MATH 10 COMMON **TRIGONOMETRY** **CHAPTER 2**

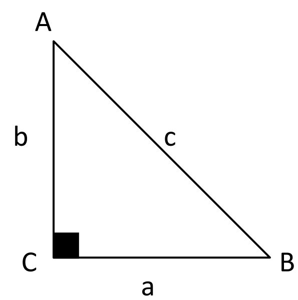
(11 Days)

Day 1 – Introduction to the Tangent Ratio

Review: How to set up your triangles:

Angles are always upper case ($\angle A, \angle B, \angle C$ etc.) and sides are always lower case (a,b,c).

$\angle C$ is always opposite side c. $\angle B$ is always opposite side b. $\angle A$ is always opposite side a.



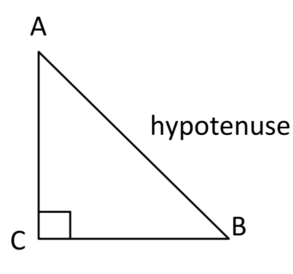
Review: Similar Triangles - How can we tell triangles are similar? (Blackline Master 2.1a)

For right triangles, look for an angle and a side to be the same or for the ratio between 2 sides to be the same.

Review: Pythagorean Theorem (Line Master 2.1c)

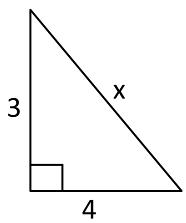
$c^2 = a^2 + b^2$ the only side that matters in this formula is **c = HYPOTENUSE**

Which side is the hypotenuse?(opposite right angle, longest side) What characteristics does the hypotenuse always possess? (it should always be the longest side in the triangle)



Examples:

1.



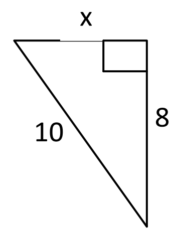
$3^2 + 4^2 = x^2$

$9 + 16 = x^2$

$25 = x^2$

$5 = x$

2.



$10^2 = 8^2 + x^2$

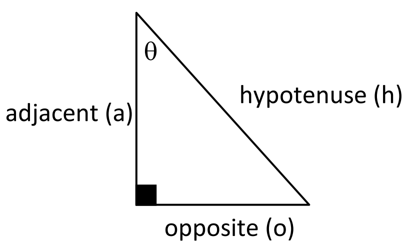
$10^2 - 8^2 = x^2$

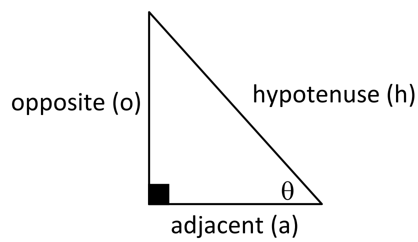
$100 – 64 = x^2$

$36 = x^2$

$6 = x$

When we get into trigonometry, we need a way to identify which side is being talked about. To do this, we always label the sides according to the angle that is being discussed. The hypotenuse is always the side opposite to the right angle. We call the side opposite the angle being talked about the opposite! Now that the hypotenuse and opposite are labeled, the last side is called the adjacent.





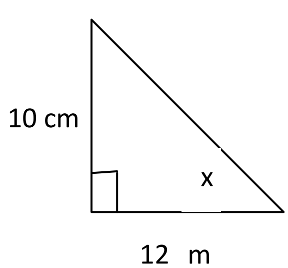
The Tangent Ratio is: TanΘ = $\frac{opposite}{adjacent}$

Once we set up the ratio, we can find the angle we are talking about by doing **2^{nd} Tan** and your ratio.

CAUTION: YOU MUST BE IN DEGREE MODE TO GET THE CORRECT ANGLE!

Examples: Find the tangent ratio and then the angle indicated to the nearest tenth (±0.1)

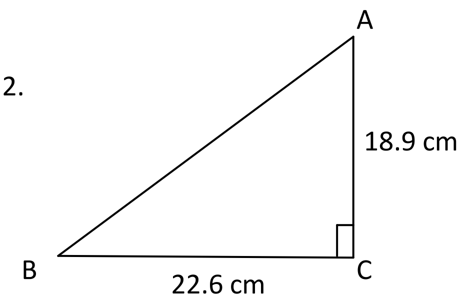
1.



Tan x =

$x = 40^o$

2.

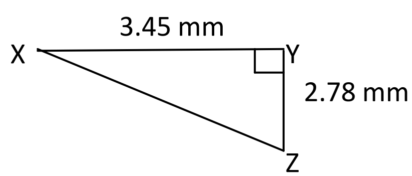


Tan A = <A = 50°

Tan B = <B = 40°

c = 29.5 cm

3.



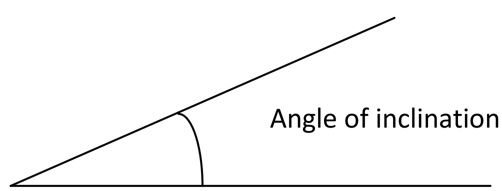
y = 4.43 mm

Tan X = <X = 39°

Tan Z = <Z = 51°

What do you notice about the tan ratio when the angle is greater than 45°? When you notice that the ratio is larger than 1, then the angle is larger than 45°! So, when the tan ratio is less than 1, the angle is less than 45°! This allows us to make predictions about the angles created by the tangent ratios when we are evaluating our answers.

When we are using angles in real life situations, we will be talking about an angle of inclination. This is the acute angle made with the horizontal line.



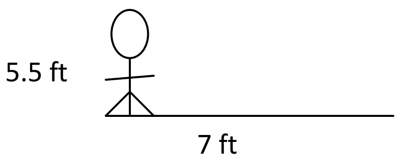
Ex. 4. A ladder is 5 feet from the bottom of a wall. The ladder reaches 12 feet up the wall.

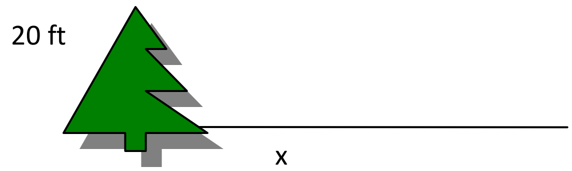
a) How long is the ladder? (13ft)

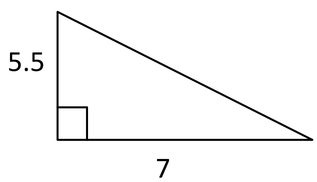
b) What is the angle of inclination of the ladder? (67)

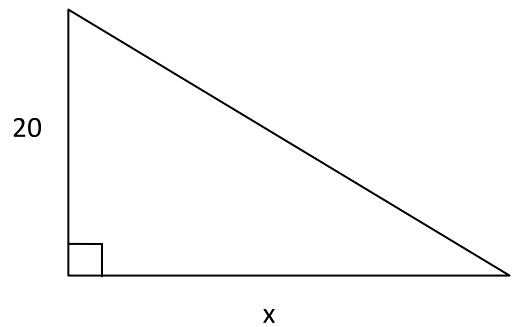
Example 3 Pg. 73 is a good example. (Real life situation) Work through on board

Ex. 5 Mandy is standing outside in the sunshine. She is 5.5 ft tall and casts a 7ft shadow. How long of a shadow will a tree that is 20ft high make at this same time of day? What is the angle of inclination of the sun?









$$\frac{5.5}{7} = \frac{20}{x}$$

5.5(x) = 20(7)

$$x = \frac{20(7)}{5.5}$$

X = 25.5 m

$$\tan\theta = \frac{5.5}{7}$$

$$\theta = 38^\circ$$

Assignment: Pg. 75 #3-7, 9, 11-13, 16, 18-20, 21. Challenger question: 23

Day 2 – Using the Tangent Ratio to calculate lengths

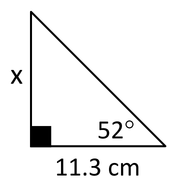
Review: $x = \frac{a}{b}$ Solve for: a Solve for: b? (Line master 2.1b)

To solve for lengths using the Tangent Ratio, we are using the same principles.

If you calculate Tan 45°, you should notice that you get a number (1). These Tan values are simply numbers that can be used in the same way as every other number! So, when we are solving for lengths, use your calculator to its fullest – type in what you see when you solve! Don't round values! You're insulting the capabilities of your calculators!!

Determine the lengths indicated:

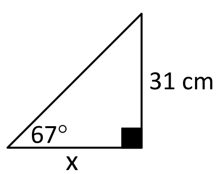
1.



$\tan 52° = \frac{x}{11.3}$

x = 14.46 cm

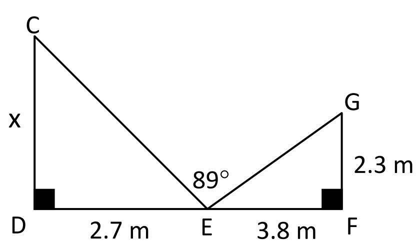
2.



$\tan 67° = \frac{31}{x}$

x = 13.16 cm

3.



$\tan \angle GEF = \frac{2.3}{8.9}$ $\angle GEF = 31.18°$

$\angle CED = 180 - 89 - 31.18 = 59.82°$

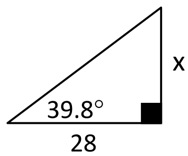
$\tan 59.82° = \frac{x}{2.7}$

x = 4.64 m

When we are finding angles or sides using a formula it is called **indirect measurement**. When we use a measuring tool to get a measurement, it is called **direct measurement**. So, we used indirect measurement a lot in mathematics as there are some things in this world that are very difficult to measure using a tool. Play DVD Example 3 Pg. 81

Word problems are setting up situations using real world items. We need to have our common sense and a great picture of the situation to use our trigonometry skills to get the measurement we are looking for.

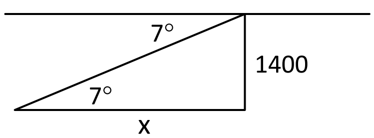
1. . The angle of elevation to the top of a building is 39.8°. If you are 28 m from the building how high is the building?



$$\tan 39.8° = \frac{x}{28}$$

x = 23.33 m

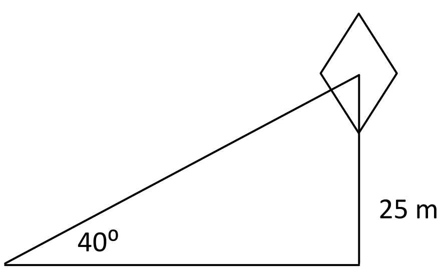
2. A plane is descending at an angle of depression (this is like the angle of inclination – it is the angle measured off the horizontal) of 7°. If the altitude of the plane is 1400 m, what is the horizontal distance between the plane and the runway?



$$\tan 7° = \frac{1400}{x}$$

x = 11 402.085 m

3. If a kite is 25 m high, how far horizontally is the kite from the person flying it if the angle of inclination of the sun is 40°?



$$\tan 40 = \frac{25}{x}$$

$$x = \frac{25}{\tan 40}$$

X = 30 meters

Assignment: Pg. 82 #3, 4, 5, 6, 8, 10, 14 Challenge Question: 16

Day 3 – Sine and Cosine Ratios

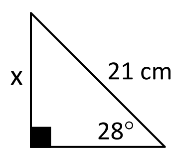
Start with Pg. 88 to determine the student's understanding to this point. Do as a class / assignment / checkpoint quiz. Focus on set up of tan ratio.

What if you don't have the opposite and the adjacent sides? What if you have the opposite and the hypotenuse? The adjacent and the hypotenuse? We have formulas for those situations too!

SinΘ = $\frac{opposite}{hypotenuse}$ CosΘ = $\frac{adjacent}{hypotenuse}$

They work in the exact same way as the Tangent ratio!!

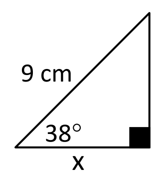
Ex. 1.



sin 28° = $\frac{x}{21}$

x = 9.86 cm

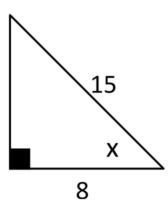
2.



cos 38° = $\frac{x}{9}$

x = 7.09 cm

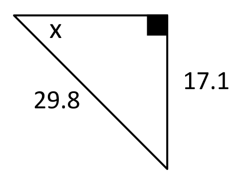
3.



cos x = $\frac{8}{15}$

x = 57.77°

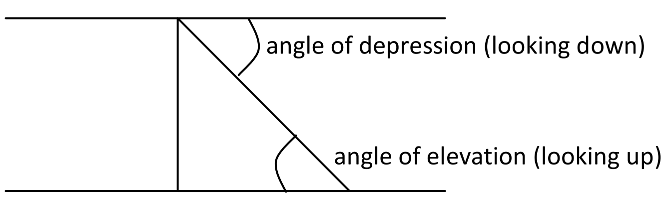
4.



sin x = $\frac{17.1}{29.8}$

x = 35.02°

Angle of elevation & depression



– **angle made with the horizontal**

– **angle of elevation = angle of depression**

Handout Day 3 to be done in groups and discussed as a class

Assignment: pg. 95 #4-8, 10, 12-14, *15-16 make sure to discuss tomorrow Challenge Question: 17

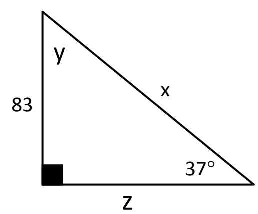
Day 4 – Choosing the right ratio

$\sin\theta = \frac{opposite}{hypotenuse}$ $\cos\theta = \frac{adjacent}{hypotenuse}$ $\tan\theta = \frac{opposite}{adjacent}$ or SOH CAH TOA

The best way to figure out which of the three ratios to use in a situation, is to identify which sides you have. Labeling your triangle will tell you quickly which ratio to use or if Pythagorean theorem can be used too.

1. Solve the triangle. This means solve for all unknown sides and angles. (Give $90°$, $37°$ and 83)

$$y = 180° - 90° - 37° = 53°$$



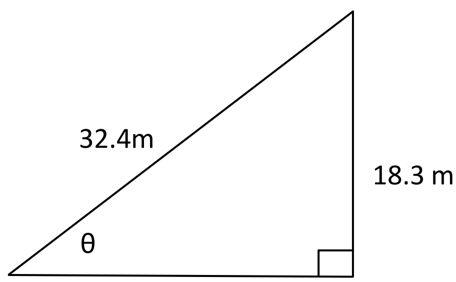
$\tan 37° = \frac{83}{z}$

$z = 110$

$\sin 37° = \frac{83}{x}$

$x = 138$

2. A kite string is 32.4m long and the height of the kite flying is 18.3m. At what angle does the kite string make with the ground?



$\sin\theta = \frac{18.3}{32.4}$

$\theta = 34.4°$

Assignment Pg. 101 #3-6, 8-12 Challenge Question: 14

Day 5 – Applying the Trigonometric Ratios

Do Pg. 104 as class/assignment/quiz to assess understanding to this point.

Show how triangles can be found in many shapes. By knowing triangles, we can figure out perimeter of more complicated shapes. Give Example 3 DVD on pg. 109.

Put students in groups of 2-3. Go to page 111-112 and have students do any 3 questions on the page in section A. Did they all use the same method to solve? Could different methods be used? Stay in groups and discuss how they would solve #8-11. What was the first step? Does everyone need to draw a diagram? What was the most important thing on the diagram? Does everyone's diagram look the same? Why or why not? Does the little details make the question different or better? Solve as a class.

Assignment: Pg. 112 #12-14 and Worksheet on trig. I - II

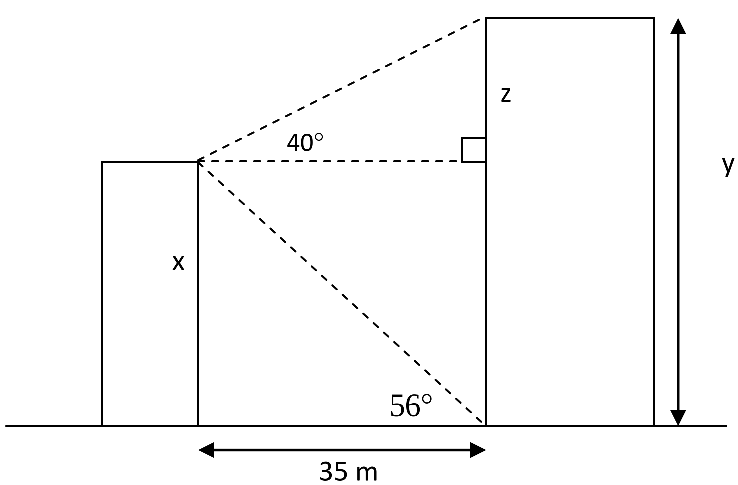
Day 6 – Problem Solving

When solving problems that involve more than one triangle, you need to look for what is the common side/angle that links these triangles. There has to be information you calculate in one triangle that gives you information in the other triangle that has your ultimate goal in mind. Find that link!! What makes these two triangles together??

Go through Example 1 Pg.114 with students to show how we look for the common side between the triangles.

Show DVD Example 2 Pg.115

From the top of a short building, the angle of elevation to the top of a tall building is $40°$. The angle of depression to the base of the tall building is $56°$. The buildings are 35m apart. Find the height of the two buildings.



$$\tan 56° = \frac{x}{35}$$

$$x = 52m$$

$$\tan 40° = \frac{z}{35}$$

$$z = 29m$$

$$y = x + z = 52 + 29 = 81m$$

HONOURS ONLY : Hand out Advanced Trigonometry worksheet . Do 3 Questions together and then have groups solve the problems. This will be more group and individual work. Put questions on board as needed to further instruction.

Assignment: Pg. 118 #3(a, b), 4(a, b), 5 (a, b), 8, 11, 12 Challenge Question: 19

<u>Day 7 – The Sine Law</u>

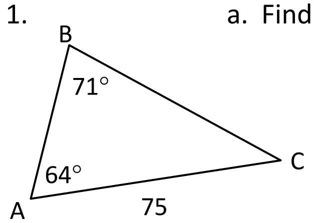
I. Law of Sines. Sin law: $\frac{a}{\sin\angle A} = \frac{b}{\sin\angle B}$

In an oblique triangle (no right angle) when 2 angles and one side is given (AAS or ASA),

the other sides can be found using the law of sines.

Examples:

1.



a. Find c. $\frac{75}{\sin 71^\circ} = \frac{c}{\sin 45^\circ}$

$75\sin 45^\circ = c \sin 71^\circ$

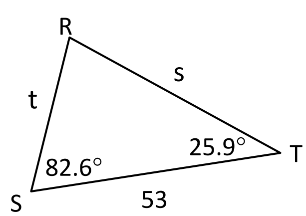
$\frac{75\sin 45^\circ}{\sin 71^\circ} = c$

$56.1 = c$

b. Find a $\frac{a}{\sin 64^\circ} = \frac{75}{\sin 71^\circ}$

$a = 71.3$

2. Find t and s in ΔRST where $\angle S = 82.6^\circ$, $\angle T = 25.9^\circ$ and r = 53 m.



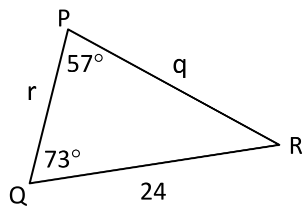
$\angle R = 180 - (82.6^\circ + 25.9^\circ)$

$\angle R = 71.5^\circ$

$\frac{s}{\sin 82.6^\circ} = \frac{53}{\sin 71.5^\circ}$ $\qquad$ $\frac{t}{\sin 25.9^\circ} = \frac{53}{\sin 71.5^\circ}$

s = 55.4 m $\qquad$ t = 24.4 m

3. Given $\triangle PQR$, $\angle P = 57^\circ$, $\angle Q = 73^\circ$ and p = 24 m, solve the triangle.



$\angle R = 180^\circ - (73^\circ + 57^\circ)$

$= 50^\circ$

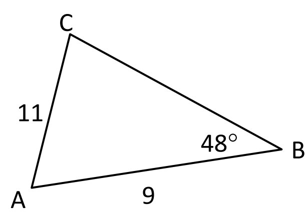
$$\frac{24}{\sin 57^\circ} = \frac{r}{\sin 50^\circ}$$

r = 21.9 m

$$\frac{24}{\sin 57^\circ} = \frac{q}{\sin 73^\circ}$$

q = 27.4 m

4.



Find $\angle C$.

$$\frac{9}{\sin \angle C} = \frac{11}{\sin 48^\circ}$$

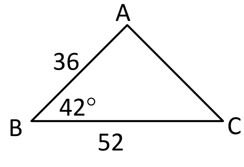
$$\sin \angle C = \frac{9 \sin 48^\circ}{11}$$

$\sin \angle C = 0.608$

Assignment: Worksheet III

Day 7 Law of Cosines. Cos law: $c^2 = a^2 + b^2 - 2ab \cos \angle C$

1. In $\triangle ABC$, $\angle B = 42^\circ$, a = 52 m and c = 36 m. Find b to the nearest metre.



$b^2 = 52^2 + 36^2 - 2(52)(36)(\cos 42^\circ)$

$b^2 = 1217.66$

b = 35 m

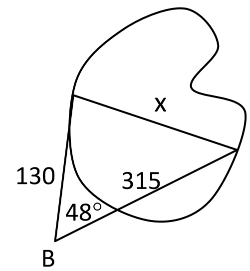
2. Find the width of a pond if from point B an

angle of 48° is contained by sides of length

130 m and 315 m.

$x^2 = 130^2 + 315^2 - 2(130)(315)\cos 48°$

$x = 247.6$ m



Assignment: IV

Day 9 – Quiz

Do Tasty Trigonometry Trivia with students to warm up and build confidence. Do any questions the students might have.

Quiz.

Day 10 – Review

Do summary sheet with students to review. Hand out review to be worked on.

Day 11 – Unit Test