
MATH 11022: Angles

Definitions:

- An **angle** is a pair of rays having the same endpoint or **vertex**. An angle can also be formed by rotating a ray around its endpoint.
- Angles are drawn by showing the direction and amount of rotation from the **initial side** to the **terminal side**.
- If the rotation is counterclockwise, the angle is **positive**; if the rotation is clockwise, the angle is **negative**.
- Angles are usually denoted by lower case Greek letters:
 α — “alpha” β — “beta” γ — “gamma” θ — “theta” ϕ — “phi”
Upper case English letters are also used to denote angles.
- An **acute angle** is an angle measuring more than 0° but less than 90° .
- A **right angle** is an angle measuring 90° .
- An **obtuse angle** is an angle measuring more than 90° but less than 180° .
- A **straight angle** is an angle measuring exactly 180° .
- Two angles are **complementary angles** if the sum of their measures is 90° .
- Two angles are **supplementary angles** if the sum of their measures is 180° .

DEGREE MEASURE

- $360^\circ =$ one revolution (measured counterclockwise)
- $1^\circ = \frac{1}{360}$ revolution

DEGREES, MINUTES, SECONDS (DMS)

- One degree is equal to sixty **minutes**. That is,

$$1^\circ = 60'$$

- One minute is equal to sixty **seconds**. Hence,

$$1' = 60'' \quad \text{and} \quad 1^\circ = 3600''$$

Example 1: Convert $30^\circ 6' 27''$ into decimal degrees.

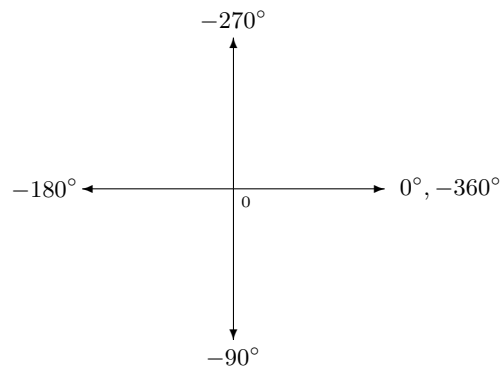
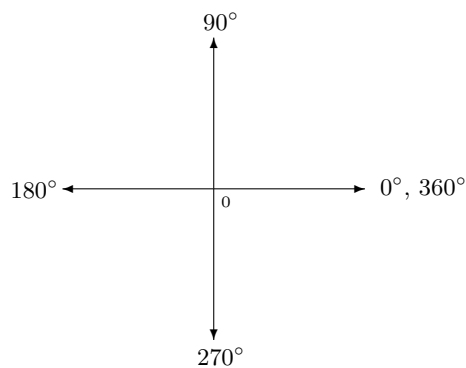
Example 2: Convert $58^\circ 12' 18''$ into decimal degrees.

Example 3: Convert 25.139° into DMS.

Definition. An angle θ is in **standard position** if its vertex is at the origin on a rectangular coordinate system and its initial side is the along the positive x -axis.

Definition. If the terminal side of θ lies on the x or y -axes, then θ is a **quadrantal angle**.

MEMORIZE You must memorize the quadrantal angles:



Example 4: Draw each angle:

(a) $\alpha = 45^\circ$

(d) $\theta = 480^\circ$

(b) $\beta = -45^\circ$

(e) $\phi = -225^\circ$

(c) $\gamma = 230^\circ$

(f) $C = -310^\circ$

Definition. Angles that have the same initial and terminal sides are **coterminal angles**.

Result. Let θ be any angle. Then there are an infinite number of angles that are coterminal with θ . These coterminal angles all differ by a multiple of 360° .

Example 5: Give two positive and two negative angles that are coterminal with

(a) $\theta = 40^\circ$

(b) $\theta = 160^\circ$

(c) $\theta = -100^\circ$