Algebra II

Chapter 13 Notes
Sections 13.1 & 13.2

Name
13.1 Right Triangle Trigonometry Day One

Today I am...using SOHCAHTOA and special right triangle to solve trig problems.
I am successful today when I can...use SOHCAHTOA.
It is important for me to know/do this because...SOHCAHTOA is useful in solving real-life problems.

SOH CAH TOA is an acronym to help you remember the trigonometric ratios of an angle in a right triangle.

(sine) \( \sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} = \) 

(cosine) \( \cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \) 

(tangent) \( \tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \) 

Use SOHCAHTOA to find the missing side in each triangle.

1. Find \( x \). 

\[
\begin{array}{c}
\begin{tikzpicture}
\draw (0,0) -- (90:2) -- (0:2) -- cycle;
\node at (45:1) {19};
\node at (0:1) {32'};
\node at (0:2) {x};
\end{tikzpicture}
\end{array}
\]

- Set calculator to DEGREES
- Start at the angle that is given and determine from that angle which two sides you have (opp, adj, or hyp)
- Then use the appropriate trig function – sin, cos or tan

2. Find \( x \). 

\[
\begin{array}{c}
\begin{tikzpicture}
\draw (0,0) -- (90:2) -- (0:2) -- cycle;
\node at (45:1) {50'};
\node at (0:1) {35};
\node at (0:2) {x};
\end{tikzpicture}
\end{array}
\]

3. Find \( x \). 

\[
\begin{array}{c}
\begin{tikzpicture}
\draw (0,0) -- (90:2) -- (0:2) -- cycle;
\node at (45:1) {11};
\node at (0:1) {21};
\node at (0:2) {x};
\end{tikzpicture}
\end{array}
\]

You can also use SOH CAH TOA to find the measure of an angle.

To find the angle measure using SOH CAH TOA, you must use the inverse of sine, cosine and tangent. Those buttons on the calculator are: \( \sin^{-1}, \cos^{-1}, \tan^{-1} \)

They are usually found above the actual sin, cos and tan buttons. You will need to hit the 2nd button to access them.

Find the angle measure in each triangle.

4. 

\[
\begin{array}{c}
\begin{tikzpicture}
\draw (0,0) -- (90:2) -- (0:2) -- cycle;
\node at (45:1) {8};
\node at (0:1) {12};
\node at (0:2) {x};
\end{tikzpicture}
\end{array}
\]

5. 

\[
\begin{array}{c}
\begin{tikzpicture}
\draw (0,0) -- (90:2) -- (0:2) -- cycle;
\node at (45:1) {32};
\node at (0:1) {40};
\node at (0:2) {x};
\end{tikzpicture}
\end{array}
\]
Special Right Triangles
45-45-90 and 30-60-90

Find x and y in each special triangle... NO DECIMALS.

1. \(x = \), \(y = \)

2. \(x = \), \(y = \)

3. \(x = \), \(y = \)

4. \(x = \), \(y = \)

5. \(x = \), \(y = \)

6. \(x = \), \(y = \)
7. $x = \underline{\hspace{2cm}}$, $y = \underline{\hspace{2cm}}$

8. $x = \underline{\hspace{2cm}}$, $y = \underline{\hspace{2cm}}$

9. $x = \underline{\hspace{2cm}}$, $y = \underline{\hspace{2cm}}$

10. $x = \underline{\hspace{2cm}}$, $y = \underline{\hspace{2cm}}$

Solve $\triangle ABC$.

$B = \underline{\hspace{2cm}}$

11. $a = \underline{\hspace{2cm}}$ $b = 11$

$c = \underline{\hspace{2cm}}$

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**Homework: 13.1 Day One Worksheet**
13.1 Right Triangle Trigonometry Day Two

Today I am...evaluating trig functions of acute angles.
I am successful today when I can...find the six trig values of acute angles.
It is important for me to know/do this because...trig functions can help solve real-life problems.

There are three other common trigonometric ratios...SECANT, COSECANT and COTANGENT.
\[ \csc \theta = \frac{1}{\sin \theta} \] (do the reciprocal of \( \sin \theta \))
\[ \sec \theta = \frac{1}{\cos \theta} \] (do the reciprocal of \( \cos \theta \))
\[ \cot \theta = \frac{1}{\tan \theta} \] (do the reciprocal of \( \tan \theta \))

Find the exact value of the six trigonometric functions of the angle \( \Theta \) shown in the figure.
You are going to need to use SOHCAHTOA and the Pythagorean Theorem.

1. \( \cos \) _______ \( \sec \) _______
   \( \sin \) _______ \( \csc \) _______
   \( \tan \) _______ \( \cot \) _______

2. \( \cos \) _______ \( \sec \) _______
   \( \sin \) _______ \( \csc \) _______
   \( \tan \) _______ \( \cot \) _______

3. \( \cos \) _______ \( \sec \) _______
   \( \sin \) _______ \( \csc \) _______
   \( \tan \) _______ \( \cot \) _______
4. \( \cos \) _______ \( \sec \) _______

\( \sin \) _______ \( \csc \) _______

\( \tan \) _______ \( \cot \) _______

\[ \begin{array}{c}
\sqrt{85} \\
8 \\
\theta
\end{array} \]

Use a calculator to evaluate the trigonometric functions.

5. \( \sin 37^\circ \) _______

6. \( \cos 128^\circ \) _______

7. \( \tan 58^\circ \) _______

8. \( \sec 110^\circ \) _______

9. \( \csc 94^\circ \) _______

10. \( \cot 219^\circ \) _______

9. A support cable from a radio tower makes an angle of \( 56^\circ \) with the ground. If the cable is 250 feet long, how far above the ground does it meet the tower?

________________

10. An airplane flying at 20,000 feet is headed toward an airport. The airport’s landing system sends radar signals from the runway to the airplane at a \( 5^\circ \) angle of elevation. How many miles (measured along the ground) is the airplane from the runway? (1 mile = 5280 feet)

________________

**Homework: 13.1 Day Two Worksheet**
13.2 General Angles and Radian Measure

Today I am measuring angles in standard position using degrees and radians. I am successful today when I can convert back-and-forth from degrees and radians. It is important for me to know/do this because angles are everywhere in the real world.

**Angles** are formed by two rays that share a common endpoint, called the vertex.

**Initial side** – where the angle starts.

**Terminal side** – where the angle ends.

Angle measure is **positive** if the rotation is **counterclockwise**. Angle measure is **negative** if the rotation is **clockwise**.

**Standard Position** – angle whose vertex is the origin and the initial side is the positive x-axis.

Draw an angle with the given measure in standard position. Then tell which quadrant the terminal side lies.

1. $50^\circ$ Quadrant _____
2. $-120^\circ$ Quadrant _____
3. $500^\circ$ Quadrant _____

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**Degrees and Radians**

Radians are based on the circumference of the unit circle. (What is the unit circle? Good question…it will be answered on the other side of these notes.) The unit circle has a radius of 1, so using the circumference formula, its circumference is $2\pi$. Therefore, $360^\circ = 2\pi$ and $180^\circ = \pi$.

- To convert from degrees to radians, multiply by $\frac{\pi \text{ radians}}{180^\circ}$. (divide degree by 180, change to fraction, put $\pi$ in numerator)
- To convert from radians to degrees, multiply by $\frac{180^\circ}{\pi \text{ radians}}$. (replace $\pi$ with 180, then multiply/divide)

4. Convert $320^\circ$ to radians. ____________
5. Convert $-\frac{5\pi}{12}$ radians to degrees. ____________
**Unit Circle**

The unit circle is a circle with its center at the origin and a radius 1. Each quadrant is broken up into three special measures. You are eventually going to determine the sine, cosine, tangent, cosecant, secant, and cotangent for each angle measure on the unit circle.

Find the radian measure for all of the angle measures on the unit circle above.

**Homework: 13.2 Worksheet**
13.3 Trigonometric Functions of Any Angle

Today I am... evaluating trig functions of any angle.
I am successful today when I can... find the six trig values of any angle.
It is important for me to know/do this because... trig functions can help solve real-life problems.

1. Let \((-3, 4)\) be a point on the terminal side of an angle in standard position. Evaluate the six trigonometric functions of the angle.

\[
\begin{align*}
\sin \theta &= _____ & \cos \theta &= _____ & \tan \theta &= _____ \\
\sec \theta &= _____ & \csc \theta &= _____ & \cot \theta &= _____
\end{align*}
\]

A unit circle is a circle on the \(x-y\) coordinate plane with a radius of 1 and a center at the origin. Using special right triangles, you can find various trigonometric representations of angles.

2. What should you fill in first? ________________________________________________________________

3. What are the other numbers you need to remember? _____________________________________________

4. How do you find Tangent (\(\tan\))? __________________________________________________________________

   Which quadrants is tangent positive? ___________ Which quadrants is tangent negative? ___________

5. How do you find Secant (\(\sec\))? __________________________________________________________________

6. How do you find Cosecant (\(\csc\))? __________________________________________________________________

7. How do you find Cotangent (\(\cot\))? __________________________________________________________________

Algebra II – Chapter 13 Notes
Find the following using the unit circle.

8. \( \sin 45^\circ \)  
9. \( \cos 150^\circ \)  
10. \( \tan 90^\circ \)  

11. \( \sec 330^\circ \)  
12. \( \csc 30^\circ \)  
13. \( \cot 240^\circ \)  

14. \( \sin 300^\circ \)  
15. \( \sec 135^\circ \)  
16. \( \tan 180^\circ \)  

**Homework: 13.3 Day One Worksheet**
13.3 Trigonometric Functions of Any Angle Day Two

Today I am... **evaluating trig functions of any angle.**
I am successful today when I can... **find the six trig values of any angle.**
It is important for me to know/do this because... **trig functions can help solve real-life problems.**

1. Let \((5, -12)\) be a point on the terminal side of an angle in standard position. Evaluate the six trigonometric functions of the angle.

   \[
   \begin{align*}
   \sin \theta &= \text{_____} & \cos \theta &= \text{_____} & \tan \theta &= \text{_____} \\
   \sec \theta &= \text{_____} & \csc \theta &= \text{_____} & \cot \theta &= \text{_____}
   \end{align*}
   \]

**REFERENCE ANGLE** – an acute angle measured from the terminal side of an angle in standard position to the \(x\)-axis.

**Find the reference angles of the following angles.**

2. 140°
3. 32°
4. -250°
5. 340°

6. \(\frac{5\pi}{6}\)
7. \(-\frac{3\pi}{4}\)

8. The horizontal distance \(d\) (in feet) traveled by a projectile with an initial speed \(v\) (in feet per second) is given by the following formula

   \[
   d = \frac{v^2}{32} \sin 2\theta
   \]

   where \(\theta\) is the angle at which the projectile is launched.

   Estimate the horizontal distance traveled by a golf ball that is hit at an angle of \(40°\) with an initial speed of 125 feet per second.

   ______________

**Homework: 13.3 Day Two Worksheet**