SOME BASIC TRIGONOMETRY - KNOW THIS!

FUNDAMENTAL TRIGONOMETRIC IDENTITIES (IDs)

Memorize these in both “directions” (left-to-right and right-to-left).

**Reciprocal Identities**

\[
\begin{align*}
csc(x) &= \frac{1}{\sin(x)} & \sin(x) &= \frac{1}{\csc(x)} \\
sec(x) &= \frac{1}{\cos(x)} & \cos(x) &= \frac{1}{\sec(x)} \\
cot(x) &= \frac{1}{\tan(x)} & \tan(x) &= \frac{1}{\cot(x)}
\end{align*}
\]

**Warning:** The reciprocal of \(\sin(x)\) is \(\csc(x)\), not \(\sec(x)\).

**Note:** We typically treat “0” and “undefined” as reciprocals when we are dealing with basic trigonometric functions. Your algebra teacher will not want to hear this, though!

**Quotient Identities**

\[
\begin{align*}
\tan(x) &= \frac{\sin(x)}{\cos(x)} & \text{and} & \cot(x) &= \frac{\cos(x)}{\sin(x)}
\end{align*}
\]

**Pythagorean Identities**

\[
\begin{align*}
\sin^2(x) + \cos^2(x) &= 1 \\
1 + \cot^2(x) &= \csc^2(x) \\
\tan^2(x) + 1 &= \sec^2(x)
\end{align*}
\]

**Tip:** The 2\(^{nd}\) and 3\(^{rd}\) IDs can be obtained by dividing both sides of the 1\(^{st}\) ID by \(\sin^2(x)\) and \(\cos^2(x)\), respectively.

**Tip:** The squares of \(\csc(x)\) and \(\sec(x)\), which have the “Up-U, Down-U” graphs, are all alone on the right sides of the last two IDs. They can never be 0 in value. (Why is that? Look at the left sides.)
Cofunction Identities

If $x$ is measured in radians, then:

$$\sin(x) = \cos\left(\frac{\pi}{2} - x\right)$$

$$\cos(x) = \sin\left(\frac{\pi}{2} - x\right)$$

We have similar relationships for tangent and cotangent - and for secant and cosecant; remember that they are sometimes undefined.

Think: Cofunctions of complementary angles are equal.

Even / Odd (or Negative Angle) Identities

Among the six basic trigonometric functions, cosine (and its reciprocal function, secant) are even:

$$\cos(-x) = \cos(x)$$
$$\sec(-x) = \sec(x), \text{ when both sides are defined}$$

The other four (sine and cosecant, tangent and cotangent) are odd:

$$\sin(-x) = -\sin(x)$$
$$\csc(-x) = -\csc(x), \text{ when both sides are defined}$$
$$\tan(-x) = -\tan(x), \text{ when both sides are defined}$$
$$\cot(-x) = -\cot(x), \text{ when both sides are defined}$$

Note: If $f$ is an even function (such as cosine), then the graph of $y = f(x)$ is symmetric about the $y$-axis.

Note: If $f$ is an odd function (such as sine), then the graph of $y = f(x)$ is symmetric about the origin.