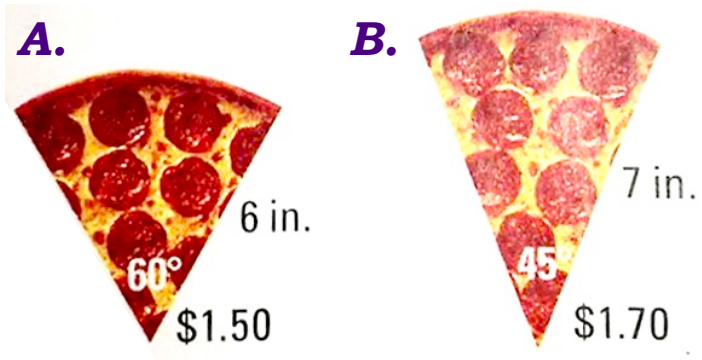


4.2 Trigonometric Functions: The Unit Circle

Objective: Today we will use the Unit Circle to find the trig values for given angles, and their coordinates.

Warm-up: Which piece of pizza is larger? (Find the area of the sector)
Which is the better deal?

$$A = \frac{1}{2}r^2\theta$$



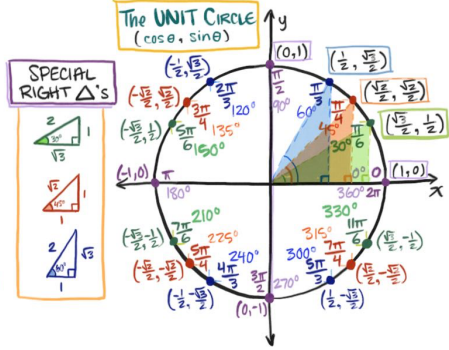
4.2 TRIGONOMETRIC FUNCTIONS: THE UNIT CIRCLE

PART 1

Consider the **UNIT CIRCLE** given by the equation $x^2 + y^2 = 1$. Then ANY POINT (x, y) on the circle is **1 UNIT** away from the center.

Using the coordinates of the point (x, y) on the **UNIT CIRCLE** we can define **SIX TRIGONOMETRIC FUNCTIONS** for a given angle θ .

- ① **SINE** $\Rightarrow \sin \theta = \frac{y}{r}$
- ② **COSINE** $\Rightarrow \cos \theta = \frac{x}{r}$
- ③ **TANGENT** $\Rightarrow \tan \theta = \frac{y}{x}$, for $x \neq 0$
- ④ **COSECANT** $\Rightarrow \csc \theta = \frac{r}{y}$
- ⑤ **SECANT** $\Rightarrow \sec \theta = \frac{r}{x}$
- ⑥ **COTANGENT** $\Rightarrow \cot \theta = \frac{x}{y}$, for $y \neq 0$

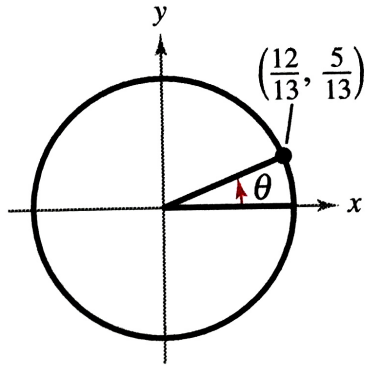


LEFT-HAND TRICK for Q2

- ① Lay your **LEFT** hand flat on the desk.
- ② **FOLD** the finger of the desired angle.
- ③ The **COORDINATES**:
 $\left(\frac{\text{# of LEFT OF FINGER}}{2}, \frac{\text{# of RIGHT OF FINGER}}{2} \right)$

Determining Values of Trigonometric Functions In Exercises 9–12, determine the exact values of the six trigonometric functions of the angle θ .

10.



Finding a Point on the Unit Circle In Exercises 13–22, find the point (x, y) on the unit circle that corresponds to the real number t .

16. $t = \frac{5\pi}{4}$

Evaluating Sine, Cosine, and Tangent In Exercises 23–32, evaluate (if possible) the sine, cosine, and tangent of the real number.

$$30. t = \frac{11\pi}{6}$$

$$32. t = -\frac{\pi}{4}$$

Evaluating Trigonometric Functions In Exercises 33–38, evaluate (if possible) the six trigonometric functions of the real number.

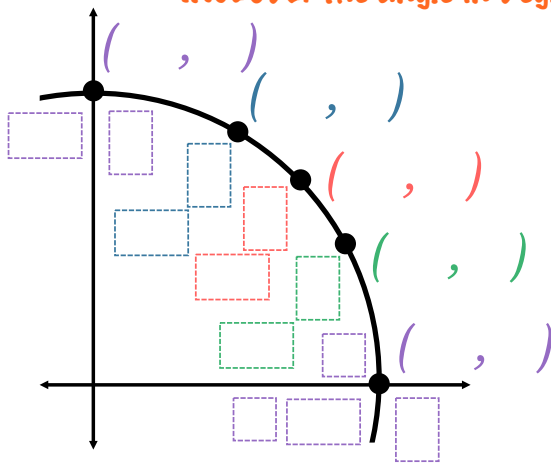
$$36. t = 3\pi/2$$

4.2 Trigonometric Functions: The Unit Circle

Objective: Today we will use the Unit Circle to find the trig values for given angles, and their coordinates.

Checkpoint: Fill in the 1st Quadrant of the Unit Circle from memory.

INCLUDE: the angle in Degrees AND Radians, and the coordinate for the angle.



4.2 TRIGONOMETRIC FUNCTIONS: THE UNIT CIRCLE

PART 2

• The **DOMAIN** of sine & cosine is ALL REAL NUMBERS.
 ↳ $D: -\infty < \theta < \infty$
 ↳ $D: (-\infty, \infty)$

• Because $r=1$ for the UNIT CIRCLE, the **RANGE** for:
 $y = \sin \theta$ & $x = \cos \theta$ is
 $R: -1 \leq y \leq 1$ & $R: -1 \leq x \leq 1$
 ↳ $R: [-1, 1]$

• Functions that behave in a **REPETITIVE (CYCLIC)** manner are called **PERIODIC**.

↳ The **PERIOD** is the length it takes to visually Repeat its position.

① $\sin(\theta + 2\pi n) = \sin \theta$

② $\cos(\theta + 2\pi n) = \cos \theta$

* The **PERIOD** of sine & cosine is 2π .
 * * $(\theta + 2\pi n)$ are **COTERMINAL** with θ .

EVEN & ODD TRIG. FUNCTIONS

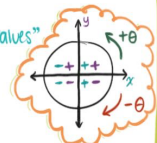
• Cosine & Secant are **EVEN** functions.

• $\cos(-\theta) = \cos(\theta)$
 • $\sec(-\theta) = \sec(\theta)$

• Sine & cosecant, AND tangent & cotangent are **ODD** functions.

• $\sin(-\theta) = -\sin(\theta)$
 • $\csc(-\theta) = -\csc(\theta)$

• $\tan(-\theta) = -\tan(\theta)$
 • $\cot(-\theta) = -\cot(\theta)$



"y-values"

"y-values" & "x-values"

Using the Period to Evaluate Sine and Cosine In Exercises 39–46, evaluate the trigonometric function using its period as an aid.

$$42. \sin \frac{9\pi}{4}$$

$$46. \cos\left(-\frac{8\pi}{3}\right)$$

Using the Value of a Trigonometric Function In Exercises 47–52, use the value of the trigonometric function to evaluate the indicated functions.

$$48. \cos t = -\frac{3}{4}$$

$$(a) \cos(-t)$$

$$(b) \sec(-t)$$

Using a Calculator In Exercises 53–70, use a calculator to evaluate the trigonometric expression. Round your answer to four decimal places. (*Radian Mode*)

54. $\tan \frac{3\pi}{5}$

58. $\cot 3.7$

