Right Triangle Trigonometry (Part 2)

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Objectives

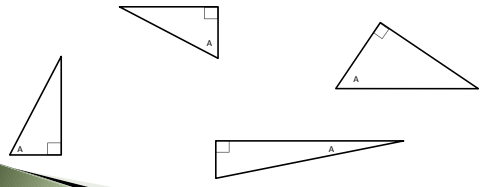
- Sine, Cosine, and Tangent Ratios
- Solving Triangles – unknown on top
- Solving Triangles – unknown on bottom
- Solving Triangles – angle unknown
- Application Problems

Trigonometric Ratios

- We are now going to learn how to find missing sides and angles of right triangles. There are many times when not all things are square – making 90 degree angles everywhere. When this is the case, we often need to use trigonometry to find dimensions needed or the angle something needs to set or cut.
- Skip to the last few problems here to see some images of examples of where you would need to use trigonometry to find a missing angle or dimension before we get a solid base of how to solve these ratios.

Trigonometric Ratios

- To use the ratios, we need to know which side is the opposite side and which is the adjacent side for a specified angle.
- Example: Label the sides opposite, adjacent, and hypotenuse for each triangle for angle A.



Trigonometric Ratios

- The sine (pronounced "sign") ratio for some angle, A, is

$$\sin A = \frac{\text{opposite side}}{\text{hypotenuse}}$$

- The cosine (pronounced "co-sign") ratio for some angle, A, is

$$\cos A = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

- The tangent ratio for some angle, A, is

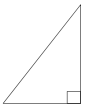
$$\tan A = \frac{\text{opposite side}}{\text{adjacent side}}$$

***Notice, each equation uses one angle and two sides.

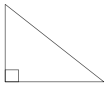
**We will always use degrees for the angle, so be sure your calculator is in degree mode.

Verifying the Trigonometric Ratios

- We will verify the trig ratios by measuring the lengths and angles of a triangle from the corner of a piece of paper.



Try Yourself – Verify your triangle



Look at patterns on Trig Table:
http://www.classzone.com/cz/books/pre_alg/resources/pdfs/formulas_and_tables/palg_table_of_trig_ratios.pdf

Solving Triangles

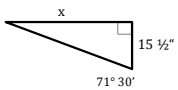
- Typically, we use the trig ratios to find missing parts of triangles, dimensions or angles
  - Situation 1 – unknown side on top
  - Situation 2 – unknown side on bottom
  - Situation 3 – angle unknown
- We will use all three trig ratios, (sin,cos,tan) depending on which one works easiest
- Always estimate what you answer should be first to be sure you used the correct ratio and set up the equation correctly

Situation 1 – unknown side on top

- Example: Find x: (Round to the nearest hundredth of a foot.)

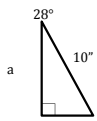
Situation 1 – unknown on top

- Example: Find x: (Round to the nearest 16th of an inch.)



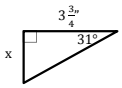
Try Yourself

- 1) Find a:



Try Yourself

- 2) Find x:



Solving for unknowns on bottom

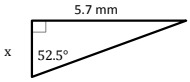
- Is this true? $2 = \frac{12}{6}$
- How do you determine 6 is correct in that spot?
- Ex: Find x: $4 = \frac{20}{x}$
- Ex: Find x: $9 = \frac{18}{x}$
- Ex: Find x: $11.32 = \frac{57.91}{x}$
- Ex: Find x: $0.792 = \frac{15}{x}$

Try Yourself

- 1) Find x: $6 = \frac{42}{x}$
- 2) Find x: $0.707 = \frac{9.625}{x}$

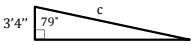
Situation 2 – unknown on bottom

- Example: Find x:



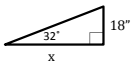
Situation 2 – unknown on bottom

- Example: Find c: (Round to the closest foot and half inch.)



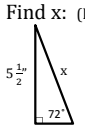
Try Yourself

- 1) Find x: (Round to the nearest 16th of an inch.)



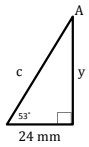
Try Yourself

- 2) Find x: (Round to the nearest 16th of an inch.)



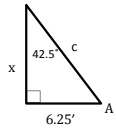
Finding Missing Sides and Angle Given an Angle and Side

- Example: Find c, y, and A: (Round to the nearest tenth of a mm and tenth of a degree.)



Try Yourself

- Example: Find the missing angles and sides: (Round to the nearest tenth of a degree and hundredth of a foot.)



Finding Angles

- In order to find a missing angle, we need to use the inverse trig functions on our calculators. For most calculators, you hit 2nd, then the trig function, then enter the value equal to the trig function of the angle.
- Example: Find A: sin A= 0.357

Finding Angles

- Examples: Find the angle to the nearest tenth of a degree.
  - sin B = 0.5
  - cos A = 0.087
  - tan B = 0.75
  - tan B = 1.8
  - sin A = 1.8
  - cos A = 1.8

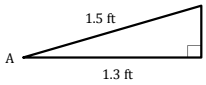
Again, look at patterns on Trig Table: http://www.classzone.com/cz/books/pre_alg/resources/pdfs/formulas_and_tables/palg_table_of_trig_ratios.pdf

Try Yourself

- 1) Find A to the nearest tenth of a degree:
  sin A = 0.95
- 2) Find A in degrees and the nearest minute:
  cos A = 0.33

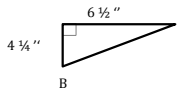
Situation 3 – angle unknown

- Example: Find A. (Round to the nearest tenth of a degree.)



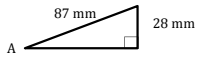
Situation 3 – angle unknown

- Example: Find B. (Round to the nearest tenth of a degree.)



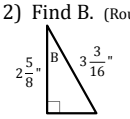
Try Yourself

- 1) Find A. (Round to the nearest tenth of a degree.)



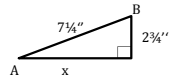
Try Yourself

- 2) Find B. (Round to the nearest tenth of a degree.)



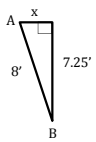
Finding the Missing Side and Angles Given Two Sides

- Example: Find A, B, and x. (Round to the nearest tenth of a degree and 16th of a inch.)



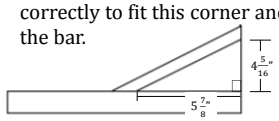
Try Yourself

- Example: Find the missing angles and sides: (Round to the nearest tenth of a degree and hundredth of a foot.)



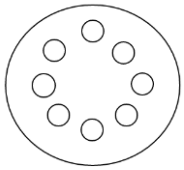
Application Problems

- The following is a skewed T-Joint that you need to prepare. Find the angles the bar needs to be cut to place correctly to fit this corner and the length of the inside of the bar.



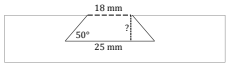
Application Problems

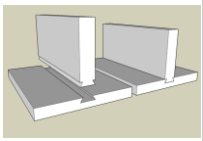
- A bolt-hole circle has 8 holes evenly spaced. The radius is 5 ¾". Find the distance between two holes.



Try Yourself

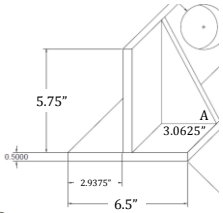
1) Determine the missing dimension in the dovetail joint below.





Try Yourself

- 2) At what angle, A, shown below should the support for the T-joint be cut?



Application Problems

- For some additional application problems: https://www.wisc-online.com/Objects/ViewObject.aspx?ID=MSR3603