UNIT 6 – Trigonometry JOURNAL

Big idea/Learning Goals

For this unit you must make sure your calculator is in DEGREE mode so that the answers will always come up correctly. In this unit you will learn how to use SINe, COSine, and TANgent buttons on the calculator to solve for sides or angles of right triangles. Not all triangles you see in real life may be right angled. But ________________ and ____________________ are only used on right triangles. Then you till learn about: Sine and Cosine Laws. (There is no Tangent Law, since having the two that we develop enables us to solve ANY type of triangle). This unit is an introduction to what you will learn in grade 11. There are a lot of real life applications for trigonometry – these you will see in the word problems of this unit.

Date	Topics	**Finished the journal?** **Made corrections?**	**Did you do the HW?** **Checked if it was correct?**	**Tentative TEST date:** ____________________ **Questions to ask the teacher:**
2days	**Congruent triangles** DAY 1 HW Handout – find online on mrsk.ca website under this unit and this topic DAY 2 HW Handout – find online on mrsk.ca website under this unit and this topic			
2days	**Similar Triangles** DAY 3 HW text pg333 #4,5,6,7,8,14,15 DAY 4 HW text pg347 #1,5,7,9,11,12,16,19			
2days	**SOH CAH TOA** DAY 5 HW text pg362 #1ef,2ef,3gh,4gh,5cd,6cd,9,12 DAY 6 HW text pg374 #12,15,16,17,25,29			
	Solve word problems DAY 7 HW text pg382 #11,13,14,15,18,20,26			
2days	**STRAND assignment**			
	Sine Law DAY 1 HW text pg402 #2,4,6,9,10,13,15			
	Cosine Law DAY 2 HW text pg409 #3,5,8 Pg418 #2,6,9			
	Word Problems DAY 3 HW text pg427 #3,4,7,10,12			

Reflect – previous TEST mark ___________, Overall mark now___________.

Calculate your potential final mark to see how averages work. Show your calculations here:

potential final mark = (overall mark now)(weight so far) + (future marks)(weight to come)
= (   )(   ) + (   )(   )
=

Were you able to attain your set goal before? Looking back, what else can you improve upon? Be specific in your planning.

____
____
____
____
____
____
____
____

DAY 1 & 2 – Congruent Triangles

1. **Proving something is FALSE**
Conjectures can be proved **false** with a single ____________________________
Example Conjecture: In a quadrilateral, if all angles are congruent, then all sides are congruent.

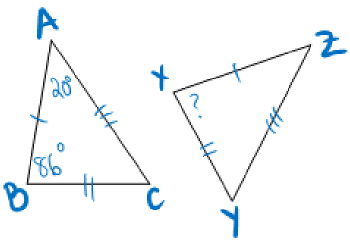
2. **Proving something is TRUE**
Conjectures can be proved **true** by using a logical argument, based on known facts. When a conjecture has been proved true, it is called a ____________________.

A proof is a logical argument. In math, something is considered true if it has been proved. It is not enough for something to *seem* true. In writing a proof, you can only use facts that have previously been proved, or facts that are assumed true without proof. In this class, we will assume the following facts are true without proving them:

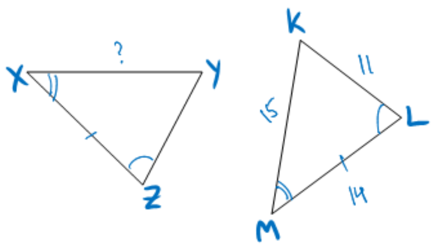
Complementary Angles	**Alternate Angles (Z pattern)**
Supplementary Angles	**Corresponding Angles (F pattern)**
Sum of Interior Angles (C – pattern)	**Opposite Angles (X pattern)**
Isoceles Triangles	**Congruent Triangles**
Equilateral Triangles	**Similar Triangles**

Prove Congruent then find the value of "?"

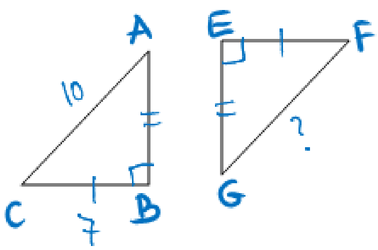
3. SSS



4. ASA or AAS

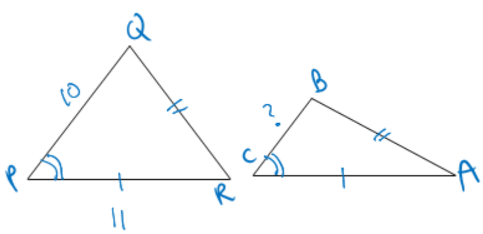


5. SAS

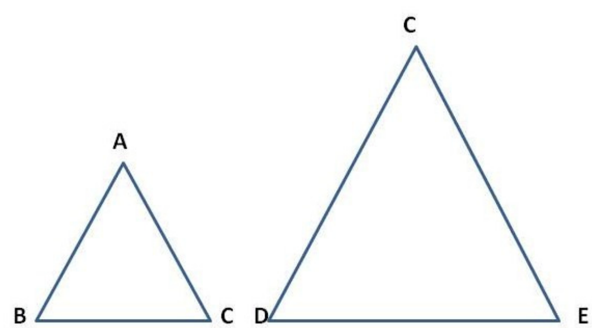


Talk about why SSA or AAA is not enough to prove congruency:

6. Not SSA



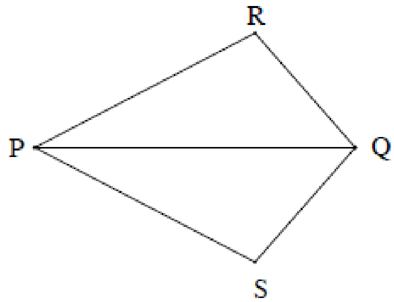
7. Not AAA



Two Formats for Proof

paragraph form – used by mathematicians

8.

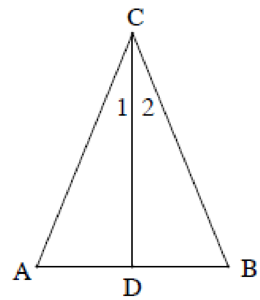


Given: RQ=SQ and RP=SP.
Prove: ∠ R = ∠ S.

The given information is: _____________ and ________________. PQ=PQ because ________________. So ΔPRQ≅ ΔPSQ because of the ___________ property for congruent triangles. Therefore, _____________ because corresponding parts of congruent triangles are congruent.

two-column form – students prefer this one

9.



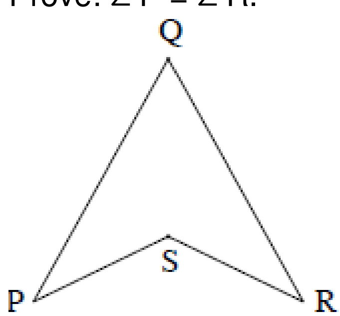
Given: AC=BC and ∠ 1 = ∠ 2.
Prove: ∠ A = ∠ B.

Proof.

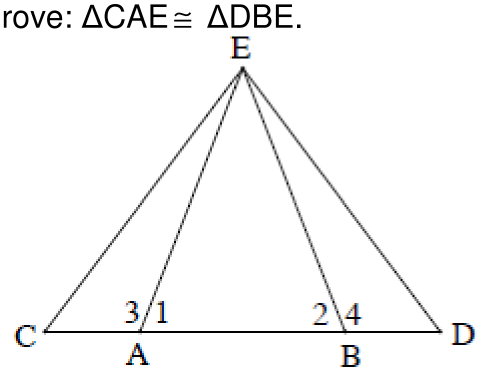
Statements	Reasons
1. AC = BC	1.
2.	2. Given
3. CD = CD	3.
4.	4. by SAS property
5. ∠A = ∠B	5.

NOTES:

10. Given: PQ = RQ and PS = RS.
Prove: ∠ P = ∠ R.



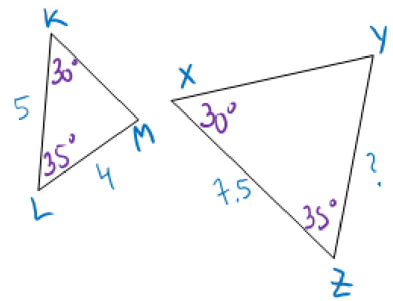
11. Given: AC = BD and ∠ 1 = ∠ 2.
Prove: ΔCAE≅ ΔDBE.



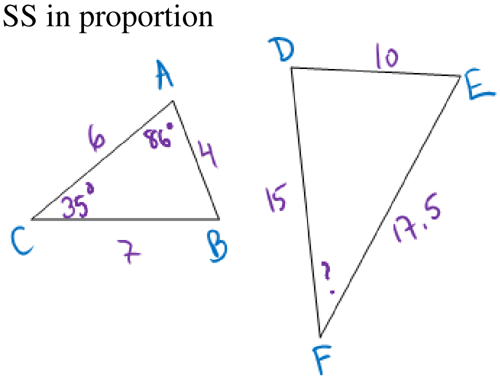
DAY 3 & 4 – Similar Triangles

Prove Similar then find the value of "?"

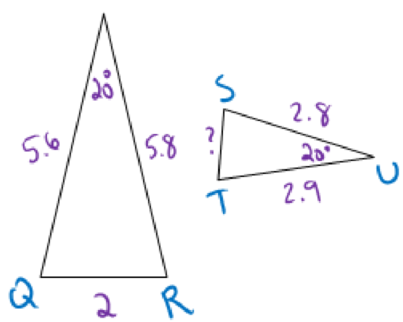
1. AAA or just AA



2. SSS in proportion

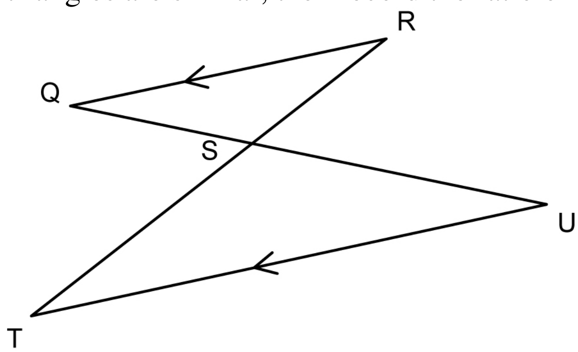


3. SAS in proportion

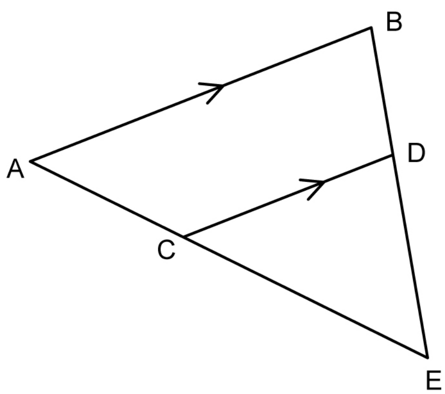


Prove triangles are similar, then record the ratio of sides statement.

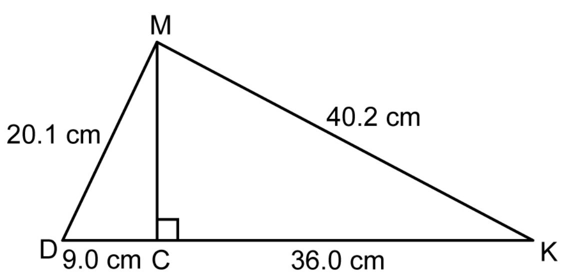
4.



5.

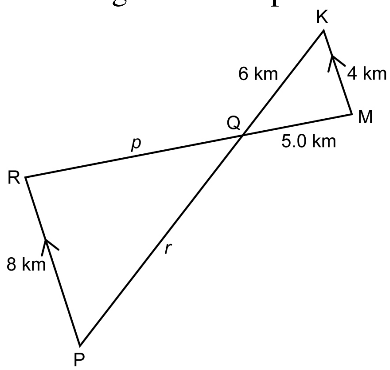


6.



Prove the triangles in each pair are similar. Then find the unknown side lengths

7.



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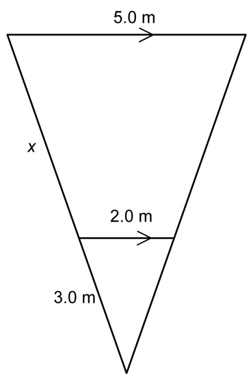

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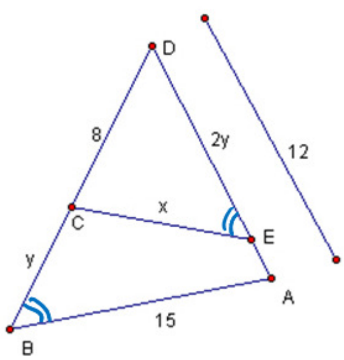
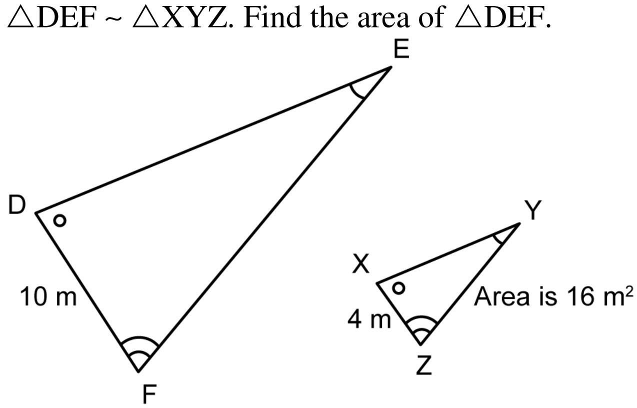


NOTES:

10. A right triangle has side lengths 5 cm, 12 cm, and 13 cm.
    - **a)** A similar triangle has a hypotenuse 52 cm long. What is the scale factor?
    - **b)** What are the lengths of the legs of the triangle in part a)?
    - **c)** Find the area of each triangle.
    - **d)** How are these areas related?

11. △DEF ~ △XYZ. Find the area of △DEF.



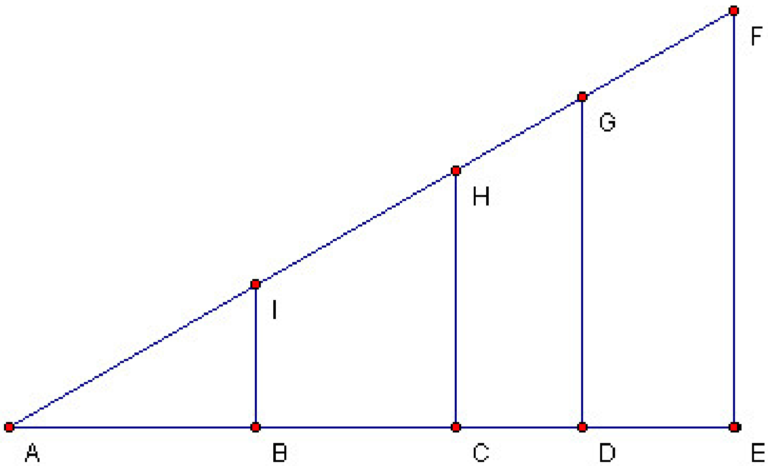
12. Bill placed a mirror on the ground 5 m from the base of a flagpole. He stepped back until he could see the top of the flagpole reflected in the mirror. Bill is 1.5 m tall and saw the reflection when he was 1.25 m from the mirror. How high is the flagpole?

13. A person 1.9 m tall casts a shadow 3.8 m long. At the same time a tree casts a shadow 18 m long. Find the height of the tree.

DAY 5 – Introduction to Solving Right Triangles

In early times, similar triangles were used to solve problems about measurement.
One individual, Hipparchus, 140 B.C.E., found that right angle triangles had a special property.
Let's investigate what this special property is.

This diagram shows some similar **right** triangles with a common angle A. Measure the side lengths of each triangle and record your findings in the table below.



round to one decimal place

Triangles	Side Opposite to $\angle A$	Side Adjacent to (beside) $\angle A$	Hypotenuse	Calculate these Trigonometric Ratios		
				$\frac{opposite}{hypotenuse}$	$\frac{adjacent}{hypotenuse}$	$\frac{opposite}{adjacent}$
ΔABI						
ΔACH						
ΔADG						
ΔAEF						

1. Explain why the ratios of the triangles are the same.

2. Measure the angle A using the protractor: $< A =$ _____

3. MAKE SURE your calculator is in DEGREE mode!
   Use the calculator to calculate the following trigonometric functions

$\sin A =$ $\qquad\qquad$ $\cos A =$ $\qquad\qquad$ $\tan A =$

$\frac{opposite}{hypotenuse}$ is called ____________ or _______ for short

$\frac{adjacent}{hypotenuse}$ is called ____________ or _______ for short

$\frac{opposite}{adjacent}$ is called ______________ or _______ for short

A way to remember Trig Ratios

_ _ _   _ _ _   _ _ _

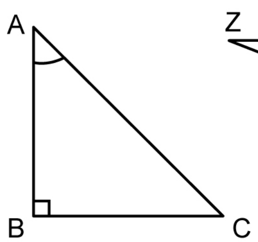
4. Try $\sin 90^\circ =$ ________ $\cos 90^\circ =$ _________ $\tan 90^\circ =$ _________

5. What can you conclude about which angles you can use (highlight) when labeling opposite/adjacent/hypotenuse for SOH CAH TOA on the right triangle?

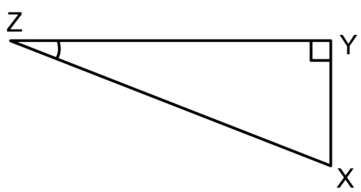
NOTES: How and when to round decimals

6. Practice labelling triangles: Label the hypotenuse, the opposite, and the adjacent sides relative to each marked angle.

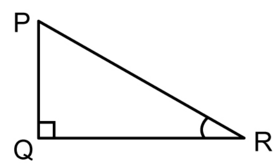
a)



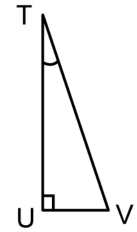
b)



c)



d)



7. Practice using the calculator: Make sure your calculator is in **DEGREE** (DEG) mode

Given the angle find the ratio

a) sin 45°

b) cos 98°

c) tan 4°

d) $\cos 76^o = \frac{3}{x}$

Given the angle fnd the angle (use the SHIFT or 2ND buttons)

e) sin A = 0.557

f) cos C = 0.705

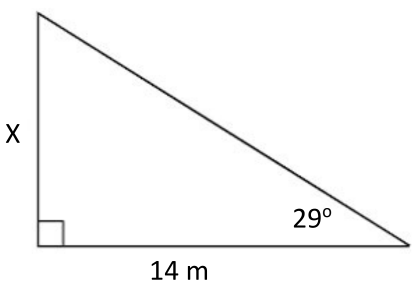
g) tan B = 2.984

h) $\sin x = \frac{5}{6}$

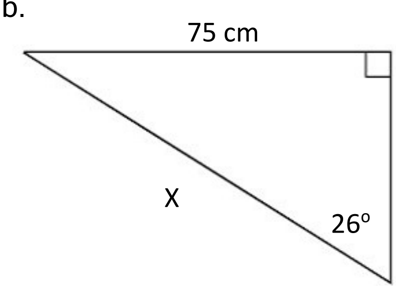
NOTES:

8. Practice solving triangles: Determine the measure of the missing angles or sides

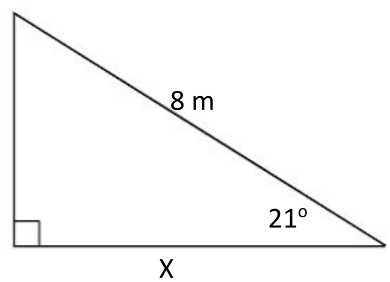
a.



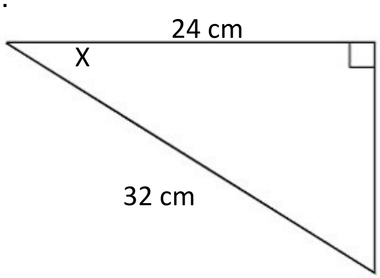
b.



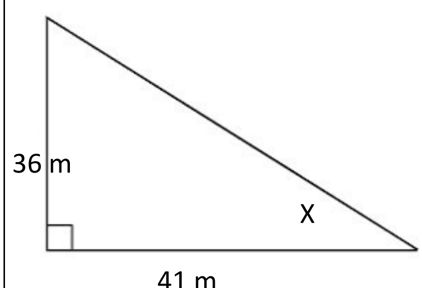
c.



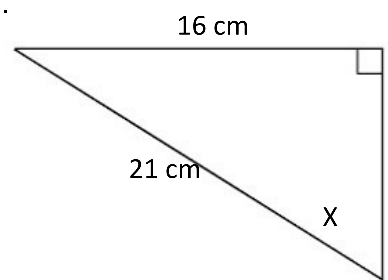
d.



e.



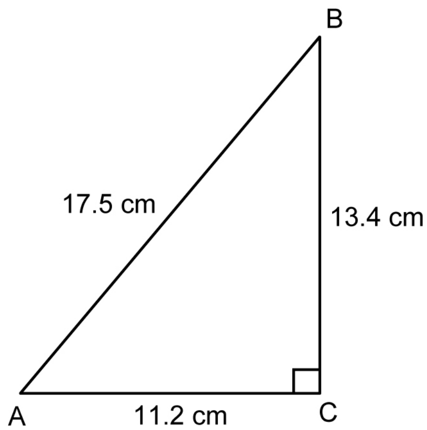
f.



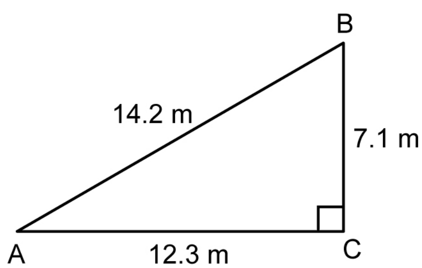
DAY 6 – More Trig Ratios

1. Find the three primary trigonometric ratios for ∠A, to four decimal places.

a)



b)



2. Find the measures of both angles A and B in part a) above. Discuss several methods of doing so.

3. Evaluate with a calculator. Round your answers to four decimal places.

a) sin 72°

b) cos 36°

c) tan 57.4°

4. Find the measure of each angle, to the nearest degree.

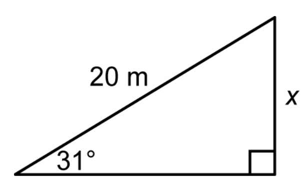
a) $\sin \theta = 0.5189$

b) $\cos B = \dfrac{9}{10}$

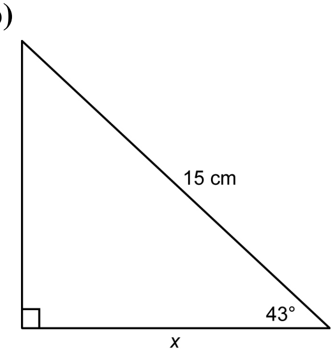
c) $\tan \theta = \dfrac{9}{14}$

5. Find the value of x, to the nearest tenth of a metre.

a)

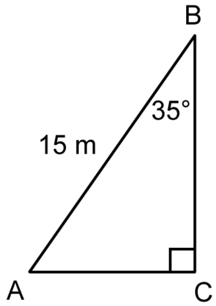


b)



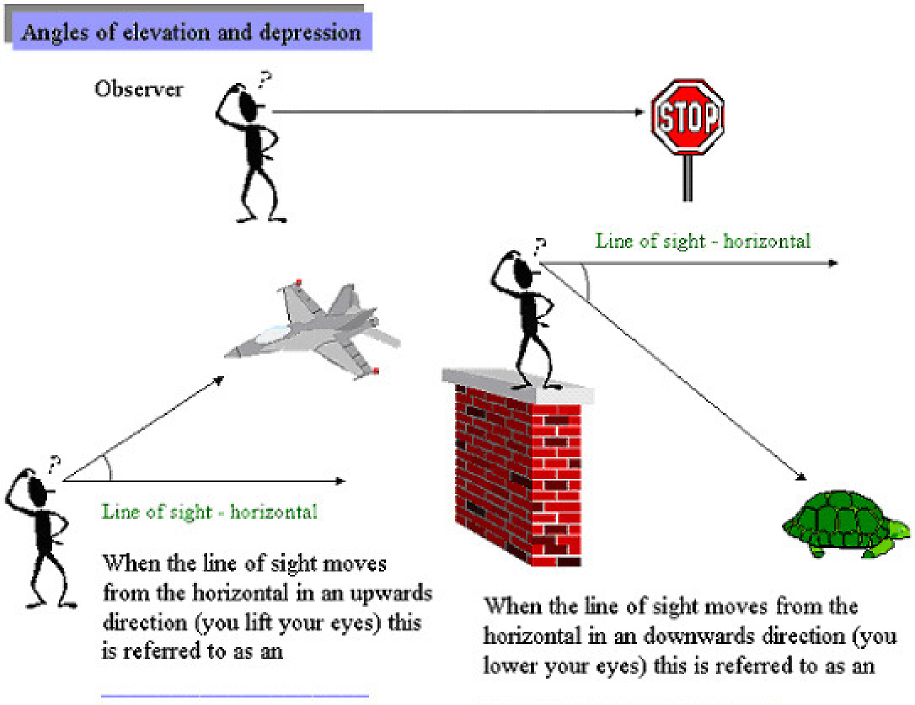
6. Solve each triangle. Round side lengths to the nearest tenth of a metre.

a)



b) In △PQR, ∠Q = 90°, p = 14 m and q = 20 m.

7. In order to measure the height of a tree, Dan calculated that its shadow is 12 m long and that the line joining the top of the tree to the tip of the shadow forms an angle of 52° with the flat ground.
   a) Draw a diagram to illustrate this problem.
   b) Find the height of the tree, to the nearest tenth of a metre.

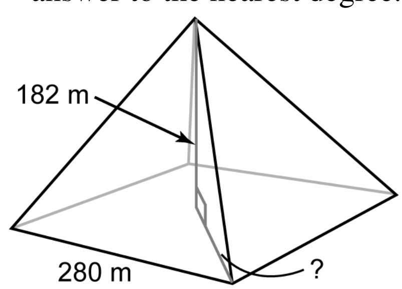


NOTES:

DAY 7 – Problem Solve with Trig

1. Aimee and Russell are facing each other on opposite sides of an 8-m telephone pole. From Aimee's point of view, the top of the telephone pole is at an angle of elevation of 52°. From Russell's point of view, the top of the telephone pole is at an angle of elevation of 38°. How far apart are Aimee and Russell?

2. A square-based pyramid has a height of 182 m and a base length of 280 m. Find the angle, to the nearest degree, that one of the edges of the pyramid makes with the base. Round your answer to the nearest degree.



3. A monument casts a shadow 13 m long. The sun's rays form an angle of 63° with the ground. Calculate the height of the monument to on decimal place.

4. A ladder leans against a wall forming a 25° angle with the wall. If the ladder reaches 2.8 m up the wall, how long is the ladder?

5. Brook is flying a kite while standing 24 m from the base of a tree at the park. Her kite is directly above the 3-m tree and the 25-m string is fully extended. Approximately how far above the tree is her kite flying?

6. A carpenter leans a 4 m ladder against a wall. It reaches 3.5 m up the wall. What is the angle the ladder makes with the wall?

7. The foot of a ladder is 1.2 m from a fence that is 1.8 m high. The ladder touches the fence and rests against a building that is 1.8 m behind the fence. Draw a diagram, and determine the height on the building reached by the top of the ladder.

8. A tower casts a shadow 7 m long. A vertical stick casts a shadow 0.6 m long. If the stick is 1.2 m high, how high is the tower?

NOTES:

Sine Law

Cosine Law

DAY 8 – Sine Law

1. Draw a diagram and label the given information. Then, find the measure of the indicated side in each triangle, to the nearest tenth of a unit.

   a) In acute $\triangle ABC$, $\angle A = 72°$, $\angle B = 68°$, and $a = 12$ cm. Find side b.

   b) In acute $\triangle DEF$, $\angle D = 52°$, $\angle F = 71°$, and $e = 8.0$ m. Find side d.

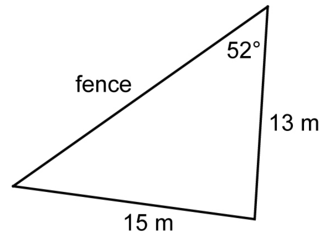
2. Draw a diagram and label the given information. Then, find the measure of the indicated angle in each triangle, to the nearest degree.

   a) In acute $\triangle PQR$, $\angle P = 64°$, $p = 5.7$ cm, and $r = 4.1$ cm. Find $\angle R$.

   b) In acute $\triangle STU$, $\angle S = 57°$, $s = 12$ m, and $u = 9$ m. Find $\angle U$.

3. Draw a diagram and label the given information. Then, solve the triangle.
   In $\triangle DMC$, $\angle D = 55°$, $d = 21$ cm, and $m = 23$ cm.

4. Angela is building a garden in the shape of a triangle, as shown. She would like to put a fence on one side of the garden.

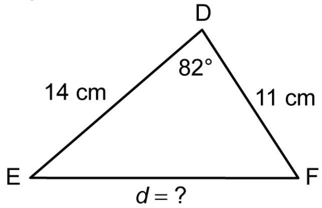


   a) Find the angle formed by the fence and the side that is 15 m in length.
   b) Find the length of the fence

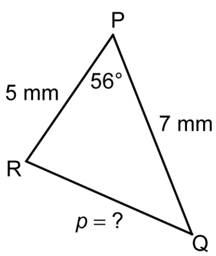
DAY 9 – Cosine Law SAS version

1. Find the length of the indicated side in each triangle, to the nearest tenth of a unit.

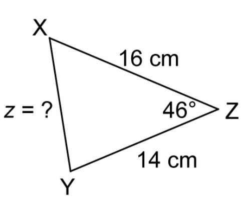
a)



b)

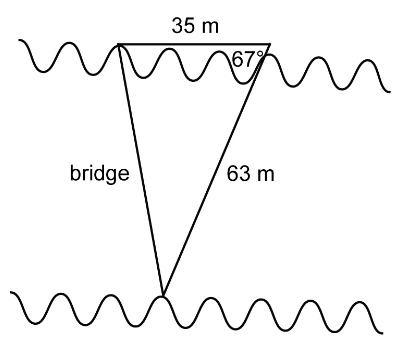


c)



2. Sketch the triangle and label the given information. Then, solve the triangle.
   In $\triangle MCB$, $\angle M = 61°$, $c = 18$ cm, and $b = 21$ cm.

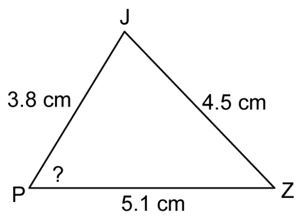
3. Find the length of the bridge, to the nearest metre.



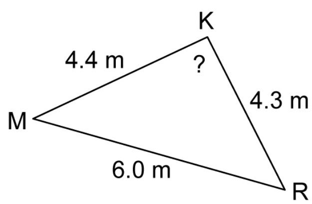
Cosine Law SSS version

4. Solve for the indicated angle, to the nearest degree.

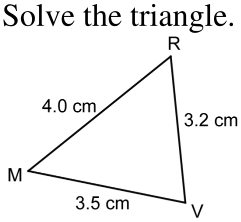
a)



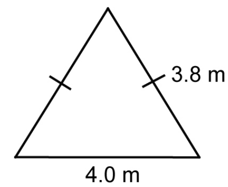
b)



5. Solve the triangle.



6. Laurissa is designing a reflecting pool, in the shape of a triangle, for her backyard.



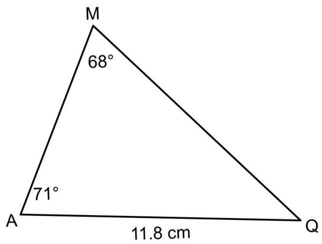
a) Find the interior angles of the reflecting pool

b) Find the surface area of the water in the reflecting pool

DAY 10 - Problem Solve with Trigonometry

Determine whether the primary trigonometric ratios, the sine law, or the cosine law should be used to solve each triangle.

1.



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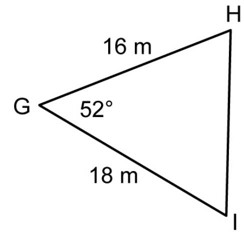

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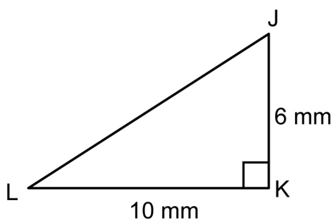
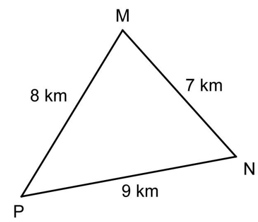


4.



5. A shed is 8 ft wide. One rafter makes an angle of 30° with the horizontal on one side of the roof. A rafter on the other side makes an angle of 70° with the horizontal. Calculate the length of the shorter rafter to the nearest foot.

6. A 10 m ladder leans against a wall. The top of the ladder is 9 m above the ground. Safety standards call for the angle between the base of the ladder and the ground to be between 70° and 80°. Is the ladder safe to climb?

7. An intersection between two country roads makes an angle of 68°. Along one road, 5 km from the intersection, is a dairy farm. Along the other road, 7 km from the intersection, is a poultry farm. How far apart are the two farms? Round the answer to the nearest tenth of a kilometre.

8. A triangle is built using three poles with lengths 17 m, 15 m and 9 m. What is the measure of the largest angle in the triangle?

9. Three islands - Fogo, Twillingate and Moreton's Harbour - form a triangular pattern in the ocean. Fogo and Twillingate are 15 nautical miles apart. The angle between Twillingate and Moreton's Harbour from Fogo is 45°. The angle between Moreton's Harbour and Fogo from Twillingate is 65°. How far is Moreton's Harbour from Fogo, to the nearest nautical mile?

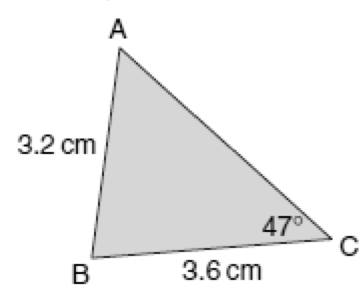
10. A golfer is faced with a shot that has to pass over some trees. The trees are 33 ft tall. The golfer finds himself 21 ft behind these trees, which obstruct him from the green. he decides to go for the green by using a 60° lob wedge. This club will allow the ball to travel at an angle of elevation of 60°. Did he make the right choice? Explain.

11. Two tracking stations, 5 km apart, track a weather balloon floating between them. The tracking station to the west tracks the balloon at an angle of elevation of 52°, and the station to the east tracks the balloon at an angle of elevation of 60°. How far is the balloon from the closest tracking station?

12. Three cell phone towers form a triangle. The distance between the first tower and the second tower is 16 km. The distance between the second tower and the third tower is 19 km. The distance between the first tower and the third tower is 19 km. Calculate the angles between the cell phone towers.

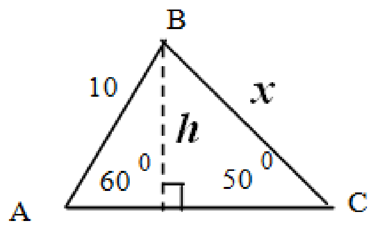
13. From the top of a cliff that is 70 m in height, the angle of depression of a sailboat on a lake is 41°. What is the distance from the base of the cliff to the sailboat?

14. What are the measures of the other two angles in this triangle, to the nearest degree?

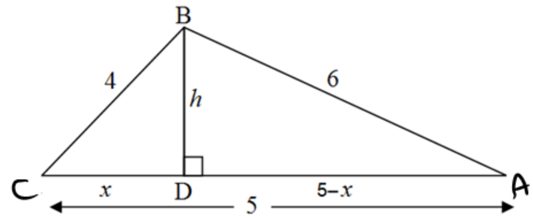


Proofs of the laws

Sine Law



Cosine Law



Proof of Quadratic Formula