You can generate any angle by using a rotation where one ray called the **initial side** is rotated until reaching another ray called the **terminal side**. If the initial side starts on the positive x-axis, the angle is said to be in **standard position**.
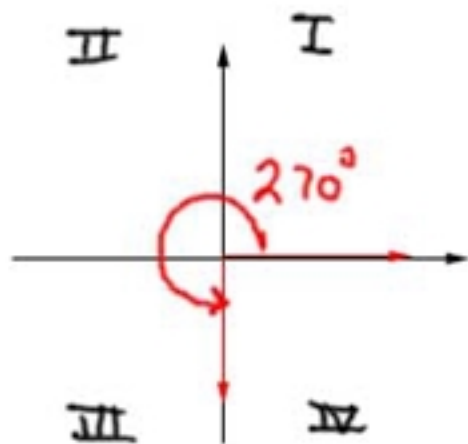
Positive angles are generated by **counterclockwise** rotations, while **negative angles** are produced by **clockwise** rotations.
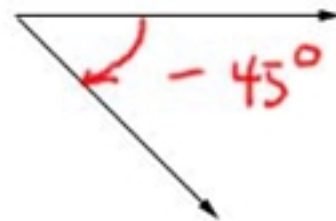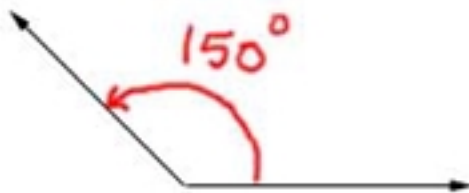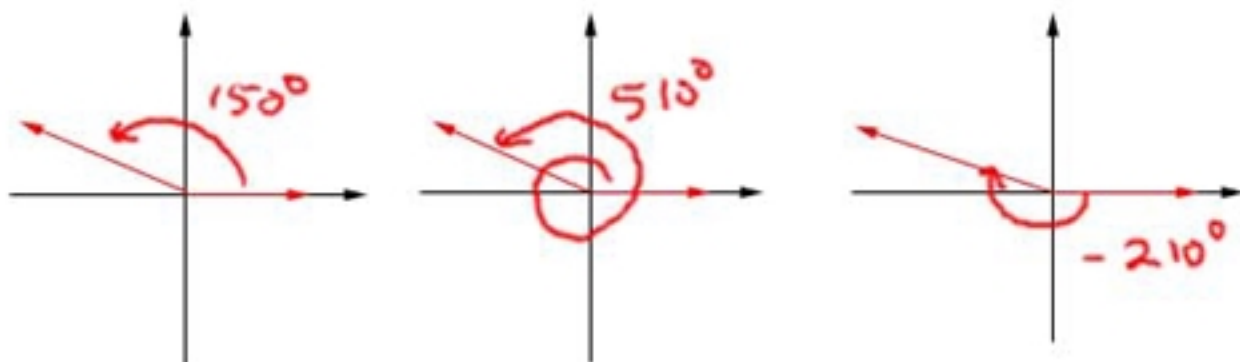

Standard position angles:
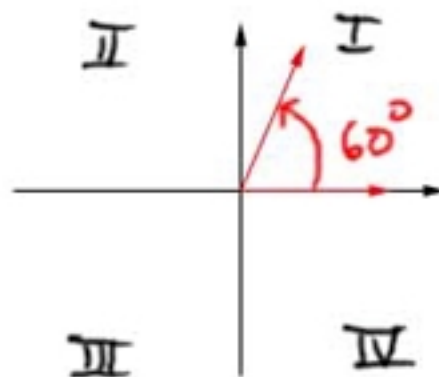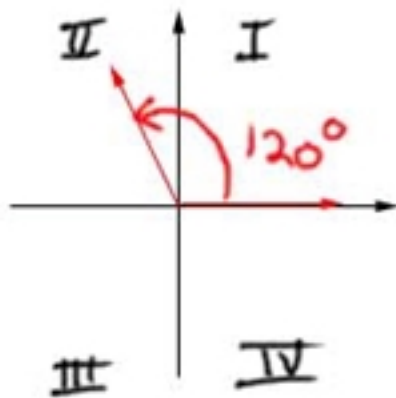
If the **terminal side** lies on the *x*-axis or *y*-axis, the angle is called a **quadrantal angle**.

II   I

$270°$

III   IV

Two standard position angles are **coterminal** if their terminal sides coincide (are the same line).

$150°$ $510°$ $-210°$

The measures of all angles coterminal with $150°$ are given by the formula: $150° + n \cdot 360°$, where n is an integer.

Ex 1a) Write a formula for the measures of all angles coterminal with $30°$.

Solution 1a) $30° + n \cdot 360°$

Ex 1b) Use the formula to find two positive angles and two negative angles that are coterminal with 30°.

Solution 1b) Let n = -2, -1, 1, and 2.

$30° + (-2) • 360° = -690°$

$30° + (-1) • 360° = -330°$

$30° + (1) • 360° = 390°$

$30° + (2) • 360° = 750°$

For greater accuracy, one degree (1°) can be divided into 60 minutes (60'), or 1° = 60'.
One minute (1') can be divided into 60 seconds (60"), or 1' = 60".

Use the following summary for degrees, minutes, and seconds:

$$1' = \left(\frac{1}{60}\right)° \qquad 1'' = \left(\frac{1}{60}\right)' = \left(\frac{1}{3600}\right)°$$

Ex 2a) Express 14° 36' 54" in decimal degrees:

2a) 14° 36' 54" =

$$14°36'54" = 14° + \left(\frac{36}{60}\right)° + \left(\frac{54}{3600}\right)°$$

$= 14° + 0.6° + 0.015°$

$= 14.615°$

Ex 2b) Express 72.568° in degrees, minutes, and seconds
rounded to the nearest second.

2b) 72.568° = 72° + (0.568 x 60)'
= 72° + 34.08'
= 72° + 34' + (0.08 x 60)"
= 72° + 34' + 4.8"
= 72° 34' 5"