Unit 2 lesson 1.

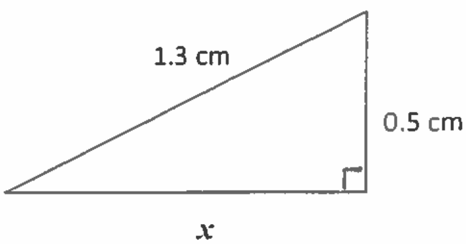
MAP 4CI **Trigonometry Intro** Date:_______________

Set your calculator to **DEGREE mode

1. **Pythagorean Theorem**. Draw a right triangle. Label the sides a, b and c (c must be the longest side). Side c is called the hypotenuse.

Now draw a square on each side of the triangle. State the relationship between the squares on the sides of the right triangle. $a^2+b^2=c^2$

Ex. 1 Determine the length of the indicated side.



$x^2+0.5^2=1.3^2$

$x^2=1.3^2-0.5^2$

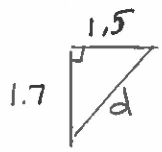
$x^2=1.69-0.25$

$x^2=1.44$

$x=\sqrt{1.44}$

$\boxed{x=1.2\text{ cm}}$

Ex. 2 Brad walks 1.7 km North and then 1.5 km East along the sides of a park. Dan starts at the same point and takes a shortcut along the diagonal. How much shorter is Dan's walk?



Brad's walk is 1.7km + 1.5km = 3.2km

Dan's walk is 2.3 km

So, Brad walked 0.9 km farther than Dan.

$1.7^2+1.5^2=d^2$

$d^2=2.89+2.25$

$d^2=5.14$

$d=2.3$

2.267

2. **Solving Equations**.

Ex. 1 Solve for x to the nearest tenth.

a) $\frac{12}{x}=\frac{20}{3}$

$20x=36$

$\frac{20x}{20}=\frac{36}{20}$

$x=1.8$

b) $\frac{6.7}{2.8}=\frac{x}{4.2}$

$2.8x=6.7\times4.2$

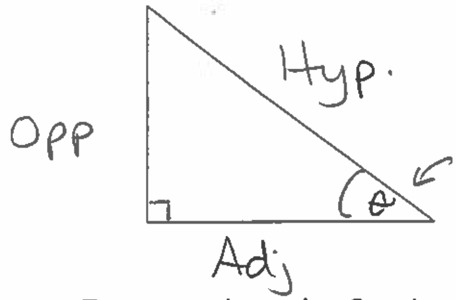
$2.8x=28.14$

$\frac{2.8x}{2.8}=\frac{28.14}{2.8}$

$x\doteq10.1$

10.05

3. **Primary Trig Ratios.** Given a right triangle with angle θ (theta), label the sides "hypotenuse", side "opposite" to angle θ, and side "adjacent" to angle θ.



θ is the reference angle

To remember the 3 primary trig. ratios of the sides of a right triangle relative to angle θ use SOH CAH TOA

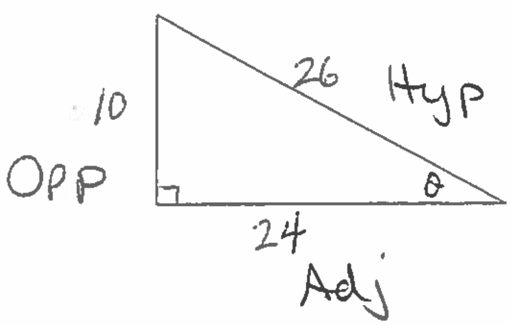
The 3 primary trig ratios are:

sine θ = $\frac{\text{Opposite}}{\text{Hypotenuse}}$ $\quad$ $\sin\theta = \frac{O}{H}$

cosine θ = $\frac{\text{Adjacent}}{\text{Hypotenuse}}$ $\quad$ $\cos\theta = \frac{A}{H}$

tangent θ = $\frac{\text{Opposite}}{\text{Adjacent}}$ $\quad$ $\tan\theta = \frac{O}{A}$

Ex. 1 Write the 3 primary trig ratios relative to θ.



$\sin\theta = \frac{10}{26}$ $\quad$ $\cos\theta = \frac{24}{26}$ $\quad$ $\tan\theta = \frac{10}{24}$

$\sin\theta = \frac{5}{13}$ $\quad$ $\cos\theta = \frac{12}{13}$ $\quad$ $\tan\theta = \frac{5}{12}$

Ex. 2 Evaluate to four decimal places.

a) $\sin 54^\circ = 0.8090$ $\quad$ b) $\cos 14^\circ = 0.9703$ $\quad$ c) $\tan 61^\circ = 1.8040$

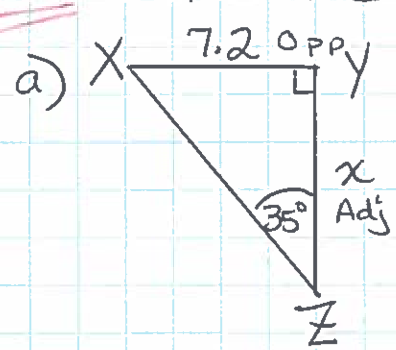
Practice: Pg 72 # 4 - 7, 9, 10 ab $\quad$ **Check Answers: Pg. 540**

MAP Unit 2 lesson 2 - blackboard.

Determining Lengths of Sides in Right Triangles

Ex. 1 Determine the length of x to the nearest tenth.

a)



Have: $O = 7.2$

Need: side A

Use $\tan 35° = \frac{O}{A}$

$$\tan 35° = \frac{7.2}{x}$$

Cross multiply.

$$\frac{\tan 35°}{1} \times \frac{7.2}{x}$$

$$\tan 35° x = 7.2$$

$$\frac{1\,(\cancel{\tan 35°})x}{1\,\cancel{\tan 35°}} = \frac{7.2}{\tan 35°}$$

$$x = 10.28$$

$$x \doteq 10.3$$

With tan (& only with tan) if the unknown is in denominator, you may switch the reference angle so the unknown is in the numerator

$\angle X = 180° - 90° - 35°$

$\angle X = 55°$

then $A = 7.2$

$x = \text{Opp}$.

$$\tan 55° = \frac{x}{7.2}$$

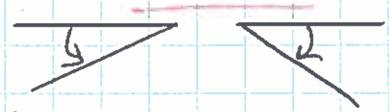
$$x = 7.2 \tan 55°$$

$$x \doteq 10.3$$

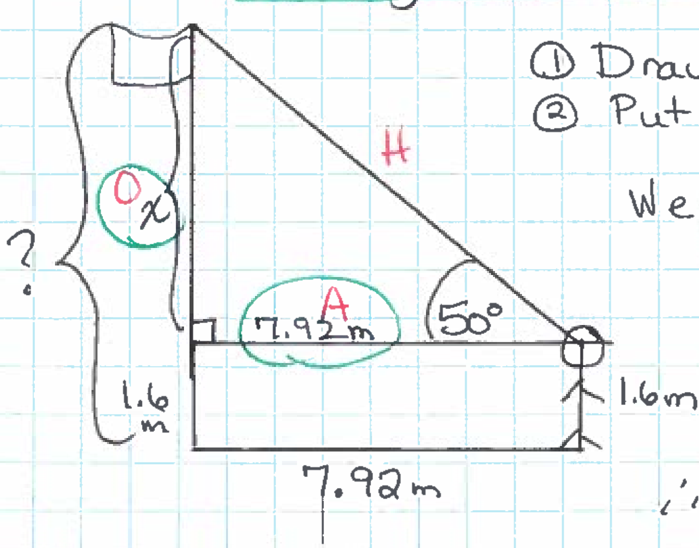
Recall:

Angle of Elevation/Inclination is measured UP from the HORIZONTAL

Angle of Depression/Declination is always measured DOWN from the HORIZONTAL



Ex. 2 Tanya is standing 7.92 m from the flagpole. She is holding a clinometer at eye level 1.6 m above the ground. How tall is the flagpole if she measures a 50° angle of elevation?



① Draw and label diagram.

② Put A, H, O on diagram using 50° as reference angle.

We have A, looking for O so use tan

$$\tan 50° = \frac{x}{7.92}$$

$$x = 7.92 \tan 50°$$

$$x \doteq 9.4$$

$\therefore$ the flagpole is $1.6 + 9.4 = 11.0$ m tall.

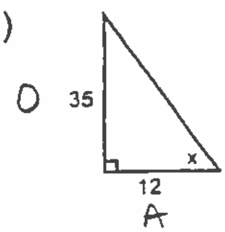
unit 2 lesson 3

Determining Measures of Angles in Right Triangles

Trig ratios can also be used to find the measures of angles of a right triangle that are not known.

Examples: For the following triangles, identify the trig ratio to use, write the equation and solve it to one decimal place using the inverse trig buttons $\boxed{\sin^{-1}}$ $\boxed{\cos^{-1}}$ $\boxed{\tan^{-1}}$ on your calculator.

a)



$A=12$ $O=35$

Have: Adj, Opp

Need: x

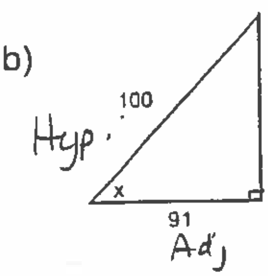
Use: $\tan x = \frac{O}{A}$

$\tan x = \frac{35}{12}$

$x = \tan^{-1}(35 \div 12)$

$x \doteq 71.1^\circ$ 71.075

b)



$A=91$ $H=100$

Have: Adj, Hyp

Need: x

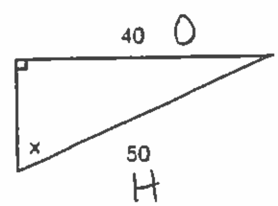
Use: $\cos x = \frac{A}{H}$

$\cos x = \frac{91}{100}$

$x = \cos^{-1}(0.91)$

$x \doteq 24.5^\circ$ 24.49

c)



$O=40$ $H=50$

Have: Opp, Hyp

Need: x

Use: $\sin x = \frac{O}{H}$

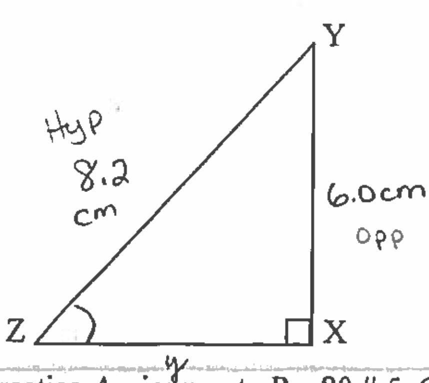
$x = \sin^{-1}\left(\frac{40}{50}\right)$

$x = \sin^{-1}(0.8)$

$x \doteq 53.1^\circ$ 53.13

Ex. 2 Solve Δ XYZ given that $\angle X = 90^\circ$, $x = 8.2\,cm$, $z = 6.0\,cm$.

To solve means to determine the values of all missing sides and angles.



$\sin Z = \frac{6}{8.2}$

$Z = \sin^{-1}(0.7317)$

$\boxed{Z \doteq 47^\circ}$

$Y = 180^\circ - 90^\circ - 47^\circ$

$\boxed{Y = 43^\circ}$

$y^2 = x^2 - z^2$

$y^2 = 8.2^2 - 6.0^2$

$y^2 = 67.24 - 36$

$y^2 = 31.24$

$y = \sqrt{31.24}$

$\boxed{y \doteq 5.6}$

5.589

Practice Assignment: Pg. 80 # 5, 6, 7, 11, 13 ✓ Answers Pg. 540 2.1

Unit 2 Lesson 4: Investigating Obtuse Angles

Introduction to the Activity:

In this activity, you will use your calculator and the following chart to investigate the trigonometric ratios of obtuse angles. Then, you will analyze the results to determine any patterns.

Performing the Activity

1) Refer to the chart that follows. For each of the listed angles, use your calculator to determine the value of each primary trigonometric ratio in the chart.
2) After you have completed the chart, answer the questions that follow.

Round values to 3 decimal places. There will be some rounding error.

Primary Angle, *B*	*sin B*	*cos B*	*tan B*
5°	$\frac{opp}{hyp} \approx 0.087$	$\frac{adj}{hyp} \approx 0.996$	$\frac{opp}{adj} \approx 0.087$
10°	0.174	0.985	0.177
25°	0.423	0.906	0.466
30°	0.500	0.866	0.577
89°	1.000	0.017	57.290
Supp < 91°	1.000	−0.017	−57.290
150°	0.500	−0.866	−0.577
155°	0.423	−0.906	−0.466
170°	0.174	−0.985	−0.177
175°	0.087	−0.996	−0.087

Investigating Obtuse Angles (Continued)

After you have completed the chart, answer the following questions.

1) What do you notice about the signs (positive? negative?) of the values of *sin B*? Be as specific as possible. Why does this happen?

   SinB is always positive. (O, H are both positive)

2) What do you notice about the signs (positive? negative?) of the values of *cos B*? Be as specific as possible. Why does this happen?

   A, H both >0 → cos B is positive when B is acute (between 0° and 90°)
   A or H <0 cos B is negative when B is obtuse (between 90° and 180°)

3) What do you notice about the signs (positive? negative?) of the values of *tan B*? Be as specific as possible. Why does this happen?

   O and H both >0 tan B is positive when B is acute.
   O or H <0 tan B is negative when B is obtuse.

4) Write down pairs of $\angle B$ that have approximately the same value for *sin B*. Verify that the values are actually the same using your calculator. For example, check that sin 5° and sin 175° give the same value. How are the angles related to each other?

   sin 10° = sin 170° sin 89° = sin 91°
   sin 25° = sin 155° Sine of Supplementary angles (angles that add to 180°)
   sin 30° = sin 150° are equal.

   Using the same pairs of angles, what do you notice about the values of *cos B*? (Verify on your calculator if needed.)

   Cosine of supplementary angles are opposites.

   Using the same pairs of angles, what do you notice about the values of *tan B*? (Verify on your calculator if needed.)

   Tangent of supplementary angles are opposites.

5) Use $\sin^{-1}$ on your calculator to solve for angle B in *sin B* = 0.5. What value does your calculator give? 30°

   What other value for B is possible? 180° − 30° = 150°

   How can you quickly determine the value of the second angle? 180° − first angle.

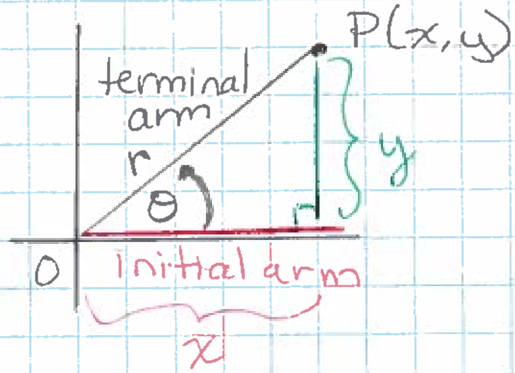
   Complete the following using a calculator and what you have learned:

sin B ≈ 0.7660	B ≈ 50°	or B ≈ 180° − 50° = 130°
sin B ≈ 0.9205	B ≈ 67°	or B ≈ 180° − 67° = 113°

Unit 2 lesson 4 Obtuse Angles In Standard Postion.

Angles in standard position.
* You will be given an ordered pair
* plot that point on the Cartesian Plane
* join that point to the origin (this line segment is called the terminal arm).
* draw the 'Initial arm' on the positive x-axis beginning at the origin
* θ is measured from the initial arm counter-clockwise to the terminal arm.

To find the primary trig ratios, drop a vertical line segment from the plotted point to the x-axis. This will form a right triangle.



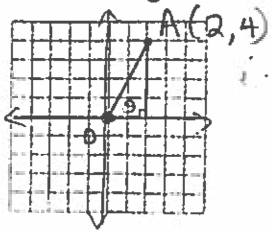
Unit 2 Lesson 4 part 2

2.2 Trigonometric Ratios With Obtuse Angles

Practise

Section 2.2

1. The terminal arm of an angle, θ, in standard position passes through A(2, 4).
   a) Sketch a diagram for this angle in standard position.



   b) Determine the length of OA.

   h 4 2

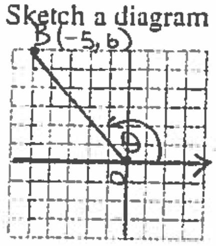
   $h^2 = 2^2 + 4^2$
   $h = \sqrt{20}$

   $\overline{OA} = \sqrt{20}$

   c) Determine the primary trigonometric ratios to three decimal places.

   $\sin\theta = \frac{4}{\sqrt{20}} \doteq 0.894$ $\cos\theta = \frac{2}{\sqrt{20}} \doteq 0.447$ $\tan\theta = \frac{4}{2} = 2$

2. The terminal arm of an angle, θ, in standard position passes through B(−5, 6).
   a) Sketch a diagram for this angle in standard position.



   b) Determine the length of OB.

   6 h 5

   $|\overline{OB}|^2 = 5^2 + 6^2$
   $= 25 + 36$

   $|\overline{OB}| = \sqrt{61}$

   c) Determine the primary trigonometric ratios to three decimal places.

   $\sin\theta = \frac{6}{\sqrt{61}} \doteq 0.768$ $\cos\theta = \frac{-5}{\sqrt{61}} \doteq -0.640$ $\tan\theta = -\frac{6}{5} = -1.2$

3. Complete the table. For each angle, indicate whether each trigonometric ratio is positive or negative. Round your answers to three decimal places.

Angle	Sine	Cosine	Tangent
60°	0.866	0.5	1.732
120°	0.866	−0.5	−1.732
98°	0.990	−0.139	−7.115
145°	0.574	−0.819	−0.700
162°	0.309	−0.951	−0.325

MAP 4CI Trigonometric Ratios for Obtuse Angles in Standard Position Date:__________
Unit 2 Lesson 5

1. The sine of an obtuse angle, θ, in standard position is $\frac{3}{5}$.

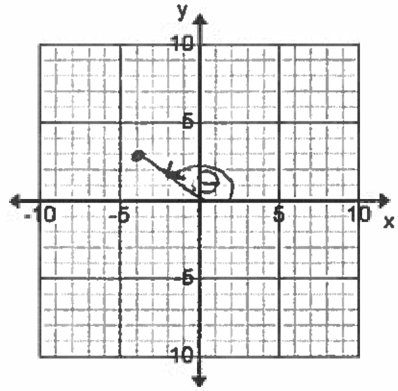
a) Identify the coordinates of a point that lies on the terminal arm of $\angle\theta$.

$\sin\theta = \frac{3}{5}$ ← y ← r

$x^2+y^2=r^2$
$x^2+3^2=5^2$
$x^2=25-9$
$x^2=16$
$x=\sqrt{16}$
$x=4$

Point is at $(-4,3)$

b) Sketch a diagram of $\angle\theta$.



c) Determine cos θ and tan θ.

$\cos\theta = \frac{-4}{5}$ $\tan\theta = -\frac{3}{4}$

$\cos\theta = -0.8$ $= -0.75$

d) Determine the measure of $\angle\theta$, using a calculator.

$\theta = \cos^{-1}(-0.8)$
$\theta \doteq 143°$

2. The tangent of an obtuse angle, θ, in standard position is -1.

a) Identify the coordinates of a point that lies on the terminal arm of $\angle\theta$.

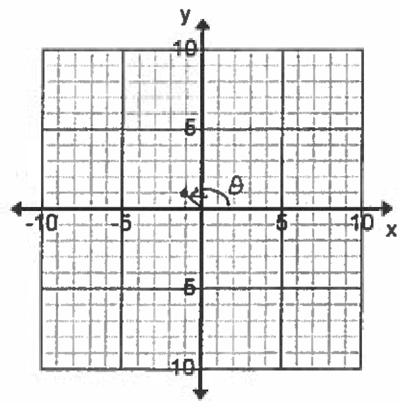
$\tan\theta < 0$ so $x<0,\ y>0$

$\tan\theta = \frac{-1}{1}$

so $\frac{y}{x} = \frac{1}{-1}$

$x=-1,\ y=1$
$r=\sqrt{(-1)^2+1^2}$
$r=\sqrt{2}$

b) Sketch a diagram of $\angle\theta$.



c) Determine sin θ and cos θ. Round your answers to three decimal places.

$\sin\theta = \frac{1}{\sqrt{2}}$ $\cos\theta = \frac{-1}{\sqrt{2}}$

$\doteq 0.707$ $\doteq -0.707$

d) Determine the measure of $\angle\theta$, using a calculator.

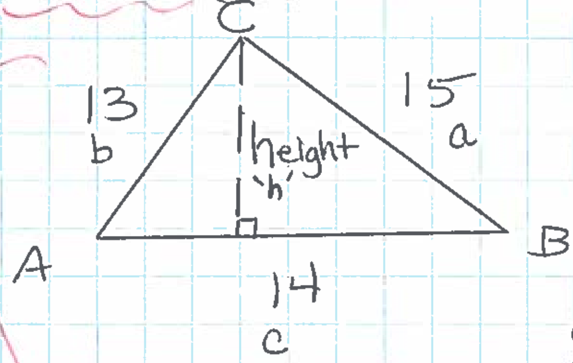
$\theta = \cos^{-1}(-0.707)$
$\theta \doteq 135°$

MAP 4CI Unit 2 lesson 6

Sine Law for Oblique Triangles

↳ non right-angled triangles.

General Case



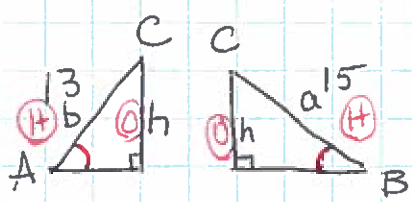
Create two right triangles so we can use trig. ratios.

where sine law comes from

$\sin A = \frac{O}{H}$

$\frac{\sin A}{1} = \frac{h}{13}$

$h = 13\sin A$



$\sin B = \frac{O}{H}$

$\frac{\sin B}{1} = \frac{h}{15}$

$h = 15\sin B$.

so, $13\sin A = 15\sin B$

$\div 13, \div 15$ (undo the cross multiplying).

$\frac{\sin A}{15} = \frac{\sin B}{13}$

a b

$\frac{\sin A}{a} = \frac{\sin B}{b}$

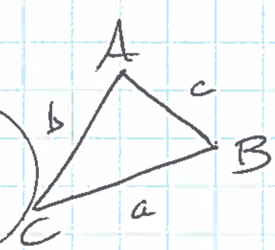
This can be extended to include C.

Sine Law

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

OR

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

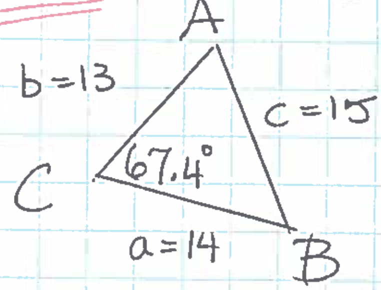


To use the sine law you need one complete angle/side pair. (You need A, a OR B, b OR C, c)

Unit 2 lesson 6 Sine Law (cont'd) pg. 2.

Ex. 1 Calculate the value of angle A and angle B.

Round to one decimal place



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

$$\frac{\sin A}{14} = \frac{\sin B}{13} = \frac{\sin 67.4^\circ}{15}$$

$$\frac{\sin A}{14} = \frac{\sin 67.4^\circ}{15}$$

$$\sin A = \frac{\sin 67.4^\circ \times 14}{15}$$

$$\sin A = 0.8616628$$

$$A = \sin^{-1}(0.8616628)$$

$$A = 59.50$$

$$\boxed{A \doteq 59.5^\circ}$$

$$B = 180^\circ - 59.5^\circ - 67.4^\circ$$

$$\boxed{B = 53.1^\circ}$$

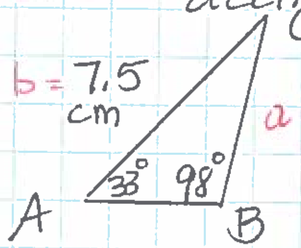
check:

$$\frac{\sin B}{13} = \frac{\sin 67.4^\circ}{15}$$

$$B = \sin^{-1}\left(\frac{\sin 67.4^\circ \times 13}{15}\right)$$

$$B = 53.1^\circ$$

Ex. 2. Determine the length of a to one decimal place.



$$\frac{a}{\sin 33^\circ} = \frac{7.5}{\sin 98^\circ}$$

$$a = \frac{7.5 \times \sin 33^\circ}{\sin 98^\circ}$$

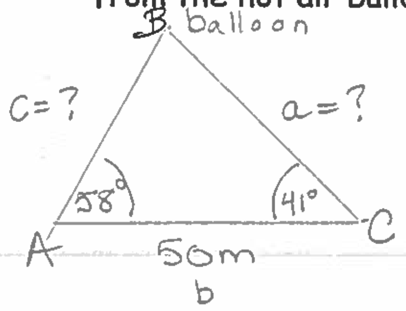
$$a = 7.5 \times \sin 33^\circ \div \sin 98^\circ$$

$$a \doteq 4.1249$$

$$\boxed{a \doteq 4.1\text{cm}}$$

APPLICATIONS OF SINE LAW

1. Two people stand approximately 50 m apart on level ground. One person measures the angle of elevation of a hot air balloon to be 58°. The other person measures the angle of elevation to be 41°. How far is each person from the hot air balloon?



$\angle B = 180° - 58° - 41°$

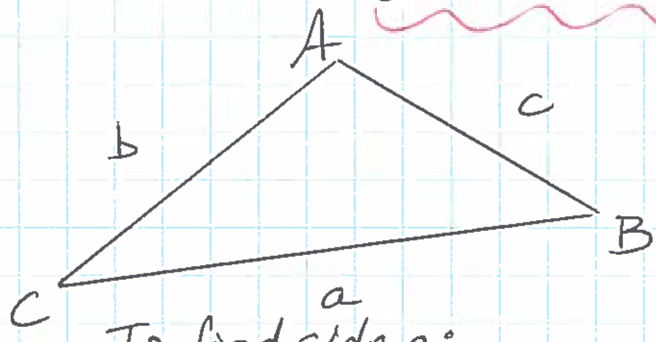
$$\frac{a}{\sin 58°} = \frac{50}{\sin 81°} = \frac{c}{\sin 41°}$$

$$a = \frac{50\sin 58°}{\sin 81°} = 42.9\ m$$

$$c = \frac{50\sin 41°}{\sin 81°} = 33.2\ m$$

∴ the first person is 33.2 m from the balloon, the second person is 42.9 m from the balloon.

Unit 2 lesson 8 Cosine Law (for oblique triangles).



To find side a:

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

adjust formula accordingly if you are looking for another side

For E.g., q in ΔPQR

$$q^2 = p^2 + r^2 - 2pr\cos Q.$$

To find angle A

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

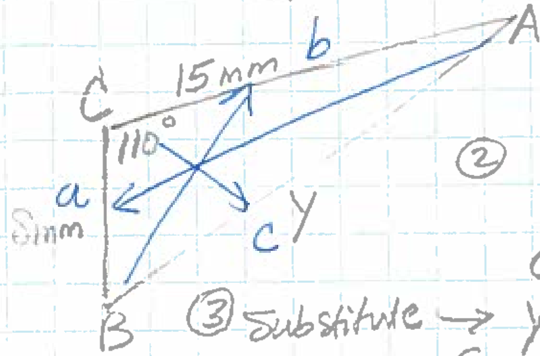
OR

$$A = \cos^{-1}\left[\frac{(b^2+c^2-a^2)}{(2bc)}\right]$$

Use Cosine law
- if you have all 3 sides and you are looking for an angle.
- if you have 2 sides and the contained angle, and you are looking for third side.

Cosine Law Examples   Unit 2 lesson 8   pg. 2

Ex. 1 Determine length of indicated side to the nearest tenth.



① Label diagram

② Formula:

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

③ Substitute → $y^2 = 8^2 + 15^2 - 2(8)(15)\cos 110$

$= 64 + 225 - (-82.0848344)$

④ Calculate

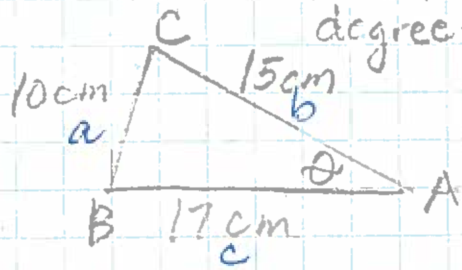
$y^2 = 289 + 82.0848...$

$y = \sqrt{371.0848...}$

$y = 19.3\text{ mm}$

Keep all decimal places

Ex. 2 Determine measure of indicated angle to nearest degree.



① Label diagram

② Formula:

$\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

$\angle A = \cos^{-1}\left(\dfrac{b^2 + c^2 - a^2}{2bc}\right)$

③ Substitute $\angle A = \cos^{-1}\left(\dfrac{15^2 + 17^2 - 10^2}{2(15)(17)}\right)$

$= \cos^{-1}\left(\dfrac{225 + 289 - 100}{510}\right)$

$= \cos^{-1}\left(\dfrac{414}{510}\right)$

$= \cos^{-1}(0.81176...)$

$= 35.7$

$= 36°$

Practice: Pg. 110 # 1a, 3, 4a, 5, 6, 7a

✓ Answers Pg. 541 – 542 2, 4

Unit 2 Lesson 9: Cosine Law Applications

Review Cosine Law:

The Cosine Law can be used to solve for an unknown side, if you are given two sides and a contained angle:

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

It can also be re-arranged to solve for an unknown angle:

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

<u>Bearings:</u> Direction can be written in several ways

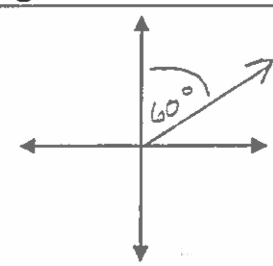
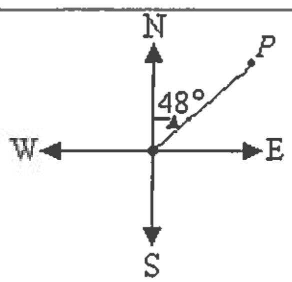
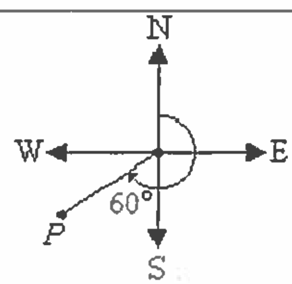
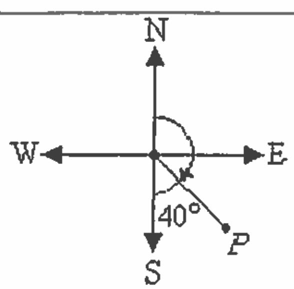
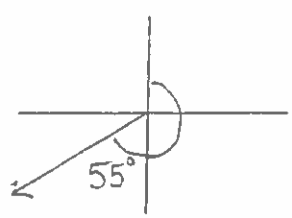
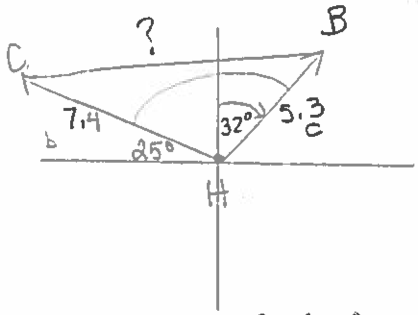
Direction	bearing	Diagram
N60°E	060° measured clockwise from North.	

Diagram	Bearing	Direction	Diagram	Bearing	Direction
	48°	N48°E		180°+60° 240°	S60°W
	180°−40° 140°	S 40°E	Provide a sketch here. 	235°	S55°W

Applications of Cosine Law lesson 9 page 2

1. A harbour master uses radar to monitor two ships. B and C, as they approach the harbour, H. One ship is 5.3 miles from the harbour on a bearing of 032°. The other ship is 7.4 miles away from the harbour on a bearing of 295°. How far apart are the two ships?



$h^2 = b^2 + c^2 - 2bc\cos H$

$h^2 = 7.4^2 + 5.3^2 - 2(7.4)(5.3)\cos 97°$

$h^2 = 92.4094313$

$h = 9.6$

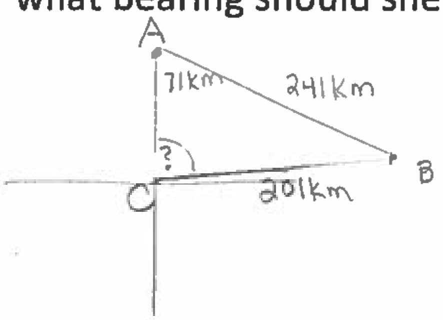
$\angle BHC = 32° + (90° - 25°)$

$= 32° + 65°$

$= 97°$

$\therefore$ the two ships are about 9.6 miles apart.

2. An aircraft navigator knows that town A is 71 km due north of the airport, town B is 201 km from the airport, and towns A and B are 241 km apart. On what bearing should she plan the course from the airport to town B?



$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

$\cos C = \dfrac{201^2 + 71^2 - 241^2}{2(201)(71)}$

$C = \cos^{-1}(-12639 \div 28542)$

$C = \cos^{-1}(-0.44282)$

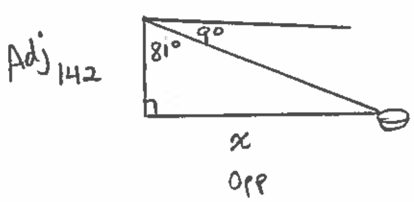
$C \doteq 116°$

$\therefore$ the plane should plan the course on a bearing of 116°.

Applications of Trigonometry

Date:________________

Ex. 1 From the top of a vertical cliff a person measures the angle of depression of a boat as 9º. The height of the cliff is 142 m. How far is the boat from the base of the cliff? Round your answer to the nearest m.



$\tan 81^\circ = \frac{x}{142}$

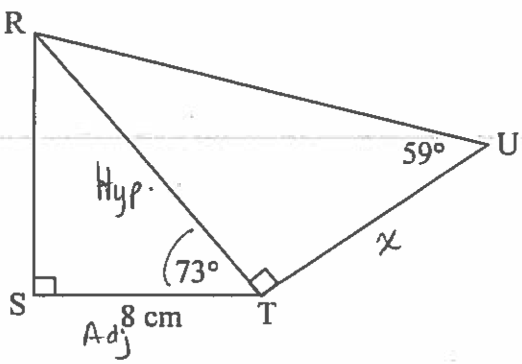
$x = 142 \tan 81^\circ$

$x = 896.5527$

$x \doteq 897\text{ m}$

∴ the boat is about 897 m from the base of the cliff.

Ex. 2 Find the length of TU to the nearest tenth.

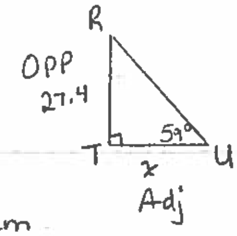


In △RST,

$\cos 73^\circ = \frac{8}{H}$

$H = \frac{8}{\cos 73^\circ}$

$H \doteq 27.362\text{ cm}$



In △RTU

$\tan 59^\circ = \frac{27.362}{x}$

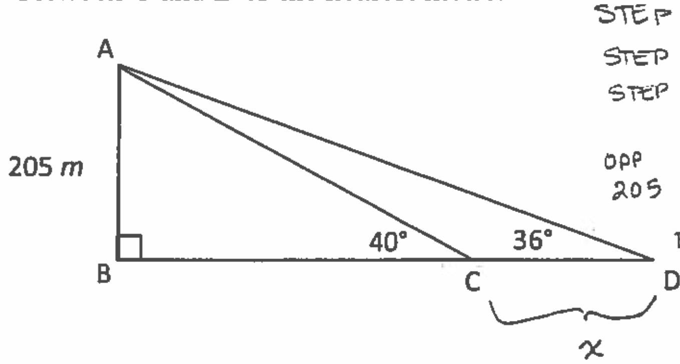
$x = \frac{27.362}{\tan 59^\circ}$

$x \doteq 16.4$

16.44

∴ TU is 16.4 cm

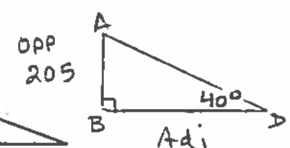
Ex. 3 A smokestack, **AB**, is 205m high. From two points C and D on the **same side** of the smokestack's base B, the angles of elevation to the top of the smokestack are 40° and 36° respectively. Find the distance between C and D to the nearest metre.



STEP ① Find BD

STEP ② Find BC

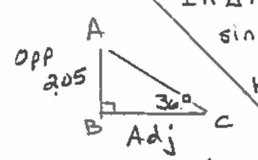
STEP ③ CD = BD − BC



$\tan 40^\circ = \frac{a}{205}$

$a = 205/\tan 40^\circ$

$a = 244.309$



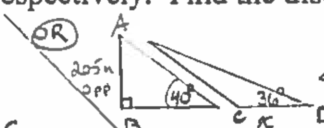
$a = 205/\tan 36^\circ$

$a = 282.158$

$CD = 282.158 - 244.309$

$\doteq 38\text{ m}$.

OR



In △ACD

∠C = 140°,

∠A = 4°

In △ABC,

$\sin 40^\circ = \frac{205}{H}$

$H = 318.923$

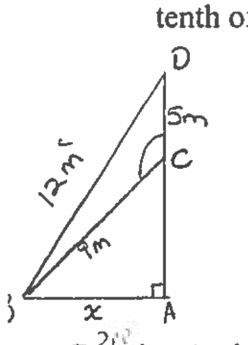
In △ACD,

$AC = 318.923$

$\frac{x}{\sin 4^\circ} = \frac{318.923}{\sin 36^\circ}$

$x \doteq 38\text{ m}$

Ex. 4 Two guy-wires are anchored at the same point. The first guy-wire is 12 m in length and is attached to the top of a tower. The second guy-wire is 9 m in length and is attached to a point 5 m below the top of the tower. How far are the wires anchored from the base of the tower? Round your answer to the nearest tenth of a metre.



In △BCD

$C = \cos^{-1}\left(\frac{5^2 + 9^2 - 12^2}{2(5)(9)}\right)$

$C = \cos^{-1}\left(-\frac{38}{90}\right)$

$C = 114.97^\circ$

In △ABC,

$\angle C = 180^\circ - 114.97^\circ$

$\angle C = 65.03^\circ$

$\sin 65.03^\circ = \frac{x}{9}$

$x = 9 \sin 65.03^\circ$

$x \doteq 8.15$

$x \doteq 8.2$ metres.

∴ the guy wires are attached 8.2 m from the base of the tower.

Practice Assignment: Pg 126 # 1, 2, 3, 5, 7, 9, 11 ✓ Answers Pg 542 2.5

Unit 2 Lesson 11 part 1: Review

FOR RIGHT ANGLE TRIANGLES

PYTHGOREAN Formula

$a^2 + b^2 = c^2$ where c must be the hypotenuse

SOHCAHTOA

$$\sin\theta = \frac{opp}{hyp}, \cos(\theta) = \frac{adj}{hyp}, \tan(\theta) = \frac{opp}{adj}$$

FOR OBLIQUE TRIANGLES (non-right angled, including obtuse triangles)

Sine Law

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

Use when you have

- 2 sides and one opposite angle

+ need a complete pair.

- 2 angles and one opposite side

Cosine Law

$$a^2 = b^2 + c^2 - 2bc\cos A \quad \text{or} \quad \cos A = \frac{b^2+c^2-a^2}{2bc}$$

Use when you have

- 2 sides and a contained angle (find the opposite side)
- All three sides (find an angle)

Obtuse Angles

Obtuse angle - $90° \leq \theta \leq 180°$

Supplementary Angles $A+B=180°$

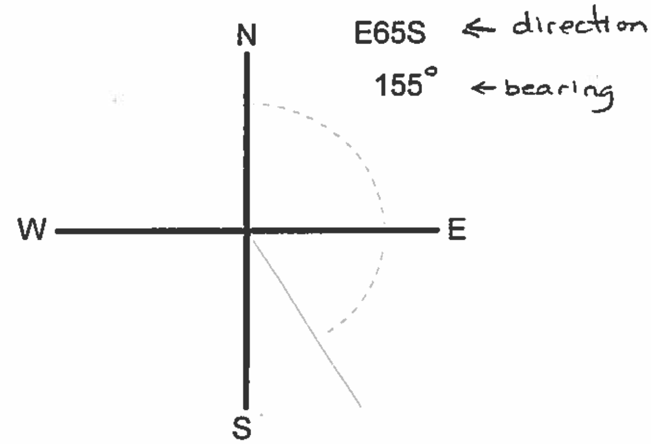
$$\sin A = \sin B, \qquad \cos A = -\cos B, \qquad \tan A = -\tan B$$

The primary trigonometric ratios of an angle, θ, in standard position are defined in terms of the coordinates of a point, (x, y), on the terminal arm, as follows:

$\sin\theta = \frac{y}{r}$ $\quad \cos\theta = \frac{x}{r}$ $\quad \tan\theta = \frac{y}{x}$ where $r = \sqrt{x^2 + y^2}$

Bearing and Directions

Bearings - 050°, Directions – N50°E



Types of Problems

Directions,

Solve a Triangle

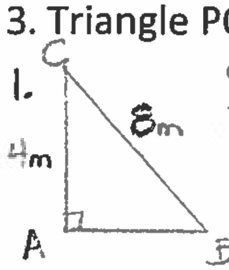
Area

Practice Drawing Triangles.

Draw the following triangles, state unknowns and approach to solving:

1. Triangle ABC, where a=8m, b=4m, A=90°
2. Triangle XYZ, where X=108°, z=27mm, y=12mm.
3. Triangle PQR, where P=43°, R=118°, q=50m.

1.



$c \rightarrow$ Pyth. Th^{m}

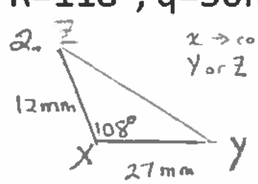
$\angle B$ or C SOHCAHTOA

$B = \sin^{-1}\left(\frac{1}{2}\right)$

$B = 30°$

$C = 60°$

2.



$x \rightarrow$ cosine law

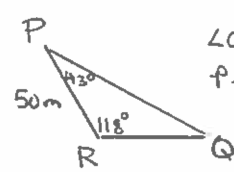
Y or Z sine law or cosine law

$x^2 = 12^2 + 27^2 - 2(12)(27)\cos 108°$

$x = 32.8$ mm

$\frac{\sin Y}{12} = \frac{\sin 108}{32.8}$

3.



$\angle Q$ ASTT

p, r sine law

$\angle Q = 19°$

$\frac{r}{\sin 118°} = \frac{50}{\sin 19°}$

$r = 135.6$ m

$\frac{p}{\sin 43°} = \frac{50}{\sin 19}$

$p = 104.7$ m

Example #1 : Calculate the length of the unknown side in each triangle.

a. cosine law

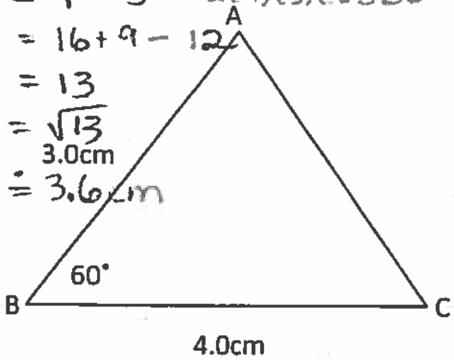
$b^2 = 4^2 + 3^2 - 2(4)(3)\cos 60^\circ$

$= 16 + 9 - 12$

$= 13$

$b = \sqrt{13}$

$b \doteq 3.6\,cm$

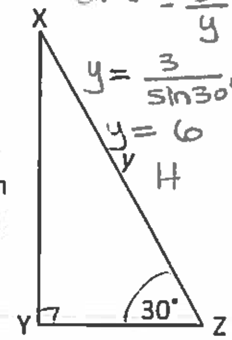


b. SOHCAHTOA

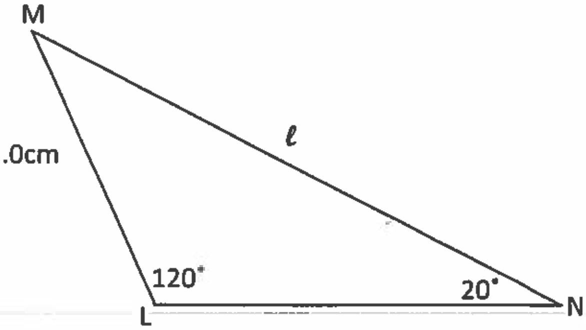
$\sin 30^\circ = \frac{3}{y}$

$y = \frac{3}{\sin 30^\circ}$

$y = 6$



c. Sine law



$\frac{l}{\sin 120^\circ} = \frac{3}{\sin 20^\circ}$

$l = \frac{3\sin 120^\circ}{\sin 20^\circ}$

$l \doteq 7.6\,cm$

Example #2 : Calculate the indicated angle in each triangle.

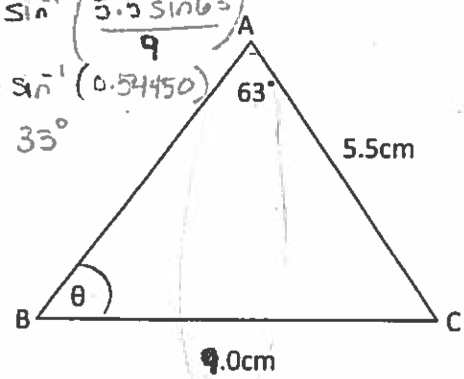
a. Sine law

$\frac{\sin B}{5.5} = \frac{\sin 63^\circ}{9}$

$B = \sin^{-1}\left(\frac{5.5\sin 63^\circ}{9}\right)$

$= \sin^{-1}(0.54450)$

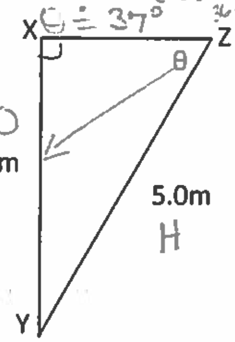
$\doteq 33^\circ$



b. SOHCAHTOA

$\theta = \sin^{-1}\left(\frac{3}{5}\right)$

$\theta \doteq 37^\circ$ 36.86°



c. cosine law

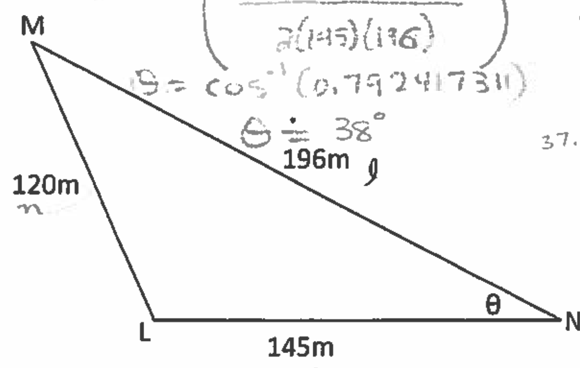
$\theta = \cos^{-1}\left(\frac{145^2 + 196^2 - 120^2}{2(145)(196)}\right)$

$\theta = \cos^{-1}(0.79241731)$

$\theta \doteq 38^\circ$

4500 / 5684

37.588°



Example #3

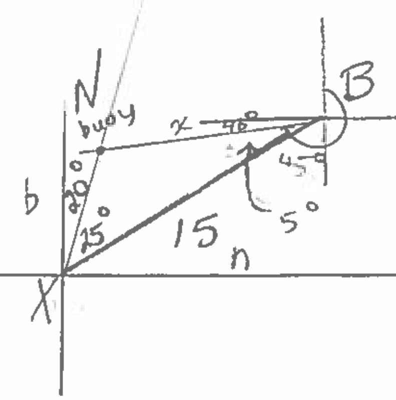
A boat is proceeding on a bearing of 045˚ at 12 km/hr. At 3:00PM the captain sees a navigation buoy at 020˚. He sights the same buoy at 230˚ at 4:15. How many km's is the boat from the buoy at 4:15PM?

$1.25 \times 12 = 15$

a. Draw the figure

b. Determine what Trig Rules to use sine law

c. Solve for unknown.

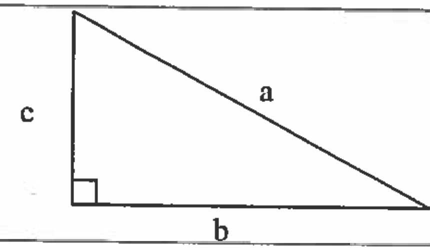
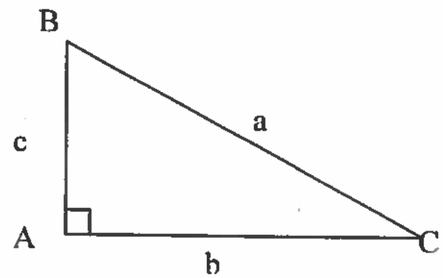
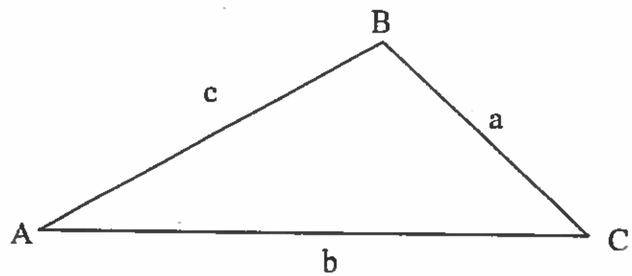
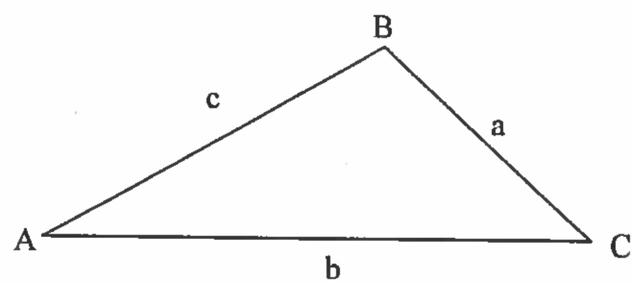


$\angle N = 180^\circ - 25^\circ - 5^\circ$

$\angle N = 150^\circ$, $n = 15$ $\quad X = 25^\circ$

$\frac{x}{\sin 25^\circ} = \frac{15}{\sin 150^\circ}$ $\quad x = \frac{15\sin 25^\circ}{\sin 150^\circ}$

Deciding how to solve a triangle?

Formula	Picture	When to use	
Pythagorean $\boxed{a^2 = b^2 + c^2}$		Right angle triangle - given 2 sides	- asked to find third side
Trig Ratios SOHCAHTOA		Right angle triangle - given two sides - given one side and an angle	- asked to find angle - asked to find side
Sine Law $\boxed{\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}}$		No right angle - given two angles and one opposite side - given two sides and one opposite angle	- asked to find other opposite side - asked to find other opposite angle
Cosine Law $\boxed{a^2 = b^2 + c^2 - 2bc\cos A}$ or $\boxed{\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}}$		No right angle - given two sides & a contained angle - given three sides	- calculate the third side - can calculate angle