**PreCalculus - NOTES**

**5.5 The Law of Sines**

For any triangle (right, acute or obtuse), you may use the following formula to solve for missing sides or angles:

Use the Law of Sines when…**you have 3 dimensions** of a triangle and you need to find the other 3 dimensions - **they cannot be just ANY 3 dimensions** though, or you won’t have enough info to solve the Law of Sines equation. Use the Law of Sines if you are given:

**Example 1**

You are given a triangle, ABC, with angle A = 70°, angle B = 80° and side *a* = 12 cm. Find the measures of angle C and sides *b* and *c*.

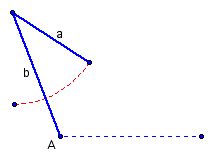
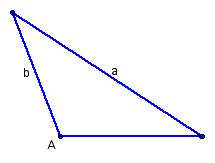
**Example 2**

You are given a triangle, ABC, with angle C = 115°, angle B = 30° and side *a* = 30 cm. Find the measures of angle A and sides *b* and *c*.

**The Ambiguous Case**

When given **SSA** (two sides and an angle that is NOT the included angle) , the situation is ambiguous. The dimensions may not form a triangle, or there may be 1 or 2 triangles with the given dimensions. We first go through a series of tests to determine how many (if any) solutions exist.

**If angle A is obtuse…**

1. If angle A is obtuse, and a < b or a = b, no such triangle exists.
2. If angle A is obtuse, and a > b, one such triangle exists.

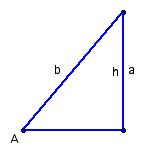
Ex I) Given a triangle with angle A = 120°, side

*a* = 22 cm and side *b* = 15 cm,

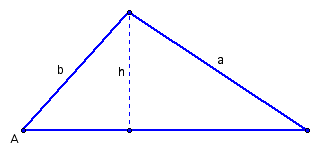
find the other dimensions.

**If angle A is acute…**



1. If angle A is acute, and a < h, no such triangle exists.
2. If angle A is acute, and a = h, one possible triangle exists.

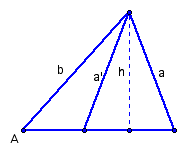
Angle B is a right angle.

1. If angle A is acute, and a > b, one possible triangle exists.

Ex II-2) Given a triangle with angle A = 40°,

side a = 12 cm and side b = 10 cm,

find the other dimensions.

1. If angle A is acute, and h < a < b, two possible triangles exist.

Ex II-1)Given a triangle with angle A = 40°,

side a = 12 cm and side b = 15 cm,

find the other dimensions.

**SSA Summary:**

**Ambiguous Examples:**

1. Given: A = 130°, *c* = 9, *a* = 12… Find: B, C, *b*
2. Given: B = 90°, C = 30°, *c* = 2… Find: A, *a*, *b*
3. Given: A = 65°, *a* = 6, *c* = 8… Find: B, C, *b*

**Example 3**

Two observers are 600 ft apart on opposite sides of a flagpole. The angles of elevation from the observers to the top of the pole are 19⁰ and 21⁰. Find the height of the flagpole.

[](http://www.google.com/imgres?q=flag+pole&um=1&hl=en&safe=active&sa=N&rls=com.microsoft:en-us:IE-SearchBox&biw=1440&bih=748&tbm=isch&tbnid=gxTdGjq7ezEehM:&imgrefurl=http://www.signaturehardware.com/product5978&docid=dSKufKC5IbRbUM&imgurl=http://img0.signaturehardware.com/images/hardware/3/alumpole_l.jpg&w=500&h=500&ei=ejMxT_WoGtKDtgeo_9iuBw&zoom=1&iact=rc&dur=16&sig=101985037167604958503&page=4&tbnh=172&tbnw=172&start=99&ndsp=28&ved=1t:429,r:21,s:99&tx=85&ty=79)

**Example 4**

[](http://www.google.com/imgres?q=police&um=1&hl=en&safe=active&rls=com.microsoft:en-us:IE-SearchBox&biw=1440&bih=748&tbm=isch&tbnid=43KtoCGTp2fJJM:&imgrefurl=http://www.rivierabch.com/police.asp&docid=QWFCIWdBqK7NrM&imgurl=http://www.rivierabch.com/documents/police/PoliceCarRear2.jpg&w=695&h=580&ei=NDQxT7LCJtKutwf7qNDxBg&zoom=1)Officer Chamblee at checkpoint A notices 2 wrecked cars in the direction 48⁰ east of north. Officer Thorne at checkpoint B, 12 miles due east of A, spots the same accident 30⁰ west of north. Find the distance from each checkpoint to the accident.