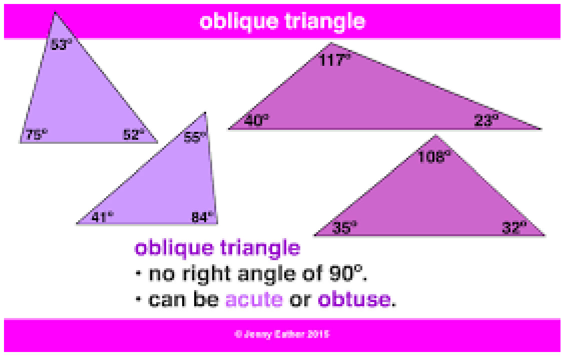
3.2 –The Sine Law for Acute-Oblique Triangles (Concept #22/23)

REVIEW: We can use the trigonometric ratios (sine, cosine and tangent) and Pythagoras' Theorem to find missing measures in a right triangle. What can we do if we do not have a right triangle?

Define Oblique Triangle – Any Triangle that does not contain a right angle



http://www.mathopenref.com/lawofsines.html - App to show that law of sines is true for any oblique triangle

The Sine Law: For any triangle $\triangle ABC$ ***where a,b,c are sides and*** $\angle A, \angle B, \angle C$ ***respectively***

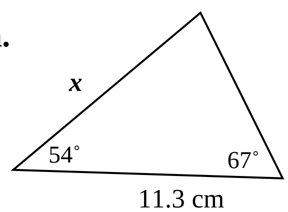
Given ΔABC: $$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c} \quad \text{or} \quad \frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

Note: You use only two of the three ratios to find a missing measure!

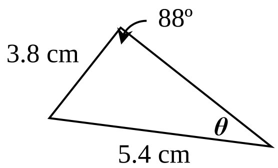
Example #1

Determine the indicated side length or angle to the nearest tenth of a unit. **(Concept #22)**

a.



b.



In grade 10 Math, you learned that ***solving a triangle*** means to find the measures of the missing sides and angles. You need at least three pieces of information to solve a triangle.

The ***Sine Law*** is used to solve triangles if:

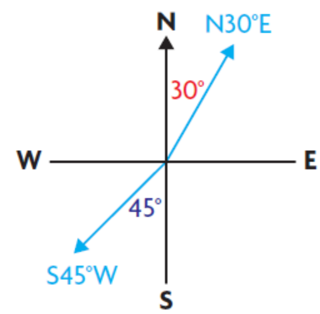
- you know the length of a side of a triangle and the measure of any two angles, you can find the measure of the other two sides.
- you know the length of two sides and the measure of a non-included angle, you can find the measure of the measure of the other non-included angle *provided the triangle can exist**.

Ex# 2./ Solve ΔXYZ, given $\angle X = 85^\circ$, $x = 15$ cm and $y = 12$ cm. **(Concept #22)**

Ex# 3/ Cape Knox is located 215.0 km due south of Cape Ommaney, British Columbia. A hovercraft leaves Cape Ommaney on a heading of S22ºW. A tug boat leaves Cape Knox and travels on a heading of N72ºW. How far from Cape Knox will their paths cross? **(Concept #23)**

Communication | ***Tip***

Directions are often stated in terms of north and south on a compass. For example, N30°E means travelling in a direction 30° east of north. S45°W means travelling in a direction 45° west of south.



3.2 Assignment Pg 124 Concept #22 : #2,3af,6ac,7,8 Concept #23 =: # 5, 10, 12

4.1/4.2 The Sine law for Obtuse – Oblique Triangles (Concept #22)

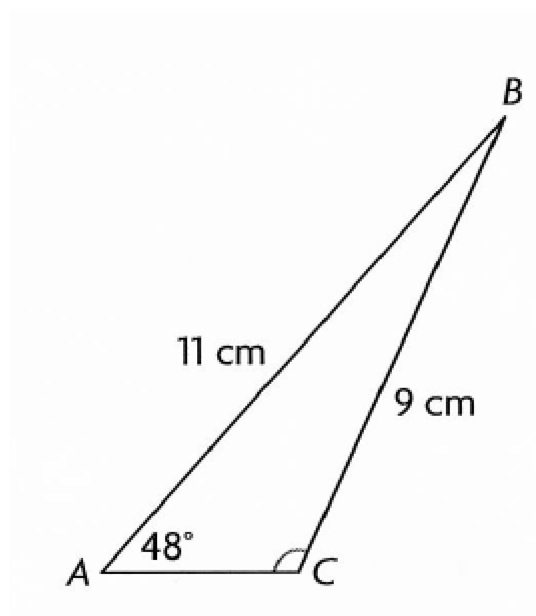
Supplementary angles have the same sin ratio. Supplmentary angles are two angles that add up to 180. For example the supplmentary angle to 80 is 100 because 180-80 = 100

Example #1/ Determine the measure of 2 angles between 0-180 that have the following sine ratios. Round to the nearest degree.

a) 0.34

b) 4/7

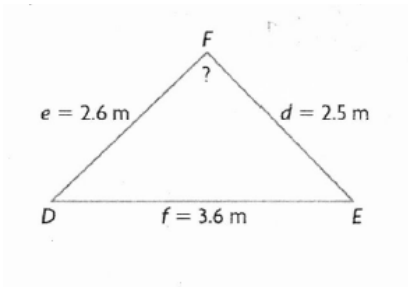
Ex. #2) Determine the measure of angle C to the nearest degree.

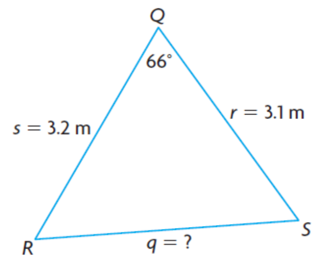


4.1/2 Assignment Pg 173 #15, pg 175 #8 Pg 163 #3

3.3/4.2 – The Cosine Law for Oblique Triangles (Concept #22/23)

Use the Sine Law to write the relationship of the three pairs of sides and opposite angles for each triangle, then solve for the unknown values.





Is there a problem?

The Sine Law will work only with certain types of given information:

- If you know the length of a side of a triangle and the measure of any two angles, you can find the measure of the other two sides. (ASA or AAS triangles)
- If you know the length of two sides and the measure of an angle opposite a known side, you can find the measure of the measure of the angle opposite the other known side *provided the triangle can exist**. (SSA triangles)

What type of information is provided in the two given triangles? What is the missing measure?

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The Cosine Law

Given ΔABC:

$$a^2 = b^2 + c^2 - 2bc\,\text{Cos}\,A$$

$$b^2 = a^2 + c^2 - 2ac\,\text{Cos}\,B$$

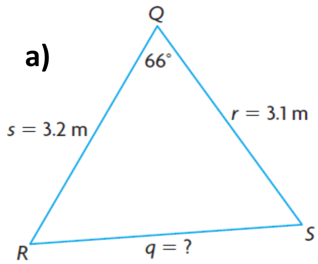
$$c^2 = a^2 + b^2 - 2ab\,\text{Cos}\,C$$

**Note:

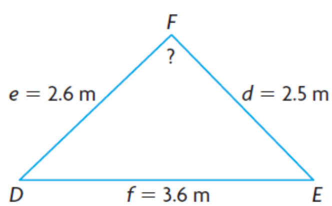
- The largest angle is always opposite the larges

Example#1: Determine the indicated side length or angle to the nearest tenth of a unit (Concept #22)

a)



b)



Ex#2/. Solve $\triangle ABC$ given a = 6 cm, b = 7 cm and $\angle C$ = 103˚. Round all answers to the nearest tenth of a unit.(Concept #22)

Ex#3/. During a hockey game, a player on the blue line shoots a puck toward the 1.83-m-wide net from a point that is 20.3 m from one goal post and 21.3 m from the other goal post. Within what angle must he shoot to hit the net? Answer to the nearest tenth of a degree. (Concept #23)

3.3/4.2 Assignment Pg 138 #2,3,4a,5b,7bc (Concept #22) Pg 138 # 8,10,11 (CONCEPT #23)

Summary when to use Sine Law vs Cosine Law

Law of Sines a) use when given 2 angles and a side ***OR*** (ASA or AAS)

b) 2 sides and an angle opposite a given side. (ASS)

$$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c} \quad \text{or} \quad \frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

Law of Cosines a) use to find an angle when given 3 sides ***OR (SSS)***

b) use to find a side when given 2 sides and the included angle (SAS)

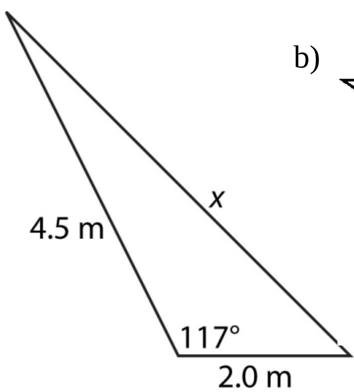
$a^2 = b^2 + c^2 - 2bc\text{Cos}A$

$b^2 = a^2 + c^2 - 2ac\text{Cos}B$

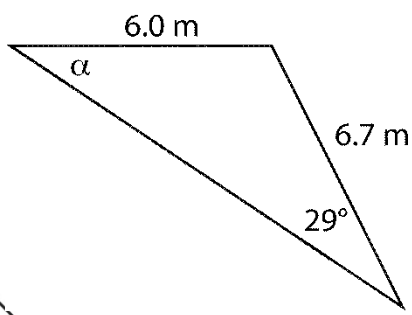
$c^2 = a^2 + b^2 - 2ab\text{Cos}C$

1. What law or property would you use to determine the unknown side length or angle?

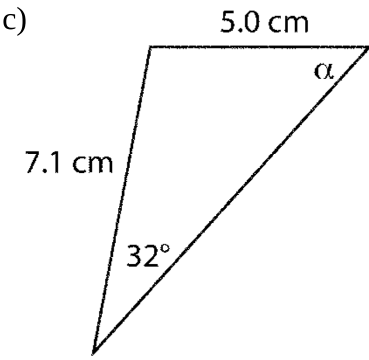
a)



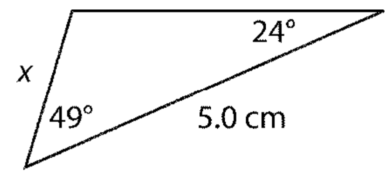
b)



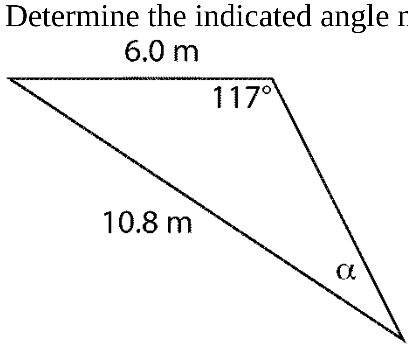
c)



d)



2. Determine the indicated angle measure to the nearest degree.



3. Determine the indicated side length to the nearest tenth of a centimetre.