**Standard Angle (θ) & Principle Angle**

We commonly use θ (theta) to denote an arbitrary missing angle. In particular, we use θ to denote an angle relative to the x+ axis with the counter clockwise orientation as positive and clockwise orientation as negative. This is called the **standard angle**. e.g. θ = +90° is the same direction as θ = -270°. θ =10° is the equivalent direction as θ = 370°. When θ is simplified to its equivalent angle between 0° and 360° (0° ≤ θ < 360°) we call this the **principle angle**.

However, there are times when final direction is not the only concern. The dial for a radio tuner or winding a spring are good examples where ± rotation is crucial.

**Standard Angles, Azimuth, Bearing and Back Angles**

**Standard Angle** is measured from the positive x-axis (East) with counter-clockwise being positive. The standard angle is usually denoted by θ. In mechanical drawings, engineering diagrams and mathematics standard angle is the most common choice.

**Azimuth** (abbreviated azi) is a compass heading measured from due North with clockwise being positive. e.g. 135° azi = due SE.

**Bearing** is by compass quadrants. It’s measured from due North or due South whichever is closer. e.g. N 45° E = due NE.

Both azimuth and bearing are common where angle orientation is key.

In a **Cartesian Coordinate System** each (x,y) point may be associated with an angle. Using Cartesian points is convenient when the reference system is primarily horizontal and vertical shifts such as programming in a milling machine layout or architectural drawing.
Label the following on the unit circle \((r = 1)\)

**Standard Angles in Degrees:** 0°, 30°, 45°, 60°, 90°, 135°, 180°, 270°, -30°, 900°, -585°

**Standard Angles in Radians:** 0, \(\pi/6\), \(\pi/3\), \(\pi/4\), \(\pi/2\), \(\pi\), -\(\pi/4\), 15\(\pi\), -23.25\(\pi\)

**Bearings:** SW, S 30° W, N 30° W

**Azimuths:** 150° azi, 210° azi, 300° azi

**Coordinate Points:** (1, 0); \((\sqrt{1}/2, \sqrt{1}/2)\); \((\sqrt{1}/2, -\sqrt{1}/2)\); \((\sqrt{1}/4, \sqrt{1}/2)\); (0, -1)

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**The Critical Angles of the Unit Circle**

1. **Radians and Degrees**

2. **Azimuths and Bearings**

3. **(x, y) Coordinate Points**

4. **Table of Relationships**

<table>
<thead>
<tr>
<th>(\theta°)</th>
<th>(\theta\ rad)</th>
<th>(m)</th>
<th>(x, y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0</td>
<td></td>
<td>(1, 0)</td>
</tr>
<tr>
<td>30°</td>
<td>(\pi/6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45°</td>
<td>(\pi/4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60°</td>
<td>(\pi/3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90°</td>
<td>(\pi/2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120°</td>
<td>(2\pi/3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135°</td>
<td>(\pi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150°</td>
<td>5(\pi/6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180°</td>
<td>(\pi)</td>
<td></td>
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</tr>
</tbody>
</table>

5. Convert 100° azi to its equivalent bearing _________ and positive standard degree angle _________.

6. Convert S 55° E to its equivalent azimuth _________ and negative standard degree angle _________.

7. Convert \(\theta = 70°\) to its equivalent bearing _________ and negative radian angle _________.

8. Convert -1.4\(\pi\) radians to its equivalent bearing _________ and positive standard radian angle _________.

9. Find the back angle in positive degrees for 0.2\(\pi\) radians _________.

10. Find the principle angle (degrees) of 1240° _________. Find the principle angle (radians) of 37.25\(\pi\) _________.