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MATH@TD

Unit 5 – Trigonometric Ratios

5.7: The Cosine Law (Should be review)

Learning Goal: We are learning to use the cosine law to solve non-right angle triangles.

The Cosine Law is another "formula" for solving Oblique Triangles. Remember, to "solve" a triangle you MUST be given **3 PIECES OF INFORMATION** about the triangle (and I should note that one of those given pieces **MUST BE A SIDE LENGTH**).

The main question you will have to be able to answer is this:

When do you use

1) SOH CAH TOA

When you have a right angle △

If the given angle is acute ⇒ check for BUM case

not right angle

2) The SINE LAW

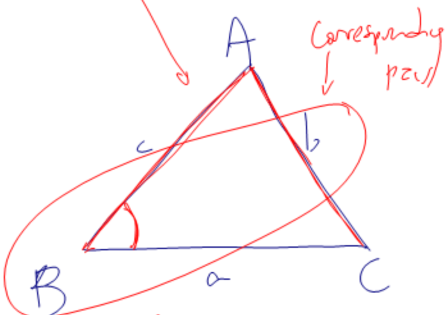
When you have a oblique △

and you have a CORRESPONDING PAIR in the triangle

If the given angle is obtuse (> 90°) ⇒ no BUM CASE

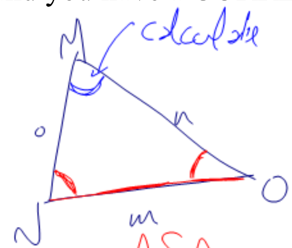
known information

corresponding pair



ASS ⇒ sine law

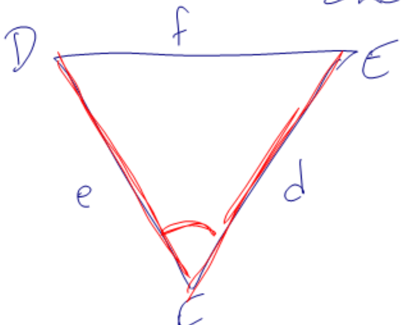
calculate 3rd angle ⇒ gives the corresponding ∠M & side m.



ASA

3) The COSINE LAW when we have an oblique △

and we CANNOT use the sine (ie no corresponding pair)



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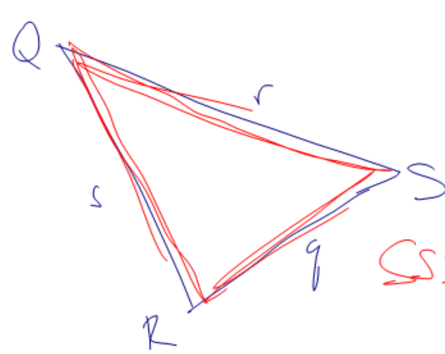
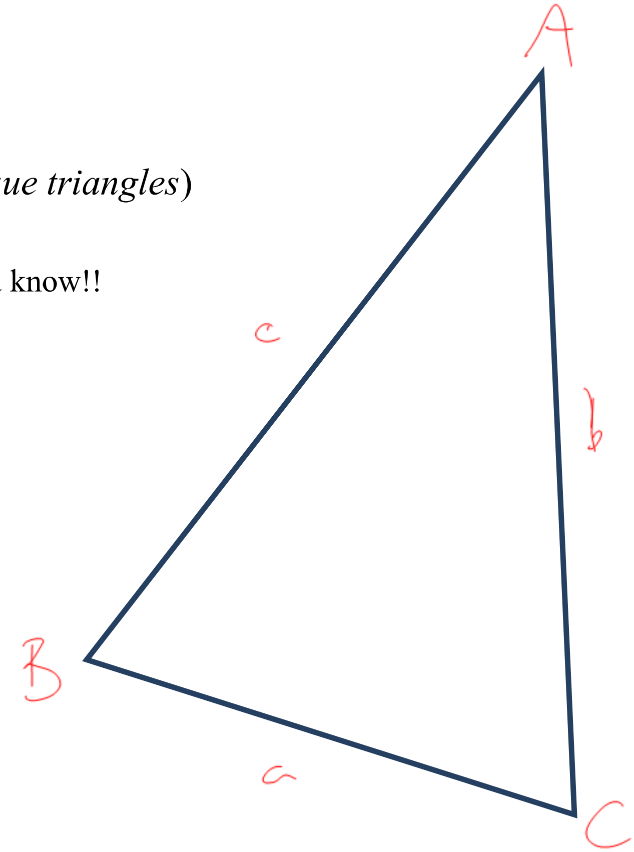


SSS

The Cosine Law *(for oblique triangles)*



There are **THREE SIDE FORMS** you should know!!

Given the non-right triangle, ΔABC, then:

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$

or

$$b^2 = a^2 + c^2 - 2ac\cos(B)$$

or

$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

Also, there are **THREE ANGLE FORMS** you should know!!

The formula you use depends on which side or angle you are looking for!!!

$$\cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

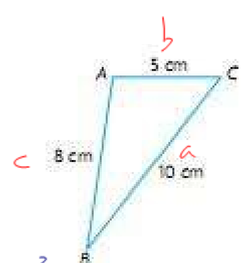
or

$$\cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$$

or

$$\cos(C) = \frac{c^2 - a^2 - b^2}{-2ab}$$

e.g. Determine angle B



$$\cos(B) = \frac{(b^2 - a^2 - c^2)}{(-2ac)}$$

B ac

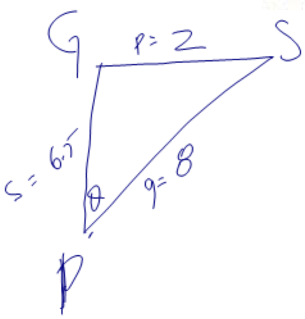
$$\Rightarrow \cos(B) = \frac{5^2 - 10^2 - 8^2}{-2(10)(8)}$$

$$\Rightarrow B = \cos^{-1}\left(\frac{(5^2 - 10^2 - 8^2)}{(-2(10)(8))}\right) \doteq 27^\circ$$

Example 5.7.1

From your text: Pg. 326 #5

The posts of a hockey goal are 2.0 m apart. A player attempts to score by shooting the puck along the ice from a point 6.5 m from one post and 8.0 m from the other. Within what angle θ must the shot be made? Round your answer to the nearest degree.



$$\cos(P) = \frac{p^2 - s^2 - g^2}{-2sg}$$

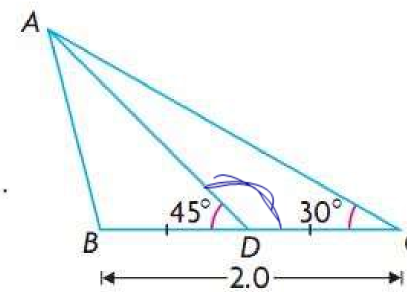
$$\cos(P) = \frac{(2^2 - 6.5^2 - 8^2)}{(-2(6.5)(8))} = 0.9832$$

$$P = \cos^{-1}(0.9832)$$
$$= 11^\circ$$

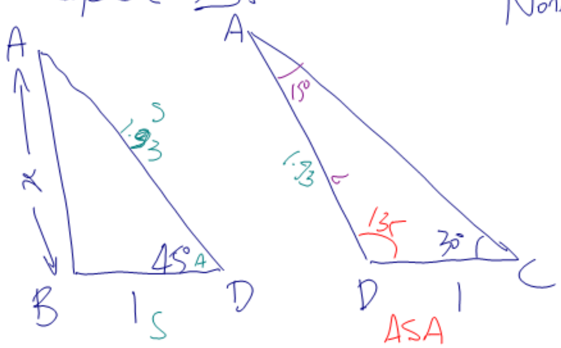
Example 5.7.2

From your text: Pg. 327 #7

Given $\triangle ABC$ at the right, $BC = 2.0$ and D is the midpoint of BC. Determine AB, to the nearest tenth, if $\angle ADB = 45^\circ$ and $\angle ACB = 30^\circ$.



Separate △'s



Note $\angle ADC = 180 - 45^\circ$
$= 135^\circ$ (SAT)

$\angle DAC = 180 - 135 - 30$
$= 15^\circ$. (+180° − ASTT)

Sine law on $\triangle ADC$

$$\frac{AD}{\sin(30)} = \frac{1}{\sin(15)}$$

$$\Rightarrow AD = \frac{\sin(30)}{\sin(15)} \doteq 1.93$$

In $\triangle ABD$ use cosine law to find "x"

$$x^2 = 1^2 + 1.93^2 - 2(1)(1.93)\cos(45)$$

$$\Rightarrow x = \sqrt{1^2 + 1.93^2 - 2(1)(1.93)\cos(45)}$$

$$\doteq 1.41 \text{ units}$$

Success Criteria:

- I can use the cosine law, given S-A-S or S-S-S
- I can rearrange the cosine law to solve for an unknown angle