Section 6.2 – Solving Right Angle Triangles

This booklet belongs to: ____________________________ Block: ______

- Solving triangles involves solving for all three angles and all three sides
- A quick reminder, all three angles in a triangle add up to 180°
- At this level we only discuss RIGHT ANGLE triangles so we already know one angle is 90°
- So the other two must also add to 90°

Solving Triangles

- Whenever we are solving triangle we need at least 2 pieces of information
- Either 2 sides or 1 side and 1 angle
- From there we can then solve for everything else

All of the rest of the information comes from working with ratios

To help remember these ratios we think about these three words

SOH

They stand for:

\[
\text{Sine} \theta = \frac{\text{Opposite}}{\text{Hypotenuse}} \quad \text{Cosine} \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} \quad \text{Tangent} \theta = \frac{\text{Opposite}}{\text{Adjacent}}
\]

- With a right angle triangle, depending on what angle you want, the sides get named differently

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Different Solving Scenarios

An unknown Side – Using Tangent

- If you look at the triangle we have an angle and the opposite side
- We want the adjacent side
- So we have two letters of TOA, so were using \( \text{TANGENT} \)

\[
\text{Using the TOA Ratio from before:} \quad \tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}} \quad \Rightarrow \quad \tan(30) = \frac{7}{t}
\]

- Doing some Algebra:

\[
(t)\tan(30) = 7 \quad \Rightarrow \quad t = \frac{7}{\tan(30)}
\]

- Then we solve, you can simplify the \( \tan(30) \) 1st

\[
t = \frac{7}{0.5774} \quad \Rightarrow \quad t = 12.1
\]

An unknown Side – Using Tangent

- If you look at the triangle we have an angle and the adjacent side
- We want the opposite side
- So we have two letters of TOA, so were using \( \text{TANGENT} \)

\[
\text{Using the TOA Ratio from before:} \quad \tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}} \quad \Rightarrow \quad \tan(25) = \frac{x}{15}
\]

- Doing some Algebra:

\[
(15)\tan(25) = x \quad \Rightarrow \quad x = 7.0
\]
An unknown Side – Using Sine

- If you look at the triangle we have an angle and the opposite side
- We want the hypotenuse
- So we have two letters of SOH, so we're using SINE

- Using the SOH Ratio from before:
  \[ \sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}} \rightarrow \sin(30) = \frac{7}{t} \]
  - Doing some Algebra:
    \[ (t)\sin(30) = 7 \rightarrow t = \frac{7}{\sin(30)} \]
  - Then we solve, you can simplify the \( \sin(30) \) 1st
    \[ t = \frac{7}{0.5} \rightarrow t = 14 \]

An unknown Side – Using Sine

- If you look at the triangle we have an angle and the hypotenuse
- We want the opposite side
- So we have two letters of SOH, so we're using SINE

- Using the SOH Ratio from before:
  \[ \sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}} \rightarrow \sin(25) = \frac{x}{15} \]
  - Doing some Algebra:
    \[ (15)\sin(25) = x \]
  - Then we solve, you can simplify the \( \sin(25) \) 1st
    \[ (15)(0.4226) = x \rightarrow x = 6.3 \]
An unknown Side – Using Cosine

- If you look at the triangle we have an angle and the adjacent side
- We want the hypotenuse
- So we have two letters of CAH, so were using COSINE

\[ \cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}} \]

\[ \cos(30) = \frac{7}{t} \]

Doing some Algebra:

\[ (t)\cos(30) = 7 \Rightarrow t = \frac{7}{\cos(30)} \]

Then we solve, you can simplify the \( \cos(30) \) 1st

\[ t = \frac{7}{0.8660} \Rightarrow t = 8.1 \]

An unknown Side – Using Cosine

- If you look at the triangle we have an angle and the hypotenuse
- We want the adjacent side
- So we have two letters of CAH, so were using COSINE

\[ \cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}} \]

\[ \cos(25) = \frac{x}{15} \]

Doing some Algebra:

\[ (15)\cos(25) = x \]

Then we solve, you can simplify the \( \cos(25) \) 1st

\[ (15)(0.9063) = x \Rightarrow x = 13.6 \]
**An unknown Angle – Using Tangent**

- If you look at the triangle we have the **opposite and adjacent sides**
- We want the **angle**
- So we have **two letters of TOA**, so we are using **TANGENT**

![Diagram of a right triangle with sides 7 and 12 labeled](image)

- Using the **TOA Ratio** from before:
  \[
  \tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}} \quad \Rightarrow \quad \tan(\theta) = \frac{7}{12}
  \]

- Then we can simplify the \(\frac{7}{12}\) to 1st

  \[
  \tan(\theta) = 0.5833
  \]

- Then we use the inverse Tangent button

  \[
  \theta = \tan^{-1}(0.5833) \quad \Rightarrow \quad 30.3^\circ
  \]

**An unknown Angle – Using Sine**

- If you look at the triangle we have the **opposite side and hypotenuse**
- We want the **angle**
- So we have **two letters of SOH**, so we are using **SINE**

![Diagram of a right triangle with sides 7 and 12 labeled](image)

- Using the **SOH Ratio** from before:
  \[
  \sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}} \quad \Rightarrow \quad \sin(\theta) = \frac{7}{12}
  \]

- Then we can simplify the \(\frac{7}{12}\) to 1st

  \[
  \sin(\theta) = 0.5833
  \]

- Then we use the inverse Sine button

  \[
  \theta = \sin^{-1}(0.5833) \quad \Rightarrow \quad 35.7^\circ
  \]
An unknown Angle – Using Cosine

- If you look at the triangle we have the **adjacent side and hypotenuse**
- We want the **angle**
- So we have **two letters of CAH**, so we’re using **COSINE**

![Triangle Diagram]

- Using the **CAH Ratio** from before:

\[
\cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}} \quad \rightarrow \quad \cos(\theta) = \frac{7}{12}
\]

- Then we can simplify the \( \frac{7}{12} \) to its **1st** form:

\[
\cos(\theta) = 0.5833
\]

- Then we use the inverse Sine button

\[
\theta = \cos^{-1}(0.5833) \quad \rightarrow \quad 54.3^\circ
\]
Section 6.2 – Practice Problems

Use your Trigonometric Ratios to solve for the desired side.

1. \( r = \) 

2. \( c = \) 

3. \( u = \) 

4. \( m = \) 

5. \( v = \) 

6. \( a = \)
Find the measure of the indicated angle, to the nearest tenth of a degree.

7. $m \angle K = \ldots^\circ$

8. $m \angle K = \ldots^\circ$

9. $m \angle K = \ldots^\circ$

10. $m \angle V = \ldots^\circ$

11. $m \angle F = \ldots^\circ$

12. $m \angle D = \ldots^\circ$
Find the length of the side denoted by a variable. Round answers to the nearest tenth.

13. \( s = \)? in

14. \( b = \)? cm

Find the area of the triangle. Round answers to the nearest tenth.

15. \( h = \)? ft

16. \( d = \)? in

17. \( \text{Area} = \)? mm\(^2\)

18. \( \text{Area} = \)? yd\(^2\)
### Answer Key – Section 6.2

1. \( r = 3.86 \)
2. \( c = 11.47 \)
3. \( u = 23.81 \)
4. \( m = 4.53 \)
5. \( v = 16.48 \)
6. \( a = 9.33 \)
7. \( 64.9^\circ \)
8. \( 43.6^\circ \)
9. \( 48.9^\circ \)
10. \( 30.5^\circ \)
11. \( 53.1^\circ \)
12. \( 12.7^\circ \)
13. \( 49.1\text{in} \)
14. \( 94.9\text{cm} \)
15. \( 15.1\text{ft} \)
16. \( 8.1\text{in} \)
17. \( 924.8\text{mm}^2 \)
18. \( 3729.9\text{yd}^2 \)
Extra Work Space