

Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: <u>11/27</u> Topic: <u>13D - 13E Review</u>	0 1 2	
Tuesday Date: <u>11/28</u> Topic: <u>Review</u>	0 1 2	
Wednesday Date: <u>11/29</u> Topic: <u>25B: Law of Sines Area</u>	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Class Plan:

1. Warm-up

2. Law of Sines Investigation

c

Chapter 25

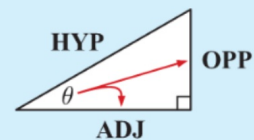
THE SINE RULE

3. Example

4. Practice

In any right angled triangle with one angle θ , we have:

$$\sin \theta = \frac{\text{OPP}}{\text{HYP}}, \quad \cos \theta = \frac{\text{ADJ}}{\text{HYP}}, \quad \tan \theta = \frac{\text{OPP}}{\text{ADJ}}$$



C**THE SINE RULE**

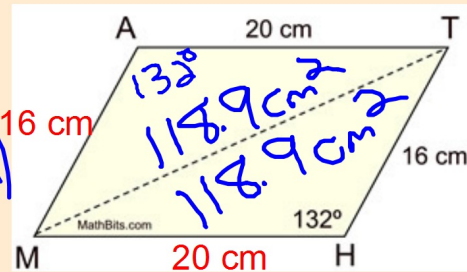
Warm-up: Find the area of the parallelogram.

$$\text{area} = \frac{1}{2}ab \sin C$$

$$A = \frac{1}{2}(20)(16)\sin(132)$$

$$A \approx 118.9 \text{ cm}^2$$

$$\text{Parallelogram Area} = 2 \cdot (118.9)$$
$$\approx 237.8 \text{ cm}^2$$



C

THE SINE RULE

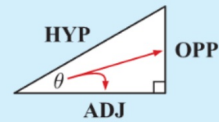
Driving Question:

*Given a non-right triangle,
How can we use trig to solve for
sides lengths and angle measures?*

Recall...

In any right angled triangle with one angle θ , we have:

$$\sin \theta = \frac{\text{OPP}}{\text{HYP}}, \quad \cos \theta = \frac{\text{ADJ}}{\text{HYP}}, \quad \tan \theta = \frac{\text{OPP}}{\text{ADJ}}$$



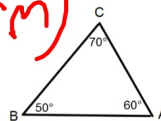
...only works on right triangles

INVESTIGATION 1

THE SINE RULE

1. Explore measurements
2. Explore ratios

Step 1: Use your ruler to measure the three sides of triangle ABC , in centimeters.



$AB = \quad \text{cm}$
 $BC = \quad \text{cm}$
 $CA = \quad \text{cm}$

a) $\frac{\sin A}{BC} = \frac{\sin 60^\circ}{\quad} \approx$

b) $\frac{\sin B}{CA} = \frac{\sin 50^\circ}{\quad} \approx$

c) $\frac{\sin C}{AB} = \frac{\sin 70^\circ}{\quad} \approx$

Step 2: Identify the side opposite of each angle.

- a) $\angle A$ is opposite side _____ b) $\angle B$ is opposite side _____ c) $\angle C$ is opposite side _____

3. Conclude

Conclusions

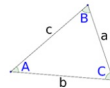
- a) Examine step 3 and the final measures for parts **a**, **b**, **c**. What do you notice?

4. Generalize: What is "The Sine Rule"!

Generalize

- b) Using the triangle at the right, complete the relationship you noticed in the **conclusion**.

$$\sin \quad = \sin \quad = \sin \quad$$

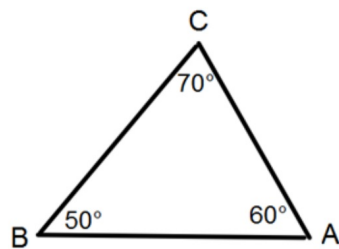


5. Apply the Sine Rule

When done: Show teacher your investigation

INVESTIGATION 1**THE SINE RULE****1. Explore measurements**

Step 1: Use your ruler to measure the three sides of triangle ABC , in centimeters.



$$AB = \underline{\hspace{2cm}} \text{ cm}$$

$$BC = \underline{\hspace{2cm}} \text{ cm}$$

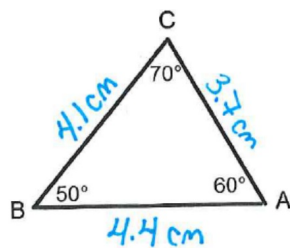
$$CA = \underline{\hspace{2cm}} \text{ cm}$$

Step 2: Identify the side opposite of each angle.

- a) $\angle A$ is opposite side _____ b) $\angle B$ is opposite side _____ c) $\angle C$ is opposite side _____

INVESTIGATION 1**THE SINE RULE****1. Explore measurements****Solution**

Step 1: Use your ruler to measure the three sides of triangle ABC , in centimeters.



$AB =$	<u>4.4</u>	cm
$BC =$	<u>4.1</u>	cm
$CA =$	<u>3.7</u>	cm

Step 2: Identify the side opposite of each angle.

- a) $\angle A$ is opposite side \overline{BC} b) $\angle B$ is opposite side \overline{CA} c) $\angle C$ is opposite side \overline{AB}

INVESTIGATION 1

THE SINE RULE

2. Explore ratios

Step 3: Substitute the appropriate measures of triangle ABC into the ratios below and use your calculator to find the answer. (*The first one is partially started for you...*) **Round to 3 decimals.**

$$\text{a) } \frac{\sin A}{BC} = \frac{\sin 60^\circ}{4.1} \approx$$

.217

$$\text{b) } \frac{\sin B}{CA} = \frac{\sin 50}{3.7} \approx$$

.207

$$\text{c) } \frac{\sin C}{AB} = \frac{\sin 70}{4.4} \approx$$

.213

.22

.21

.21

3. Conclude

Conclusions

a) Examine step 3 and the final measures for parts **a, b, c**. What do you notice?

About equal

INVESTIGATION 1

THE SINE RULE

2. Explore ratios

Solution

Step 3: Substitute the appropriate measures of triangle ABC into the ratios below and use your calculator to find the answer. (*The first one is partially started for you...*) **Round to 3 decimals.**

$$\text{a) } \frac{\sin A}{BC} = \frac{\sin 60^\circ}{4.1} \approx .21$$

$$\text{b) } \frac{\sin B}{CA} = \frac{\sin 50^\circ}{3.7} \approx .21$$

$$\text{c) } \frac{\sin C}{AB} = \frac{\sin 70^\circ}{4.4} \approx .21$$

3. Conclude

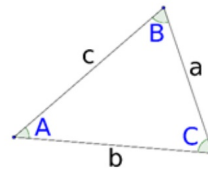
Conclusions

a) Examine step 3 and the final measures for parts **a**, **b**, **c**. What do you notice?

The ratios are equal

INVESTIGATION 1**THE SINE RULE****4. Generalize:** What is "The Sine Rule"!**Generalize**ANY \triangle b) Using the triangle at the right, complete the relationship you noticed in the **conclusion**.

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

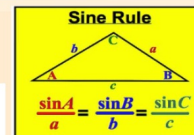


INVESTIGATION 1

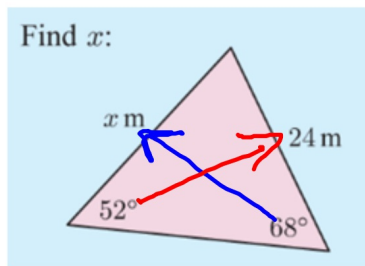
THE SINE RULE

5. Apply the Sine Rule

Practice: Use proportions to solve for the missing side.



Find x :



~~$$\frac{\sin 68}{24} = \frac{\sin 52}{x}$$~~

$$24 \sin(68) = x \cdot \sin(52)$$

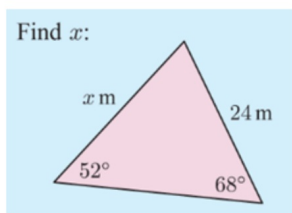
$$x = \frac{24 \sin(68)}{\sin(52)}$$

$$x \approx 28.24 \text{ m}$$

INVESTIGATION 1**THE SINE RULE****5. Apply the Sine Rule**

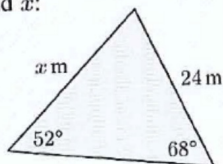
Practice: Use proportions to solve for the missing side.

Find x :



Practice: Use proportions to solve for the missing side.

Find x :



$$\frac{\sin 52}{24} = \frac{\sin 68}{x}$$

$$x = \frac{24 \sin 68}{\sin 52}$$

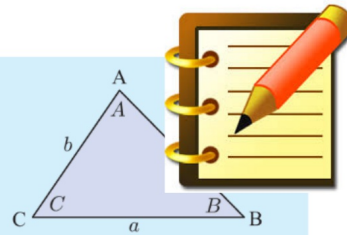
$$x \approx 28.2 \text{ m}$$

C Record in your notebook. THE SINE RULE

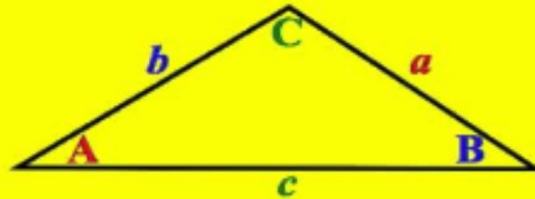
THE SINE RULE

In any triangle ABC with sides a , b , and c units, and opposite angles A , B , and C respectively,

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



Sine Rule



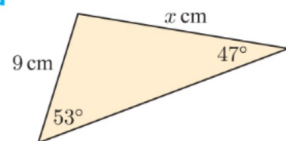
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Law of Sines to Find _____

Example #1

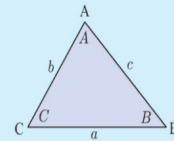
1 Find the value of x :

a



In any triangle ABC with sides a , b , and c units, and opposite angles A , B , and C respectively,

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

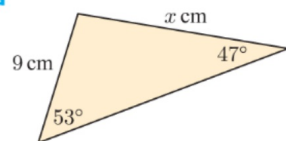


Law of Sines to Find _____

Example #1

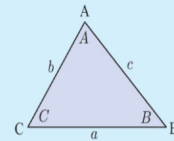
1 Find the value of x :

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In any triangle ABC with sides a , b , and c units, and opposite angles A , B , and C respectively,

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

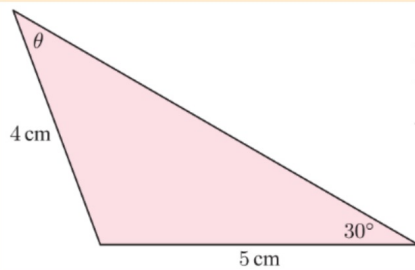


$$\frac{\sin(53^\circ)}{x} = \frac{\sin(47^\circ)}{9}$$
$$\frac{x \cdot \sin(47^\circ)}{\sin(47^\circ)} = \frac{9 \cdot \sin(53^\circ)}{\sin(47^\circ)}$$

$$x = 9.83 \text{ cm}$$

Law of Sines to Find _____

Example #2 Solve for θ .



For example, suppose we want to find the angle θ in the triangle alongside.

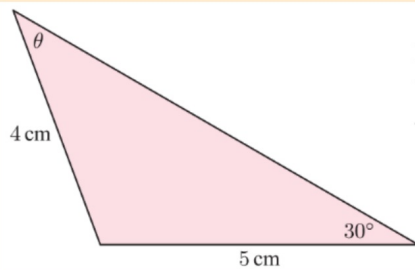
Using the sine rule, $\frac{\sin \theta}{5} = \frac{\sin 30^\circ}{4}$

$$\therefore \sin \theta = \frac{5 \times \sin 30^\circ}{4}$$

$$\therefore \sin \theta = \frac{5}{8}$$

Law of Sines to Find _____

Example #2 Solve for theta.



For example, suppose we want to find the angle θ in the triangle alongside.

Using the sine rule, $\frac{\sin \theta}{5} = \frac{\sin 30^\circ}{4}$

$$\therefore \sin \theta = \frac{5 \times \sin 30^\circ}{4}$$

$$\therefore \sin \theta = \frac{5}{8}$$

$$\frac{\sin(\theta)}{5} = \frac{\sin(30^\circ)}{4} \Rightarrow \sin(\theta) = \frac{5 \sin(30^\circ)}{4}$$

$$\sin(\theta) = 0.625$$

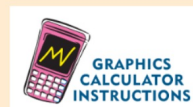
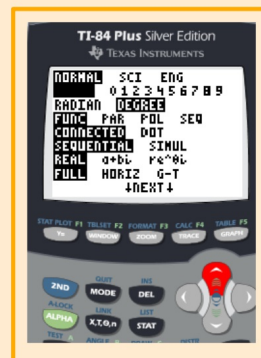
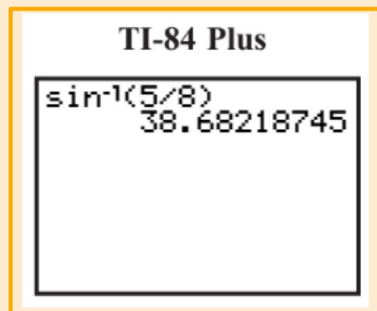
$$\theta = \sin^{-1}(0.625) \quad \boxed{\theta = 38.68^\circ}$$

Calculator

1. MODE: DEGREE

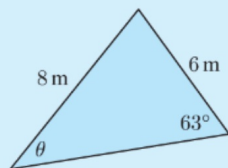
Example:

2. 2ND - SIN



Example 5**Self Tutor**

The diagrams below are drawn approximately to scale. Use the sine rule to find θ , rounding your answer to one decimal place.

a**a** Using the sine rule,

$$\frac{\sin \theta}{6} = \frac{\sin 63^\circ}{8}$$

$$\therefore \sin \theta = \frac{6 \times \sin 63^\circ}{8}$$

$$\therefore \theta = \sin^{-1} \left(\frac{6 \times \sin 63^\circ}{8} \right)$$

{as θ is clearly acute}

$$\therefore \theta \approx 41.9^\circ$$

Exercises for tonight...

25C The Sine Rule (pg. 494-6)

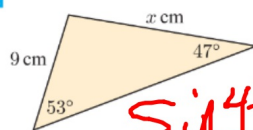
Solving for sides 25C.1 #1,2

Solving for angles 25C.2 #3(a,d,g)

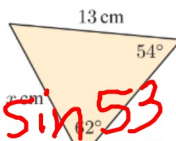
EXERCISE 25C.1

1 Find the value of x :

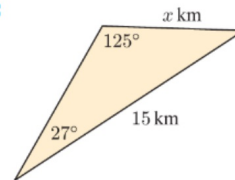
a



b



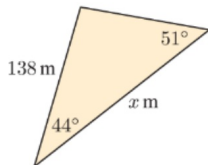
c



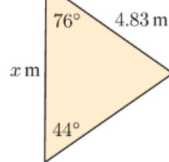
$$\frac{\sin 47}{9} = \frac{\sin 53}{x}$$

2 Find the value of x :

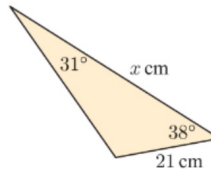
a



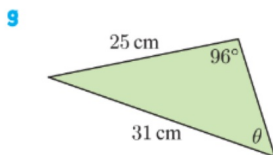
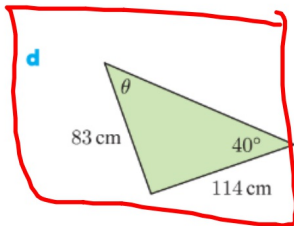
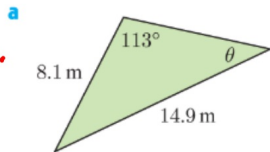
b



c



1 The diagrams below are drawn approximately to scale. Use the sine rule to find θ , rounding your answer to one decimal place.



$$\frac{\sin 40}{83} = \frac{\sin \theta}{114}$$

$$114 (\sin 40) = 83 (\sin \theta)$$

$$\frac{73.27}{83} = \frac{83 (\sin \theta)}{83}$$

$$.883 = \sin \theta$$

$$\theta \approx 62^\circ$$

Solutions

EXERCISE 25C.1

- 1** **a** $x \approx 9.83$ **b** $x \approx 11.9$ **c** $x \approx 8.31$
2 **a** $x \approx 177$ **b** $x \approx 6.02$ **c** $x \approx 38.1$
3 **a** $\theta = 50^\circ$, $x \approx 104$, $y \approx 93.2$
 b $\phi = 49^\circ$, $x \approx 161$, $z \approx 163$
 c $\phi = \theta = 39^\circ$, $x \approx 2.49$
4 $\theta = 50^\circ$, $x \approx 13.5$, $y \approx 9.03$

EXERCISE 25C.2

- 1** **a** $\theta \approx 30.0^\circ$ **b** $\theta \approx 46.8^\circ$ **c** $\theta \approx 112^\circ$
 d $\theta \approx 62.0^\circ$ **e** $\theta \approx 122^\circ$ **f** $\theta \approx 131^\circ$
 g $\theta \approx 53.3^\circ$ **h** $\theta \approx 106^\circ$ **i** $\theta \approx 109^\circ$
2 **a** $\phi \approx 50.4^\circ$, $\theta \approx 47.6^\circ$, unknown side ≈ 6.71 cm
 b $\phi \approx 15.8^\circ$, $\theta \approx 121^\circ$, unknown side ≈ 18.8 m
 c $\phi \approx 110^\circ$, $\theta \approx 38.2^\circ$, unknown side ≈ 6.77 cm