 Angles and Their Measures

- \( \text{Bisector} \)
  - A point, line, ray, or plane which divides a segment, angle or figure into two equal parts.

- \( \text{is the bisector of } \angle PVQ \) if and only if \( (\text{except for point V}) \) is in the interior of \( \angle PVQ \) and \( m\angle PVR = m\angle RVQ \)

- What would the above figure look like?
- Say \( m\angle PVR = 3x + 2 \) and \( m\angle QVR = 4x - 8 \); solve for \( x \).
3.1 Angles and Their Measures

- Assumptions from drawings page 128
- From a figure you can assume:
  1. Collinearity of points that are not drawn on lines.
  2. Intersections of lines at a given point.
  3. Points in the interior of an angle, on an angle, or in the exterior of an angle.

3.1 Angles and Their Measures

- From a figure, you cannot assume:
  1. Collinearity of points that are not drawn on lines.
  2. Parallel Lines.
  3. Exact measures of angles and lengths of segments.
  4. Measures of angles or lengths of segments are equal.

3.3 Properties of Angles

- Types of Angles (m is the measure)
  - Zero angle m = 0°
  - Acute angle 0° < m < 90°
  - Right angle m = 90°
  - Obtuse angle 90° < m < 180°
  - Straight angle m = 180°
- Take out the Protractor worksheet Activity 3.1 and label each angle with one of the above terms.

3.3 Properties of Angles

- Complementary Angle
  - Two angles that add to make 90°
  - Say m1 + m2 = 90°; what is the measure of its complement?

- Supplementary Angle
  - Two angles that add to 180°
  - Say m1 + m2 = 180°; what is the measure of its supplement?
3.3 Properties of Angles

- **Adjacent angles**
  - Two non-straight and non-zero angles are adjacent if and only if a common side is interior to the angle formed by the non-common sides.
  - What is the name of the common side?
  - What is the name of the adjacent angles?

- **Linear pair**
  - Two adjacent angles form a linear pair if and only if their non-common sides are opposite rays.
  - If $\angle 1$ and $\angle 2$ are a linear pair:
  - Then $\angle 1 + \angle 2 = 180^\circ$. What is another name for this condition?
  - $m\angle 1 = 50^\circ$, $m\angle 2 =$ ?
  - $m\angle 1 = y$, $m\angle 2 =$ ?

3.3 Properties of Angles

- **Vertical angles**
  - Two non-straight angles are vertical angles if and only if the union of their sides is 2 lines (formed by intersecting lines).

- **Theorem**
  - If two angles are vertical angles then they have equal measure.
3.4 Algebra Properties Used in Geometry

- Solve the given equation
- Identify the following steps:
  - Distributive Property
  - Combine like terms
  - Addition property of Equality
  - Multiplication property of Equality

3.4 Algebra Properties Used in Geometry

- Given: \( AB = CD \)
- Addition Property of Equality: \( AB + BC = BC + CD \)
- Segment Addition Property: \( AC = BD \)

3.5 One-Step Proof Arguments

- One-Step Proof Arguments – a given and one conclusion
- Proof Argument
  - A conditional is a sequence of justified conclusions. Starting with the antecedent and ending with the consequent.
  - Ex. 0: \( 3y - 7 = 8 \) Given
    1. \( 3y = 15 \) Addition Property of Equality
    2. \( y = 5 \) Multiplication Property of Equality

- Ex. 90 - \( x = 30 \)
3.5 One-Step Proof Arguments

- Three Types of Justification in a Proof Argument:
  1. Postulates - assumed properties
  2. Definitions - Defining properties
  3. Theorems - Deduced (previously proven) properties

- Example:
m\(<\angle ABC = 120^\circ. Justify that m\(<\angle ABC is obtuse.

3.5 One-Step Proof Arguments

- Definition of Obtuse Angles
  - An angle whose measure is greater than 90 and less than 180.
  Or
  - If an angle measure greater than 90 and less than 180
    it is obtuse.

3.6 Parallel Lines

- 3.6 Corresponding Angle Activity
- Need Puffy paper, straight edge, worksheet

3.6 Parallel Lines

- Corresponding Angles Postulate - suppose two coplanar lines are cut by a transversal.
  - If two corresponding angles have the same measure, then the lines are parallel
  - If the lines are parallel, then corresponding angles have the same measure

- Note abbreviations:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
5 & 6 & 7 & 8 \\
m & & & \\
\end{array}
\]
3.6 Parallel Lines

- Def. Slope of the Line - the slope of the line through

- Parallel lines and Slopes Theorem -
  - Two nonvertical lines are parallel if and only if they have the same slope.
  - Transitivity of Parallelism Theorem -
    - In a plane, if line l is parallel to line m and line m is parallel to line n, then line l is parallel to line n.

3.7 Perpendicular Lines

- Warm-up
- Consider points A = (5, -4), B = (3, 2), and C = (2, 5)
  1. Find the slopes of
  2. Find the product of the slopes
  3. Graph the lines and find m<CB.

- Perpendicular Lines -
  - Two segments, rays, or lines are perpendicular if and only if the lines containing them form a 90° angle.

- Do we need to label more than one angle?
3.7 Perpendicular Lines

- Two Perpendiculars Theorem:
  - If two coplanar lines \( l \) and \( m \) are each perpendicular to the same line, then they are parallel to each other.

3.7 Perpendicular Lines

- Perpendicular to Parallel Lines Theorem:
  - In a plane, if a line is perpendicular to one of two parallel lines, then it is also perpendicular to the other.

- Perpendicular Lines and Slopes Theorem:
  - Two nonvertical lines are perpendicular if and only if the product of their slopes is \(-1\).

3.8 Drawing Parallel and Perpendicular Lines

- MUST bring in compass and straight edge
- Bisector of a segment:
  - A line or ray that divides a segment into two equal parts. It is the perpendicular bisector of a segment only at its midpoint. Only one perpendicular bisector:

3.8 Drawing Parallel and Perpendicular Lines

- Constructions - a precise way of drawing which uses specific tools and follows specific rules.
- Two Tools allowed:
  1. Compass
  2. Unmarked straight-edge
- Constructions may also use Patty paper when allowed.
3.8 Drawing Parallel and Perpendicular Lines

Constructions

1. Segment copy
2. Perpendicular bisector of a line segment
3. Patty paper of #2
4. Angle bisector (traditional/ patty paper)
5. Angle Copy (traditional/ patty paper)
6. Construct a line parallel to another line through a given point.

Construct a line parallel to another line through a given point. (traditional only)
1. Draw any line m
2. Draw arcs - same setting using vertex Q, and P
3. Copy angles
4. Draw L
5. Why is it parallel?