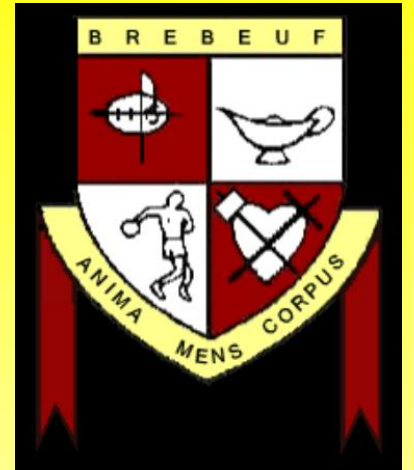


# ST. JEAN DE BREBEUF MATHEMATICS



## CHAPTER 2.3

THE SINE and

COSINE RATIOS

# CHAPTER 2.3

# THE SINE and COSINE RATIOS

## EXAMPLE 1

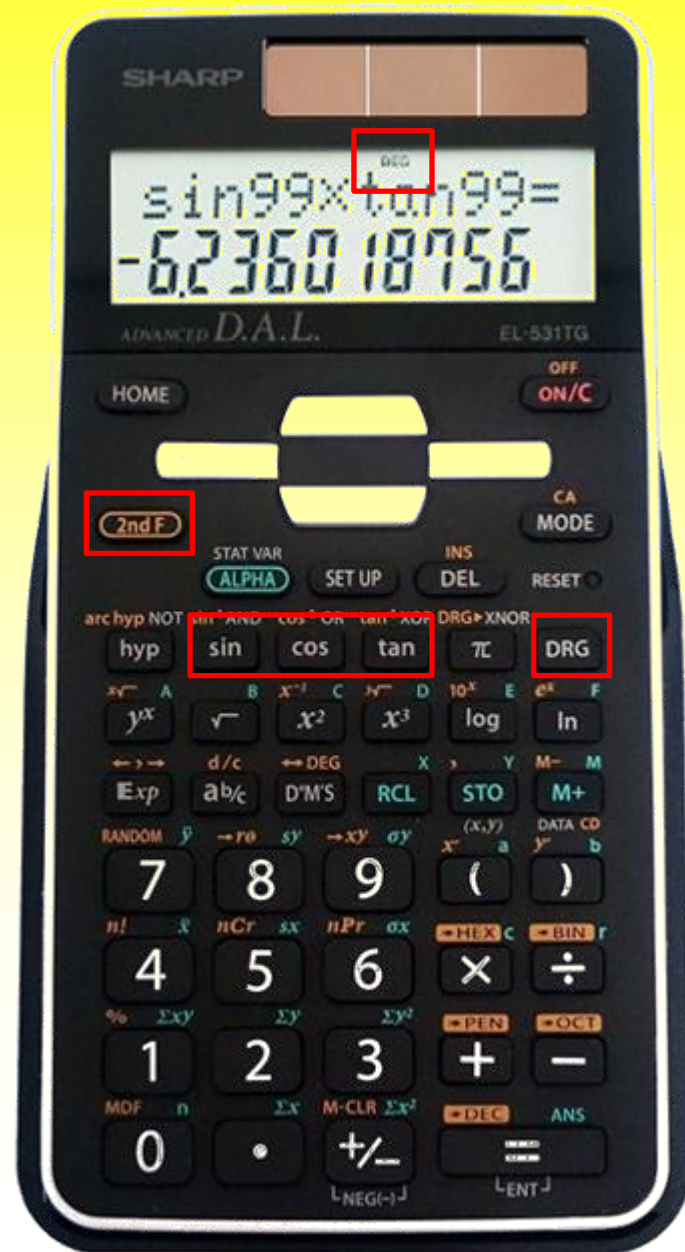
### Using Your Calculator

Make sure the calculator is in **DEG** mode!

→ If it is NOT, Press the **DRG** key until you get **DEG** at the top

We will be using the **SIN**, **COS** and **TAN** keys this Chapter!

To solve for an **angle**, you also need to press the **2ndF** key and *sin*, *cos* or *tan* key



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

## KEY CONCEPTS

The **sine** and **cosine ratios** compare the lengths of the legs of a *right* triangle to the length of the **hypotenuse**.

The **sine** and **cosine ratios** can be used to

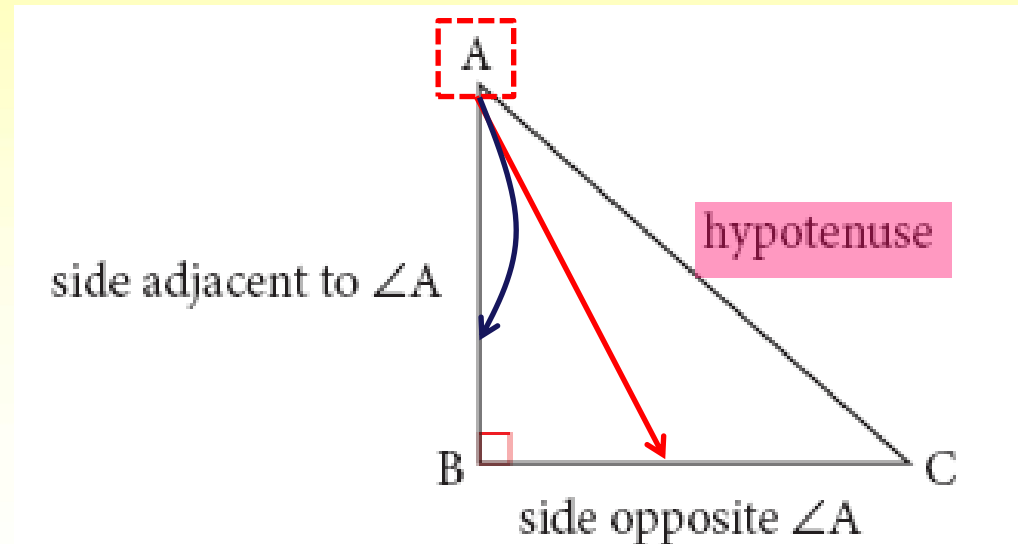
→ find side lengths in right triangles

→ find angle measures in right triangles.

## FORMULAS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

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The **sine** and **cosine ratios** compare the lengths of the legs of a *right* triangle to the length of the **hypotenuse**.

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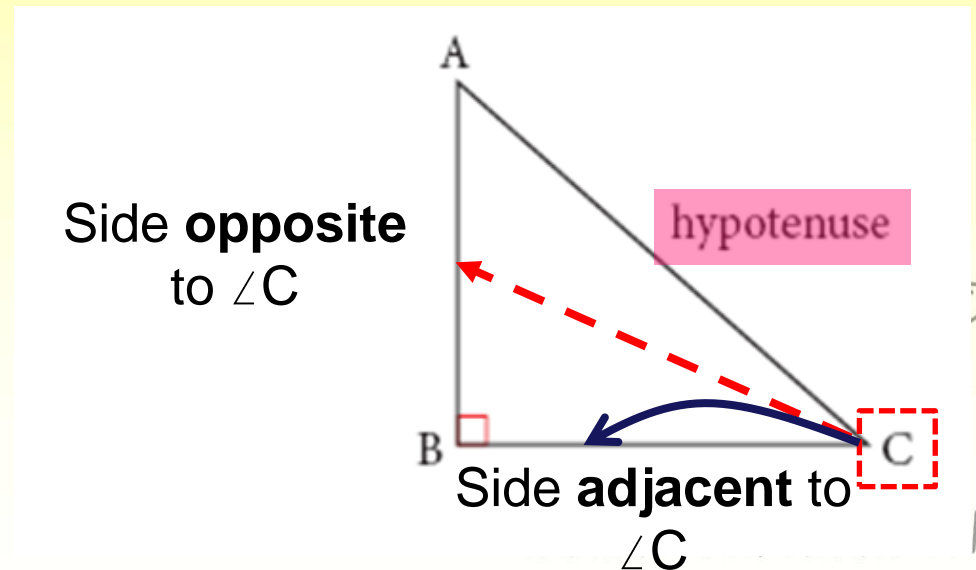
→ find side lengths in right triangles

→ find angle measures in right triangles.

## FORMULAS

$$\sin C = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos C = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 1 Using Your Calculator

Evaluate the following to four decimal places. \*\*\* MAKE SURE YOUR CALCULATOR IS IN DEGREES MODE!!!

(a)  $\sin 47^\circ = \underline{0.7314}$

(b)  $\cos 63^\circ = \underline{0.4540}$



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 2 Using Your Calculator to Find an Angle Measure

Find the measure of each angle to the nearest degree.

\*\*\* To find the angle, you use the **INVERSE** of the trigonometric ratio by pressing **2<sup>nd</sup>/SHIFT** then the trigonometric ratio

(a)  $\sin A = 0.9613$

$$\angle A = \sin^{-1}(0.9613)$$

$$\angle A = \underline{74}^{\circ}$$

**INVERSE SINE**

→ Press **2<sup>nd</sup>/SHIFT** then

**SIN**

(b)  $\cos A = 0.06976$

$$\angle A = \cos^{-1}(0.06976)$$

$$\angle A = \underline{86}^{\circ}$$

**INVERSE COSINE**

→ Press **2<sup>nd</sup>/SHIFT** then

**COS** CABILAN MATH ONLINE.COM

# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

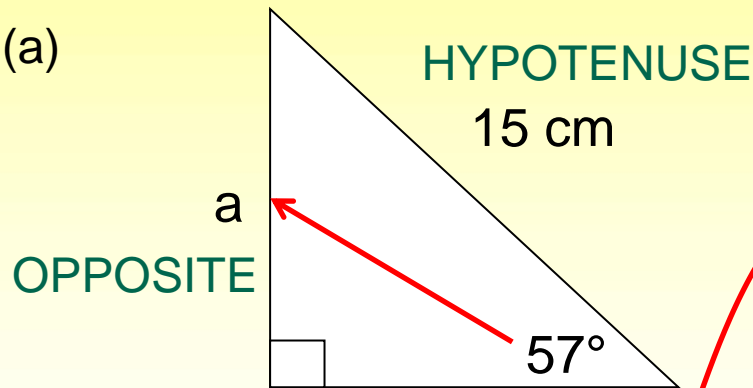
$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 3

Using the Sine and Cosine Ratio to Find Side Lengths

Use the appropriate ratio (Sine or Cosine) to calculate the length of the unknown side.

(a)



$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\sin 57^\circ = \frac{a}{15}$$

$$\frac{\sin 57^\circ}{1} = \frac{a}{15}$$

$$a = 15 \sin 57^\circ$$

$$a = 12.6 \text{ cm}$$

- \* Put over "1"
- \* Cross-multiply

## STEPS FOR USING THE SINE AND COSINE RATIOS

1. Label the sides with respect to the given angle
2. Identify which trigonometric ratio to use to solve the problem
3. Solve for the length or angle

# CHAPTER 2.3

# THE SINE and COSINE RATIOS

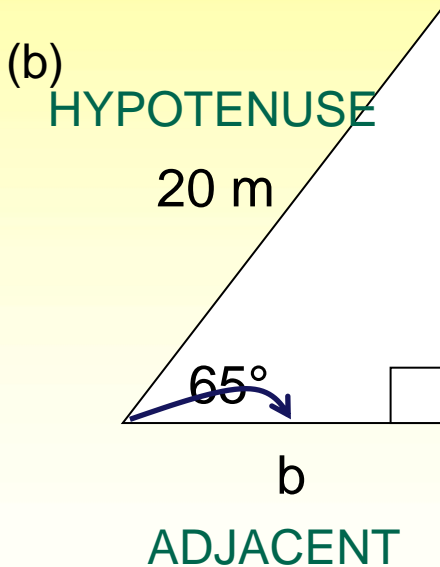
$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

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## EXAMPLE 3

Using the Sine and Cosine Ratio to Find Side Lengths

Use the appropriate ratio (Sine or Cosine) to calculate the length of the unknown side.



$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

$$\cos 65^\circ = \frac{b}{20} \quad * \text{ Put over "1"}$$

$$\frac{\cos 65^\circ}{1} = \frac{b}{20} \quad * \text{ Cross-multiply}$$

$$b = 20 \cos 65^\circ$$

$$b = 8.5 \text{ m}$$

## STEPS FOR USING THE SINE AND COSINE RATIOS

1. Label the sides with respect to the given angle
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# CHAPTER 2.3

# THE SINE and COSINE RATIOS

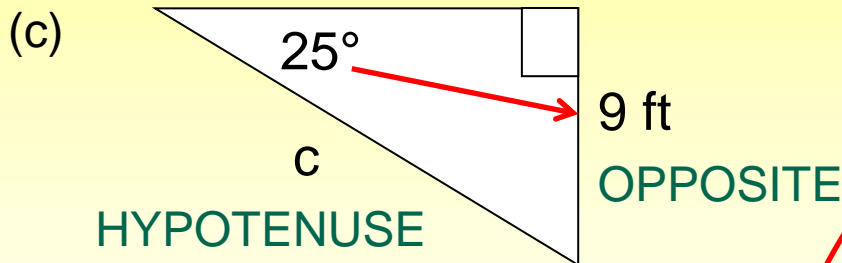
$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 3

Using the Sine and Cosine Ratio to Find Side Lengths

Use the appropriate ratio (Sine or Cosine) to calculate the length of the unknown side.



\* Put over "1"  
\* Cross-multiply

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\sin 25^\circ = \frac{9}{c}$$

$$\frac{\sin 25^\circ}{1} = \frac{9}{c}$$

$$\frac{c \sin 25^\circ}{\cancel{\sin 25^\circ}} = \frac{9}{\cancel{\sin 25^\circ}}$$

$$c = 21.3 \text{ ft}$$

## STEPS FOR USING THE SINE AND COSINE RATIOS

1. Label the sides with respect to the given angle
2. Identify which trigonometric ratio to use to solve the problem
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# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

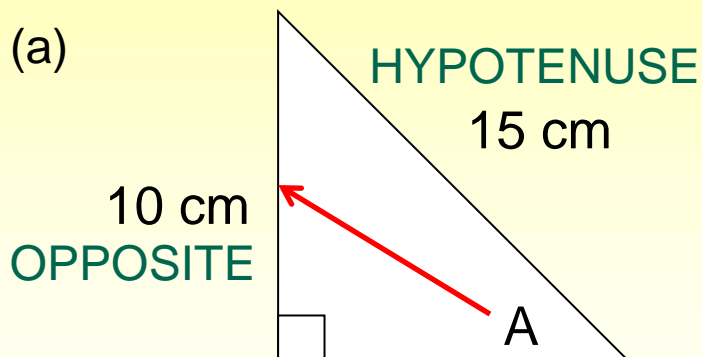
$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 4

### Using the Sine and Cosine Ratio to Find Angles

Use the appropriate ratio (Sine or Cosine) to calculate the angle measure. Express your answer to the nearest whole degree.

(a)



$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\sin A = \frac{10}{15}$$

$$\sin A = 0.6667$$

$$\angle A = \sin^{-1}(0.6667)$$

**INVERSE SINE**  
→ Press **2<sup>nd</sup>/SHIFT**  
then **SIN**

$$\angle A = 42^\circ$$

## STEPS FOR USING THE SINE AND COSINE RATIOS

1. Label the sides with respect to the given angle
2. Identify which trigonometric ratio to use to solve the problem
3. Solve for the length or angle



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

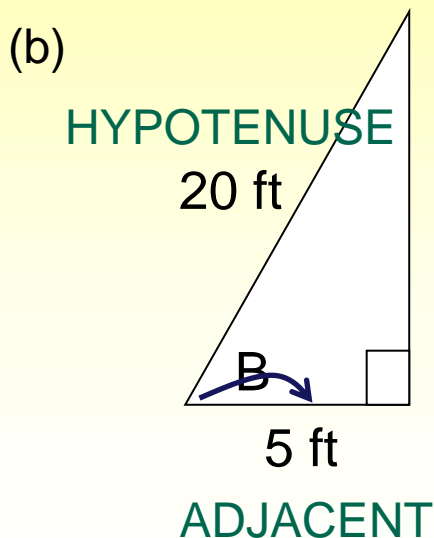
$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 4

### Using the Sine and Cosine Ratio to Find Angles

Use the appropriate ratio (Sine or Cosine) to calculate the angle measure. Express your answer to the nearest whole degree.



$$\cos B = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

$$\cos B = \frac{5}{20}$$

$$\cos B = 0.25$$

$$\angle B = \cos^{-1}(0.25)$$

$$\angle B = 76^\circ$$

**INVERSE COSINE**  
→ Press **2<sup>nd</sup>/SHIFT**  
then **COS**

## STEPS FOR USING THE SINE AND COSINE RATIOS

1. Label the sides with respect to the given angle
2. Identify which trigonometric ratio to use to solve the problem
3. Solve for the length or angle



# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

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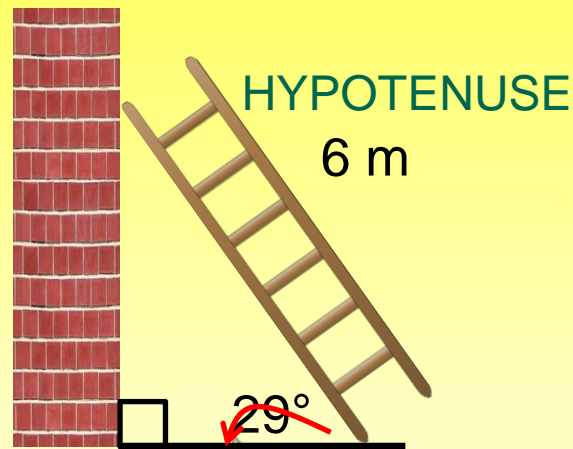
## EXAMPLE 5

*Application: The Ladder on the Wall (Revisited)*

A **6 metre** ladder is placed on a brick wall. The angle between the floor and the ladder is **29°**.

How far is the *foot (bottom)* of the ladder from the base of the wall? Use the diagram provided to help you with this question.

Let “**x**” represent the distance from the wall to the bottom of the ladder



$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}} \quad x = 6 \cos 29^\circ$$

$x = 5.2 \text{ m}$

$$\cos 29^\circ = \frac{x}{6}$$

$$\frac{\cos 29^\circ}{1} = \frac{x}{6}$$

The foot of the ladder is **5.2 metres** away from the wall.

# CHAPTER 2.3

# THE SINE and COSINE RATIOS

$$\sin A = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

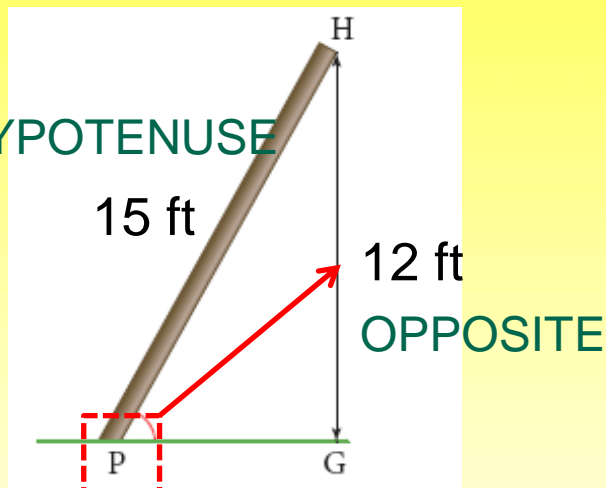
$$\cos A = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

## EXAMPLE 6

*Application: Find the Measure of an Angle*

A storm caused a **15 foot** hydro pole to lean over. The top of the pole is now **12 feet** above the ground.

Find the measure of the angle between the hydro pole and the ground, to the nearest degree.



$$\sin P = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\sin P = \frac{12}{15}$$

$$\sin P = 0.8$$

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

$$\angle P = 53^\circ$$

**INVERSE SINE**  
→ Press **2<sup>nd</sup>/SHIFT**  
then **SIN**

The angle between the hydro pole and the ground is **53°**

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# CHAPTER 2.3

# THE SINE and COSINE RATIOS

## Homework:

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#1ac, 2ab, 3a, 4, 6, 8, 11,  
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