



**Detailed Lesson Plan in Mathematics X**  
**‘Area of Triangle Using Trigonometry’**

**I. LEARNING OBJECTIVES**

During and after the 120-minute lesson, at least 75% of the students are expected to:

1. Give the trigonometric formulas for finding the area of triangle;
2. Compute for the given area of triangle using trigonometry and Heron’s formula.
3. Cite the importance of computing the given area of a triangle using trigonometry in real life scenario.

**II. SUBJECT MATTER**

A. **Topic:** Area of Triangle Using Trigonometry

B. **References:**

- <https://www.mathsisfun.com/algebra/trig-area-triangle-without-right-angle.html>
- <https://www.mathbitsnotebook.com>
- <https://www.youtube.com/watch?v=-2f-uDViUfc>
- <https://www.youtube.com/watch?v=syV6cDk7Lg>

C. **Materials:** Visual aids, white board marker and white board, LCD projector, Laptop, Power Point presentation

D. **Skills:** Analytical thinking, critical thinking, computational skill, problem solving skill

E. **Key Concepts:**

There are several ways to compute the area of triangle, one of it is using trigonometry. That is to say, the area of a triangle is half the product of two sides times the sine of the included angle.

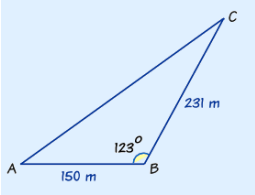
F. **Values Integration:** Collaboration, self-actualization, decision making

G. **Methodology:** 3I’s (Introduction, Interaction, Integration)

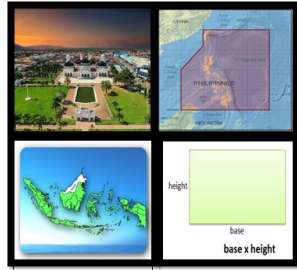
**III. PROCEDURE**

TEACHING HINTS	TEACHER’S ACTIVITY	STUDENTS’ ACTIVITY
<b>A. Preliminary Activities</b> 1. Greetings	Good morning class!	

2. Opening Prayer	-----	Good morning Sir! -----
3. Securing Cleanliness	Before you take your seats, kindly arrange your chairs and pick up the pieces of papers/plastics that you may see on the floor.	(Students will do what is said)
4. Checking of Attendance	Beadle, kindly list down the names of those who are absents for today's discussion. Please hand it to me later.	Yes Sir!
5. Checking of Assignment	Thank you very much! Now, did I give you an assignment last meeting?	No, Sir!
6. Recall	<p>Okay, since we have no assignment to check, let us have a recap of our previous lesson.</p> <p>What theorem are we going to use to find the other side of a right triangle given only the two sides?</p> <p>Excellent!</p> <p>Again, what is the formula used in Pythagorean theorem?</p> <p>Very good! What about the name of each sides of a right triangle?</p> <p>Great! Please enumerate the trigonometric ratios that you know.</p> <p>Awesome! So previously, we discussed Pythagorean theorem and</p>	<p>(Students may try to answer) *Pythagorean Theorem</p> <p>(Students may try to answer) *Sir, the formula of Pythagorean theorem is <math>c^2 = a^2 + b^2</math>.</p> <p>(Students may try to answer) *Sir, the name of the sides of the triangle are opposite, adjacent and hypotenuse.</p> <p>(Students may try to answer) *Sir, the different trigonometric ratios are sine, cosine, tangent, etc.</p>

	<p>trigonometric ratios. Later on, we will be discussing another lesson under trigonometry.</p>	
<p><b>INTRODUCTION</b></p> <p>Motivation</p>	<p>Petani Ahmad owns a triangular piece of land where he planted durian for merchandise. He used to put fence on his triangular piece of land to avoid from thief.</p>  <p>The length of the fence AB is 150 m. The length of the fence BC is 231 m.</p> <p>The angle between fence AB and fence BC is <math>123^\circ</math>.</p> <p>How much land does petani Ahmad own?</p> <p>Would you like to help petani Ahmad to know how much land he owns?</p> <p>Okay, I have a special way of helping petani Ahmad.</p> <p>But before that, Let's have first a simple game called "4 pics 1 word."</p> <p>Do you know that game?</p> <p>Wow! So, if that's the case, the first student who guess the problem will win the game and will receive a price. Are you ready class?</p> <p>Let's begin!</p>	<p>Yes Sir!</p> <p>Yes Sir!</p> <p>Yes Sir!</p>

Question number 1.



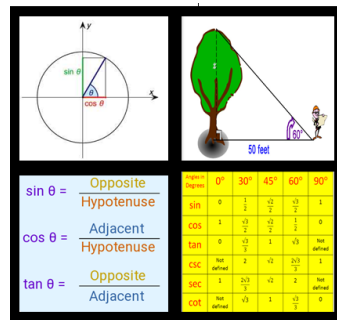
ANSWER: **AREA**

Question number 2.



ANSWER: **TRIANGLE**

Question number 3.



ANSWER: **TRIGONOMETRY**

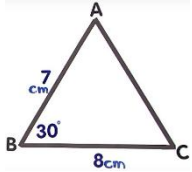
That's great! Congratulations!  
Again, what are the words you get on the game?

Sir, the words we get are area, triangle, and trigonometry.

Excellent!

Presentation of the Lesson

The words that you get has something to do with our topic for today, and our topic for today will also help petani Ahmad to know how much land he owns. Our topic for today is all about **AREA OF TRIANGLE**

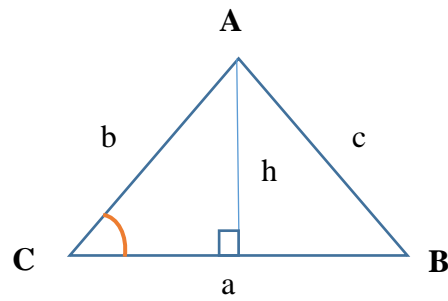
<p>Presentation of Lesson Objectives</p>	<p><b>USING TRIGONOMETRY.</b></p> <p>But before we dig deeper into the topic, here are the learning objectives that we need to attain during and at the end of the 120-minute discussion, for you to be guided. (Teacher will flash the lesson objectives on the board)</p>	
<p><b>INTERACTION</b></p> <p><b>B. Lesson Proper</b></p>	<p>There are several ways to compute for the area of triangle.</p> <p>For instance, there's a general formula for the area of a triangle which is well known.</p> <p>May you all please say it aloud the formula in finding the area of triangle?</p> <p>Very good! In this triangle, can you locate the base and the height of the triangle?</p>  <p>Excellent! Why can we just measure the height anyway? But actually we really can't do that.</p> <p>What do you observe about the triangle?</p> <p>Very good! Where can we just use this formula?</p>	<p>Sir, the formula in finding the area of triangle is <math>A_{\Delta} = \frac{1}{2}bh</math>. Where b is the base and the h is the height of the triangle.</p> <p>Sir, the base is 8 cm and basically, there is no height.</p> <p>Sir, the triangle is not a right triangle that's why it doesn't have height.</p> <p>Sir, we can only use this formula if it is a right angled triangle.</p>

Awesome.  
When you have right triangle, of course there is a 90 degrees angle. But absolutely, we can't use it for a non-right angle triangle.

So, what do you think is the formula in finding the area of non-right angled triangle given only two sides and the included angle?

If that's the case, I'll help you to discover it.

Take a look at the picture.



As you can see, the vertices are labeled capital A, B and C, and what we normally do, if we got letters A, B and C, we make side opposite angle B small b and the side opposite angle C small c and so on.

I've still put h to denote the height of the triangle. I put a little red arc here because I'm particularly interested on angle C. We're going to look within this right triangle on the left and I can write down that the Sine of angle C is equal to the opposite divided by the hypotenuse.

So, that's h divided by b.

$$\sin C = \frac{h}{b}$$

Now, if I just multiply that equation through b, I will get b sin C is equal to h.

$$b \sin C = h$$

(Student may try to answer)  
Sir, we still don't know it yet.

Let's go back to the formula of triangle

$$A_{\Delta} = \frac{1}{2}bh$$

Which in this case is a half of a multiplied by h.

$$A_{\Delta} = \frac{1}{2}ah$$

Now class, what are we going to do with h to finally get the formula?

Very good!

It is very important that you must recognize the pattern because the triangle might not be called ABC and you might not be asked to deal with angle C.

(the teacher will give the pattern to students by pointing out the sides of a triangle and the sine of the included angle (SAS))

So, what if the given angle is 'A'?  
What will be the formula?

Excellent!

What about if the given angle is 'B'?

Great!

What do you observe about the different formulas?

Very good! Now let us have some examples.

Find the area of this triangle:

(Student may try to answer)

\*Sir, we need to substitute b sin C from h, so it will become

$$A_{\Delta} = \frac{1}{2}ab \sin C$$

(Students may try to answer)

\*Sir, it will be

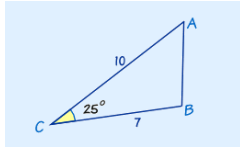
$$A_{\Delta} = \frac{1}{2}bc \sin A$$

(Students may try to answer)

\*Sir, the formula is

$$A_{\Delta} = \frac{1}{2}ac \sin B$$

Sir, I just observe that each letter occurs once in the formula.



First of all, we must decide what we know.

What's the given on the problem?

Good! So let's get going:

What formula are we going to use?

Excellent!

Put in the values we know:

$$A_{\Delta} = \frac{1}{2} \times 7 \times 10 \times \sin(25^{\circ})$$

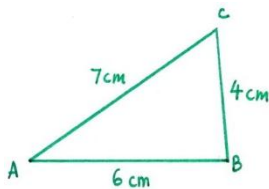
Do some calculator work:

$$A_{\Delta} = 35 \times 0.4226\dots$$

$$A_{\Delta} = 14.8 \text{ square unit}$$

Did you get it class?

What about this triangle?



Can anyone know how to answer this?

In this problem, we can't use the formula we used a while ago.

You can calculate the area of a triangle if you know the lengths of all three sides, using a formula that has been known for nearly 2000 years.

It is called "Heron's Formula."

We can solve that problem by using this two-step process:

Sir, we know angle  $C = 25^{\circ}$ , and sides  $a = 7$  and  $b = 10$ .

Sir, we must use

$$A_{\Delta} = \frac{1}{2} ab \sin C$$

Yes, Sir.

None Sir.



Step 1: Calculate "s" (half of the triangles perimeter):

$$s = \frac{a+b+c}{2}$$

Step 2: Then calculate the Area:

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

Did you get it class?

I need one volunteer to solve the problem on the board.

Let's check if \_\_\_\_\_ answer is correct.  
(the teacher will check the answer of the student)

Excellent!  
Let's give \_\_\_\_\_, a fireworks clap.  
(the teacher will demonstrate the clap)

Again, if two sides of a non-right angled triangle is given with the sine of a included angle, what formulas are we going to use?

Yes, Sir!

Okay, yes, \_\_\_\_\_?  
(the volunteer student will solve the problem on the board)

Step 1:

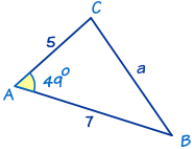
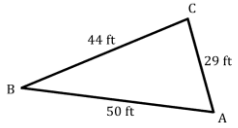
$$\begin{aligned} s &= \frac{4+7+6}{2} \\ &= \frac{17}{2} \\ &= 8.5 \end{aligned}$$

Step 2:

$$\begin{aligned} A &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \\ &= \sqrt{8.5(8.5-4)(8.5-7)(8.5-6)} \\ &= \sqrt{8.5(4.5)(1.5)(2.5)} \\ &= \sqrt{8.5(16.875)} \\ &= \sqrt{143.4375} \\ &= 11.98 \text{ cm}^2 \end{aligned}$$

(all students will do the clap)

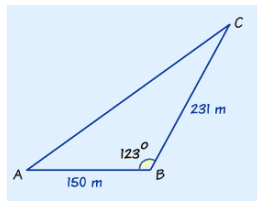
Sir, the formulas are we going to use are the following:

	<p>Excellent! How about if all the sides of a triangle is given, what formula are we going to use?</p> <p>Very good! That's it!</p>	$A_{\Delta} = \frac{1}{2} ab \sin C$ $A_{\Delta} = \frac{1}{2} bc \sin A$ $A_{\Delta} = \frac{1}{2} ac \sin B$ <p>Sir, we must use the heron's formula by following this main step: Step 1: Calculate "s" (half of the triangles perimeter):</p> $s = \frac{a+b+c}{2}$ <p>Step 2: Then calculate the Area: <math>A = \sqrt{s(s-a)(s-b)(s-c)}</math></p>
<p><b>INTEGRATION</b></p>	<p>Let us see if you understand fully what we had discussed earlier. I have here 2 triangles, one given two sides and an angle and the other is given 3 sides. We will find the area of the both triangle.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>What we are going to do is to solve it using heron's formula and the trigonometric formula. First count from one to two. (the teacher will facilitate the counting)</p> <p>For those who got number 1, you will solve the problem using the trigonometric formula for the 1<sup>st</sup> picture and for number two, you will use the Heron's formula for the 2<sup>nd</sup></p>	<p>(Students start counting).</p>

	<p>photo. Are you ready class?</p> <p>(After a few minutes) Time's up! Exchange your notebook to your seatmates. Let's check your answer!</p> <p>Solution for the 1<sup>st</sup> picture: Using trigonometric formula.</p> $A_{\Delta} = \frac{1}{2}bc \sin A$ <p>Put in the values we know: <math>A_{\Delta} = \frac{1}{2} \times 5 \times 7 \times \sin (49^{\circ})</math></p> <p>Do some calculator work: <math>A_{\Delta} = 17.5 \times 0.7547095802</math></p> <p><math>A_{\Delta} = 13.21</math> square unit</p> <p>Is your answer the same with me? If yes, give 10 points for the perfect score.</p> <p>Solution for the 2<sup>nd</sup> picture: Using Heron's formula</p> <p>Step 1:</p> $s = \frac{44+29+50}{2}$ $= \frac{123}{2}$ $= 61.5$ <p>Step 2:</p> $A = \sqrt{s(s-a)(s-b)(s-c)}$ $= \sqrt{61.5(61.5-44)(61.5-29)(61.5-50)}$ $= \sqrt{61.5(17.5)(32.5)(11.5)}$ $= \sqrt{61.5(6540.625)}$ $= \sqrt{402248.4375}$ $= 634.23 \text{ ft}^2$ <p>Do you have the same answer with me? If yes, give 10 points for the perfect score.</p>	<p>Yes, Sir!</p> <p>(the students will exchange their notebooks to their seatmates and check the answer if it is correct)</p> <p>Yes, sir!</p> <p>Yes, Sir!</p>
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Great! You're doing so well.  
But before we forget petani Ahmad,  
let us now help him know the area of  
his triangular piece of land!

By looking in the illustration of his  
land, what do you think is the area of  
this triangle?



Common let's help petani Ahmad  
solve his problem. You may do it in  
pair.

Excellent!  
The land does petani Ahmad own is  
 $14,530 \text{ m}^2$ ?

Ah! That's it. Very good. I'll tell  
petani Ahmad later.

What about giving yourselves a big  
round of applause.

### C. Generalization

So what have you learned from our  
discussion this morning?

Okay very good! So do you think it's  
also important for you to know how  
to compute for a given triangle using  
trigonometry?

(Student may try to answer)

\*Sir, petani Ahmad owns  $14,530 \text{ m}^2$  triangular piece of land.

Yes, Sir!

(Students clapping their hands)

(Students may try to answer)

\*Sir we learned how the area of  
triangle derived from  
trigonometry and its formulas. We  
also learned that if three sides of a  
triangle is given, we can use the  
Heron's formula.

Yes Sir!

	<p>In what way?</p> <p>That's right!</p> <p>Very good! What about you, do you think learning this topic is important in our real life scenario?</p> <p>Great! What about the others? Do you do think the same?</p> <p>Excellent! That's what I like. Do you have anything more to clarify?</p>	<p>Sir, one of the importance of it is the problem of petani Ahmad. Through learning the formula, we can solve that kind of problem which really help us in solving real life problem.</p> <p>Yes, Sir!</p> <p>Yes Sir!</p> <p>None Sir!</p>
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#### IV. EVALUATION

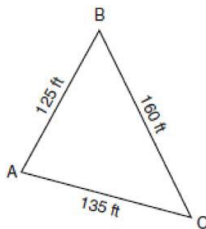
(Worksheet)

##### I. ENUMERATION:

1. Give the three different trigonometric formulas for finding the area of triangle.
2. Give and enumerate the formula and step process of Heron's formula.

**II. Directions:** Solve the following problems. Use the correct formula on each problem. Show your complete solutions.

1. In an isosceles  $\Delta$ , the two equal sides each measure 20 meters, and they include an angle of  $35^\circ$ . Find the area of the isosceles triangle, to the nearest sq. meter.
2. In a rhombus, each side is 15, and one angle is  $92^\circ$ . Find the area of the rhombus, to the nearest square unit.
3. The accompanying diagram shows a triangular plot of land located in Moira's garden. Find the area of the plot of land, and round your answer to the nearest hundred square feet.



**Reference:** Tons of Free Math Worksheets at: © [www.mathworksheetsland.com](http://www.mathworksheetsland.com)

Regents Exam Questions A2.A.74: Heron's Formula @ [www.jmap.org](http://www.jmap.org)

## V. ASSIGNMENT

I. Solve the following problems.

1. A garden in the shape of an equilateral triangle has sides whose lengths are 10 meters. What is the area of the garden?

a.  $25 \text{ m}^2$

c.  $50 \text{ m}^2$

b.  $253 \text{ m}^2$

d.  $503 \text{ m}^2$

2. In  $\triangle PQR$ ,  $PQ = 9$  meters and  $PR = 12$  meters. If the area of the triangle is 32 sq. meters, find the measure of  $\angle P$  to the nearest degree.

II. Study about the law of sine. Give the formula of laws of sine.

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