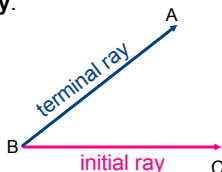
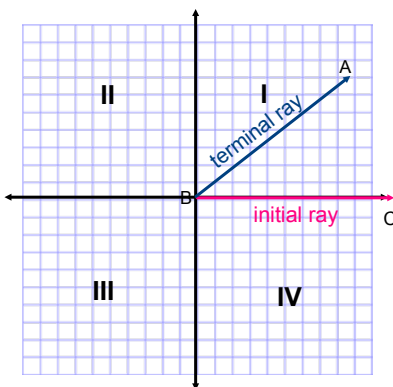


Arcs and Angles As Rotations

An **angle** is defined as a set of points that is the union of two rays having the same endpoint. Angles are measured counterclockwise from the **initial ray** toward the **terminal ray**.



When this angle is superimposed on a set of coordinate axes as below, we see that acute angle ABC lies in Quadrant I. We say that this angle is in **standard position** because its vertex is on the origin and its initial ray is the positive x -axis.



Angles on the Coordinate Plane

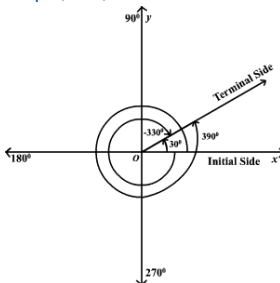
Recall: Since there are 360° in a full rotation, each quadrant contains 90° .

- **Acute** angles that measure *between* 0° and 90° , are found in Quadrant I.
- **Obtuse** angles that measure *between* 90° and 180° have their terminal rays in Quadrant II.
- Quadrant III contains angles that measure *between* 180° and 270°
- Quadrant IV contains angles that measure *between* 270° and 360°

Note: each of these definitions is for angles that fall *inside* the quadrants. The angles that measure **exactly** 0° , 90° , 180° , 270° , and 360° are known as **quadrantal angles** and are not "in" a quadrant, but rather separate the quadrants.

Coterminal Angles

Coterminal angles are angles in standard position that have a common terminal side. For example, 30° , -330° and 390° are all coterminal.



To find a positive and negative angle coterminal with a given angle, add or subtract any multiple of 360° .

Example 1:

Find a positive and negative angle coterminal with a 55° angle.

Example 2:

Find a coterminal angle of the 500° angle with a measure between 0° and 360° .

Remember: The measure of coterminal angles can be found by adding or subtracting multiples of 360° , the measure of a complete rotation.

Examples

In the examples below, name the quadrant in which an angle of each given measure lies.

1) 25°

2) 150°

3) -75°

4) -200°

5) -280°

6) $1,050^\circ$

7) 750°

8) -500°

In the examples below, find a coterminal angle with a measure of θ such that $0 \leq \theta < 360$.

9) 25°

10) 150°

11) -75°

12) -200°

13) -280°

14) $1,050^\circ$

15) 750°

16) -500°

Homework



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