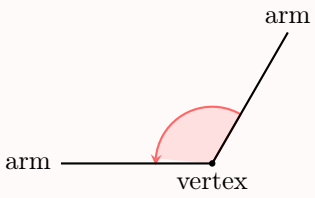
ANGLES

Angles are one of the basic ideas in geometry. An angle is formed when two rays meet at a single point. This point is called the vertex of the angle.

A WHAT IS AN ANGLE?

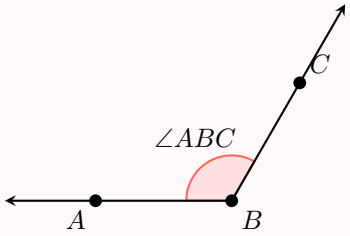
Definition Angle

An **angle** is the amount of turn between two rays that start from the same point, called the vertex. Each ray is called an arm (or side) of the angle.



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.

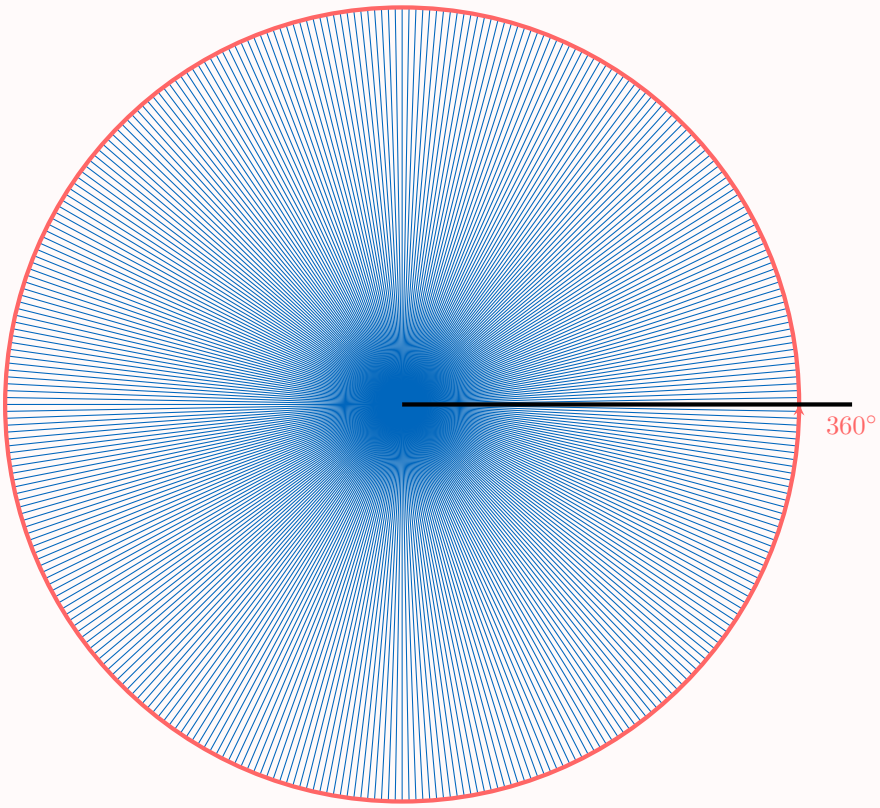


B DEGREES

A full turn, or complete circle, can be divided into 360 equal parts. Each part is called one degree.

Definition Degree Unit

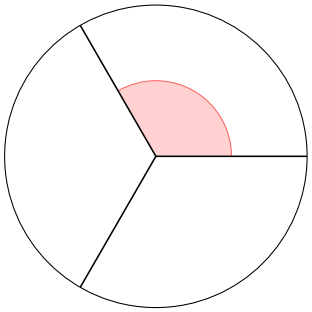
A **degree**, written with the symbol °, is a unit of angle measurement. A full turn measures 360°.



Definition **Measure of an Angle in Degrees**

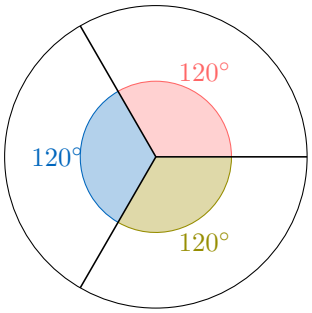
The **measure of an angle in degrees** tells us what fraction of a full turn the angle is.

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



Answer:

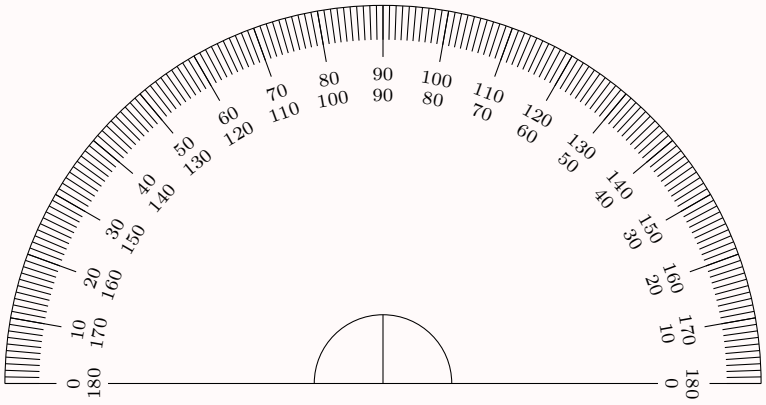
$$\begin{aligned}\text{Angle} &= \frac{1}{3} \text{ of } 360^\circ \\ &= 360^\circ \div 3 \\ &= 120^\circ\end{aligned}$$



C MEASURING AND DRAWING ANGLES WITH A PROTRACTOR

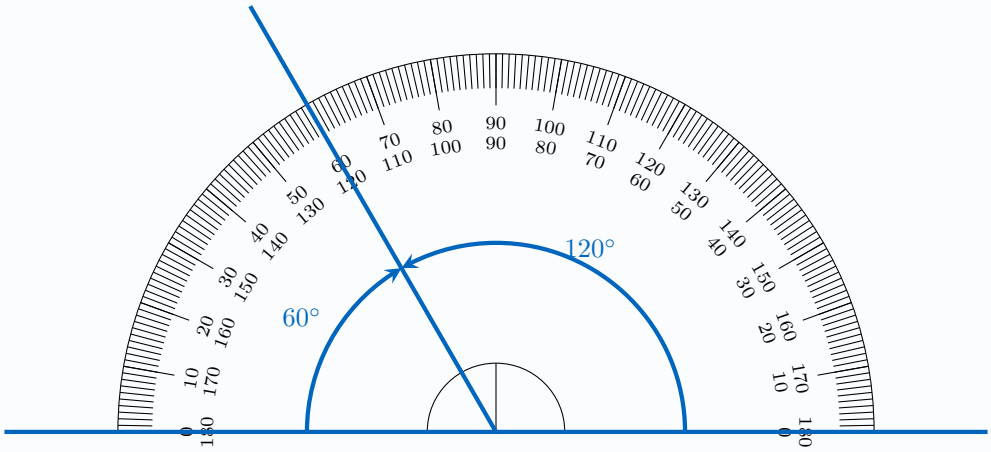
Definition **Protractor**

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°.

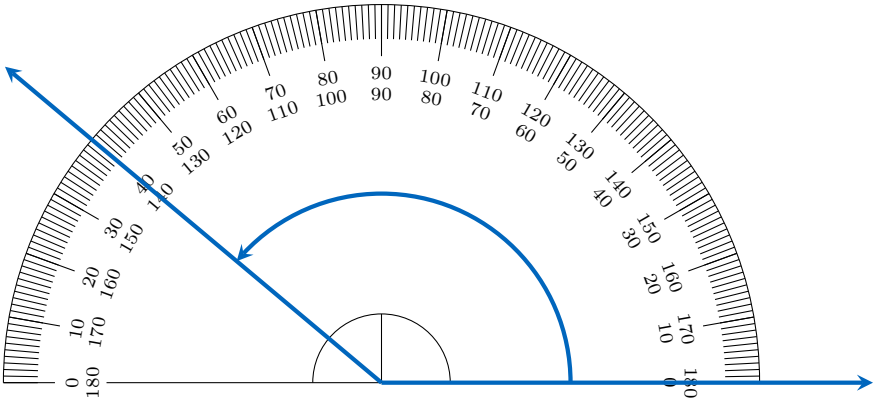


Method **Measuring an Angle with a Protractor**

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 correct scale (the one that starts at 0° on your first ray).



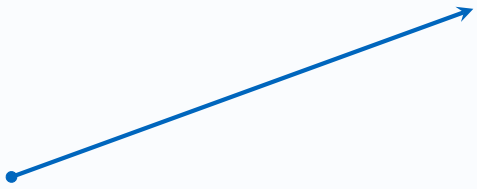
Ex: Measure the following angle.



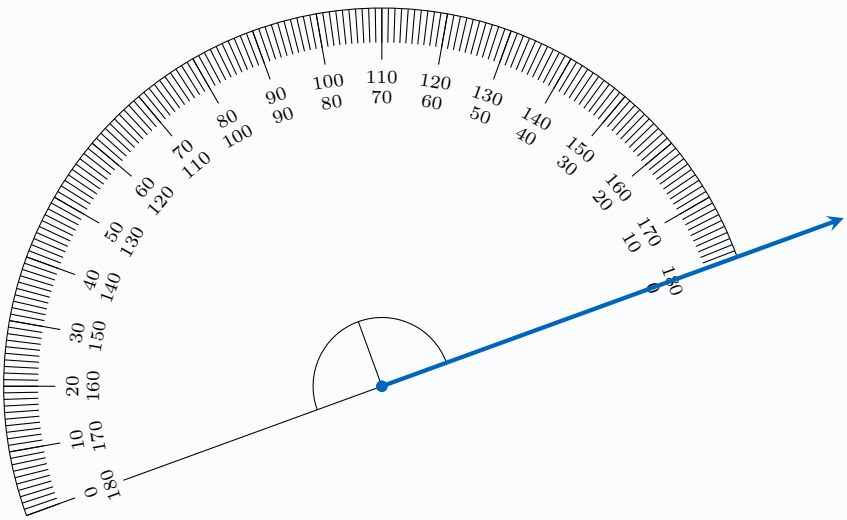
Answer: The second ray points to 140° on the protractor, so the angle measures 140°.

Method **Drawing an Angle with a Protractor**

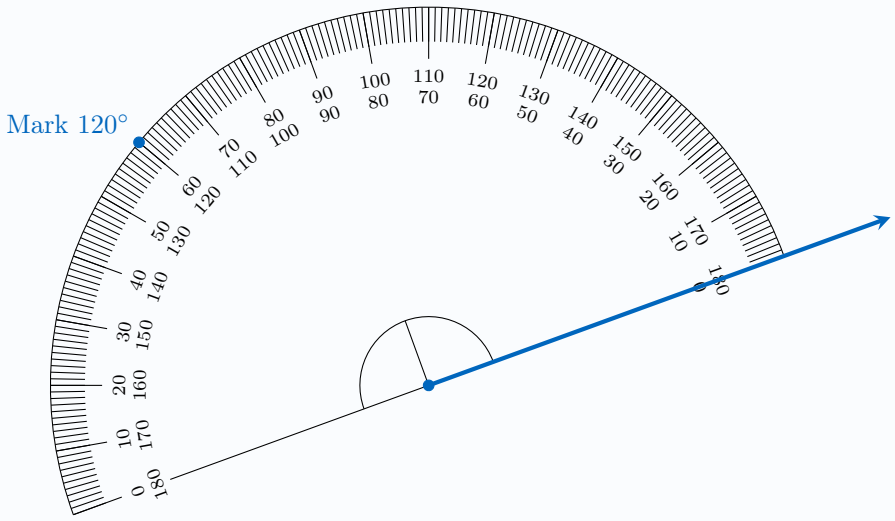
1. Draw a ray starting from a point (the vertex).



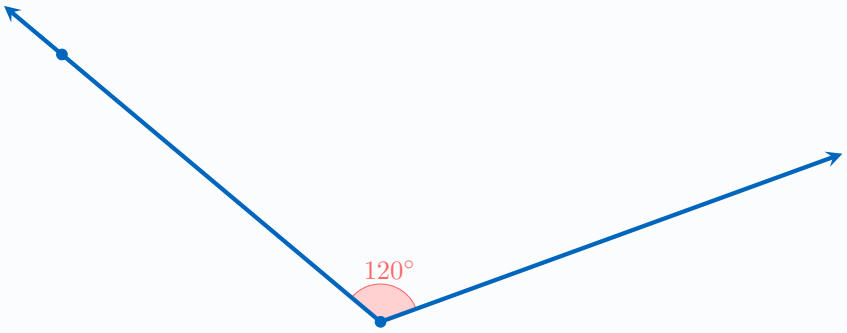
2. Place the protractor's origin over the vertex and align the baseline with the ray.



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



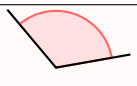
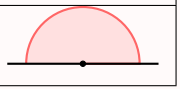
4. Draw a second ray from the vertex through the marked point to form the angle.



D CLASSIFICATION OF ANGLES

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

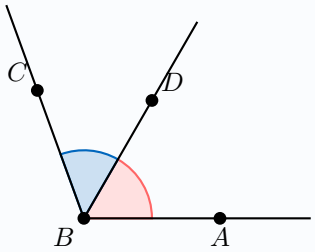
Definition **Classification of Angles**

Name	Fraction of a Full Turn	Angle Measure	Figure
Acute Angle	Less than $\frac{1}{4}$ of a full turn	Less than 90°	
Right Angle	$\frac{1}{4}$ of a full turn	Exactly 90°	
Obtuse Angle	Between $\frac{1}{4}$ and $\frac{1}{2}$ of a full turn	Between 90° and 180°	
Straight Angle	$\frac{1}{2}$ of a full turn	Exactly 180°	

E ANGLE ADDITION

Proposition **Angle Addition Postulate**

When two angles are adjacent (they share a common vertex and a common side), the measure of the angle formed by their other sides is equal to the sum of their measures.

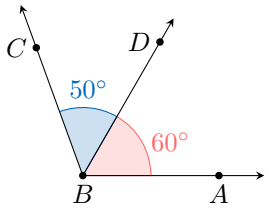


$$\angle ABC = \angle ABD + \angle DBC$$

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 adjacent angles that share a common vertex and a common side, add the measures of the smaller angles using the angle addition postulate.

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



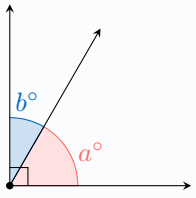
Answer: Angles $\angle ABD$ and $\angle DBC$ are adjacent and form $\angle ABC$. Using the angle addition postulate:

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

F ANGLE PROPERTIES

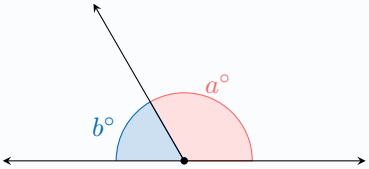
Proposition Angle Properties

- **Right Angle**: If two adjacent angles form a right angle, the sum of their measures is 90° (they are *complementary* angles).



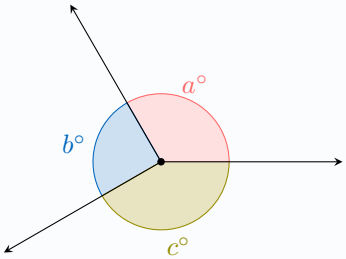
$$a^\circ + b^\circ = 90^\circ$$

- **Straight Angle**: If two adjacent angles form a straight angle, the sum of their measures is 180° (they are *supplementary* angles).



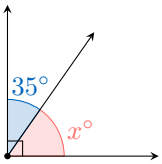
$$a^\circ + b^\circ = 180^\circ$$

- **Full Angle**: If several angles meet at a point and form a full turn around that point, the sum of their measures is 360°.



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

Ex: Calculate x°.



Answer: Since the two angles form a right angle, their measures add up to 90°:

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