DEGREE AND RADIAN

MEASURES OF ANGLES

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TOPIC OUTLINE

Degree

Radian

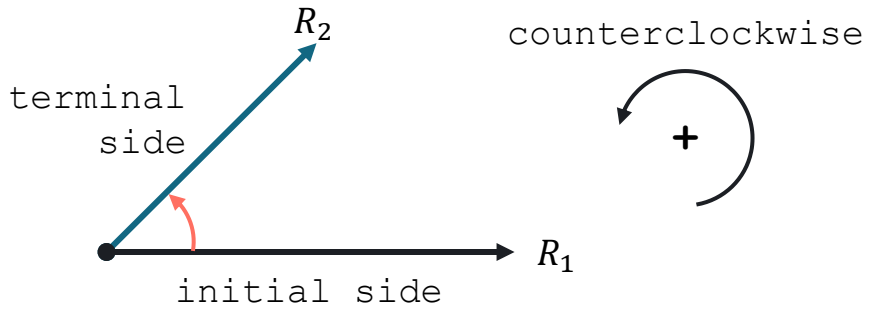
DEGREE

ANGLE

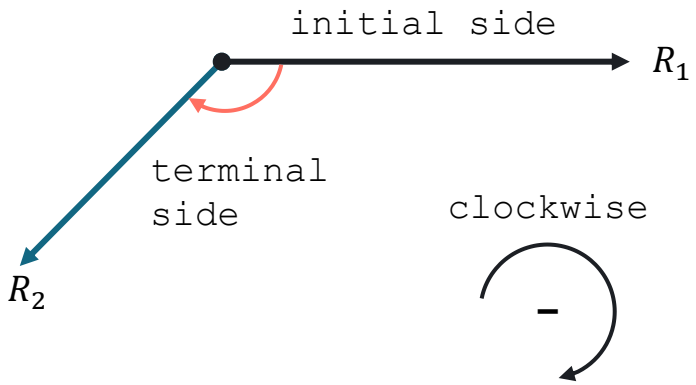
An **angle** is formed by two rays (R_1 and R_2) that share a common endpoint, called the vertex (O).

It can be interpreted as the **amount of rotation** from one ray (initial side) to another (terminal side) around the vertex.

Positive angle



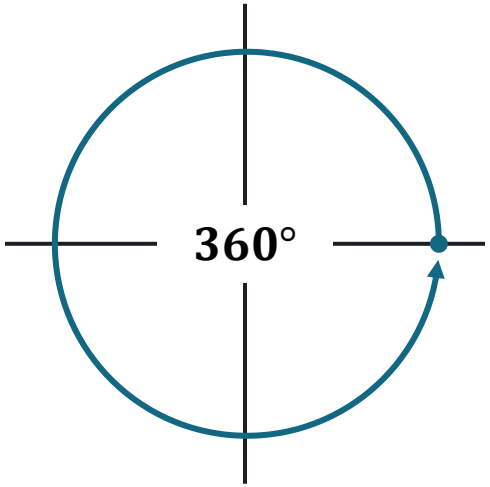
Negative angle



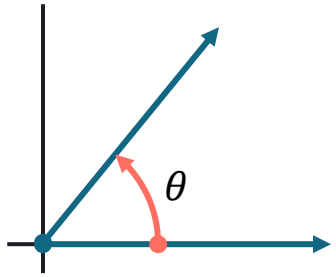
DEGREE

The **degree** (°) is the most commonly used unit for measuring angles.

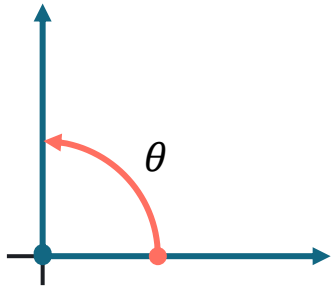
A full rotation around a circle corresponds to 360°.



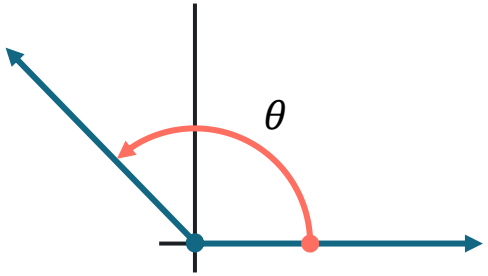
Classification of Angles



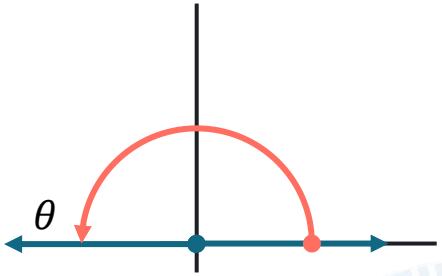
Acute angle
$0° < \theta < 90°$



Right angle
$\theta = 90°$



Obtuse angle
$90° < \theta < 180°$



Straight angle
$\theta = 180°$

COMPLEMENTARY ANGLES

If the sum of the measures of two positive angles is **90°**, the angles are **complementary** and the angles are complements of each other.

Formula

$$\theta_A + \theta_B = 90°$$

Example

Find the complement of an angle measuring 40°.

SUPPLEMENTARY ANGLES

If the sum of the measures of two positive angles is **180°**, the angles are **supplementary** and the angles are supplements of each other.

Formula

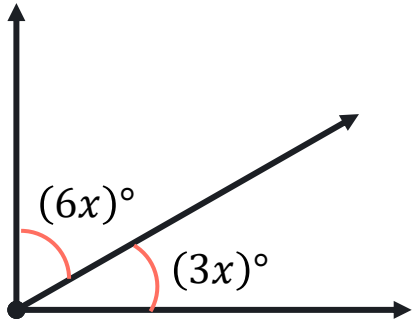
$$\theta_A + \theta_B = 180°$$

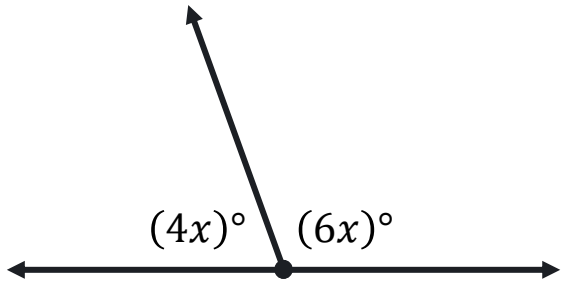
Example

Find the supplement of an angle measuring 40°.

EXERCISE

Find the measure of each marked angle.





Solution

DEGREES, MINUTES, SECONDS

One **minute** ($1'$) is $\frac{1}{60}$ of a degree.

$$\mathbf{1' = \frac{1^\circ}{60}}$$

$$\mathbf{60' = 1^\circ}$$

One **second** ($1''$) is $\frac{1}{60}$ of a minute.

$$\mathbf{1'' = \frac{1'}{60}}$$

$$\mathbf{60'' = 1'}$$

$$\mathbf{3600'' = 1^\circ}$$

Example

Convert $74°08'14''$ to decimal degrees to the nearest thousandth.

EXERCISE

Perform each calculation and express the result in degrees, rounded to the nearest thousandth.

$a.\ 51°29' + 32°46'$

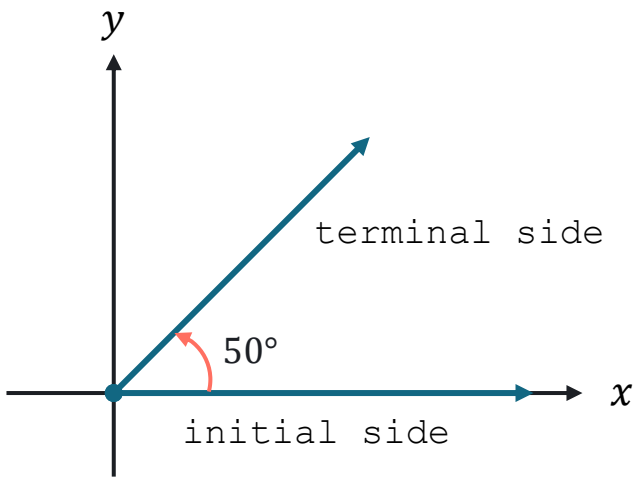
$b.\ 90° - 73°12'$

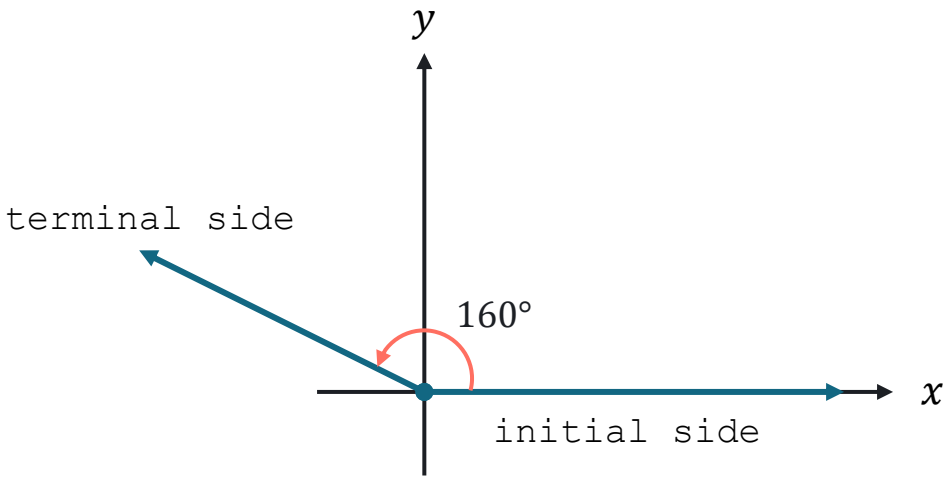
Solution

STANDARD POSITION

An angle is in **standard position** if its vertex is at the **origin** and its initial side lies on the **positive x-axis**.

Angles in Standard Position

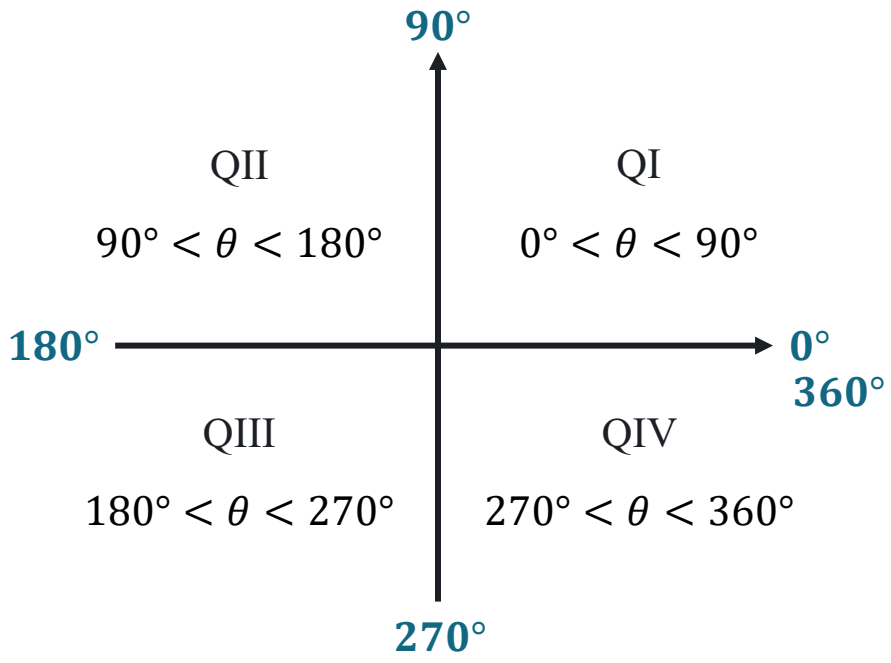




QUADRANTAL ANGLES

Angles in standard position whose terminal sides lie on the x-axis or y-axis, such as angles with measures **90°**, **180°**, **270°**, and so on, are **quadrantal angles**.

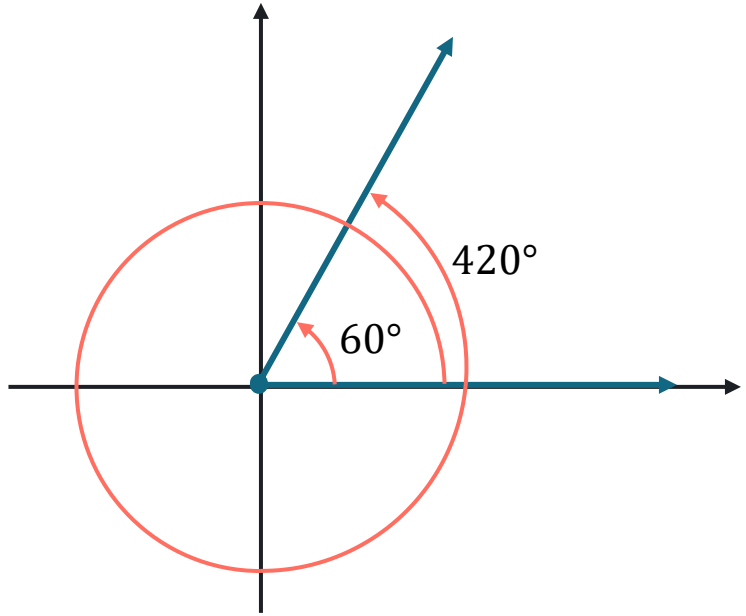
Quadrantal Angles



COTERMINAL ANGLES

Coterminal angles are angles that share the same terminal side when drawn in standard position. Their measures differ by a **multiple of 360°**, meaning they can be found by adding or subtracting 360° repeatedly.

Coterminal Angles



EXERCISE

Find the angle of least positive measure that is coterminal with each angle.

$a.\ 908°$

$b.\ -75°$

$c.\ -800°$

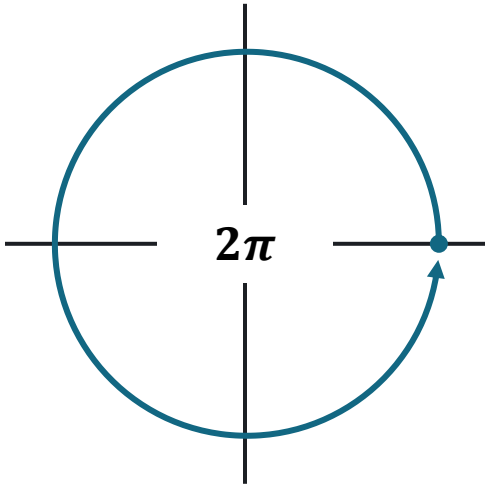
Solution

RADIAN

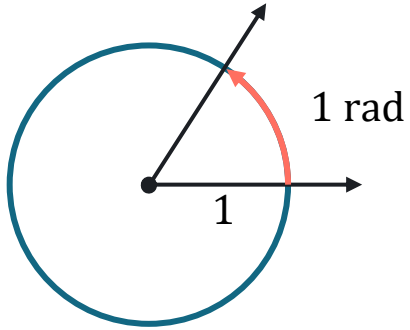
DEGREE

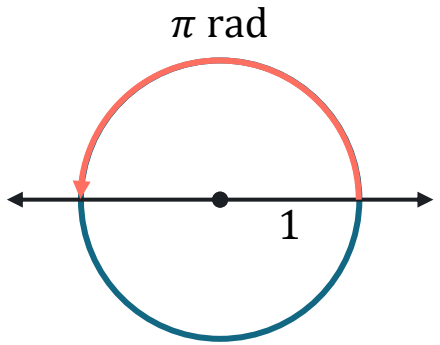
The **radian** (**rad**) is the angle subtended at the center of a circle by an arc whose length is equal to the radius of a circle.

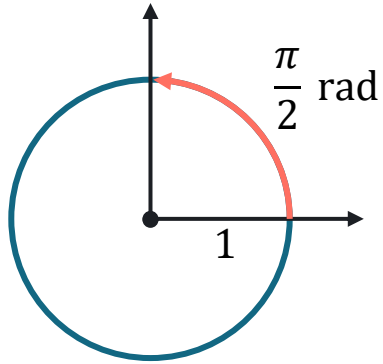
A full rotation around a circle corresponds to 2π radians.

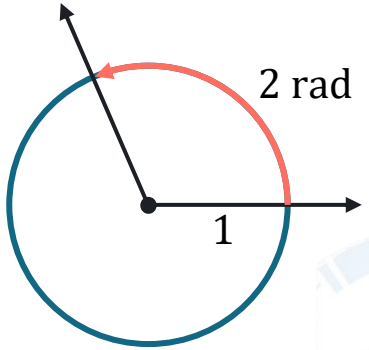


Unit Circle









EXERCISE

Find the radian measure of the angle with the given degree measure.

$a.\ 72°$

$b.\ -60°$

Solution

EXERCISE

Find the degree measure of the angle with the given radian measure.

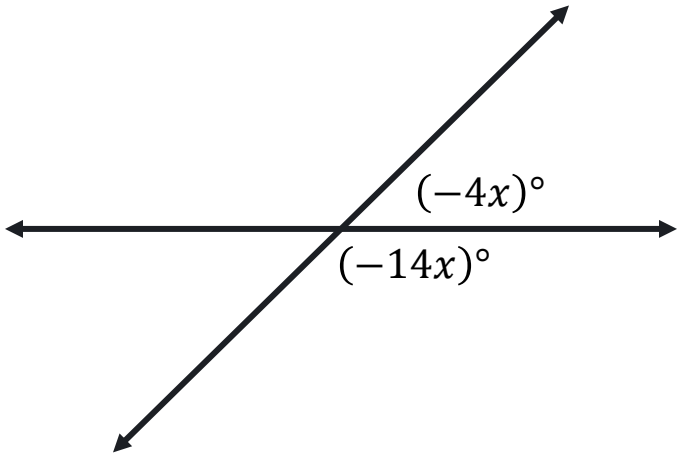
$a.\ \frac{7\pi}{6}$

$b.\ -\frac{5\pi}{4}$

Solution

EXERCISE

Find the measure of the marked angle.



Solution

EXERCISE

A constant angular velocity disk drive spins a disk at a constant speed. Suppose a disk makes 480 revolutions per min. Through how many degrees will a point on the edge of the disk move in 2 sec?

Solution

SEATWORK