

# U2D4\_T Obtuse angles

Monday, February 26, 2018 12:46 PM



U2D4a\_T  
Obtuse a...

## U2D4a: Investigating Obtuse Angles

### Introduction to the Activity:

In this activity, you will use your calculator and the following chart to investigate the trigonometric ratios of obtuse angles. Then, you will analyze the results to determine any patterns.

### Performing the Activity

- 1) Refer to the chart that follows. For each of the listed angles, use your calculator to determine the value of each primary trigonometric ratio in the chart.
- 2) After you have completed the chart, answer the questions that follow.

Round values to 3 decimal places. There will be some rounding error.

| Primary Angle, $B$ | $\sin B$                                | $\cos B$                                | $\tan B$                                |
|--------------------|---|---|---|
| $5^\circ$          | $\frac{\text{opp}}{\text{hyp}} = 0.087$ | $\frac{\text{adj}}{\text{hyp}} = 0.996$ | $\frac{\text{opp}}{\text{adj}} = 0.087$ |
| $10^\circ$         | 0.174                                   | 0.985                                   | 0.177                                   |
| $25^\circ$         | 0.423                                   | 0.906                                   | 0.466                                   |
| $30^\circ$         | 0.500                                   | 0.866                                   | 0.577                                   |
| $89^\circ$         | 1.000                                   | 0.017                                   | 57.290                                  |
| $91^\circ$         | 1.000                                   | -0.017                                  | -57.290                                 |
| $150^\circ$        | 0.500                                   | -0.866                                  | -0.577                                  |
| $155^\circ$        | 0.423                                   | -0.906                                  | -0.466                                  |
| $170^\circ$        | 0.174                                   | -0.985                                  | -0.177                                  |
| $175^\circ$        | 0.087                                   | -0.996                                  | -0.087                                  |

## Investigating Obtuse Angles (Continued)

After you have completed the chart, answer the following questions.

- 1) What do you notice about the signs (positive? negative?) of the values of  $\sin B$ ? Be as specific as possible. Why does this happen?

$\sin B$  is always positive  
( $O, H$  are both positive)

- 2) What do you notice about the signs (positive? negative?) of the values of  $\cos B$ ? Be as specific as possible. Why does this happen?

$A > 0, H > 0$   $\cos B$  is positive when  $B$  is acute (between  $0^\circ, 90^\circ$ )  
 $A < 0$  or  $H < 0$   $\cos B$  is negative when  $B$  is obtuse (between  $90^\circ, 180^\circ$ )

- 3) What do you notice about the signs ( positive? negative? ) of the values of  $\tan B$ ? Be as specific as possible. Why does this happen?

$0 < A < 90$   $\tan B$  is positive when  $B$  is acute.  
 $90 < A < 180$   $\tan B$  is negative when  $B$  is obtuse.

- 4) Write down pairs of  $\angle B$  that have approximately the same value for  $\sin B$ . Verify that the values are actually the same using your calculator. For example, check that  $\sin 5^\circ$  and  $\sin 175^\circ$  give the same value. How are the angles related to each other?

$$\sin 10^\circ = \sin 170^\circ$$

$$\sin 25^\circ = \sin 155^\circ$$

$$\sin 30^\circ = \sin 150^\circ$$

$$\sin 1^\circ = \sin 179^\circ$$

The sine of supplementary angles are equal.

↑  
add to  
 $180^\circ$

Using the same pairs of angles, what do you notice about the values of  $\cos B$ ?  
(Verify on your calculator if needed.)

Cosine of supplementary angles are opposites.

Using the same pairs of angles, what do you notice about the values of  $\tan B$ ?  
(Verify on your calculator if needed.)

Tangent of supplementary angles are opposites.

5) Use  $\sin^{-1}$  on your calculator to solve for angle B in  $\sin B = 0.5$ . What value does your calculator give?  $30^\circ$

What other value for B is possible?

$$180^\circ - 30^\circ = 150^\circ$$

How can you quickly determine the value of the second angle?

$$180^\circ - \text{first angle}$$

Complete the following using a calculator and what you have learned:

$$\sin B \approx 0.7660$$

$$B \approx \underline{50^\circ} \quad \text{or} \quad B \approx \underline{180^\circ - 50^\circ = 130^\circ}$$

$$\sin B \approx 0.9205$$

$$B \approx \underline{67^\circ} \quad \text{or} \quad B \approx \underline{180^\circ - 67^\circ = 113^\circ}$$



MAP 4CI Trigonometric Ratios with Obtuse  
Angles in Standard Position U2D4b

**OBTUSE ANGLES IN STANDARD POSITION**

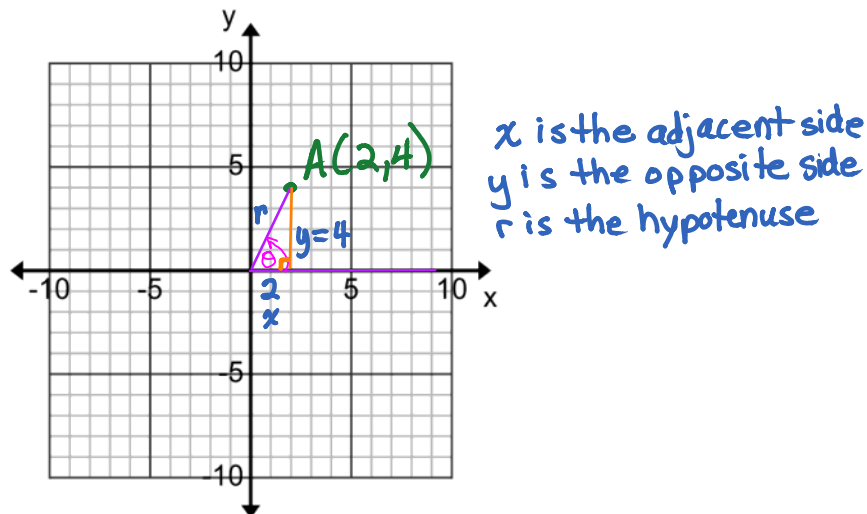
Angles in standard position:

- You will be given an ordered pair. ✓
- Plot that point on the Cartesian Plane ✓
- Join that point to the origin (this line segment is called the “terminal arm”) ✓
- Draw the “initial arm” on the positive x-axis beginning at the origin. ✓
- $\theta$  is measured from the initial arm, counter-clockwise to the terminal arm. ✓

To find the primary trig ratios, drop a vertical line segment from the plotted point to the x-axis. This will form a right triangle.

1. The terminal arm of an angle,  $\theta$ , in standard position passes through  $A(2, 4)$ .

a) Sketch a diagram for this angle in standard position.



b) Determine the length of OA  
(length of hypotenuse)

$$r^2 = x^2 + y^2$$

$$r = \sqrt{x^2 + y^2}$$

$$r = \sqrt{2^2 + 4^2}$$

$$r = \sqrt{4 + 16}$$

$$r = \sqrt{20}$$

c) Determine the primary trigonometric ratios to three decimal places.

$$\sin \theta = \frac{y}{r}$$

$$= \frac{4}{\sqrt{20}}$$

$$\approx 0.894$$

$$\cos \theta = \frac{x}{r}$$

$$= \frac{2}{\sqrt{20}}$$

$$\approx 0.447$$

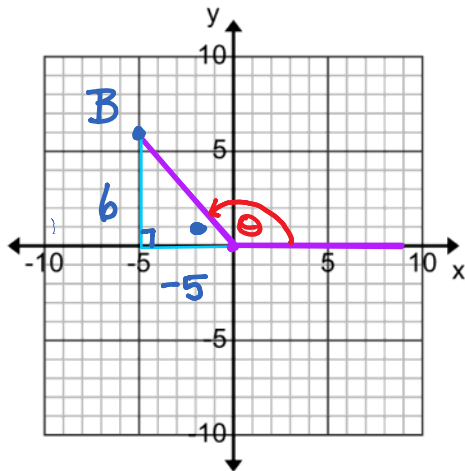
$$\tan \theta = \frac{y}{x}$$

$$= \frac{4}{2}$$

$$= 2$$

2. The terminal arm of an angle,  $\theta$ , in standard position passes through  $B(-5, 6)$ .

a) Sketch a diagram for this angle in standard position.



b) Determine the length of OB ( $r$ )

$$r = \sqrt{(-5)^2 + 6^2}$$

$$r = \sqrt{61}$$

c) Determine the primary trigonometric ratios to three decimal places.

$$\sin \theta = \frac{y}{r}$$

$$= \frac{6}{\sqrt{61}}$$

$$= 0.768$$

$$\cos \theta = \frac{x}{r}$$

$$= \frac{-5}{\sqrt{61}}$$

$$= -0.640$$

$$\tan \theta = \frac{y}{x}$$

$$= \frac{6}{-5}$$

$$= -1.2$$



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U2D5 (~~NEXT CLASS~~): QUIZ  
MONDAY