Angle Terminology

An **angle** is determined by rotating a ray (half-line) about its endpoint. The **initial side** of the angle is the starting point of the ray, and the **terminal side** is the ending position of the rotating ray. The **vertex** of the angle is the endpoint of the ray.

An angle is in **standard position** if its vertex is the origin and the initial side is the positive x-axis.

An angle is **positive** if its rotation is counterclockwise.

An angle is **negative** if its rotation is clockwise.

Two angles are **coterminal** if they have the same initial and terminal sides.

The **measure of an angle** is determined by the amount of rotation from its initial to its terminal side.

A measure of **one degree** (1°) is equivalent to a rotation of $\frac{1}{360}$ of a complete revolution about the vertex.

A **central angle** of a circle is any angle whose vertex is the center of the circle. **One radian** $(1^R$ **or** $1^{\text{rad}})$ is the measure of a central angle that intercepts (subtends) an arc length equal in length to the radius of the circle.

An angle **is in quadrant I** if it is in standard position with its terminal side in quadrant I. (Similarly for quadrants II, III, and IV.)

A **quadrantal angle** is an angle in standard position whose terminal side lies on one of the axes.

An **acute angle** is an angle whose measure is between 0° and 90°.

A **right angle** is an angle whose measure is 90°.

An **obtuse angle** is an angle whose measure is between 90° and 180°.

A **straight angle** is an angle whose measure is 180°.

Two angles are **complementary** if they are both positive and the sum of their measures is 90°.

Two angle are **supplementary** if they are both positive and the sum of their measures is 180°.

Note:

1 revolution	=	360°	=	2π radians
$\frac{1}{2}$ revolution	=	180°	=	π radians
$\frac{1}{4}$ revolution	=	90°	=	$\frac{\pi}{2}$ radians
$\frac{1}{6}$ revolution	=	60°	=	$\frac{\pi}{3}$ radians
$\frac{1}{8}$ revolution	=	45°	=	$\frac{\pi}{4}$ radians
$\frac{1}{12}$ revolution	=	30°	=	$\frac{\pi}{6}$ radians

Transformations of Graphs

Vertical Shifts

If $c > 0$, then the graph of $g(x) = f(x) + c$ is the graph of f shifted upward c units.

If $c < 0$, then the graph of $g(x) = f(x) + c$ is the graph of f shifted downpward c units.

Horizontal Shifts

Let c be a positive constant.

The graph of $g(x) = f(x + c)$ is the graph of f shifted horizontally c units to the left.

The graph of $h(x) = f(x - c)$ is the graph of f shifted horizontally c units to the right.

Expansions and Contractions

If $c > 1$, then the graph of $g(x) = cf(x)$ is the graph of f stretched vertically away from the x-axis by a factor of c.

If $0 < c < 1$, then the graph of $g(x) = cf(x)$ is the graph of f shrunk vertically toward the x-axis by a factor of c.

Reflections

The graph of $g(x) = -f(x)$ is the graph of f reflected in the x-axis.

The graph of $h(x) = f(-x)$ is the graph of f reflected in the y-axis.

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Brother Walter