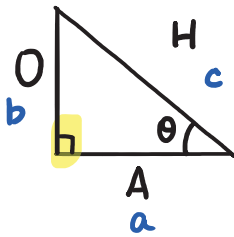


8.1 Angles in Standard Position

Recall from grade 10 math:



$$\sin \theta = \frac{O}{H}$$

$$\tan \theta = \frac{O}{A}$$

SOH CAH TOA

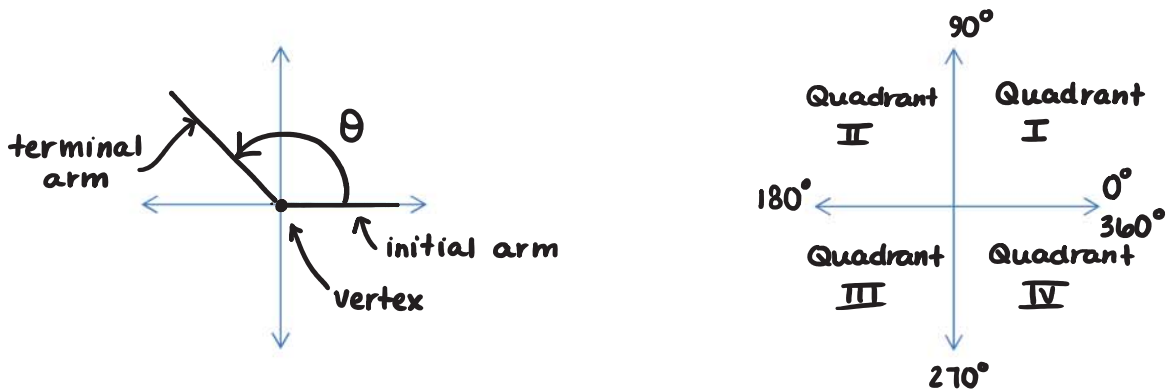
$$\cos \theta = \frac{A}{H}$$

Pythagorean theorem :

$$a^2 + b^2 = c^2$$

A. Angles in Standard Position

An angle is said to be an **angle in standard position** if its vertex is at the origin of a coordinate grid and its **initial arm coincides with the positive x-axis**.

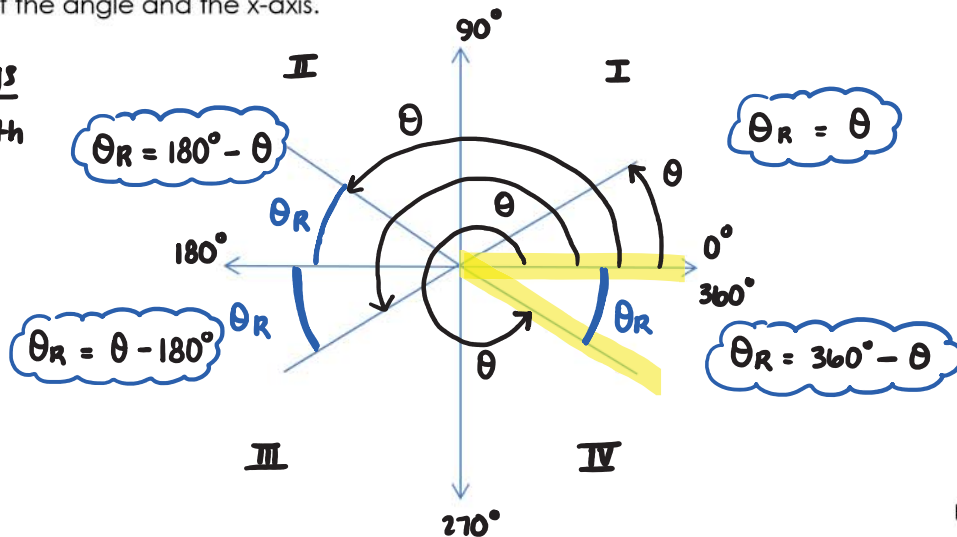


Note: all positive angles are measured counter-clockwise

B. Reference Angle θ_R

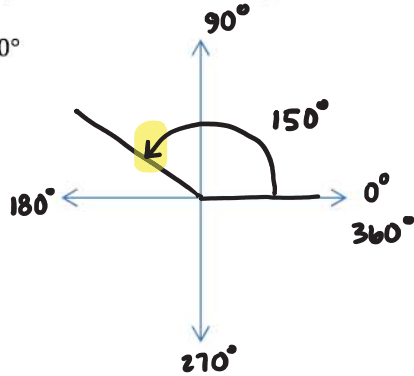
A reference angle is an **acute** angle ($< 90^\circ$) whose vertex is at the origin and whose arms are the terminal arm of the angle and the x-axis.

θ_R is always measured with the x-axis.

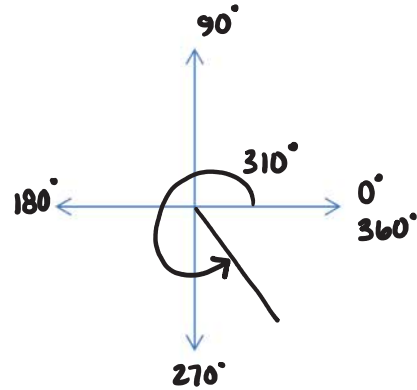


Example 1: Draw each angle in standard position.

a) 150°

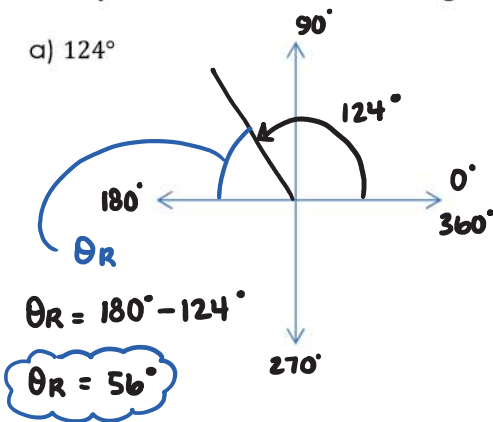


b) 310°

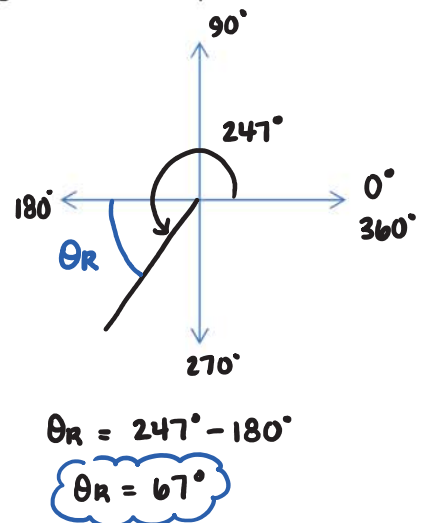


Example 2: Find the reference angle of the following angles in standard position:

a) 124°



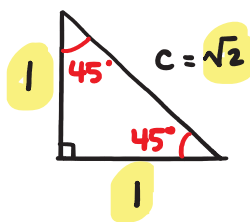
b) 247°



C. Special Right Triangles

For angles of 30° , 60° , and 45° , you can determine the exact value of the trigonometric ratios sine, cosine and tangent. (no decimals)

Type 1: $45^\circ : 45^\circ : 90^\circ$ triangle.



$$a^2 + b^2 = c^2$$

$$1^2 + 1^2 = c^2$$

$$\sqrt{2} = \sqrt{c^2}$$

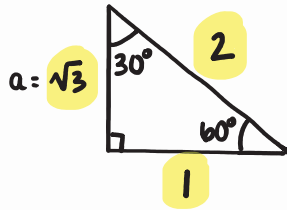
$$\sqrt{2} = c$$

$$\sin 45^\circ = \frac{O}{H} = \frac{1}{\sqrt{2}}$$

$$\cos 45^\circ = \frac{A}{H} = \frac{1}{\sqrt{2}}$$

$$\tan 45^\circ = \frac{O}{A} = \frac{1}{1} = 1$$

Type 2: $30^\circ:60^\circ:90^\circ$ triangle.



$$a^2 + b^2 = c^2$$

$$a^2 + 1^2 = 2^2$$

$$a^2 + 1 = 4$$

$$\sqrt{a^2} = \sqrt{3}$$

$$a = \sqrt{3}$$

$$\sin 30^\circ = \frac{1}{2}$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

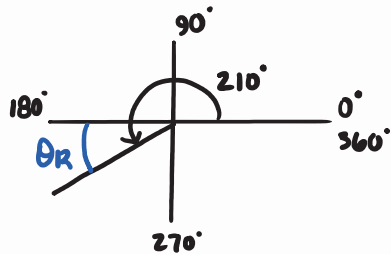
$$\cos 60^\circ = \frac{1}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\tan 60^\circ = \frac{\sqrt{3}}{1} = \sqrt{3}$$

Example 3: Determine the exact ratios for $\cos 210^\circ$ and $\tan 210^\circ$ (without using a calculator).

① draw our angle in standard position



② Calculate the reference angle

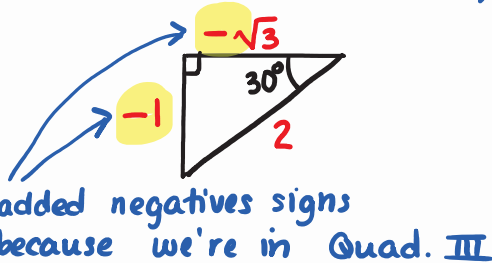
$$\theta_R = 210^\circ - 180^\circ$$

$$\theta_R = 30^\circ$$

③ Use a "special triangle" to solve the question

* using reference angle

* be aware of what quadrant you're in.



④ Write our final answer with our angle in standard position.

$$\cos 210^\circ = -\frac{\sqrt{3}}{2}$$

$$\tan 210^\circ = \frac{-1}{-\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$$\tan 210^\circ = \frac{\sqrt{3}}{3}$$

Practice: p. 83 # 2, 3abc, 4 cd, 5, 6abc, 7ab, 8, 9, 15

Mrs. Donnelly

Pre-Calc 11