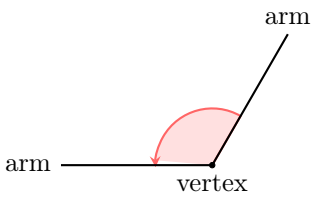
ANGLES

Angles are a fundamental concept in geometry. They are formed when two rays meet at a single point, called the vertex.

A DEFINITIONS

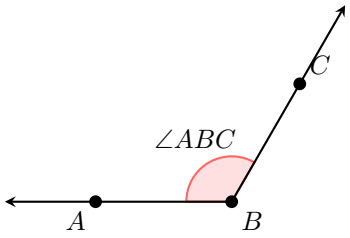
Definition Angle

An **angle** is the measure of rotation between two rays that share a common endpoint, called the vertex.



Definition Naming Angles with Three Points

An angle is named using three points with the symbol $\angle ABC$, where B is the vertex of the angle, and A and C are points on the two sides of the angle. The vertex B is always written in the middle to indicate the angle's center.

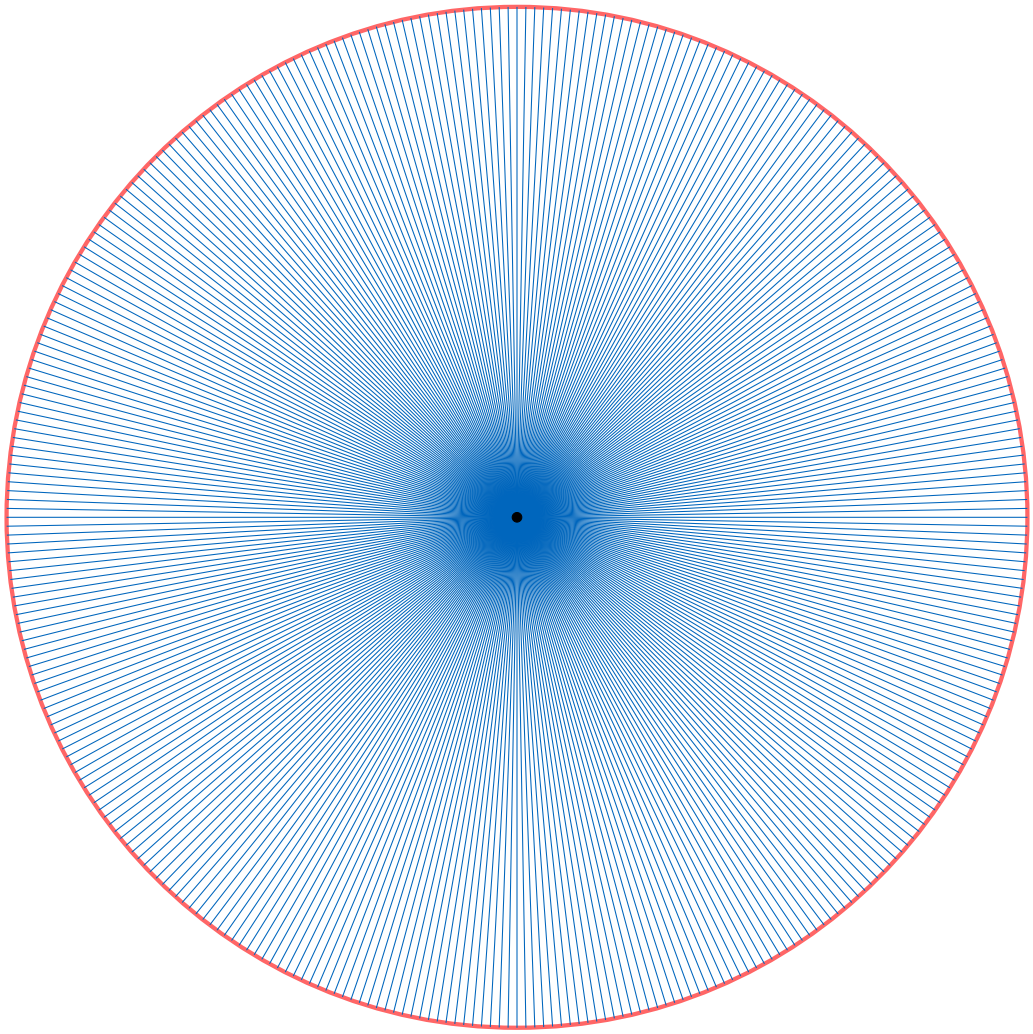


B DEGREES

A full turn, or complete circle, is divided into 360 equal parts called degrees, a convention established by ancient Babylonian astronomers.

Definition **Degree Unit**

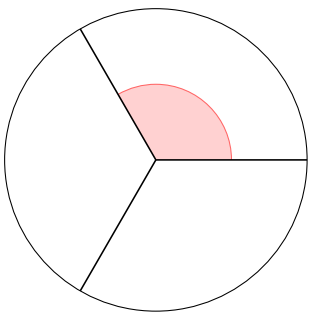
A **degree** is a unit of angle measurement. A full turn measures 360°.



Definition **Measure of an Angle in Degrees**

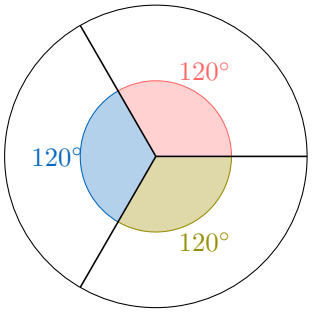
The **measure of an angle in degrees** is the fraction of a full turn it represents.

Ex: Calculate the measure of an angle that represents one-third of a full turn.



Answer:

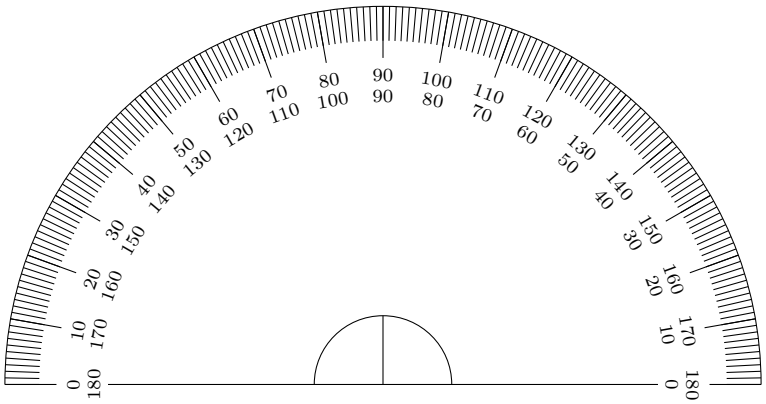
$$\begin{aligned} \text{Angle} &= \frac{1}{3} \text{ of } 360^\circ \\ &= 360^\circ \div 3 \\ &= 120^\circ \end{aligned}$$



C MEASURING AND DRAWING ANGLES WITH A PROTRACTOR

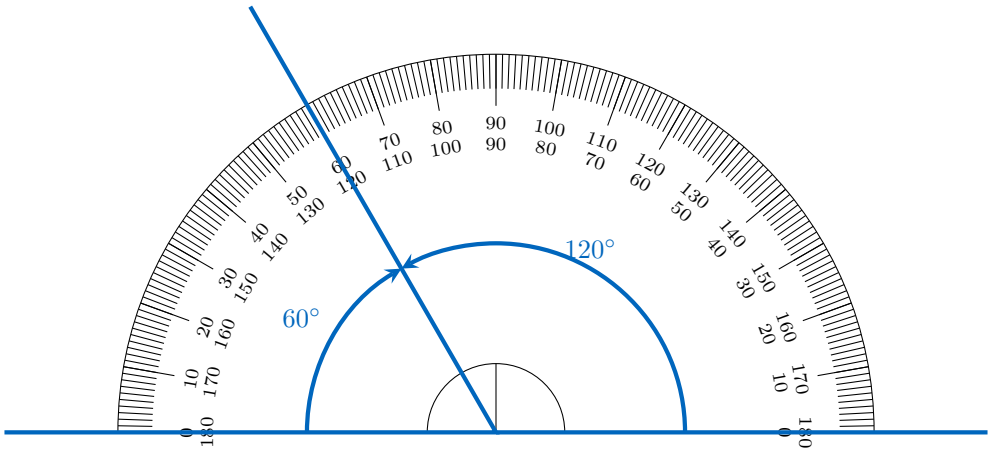
Definition **Protractor**

A **protractor** is a tool used to measure and draw angles in degrees. It is typically a semi-circular tool with a scale marked from 0° to 180°.

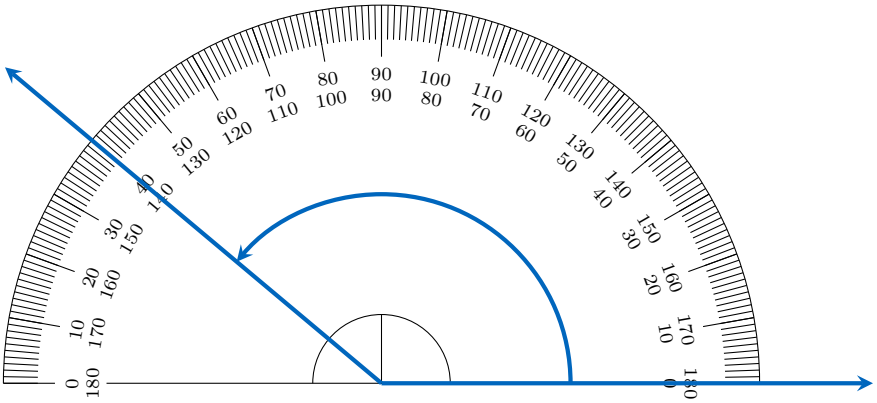


Method **Measuring an Angle with a Protractor**

1. Place the protractor's origin (center point) over the vertex of the angle.
2. Align one ray of the angle with the protractor's baseline (the 0° mark).
3. Observe where the other ray intersects the protractor's scale.
4. Read the angle measure in degrees from the scale.



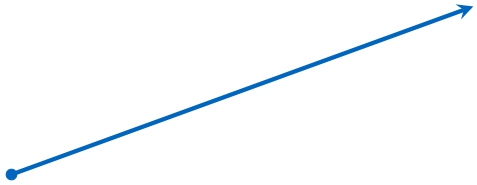
Ex: Measure the following angle.



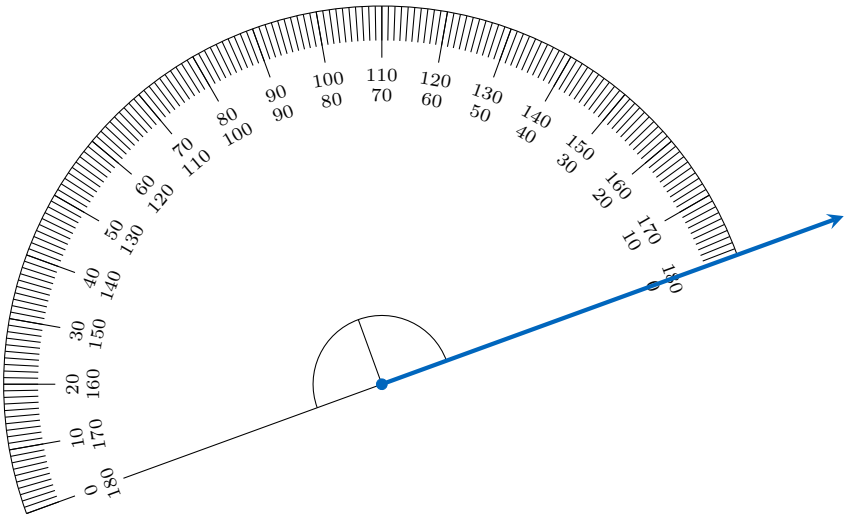
Answer: The angle measures 140°.

Method **Drawing an Angle with a Protractor**

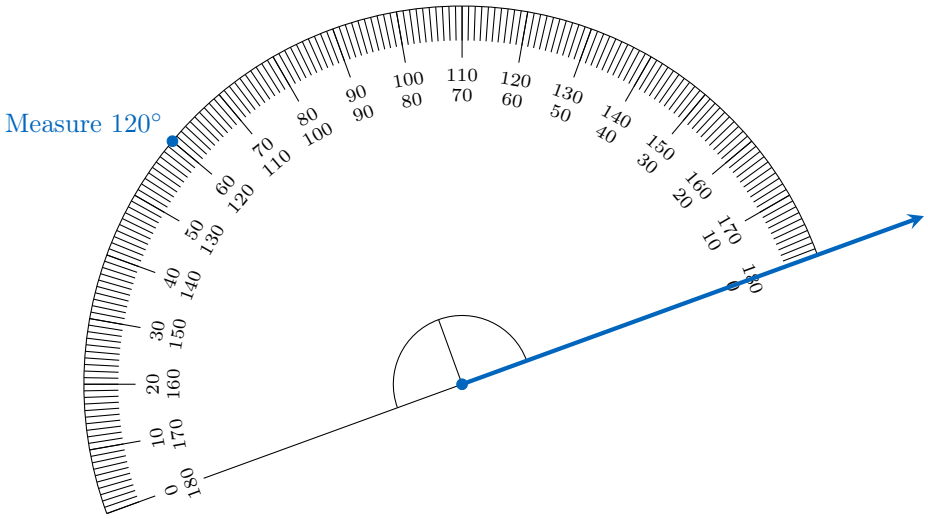
1. Draw a ray starting from a point (the vertex).



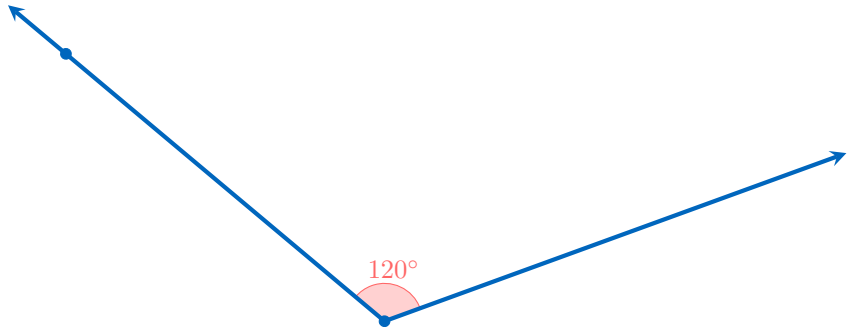
2. Place the protractor's origin over the vertex and align the baseline with the ray.



3. Locate the desired angle measure on the protractor's scale and mark the point.



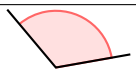
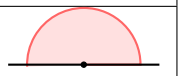
4. Draw a second ray from the vertex through the marked point to form the angle.



D CLASSIFICATION OF ANGLES

In geometry, angles are classified based on their measure. The following table defines four main types of angles: straight, right, acute, and obtuse.

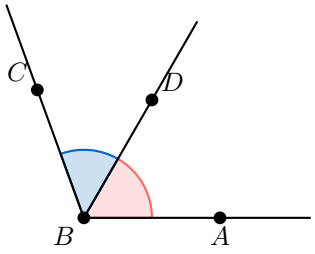
Definition **Classification of Angles**

Name	Fraction of a Circle	Angle Measure	Figure
Acute Angle	Less than $\frac{1}{4}$	Less than $90°$	
Right Angle	$\frac{1}{4}$	$\frac{1}{4}$ of $360° = 90°$	
Obtuse Angle	Between $\frac{1}{4}$ and $\frac{1}{2}$	Between $90°$ and $180°$	
Straight Angle	$\frac{1}{2}$	$\frac{1}{2}$ of $360° = 180°$	

E ANGLE ADDITION

Proposition **Angle Addition Postulate**

When two angles share a common side and vertex, the measure of the angle they form is the sum of their measures.

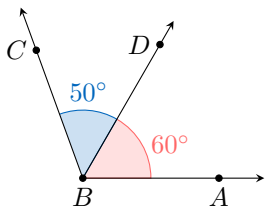


$$\angle ABC = \angle ABD + \angle DBC$$

Method **Calculating an Angle**

To find the measure of an unknown angle, use the measures of related known angles. If the unknown angle is formed by two smaller angles sharing a common side, add the measures of the smaller angles using the angle addition postulate.

Ex: Calculate $\angle ABC$ without a protractor.



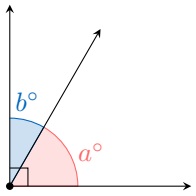
Answer: Using the angle addition postulate:

$$\begin{aligned}\angle ABC &= \angle ABD + \angle DBC \\ &= 60^\circ + 50^\circ \\ &= 110^\circ\end{aligned}$$

F ANGLE PROPERTIES

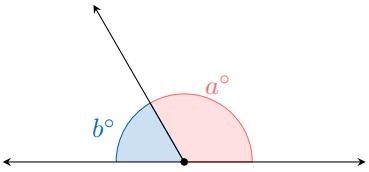
Proposition Angle Properties

- **Right Angle**: Adjacent angles that form a right angle have measures that sum to 90°.



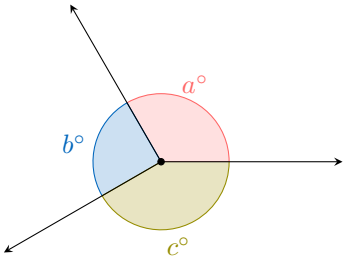
$$a^\circ + b^\circ = 90^\circ$$

- **Straight Angle**: Adjacent angles that form a straight angle have measures that sum to 180°.



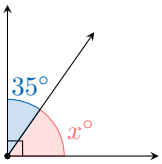
$$a^\circ + b^\circ = 180^\circ$$

- **Full Angle**: Angles around a point that form a complete rotation have measures that sum to 360°.



$$a^\circ + b^\circ + c^\circ = 360^\circ$$

Ex: Calculate x°.



Answer: Since the angles form a right angle, their measures sum to 90°:

$$\begin{aligned}x^\circ + 35^\circ &= 90^\circ \\ x^\circ &= 90^\circ - 35^\circ \\ &= 55^\circ\end{aligned}$$