

## Lesson 8-8: Complementary Sine and Cosine

### AGENDA:

- Check HW 8-7
- Notes 8.8 with Applications

### HOMWORK:8-8

- Worksheet 8-8

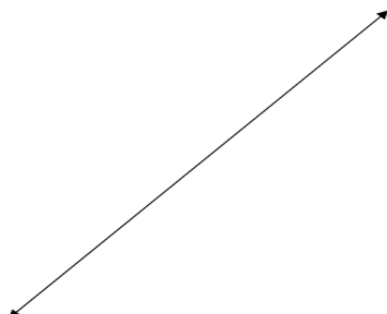
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#### 8-7 GEOMETRY LAB WORKSHEET

Name \_\_\_\_\_

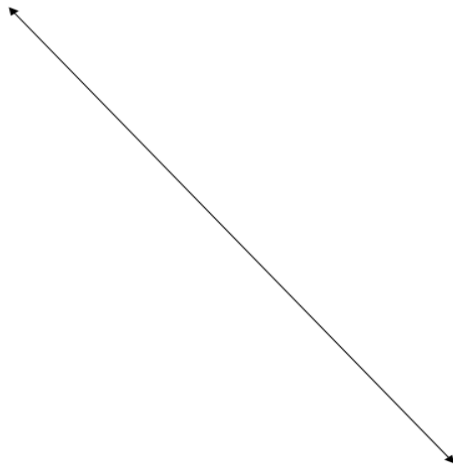
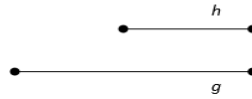
#### Constructions Practice:

- A) Construct an isosceles right triangle with the given leg length.



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B) Construct a scalene right triangle with the given leg lengths  $g$  &  $h$ .



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C) Construct a  $30^\circ$ - $60^\circ$ - $90^\circ$  right triangle  $AYZ$  in an equilateral triangle  $XYZ$ .



D) Explain why you can construct an isosceles right triangle as a way to construct a  $45^\circ$ - $45^\circ$ - $90^\circ$  special right triangle:

explain why your construction justifies that you made a  $30^\circ$ - $60^\circ$ - $90^\circ$  right triangle.

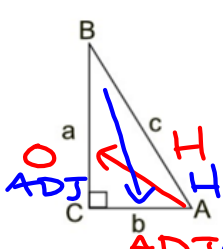
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Name \_\_\_\_\_ Date \_\_\_\_\_ Section \_\_\_\_\_

Geometry 8-7R/8-8LAB Complementary Sine and Cosine (Co-Functions)

**Exploring Complementary Sine and Cosine**

Directions: Fill in the missing pieces to the following questions. All work deals with degrees.



1. Express  $\sin A = \frac{a}{c}$       2. Express  $\cos B = \frac{a}{c}$

3. Express  $\sin B = \frac{b}{c}$       4. Express  $\cos A = \frac{b}{c}$

5.  $m\angle C = 90^\circ$       6.  $m\angle A + m\angle B = 90^\circ$

1. a) What term, based upon the answer to #6, can be used to describe  $\angle A$  and  $\angle B$ ? **COMPLEMENTARY**

b) Express  $m\angle A$  in terms of  $m\angle B$ :  $m\angle A = 90^\circ - m\angle B$

IF  $m\angle B = \theta$        $m\angle A = 90 - \theta$

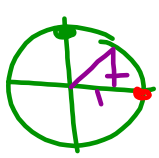
2. What observation(s) can be made regarding the sine and cosine of angles  $A$  and  $B$ ?

**SINE OF ONE ACUTE  $\angle$  = COSINE OF ITS COMPLEMENTARY  $\angle$ .**

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3. Fill the table with the trigonometric values for each acute angle measure

0.5000



	$\theta$						
	$0^\circ$	$20^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$70^\circ$	$90^\circ$
Sin $\theta$	0.0000	0.3420	0.5	0.7071	0.8660		1.0000
Cos $\theta$	1.0000		0.8660	0.7071	0.5000	0.3420	0.0000

Does the table support your observations in #2?

**$\sin \theta = \cos(90 - \theta)$**

4. Summarize your findings:  $\sin \theta = \cos(90 - \theta)$  or  $\cos \theta = \sin(90 - \theta)$

5. Now look at the table of values on the separate sheet of paper. Does this confirm your findings?

**$\sin 8^\circ = \cos 82^\circ$   
0.1342 = 0.1342 ✓**

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Types of Problems:

- Given two trig ratios are equal such as  $\cos(\ ) = \sin(\ ) \rightarrow$  set the two angle measures sum to  $90^\circ$
- Given angle measures are complementary such as  $\cos \alpha = \frac{\square}{\square}$  and  $\sin \beta = \frac{\square}{\square} \rightarrow$  set the two trig ratios equal

compl.

$\alpha + \beta = 90^\circ$

Practice

RATIOS =  $\leftrightarrow$

$\Delta$ 'S COMPLEMENTARY

$\sin \alpha = \cos \beta$  iff  $\alpha + \beta = 90^\circ$  ( $\alpha$  &  $\beta$  are complementary)

1. Solve the following.

- a)  $\sin 42^\circ = \cos \underline{x}^\circ$       b)  $\cos 12^\circ = \sin \underline{90-12}$       c)  $\sin 45^\circ = \cos \underline{x}^\circ$
- $42^\circ + x = 90^\circ$        $\cos 12^\circ = \sin 78^\circ$        $45 + x = 90$   
 $x = 48$        $x = 45$
- d)  $\cos 0^\circ = \sin \underline{90}^\circ$       e)  $\cos 65^\circ = \sin \underline{25}^\circ$       f)  $\sin 78.5^\circ = \cos \underline{x}^\circ$
- $90 - 65 = 25$        $78.5 + x = 90$   
 $x = 11.5$

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2. Find the value of x. All problems are in degrees.

A.  $\sin(x)^\circ = \cos 31^\circ$

$x + 31 = 90$   
 $x = 59$

B.  $\sin 75^\circ = \cos(x)^\circ$

$75 + x = 90$   
 $x = 15$

~~$2x = 30$~~   
 ~~$x = 15$~~

C.  $\cos(2x)^\circ = \sin 30^\circ$

$2x + 30 = 90$   
 $2x = 60$   
 $x = 30$

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$\sin 55^\circ = \cos 35^\circ$  ✓  $\sin 36^\circ = \cos 34^\circ$

3. Solve for the unknown. All problems are in degrees.

a)  $\sin(x-5)^\circ = \cos 35^\circ$

$$\begin{aligned} x-5 + 35 &= 90 \\ x+30 &= 90 \\ x &= 60 \end{aligned}$$

b)  $\sin(2x-17)^\circ = \cos(x-4)^\circ$

$$\begin{aligned} 2x-17 + x-4 &= 90 \\ 3x-21 &= 90 \\ 3x &= 111 \\ x &= 37 \end{aligned}$$

c)  $\sin(x) = \cos(x)$

$$\begin{aligned} x + x &= 90 \\ 2x &= 90 \\ x &= 45 \end{aligned}$$

d)  $\sin\left(\frac{3}{4}x\right) = \cos\left(\frac{1}{4}x\right)$

$$\begin{aligned} \frac{3}{4}x + \frac{1}{4}x &= 90 \\ 0.75x + 0.25x &= 90 \\ 1x &= 90 \\ x &= 90 \end{aligned}$$

e)  $\sin(5x-22)^\circ = \cos(x-10)^\circ$

f)  $\sin\left(\frac{3}{4}x-3\right) = \cos 66^\circ$

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4. Given right triangle ABC with right angle C, solve for x:

A.  $\sin 75^\circ = 3x$ ;  $\cos 15^\circ = 5x-8$



x' comp →

$$\begin{aligned} 3x &= 5x-8 \\ \text{RATIOS} &= \\ 8 + 3x &= 5x \\ 8 &= 2x \\ 4 &= x \end{aligned}$$

B.  $\cos 45^\circ = 8x-6$ ;  $\sin 45^\circ = 3x+4$

$$\begin{aligned} 45 + 45 &= 90 \\ 90 &= 90 \\ 8x-6 &= 3x+4 \\ 5x &= 10 \\ x &= 2 \end{aligned}$$

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Geometry Homework 8-7R/8-8LAB

Name \_\_\_\_\_ Section \_\_\_\_\_

## Complementary Sine &amp; Cosine and Practice Problems

For problems 1-8, find the value of  $x$ . All problems are in degrees.

1.  $\sin(2x + 14) = \cos(x - 5)$

2.  $\sin(x) = \cos(x + 10)$

3.  $\sin(x) = \cos(x - 40)$

4.  $\sin(x) = \cos(x)$

5.  $\sin\left(\frac{x}{3} + 30\right) = \cos(x)$

6.  $\sin(x) = \cos 60^\circ$

7.  $\sin 50^\circ = 2x - 27$ ;  $\cos 40^\circ = 13$

8.  $\sin 20^\circ = x^2$ ;  $\cos 70^\circ = 8x - 16$

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9. Find the value of:

a.  $\frac{\cos 15^\circ}{\cos 15^\circ} = \underline{\hspace{2cm}}$

b.  $\frac{\cos 15^\circ}{\sin 75^\circ} = \underline{\hspace{2cm}}$

10. Is this statement TRUE?  $(\sin 48^\circ) \cdot (\cos 42^\circ) = (\sin 48^\circ)^2$ 

Explain.

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11. If  $\sin 15^\circ = 0.2588$  and  $\cos 15^\circ = 0.9659$ , then

$$\sin 75^\circ = \underline{\hspace{2cm}} \text{ and } \cos 75^\circ = \underline{\hspace{2cm}}.$$

12. If  $\sin 30^\circ = \frac{1}{2}$  and  $\cos \theta = \frac{1}{2}$ , then  $\theta = \underline{\hspace{2cm}}$ .

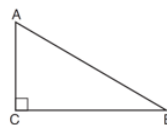
\_\_\_\_ 13. Which expression is always equivalent to  $\sin x$  when  $0^\circ < x < 90^\circ$ ?

- 1)  $\cos(90^\circ - x)$
- 2)  $\cos(45^\circ - x)$
- 3)  $\cos(2x)$
- 4)  $\cos x$

\_\_\_\_ 14. In scalene triangle  $ABC$  shown in the diagram below,  $m\angle C = 90^\circ$ .

Which equation is always true?

- 1)  $\sin A = \sin B$
- 2)  $\cos A = \cos B$
- 3)  $\cos A = \sin C$
- 4)  $\sin A = \cos B$



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## Attachments

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Quiz 1 L.pdf