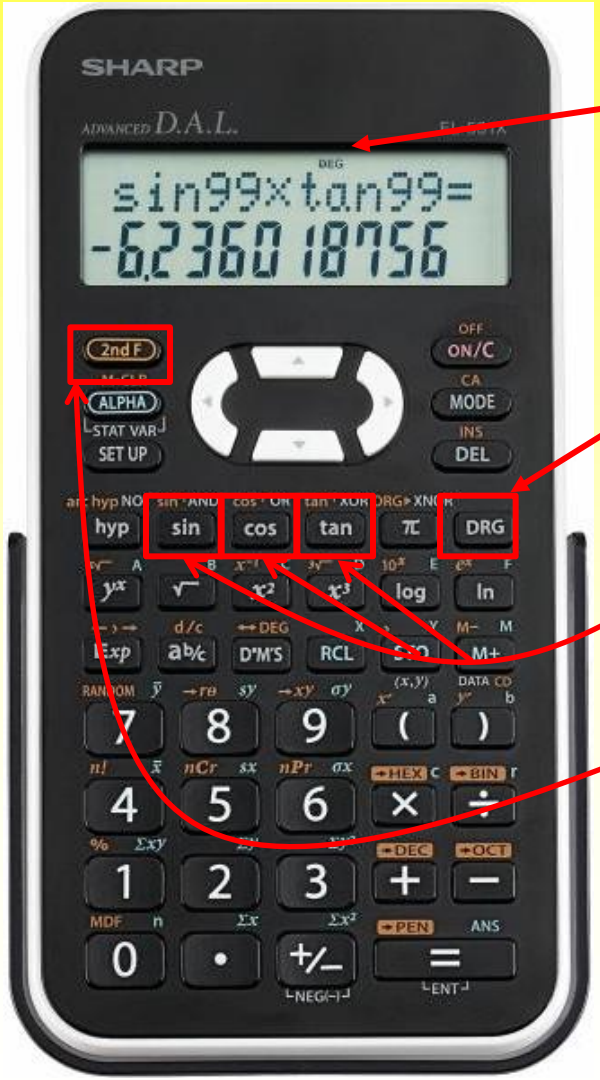
ST. JEAN DE BREBEUF MATHEMATICS

CHAPTER 2.1

BASIC TRIGONOMETRIC RATIOS

CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

GETTING TO KNOW YOUR CALCULATOR!



MAKE SURE CALCULATOR IS IN <u>DEG</u> (Degrees mode)

→If not, press **DRG** until top of screen says "DEG"

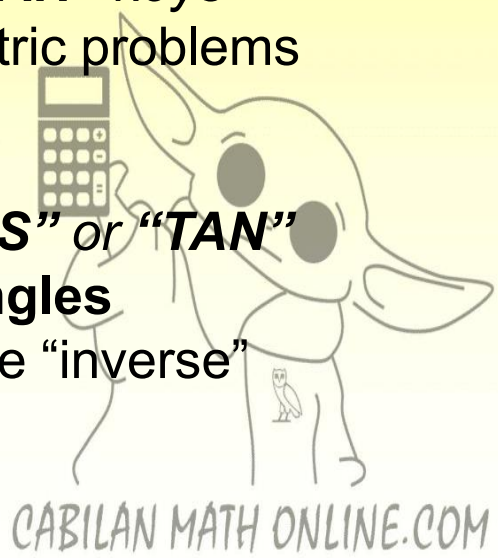
"SIN", "COS" and "TAN" *keys*

→ Used for trigonometric problems

"2ndF" + "SIN", "COS" *or* ***"TAN"***

→ Used for solving **angles**

→ Known as taking the "inverse"



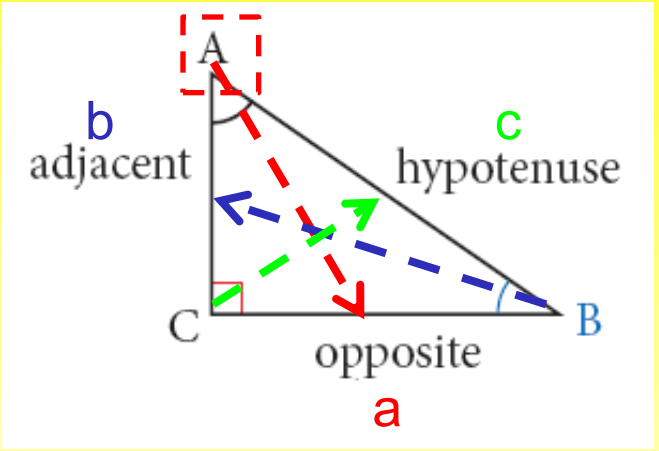
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

KEY CONCEPTS

For any right triangle, you can use the **primary trigonometric ratios** to find

The measure of **sides**

The **angles**



Where

$$\sin A = \frac{OPPOSITE}{HYPOTENUSE} = \frac{a}{c}$$

$$\cos A = \frac{ADJACENT}{HYPOTENUSE} = \frac{b}{c}$$

$$\tan A = \frac{OPPOSITE}{ADJACENT} = \frac{a}{b}$$

FACTS ABOUT **THE HYPOTENUSE**

The **hypotenuse** is

→The **longest side**

→Side *opposite* of the right angle

LABELLING TRIANGLES

The side *opposite* to any angle is designated with the lowercase of that letter

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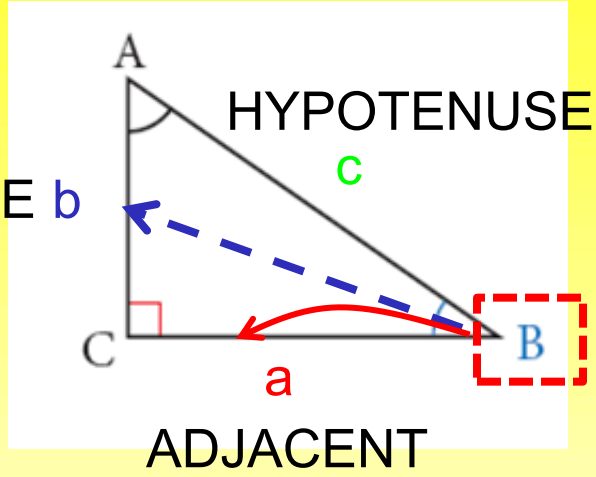

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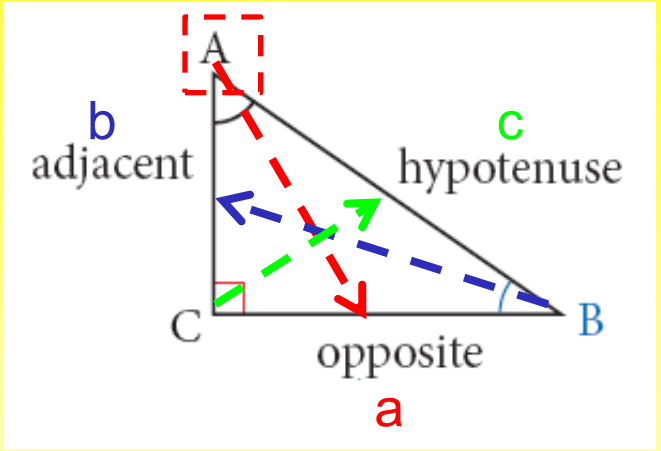

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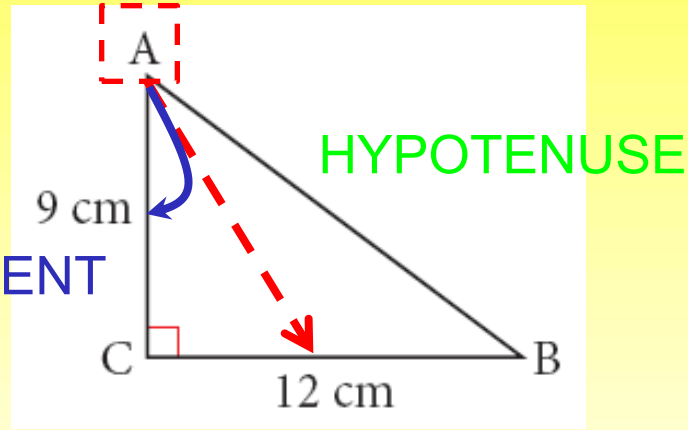
*** ***REMEMBER THE ACRONYM – <u>SOH CAH TOA</u>*** ***

CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 1 *Expressing the Trigonometric Ratios for an Angle*

For the triangle below write the trigonometric ratios for **sin A**, **cos A** and **tan A**



First, we need to solve for the length of the **hypotenuse**
→Use **Pythagorean Theorem!!!**

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

1. Label all the given information (angles and sides)

2. Use the given information to determine the ratio to use; solve the problem

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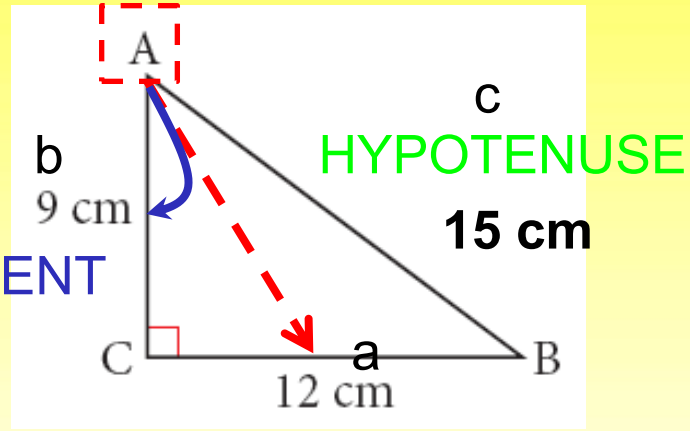
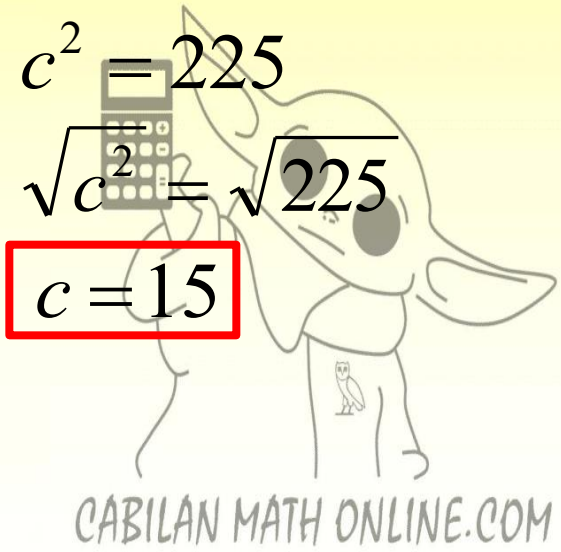


First, we need to solve for the length of the **hypotenuse**
→Use **Pythagorean Theorem!!!**

$$c^2 = a^2 + b^2$$
$$c^2 = (12)^2 + (9)^2$$
$$c^2 = 144 + 81$$
$$c^2 = 225$$
$$\sqrt{c^2} = \sqrt{225}$$
$$c = 15$$



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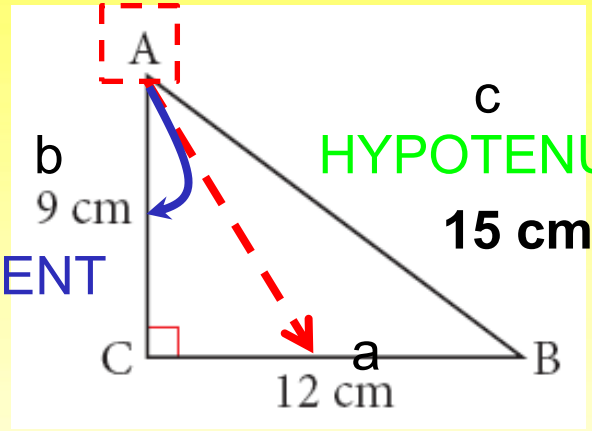

$$\sin A = \frac{OPPOSITE}{HYPOTENUSE} \qquad \cos A = \frac{ADJACENT}{HYPOTENUSE}$$

$$\sin A = \frac{12}{15} \qquad \cos A = \frac{9}{15}$$

$$\boxed{\sin A = \frac{4}{5}} \qquad \boxed{\cos A = \frac{3}{5}}$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

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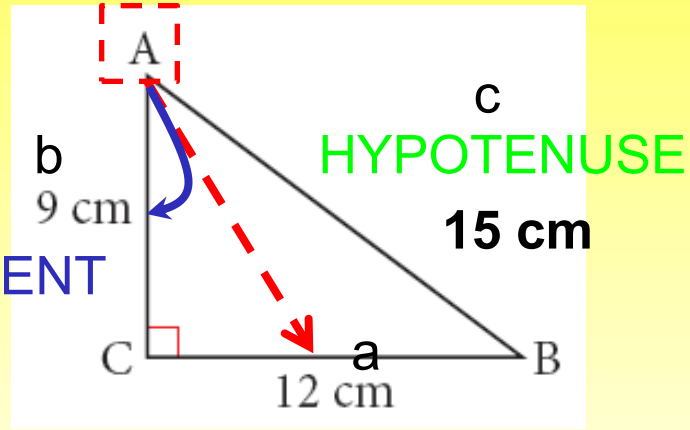
For the triangle below write the trigonometric ratios for **sin A**, **cos A** and **tan A**



$$\tan A = \frac{OPPOSITE}{ADJACENT}$$

$$\tan A = \frac{12}{9}$$

$$\tan A = \frac{4}{3}$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

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CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 2 *Evaluating Trigonometric Ratios Using a Calculator*

****** MAKE SURE YOUR CALCULATOR IS IN DEGREES MODE ******

Evaluate the following angles to four decimal places

sin 42° = 0.6691

cos 57° = 0.5446

tan 25° = 0.4663

CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 3 *Calculating the Angle, Trigonometric Ratio Given*

To find the angle measure for any trigonometric ratio, you have to find the **inverse** of the given ratio

→Usually performed by pressing **SHIFT** or **2nd Function** and the trigonometric ratio

Determine the angle measure of ∠A if **cos A = 0.6789**

Cos A = 0.6789

$\angle A = \cos^{-1}(0.6789)$

$\angle A =$ 47.2 °

This is called the **inverse *cosine***

→Press **SHIFT/2ndF** then **cos**

CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 3 *Calculating the Angle, Trigonometric Ratio Given*

To find the angle measure for any trigonometric ratio, you have to find the **inverse** of the given ratio

→Usually performed by pressing **SHIFT** or **2nd Function** and the trigonometric ratio

Try these!

sin A = 0.9781

$\angle A = \sin^{-1}(0.9781)$

$\angle A = 78.0°$

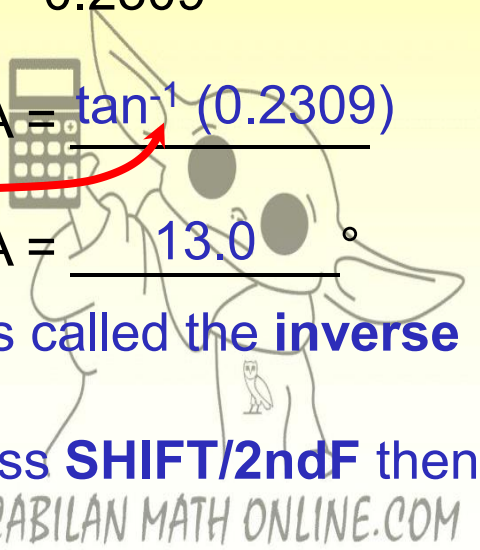
This is called the **inverse *sine***
→Press **SHIFT/2ndF** then **sin**

tan A = 0.2309

$\angle A = \tan^{-1}(0.2309)$

$\angle A = 13.0°$

This is called the **inverse *tan***
→Press **SHIFT/2ndF** then **tan**



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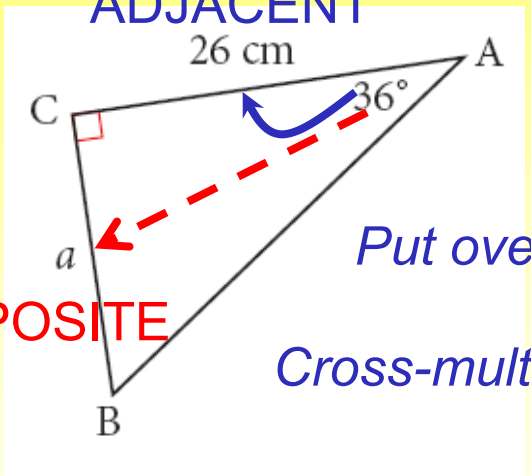
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 4 *Finding the Length of a Side*

Use a trigonometric ratio to calculate the length of side **a**. Round your answer to one decimal place



$$\tan A = \frac{OPPOSITE}{ADJACENT}$$

$$\tan 36° = \frac{a}{26}$$

Put over "1"

$$\frac{\tan 36°}{1} = \frac{a}{26}$$

Cross-multiply

$$a = 26 \tan 36°$$

$$a = 18.9\,cm$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

1. Label all the given information (angles and sides)

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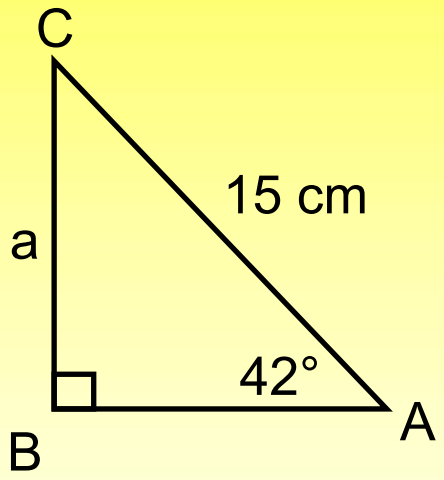
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

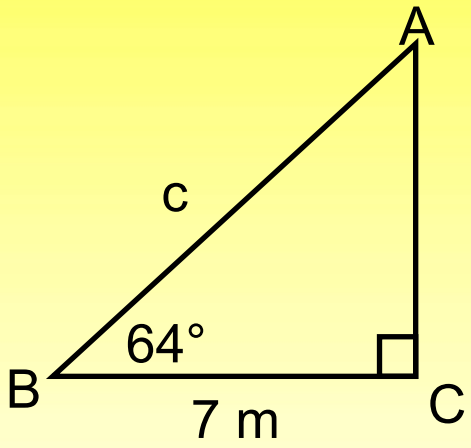
EXAMPLE 4 *Finding the Length of a Side*

Try these!

(a)



(b)



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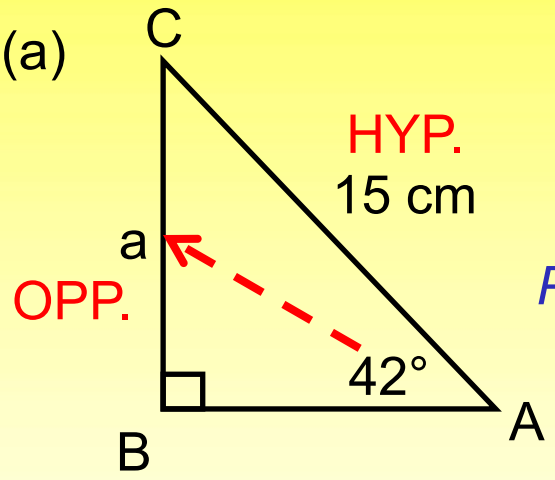
Try these!

(a)



$$\sin A = \frac{OPP}{HYP}$$

$$\sin 42° = \frac{a}{15}$$

Put over ***"1"***

Cross-multiply

$$\frac{\sin 42°}{1} = \frac{a}{15}$$

$$a = 15 \sin 42°$$

$$a = 10.0\,cm$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

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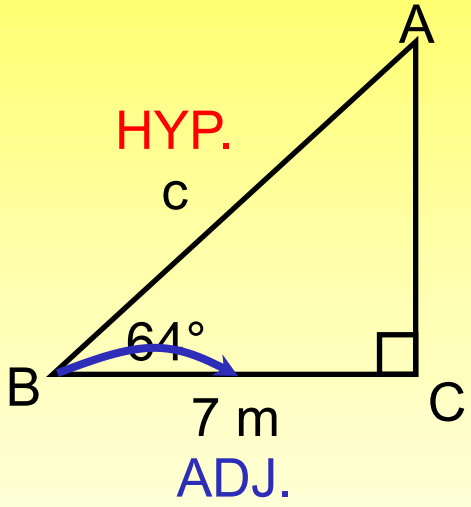
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 4 *Finding the Length of a Side*

Try these!

$$\cos B = \frac{ADJ}{HYP}$$

(b)



Put over "1"

$$\rightarrow \cos 64° = \frac{7}{c}$$

Cross-multiply

$$\frac{\cos 64°}{1} \not\times \frac{7}{c}$$

$$\frac{c\cos 64°}{\cos 64°} = \frac{7}{\cos 64°}$$

$$c = 16.0\,m$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

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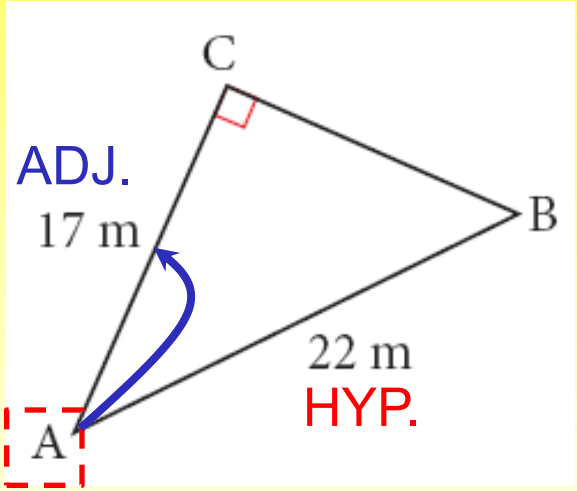
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 5 *Find the Angle Given the Length of Two Sides*

Find the measure of ∠**A**. Round to the nearest degree



$$\cos A = \frac{ADJ}{HYP}$$

$$\cos A = \frac{17}{22}$$

$$\cos A = 0.7727$$

$$\angle A = \cos^{-1}(0.7727)$$

This is called the **inverse *cosine***
→Press **SHIFT/2ndF** then **cos**

$$\angle A = 39°$$

BASIC STEPS TO SOLVING PROBLEMS WITH BASIC TRIGONOMETRIC RATIOS

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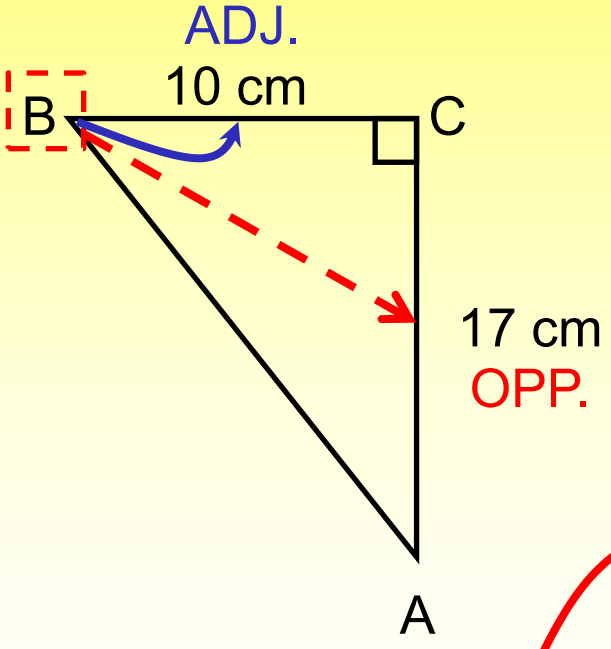
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 5 *Find the Angle Given the Length of Two Sides*

Try this!

Solve for ∠**B**



$$\tan B = \frac{OPP}{ADJ}$$

$$\tan B = \frac{17}{10}$$

$$\tan B = 1.7$$

$$\angle B = \tan^{-1}(1.7)$$

$$\angle B = 60°$$

This is called the **inverse *tan***
→Press **SHIFT/2ndF** then **tan**

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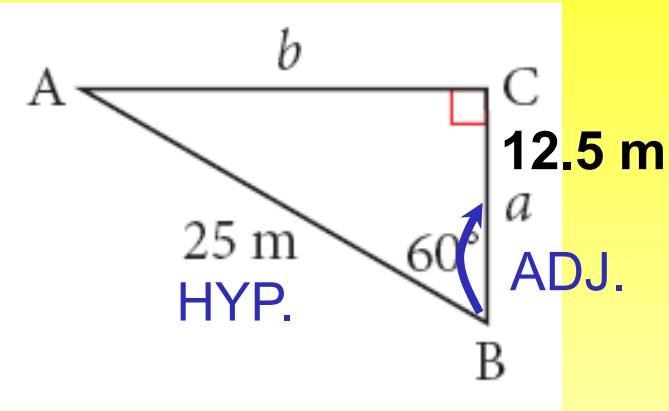
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 6

Solving a Right Triangle



Solving a right triangle means to calculate all *unknown* **angles** and side **lengths**!

→If two angles are given, solve for the third missing angle (180 – the sum of the given angles)

→If one angle and one side are given, use **trigonometric ratios** to determine a side length

Solve the triangle pictured. Express all side lengths to one decimal place. Express all angles to the nearest degree.

Solve for **"a"**

→use ∠**B** and a **trigonometric ratio**

$$\cos B = \frac{ADJ}{HYP}$$

Put over "1"

$$\cos 60° = \frac{a}{25}$$

Cross-multiply

$$\frac{\cos 60°}{1} = \frac{a}{25}$$

$$a = 25\cos 60°$$

$$a = 12.5\,m$$

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CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

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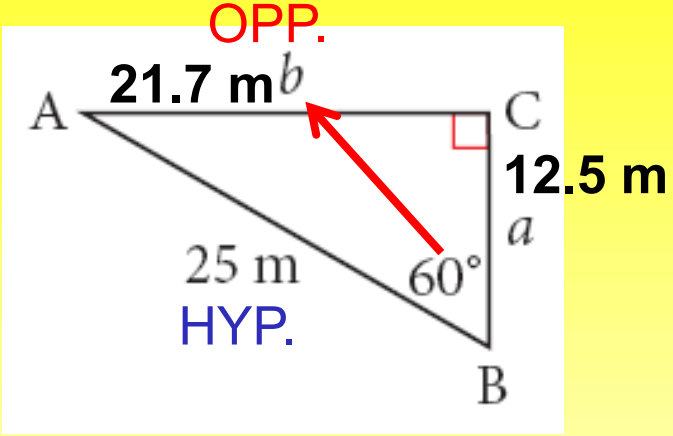
Solving a Right Triangle



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Solve the triangle pictured. Express all side lengths to one decimal place. Express all angles to the nearest degree.

Solve for **"b"**

→use ∠**B** and a **trigonometric ratio** *(use the numbers already given just to make sure!)*

$$\sin B = \frac{OPP}{HYP}$$

Put over "1"

$$\sin 60° = \frac{b}{25}$$

Cross-multiply

$$\frac{\sin 60°}{1} = \frac{b}{25}$$

$$b = 25 \sin 60°$$

$$b = 21.7\,m$$

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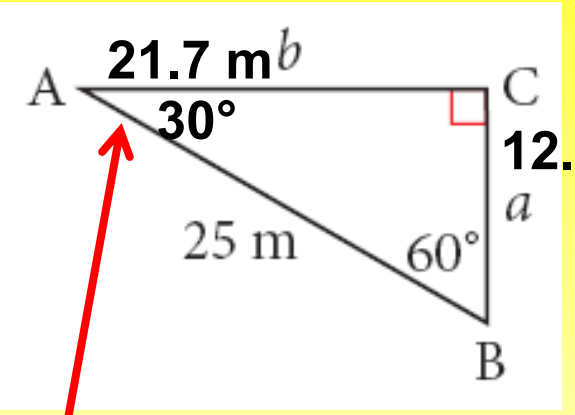
CHAPTER 2.1 BASIC TRIGONOMETRIC RATIOS

EXAMPLE 6

Solving a Right Triangle



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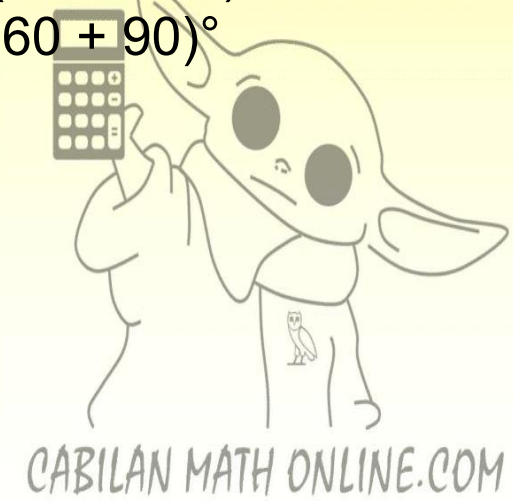
Solve the triangle pictured. Express all side lengths to <u>one decimal place</u>. Express all angles to the <u>nearest degree</u>.

Solve for ∠**A**

∠A = 180° - (∠B + ∠C)

= 180° - (60 + 90)°

= **30°**



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Homework:

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(Day 2) 1, 2, 6, 7, 9, 11, 13, 15