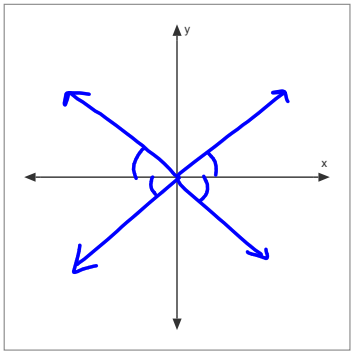

3.2 Angles in Standard Position in All Quadrants

The reference angle for an angle in standard position is the acute $< 90°$

angle between nearest x-axis and terminal arm.

Thus, there are four different rotation angles (measured from the positive x-axis) that have the same reference angle.

As a result, any angle from 90° to 360° is the reflection the x-axis and/or y-axis of the angle's reference angle.





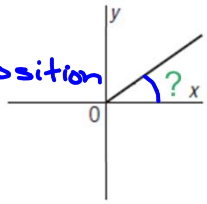
For example, each of the following rotation angles have a reference angle of 35°, but why? How do you calculate the angle in standard position given the reference angle in each quadrant?

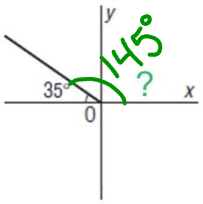
Quad. I : ref. angle = angle in standard position

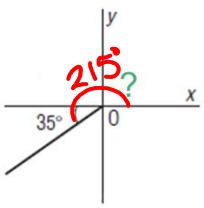
Quad II : $180° - \theta_{ref}$

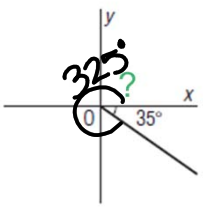
Quad III : $180° + \theta_{ref}$

Quad IV : $360° - \theta_{ref}$




## The CAST Rule

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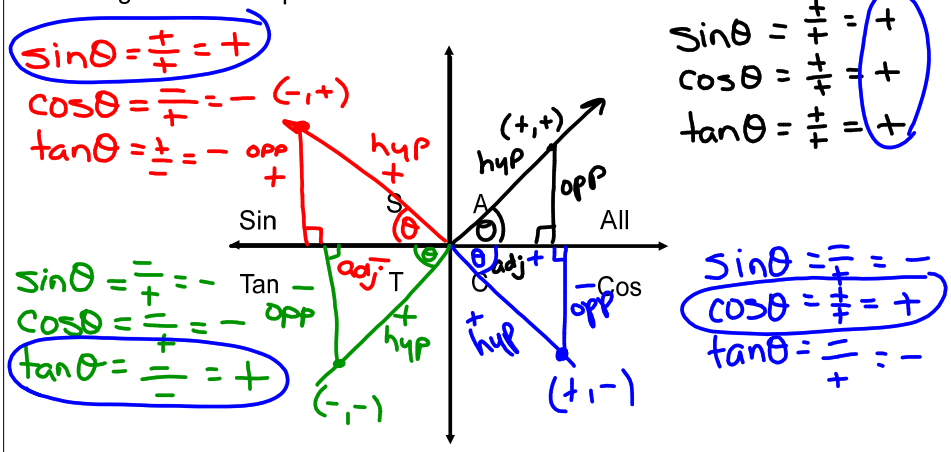
The **CAST** Rule tells us ***where*** each of the **primary trigonometric ratios** are **positive** or **negative**. If a trigonometric ratio is not listed in a quadrant, it is negative in that quadrant.




$\sin\theta = \frac{+}{+} = +$
$\cos\theta = \frac{-}{+} = -$
$\tan\theta = \frac{+}{-} = -$

$\sin\theta = \frac{+}{+} = +$
$\cos\theta = \frac{+}{+} = +$
$\tan\theta = \frac{+}{+} = +$

$\sin\theta = \frac{-}{+} = -$
$\cos\theta = \frac{-}{+} = -$
$\tan\theta = \frac{-}{-} = +$

$\sin\theta = \frac{-}{+} = -$
$\cos\theta = \frac{+}{+} = +$
$\tan\theta = \frac{-}{+} = -$


Ex.) Each angle θ is in standard position. State the quadrants in which the terminal arm of the angle could lie.

a) $\sin\theta = 4/5$

I , II

b) $\cos\theta = -1/2$

II , III

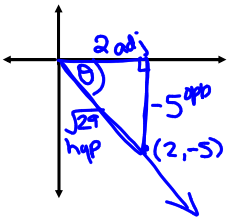
c) $\tan\theta = 1/5$

I , III

d) $\sin\theta = -0.25$

III , IV


Ex.) The point B(2, -5) is on the terminal arm of an angle θ in standard position.




a) Sketch the angle.

b) Determine the distance from the origin to point B. What is the name of this line?

$\sqrt{2^2+(-5)^2} = \sqrt{29}$

c) Write the primary trigonometric ratios of θ.

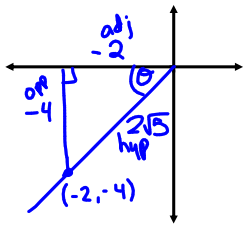
$\sin\theta = -\frac{5}{\sqrt{29}}$ $\cos\theta = \frac{2}{\sqrt{29}}$ $\tan\theta = -\frac{5}{2}$

d) Determine the measure of θ to the nearest degree.

$\theta_{ref} = 68°$

$\theta = 360° - 68° = \boxed{292°}$ ✳


Ex.) The point B(-2, -4) is on the terminal arm of an angle θ in standard position.




a) Sketch the angle.

b) Determine the distance from the origin to point B.

$\sqrt{(-2)^2+(-4)^2} = \sqrt{20} = \sqrt{4\cdot5} = 2\sqrt{5}$

c) Write the primary trigonometric ratios of θ.

$\sin\theta = -\frac{2}{\sqrt{5}}$ $\cos\theta = -\frac{1}{\sqrt{5}}$ $\tan\theta = 2$

-63° 116° 63°

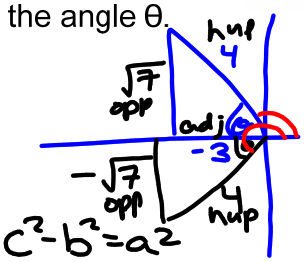
d) Determine the measure of θ to the nearest degree.

$\theta_{ref} = 63°$

$\theta = 180° + 63° = \boxed{243°}$


Ex. a) Given that $\cos\theta = -\frac{3}{4}$, determine the other primary trigonometric ratios of the angle θ.

$\frac{-3}{4}$ $\frac{adj}{hyp}$




Quad II : $\sin\theta = \frac{\sqrt{7}}{4}$ $\tan\theta = \frac{\sqrt{7}}{-3}$

Quad III : $\sin\theta = -\frac{\sqrt{7}}{4}$ $\tan\theta = \frac{\sqrt{7}}{3}$

b) To the nearest degree, determine the possible values for θ when $0° \le \theta \le 360°$

$\theta_{ref} = 41°$

II : $180° - 41° = \boxed{139°}$

III : $180° + 41° = \boxed{221°}$


Pg. 83 # 5-7.

Pg. 96 # 1bcd, 3bcd, 4, 5bcd, 6.