13.2B

Thursday, May 01, 2014
11:53 AM

Advanced Algebra with Trig
13.2 Radian Measure

Name: Key
Period:

PART I: EXPLORATION

Did you know you often speak Babylonian?? You may not think that you do – you can't ask for directions to a Babylonian restaurant or ask a good-looking Babylonian out for ice cream. But you've inherited Babylon's legacy nevertheless.

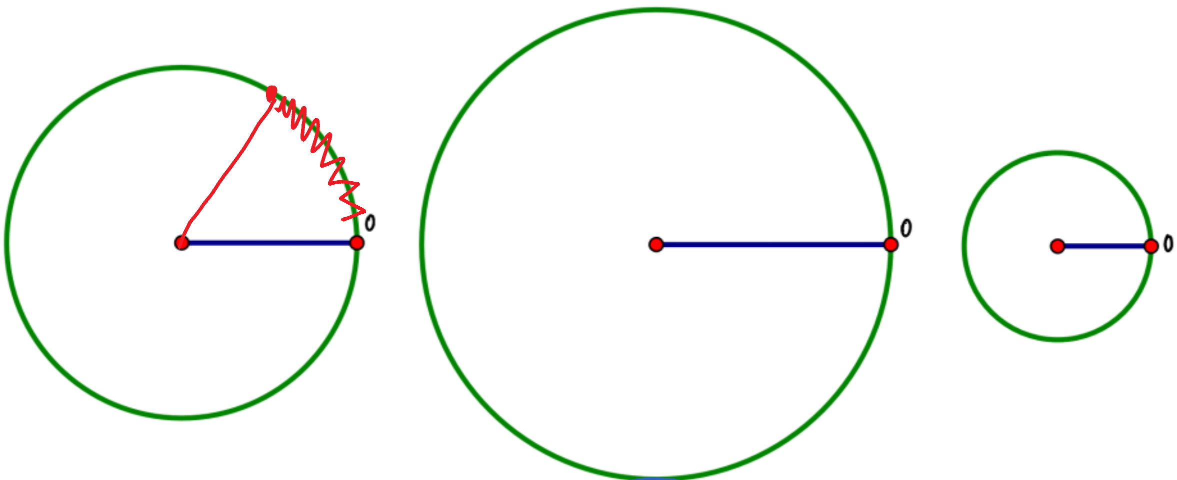
These days, our systems of counting and measuring are largely **base 10**. There are 10 years in a decade, 10 decades in a century, and 10 centuries in a millennium. But notice shorter time lengths. We don't carve up the day into 10 hours, each 100 minutes long. Instead, **we divide our time up by multiples of 60**. Why do we do this? Because our Babylonian uncles used a **base 60 number system**, and we've been following their example ever since.

Now think back to Geometry class and angle measures. **How many degrees make up a full circle?** Seems like the Babylonians are behind this, too - they decided to cut a circle into 360 pieces, and call one of those pieces a degree.

But why 360°? Quite frankly, there's no real reason. The Babylonians just really liked the number 60. The good news – there's a better way that isn't so arbitrary. Let's start exploring!

Directions:

1. "Measure" the length of the radius of each circle using your string (you may cut your string as needed).
2. "Measure" that length along the circles edge, beginning at the point labeled "0."
3. Mark that first length as "r"
4. Continue to mark off the radius length – labeling each length "r" – until you have made one complete revolution around the circle.



The distance around each circle was approximately equal to 6.2 radius lengths.

We can call these "lengths" radians. A radian is: an angle made @ the center of the circle by an arc whose length is equal to the radius of a circle

Recall the term "circumference" and its formula. Can we now get more specific about the number of radius lengths we used to measure the circumference of each circle? $2\pi r$ $2(3.14) = 6.28$

We know one rotation around a circle is 360°**.** Therefore, 2π rad ≈ 360°. OR in simpler terms, 1 rad ≈ 57.29°.

$\frac{2\pi r}{2\pi} = \frac{360}{2\pi}$

We know one rotation around a circle is 360°. Therefore, ____ rad = ____. Or in simpler terms, 1 rad = ____.

$$\frac{2\pi r}{2\pi} = \frac{360}{2\pi}$$

PART II: CONVERSIONS

Just like we can move from inches to feet to yards, we can move from degrees to radians and vice versa. Recall from above that **180° = π radians.**

Converting from Degrees to Radians	
Degrees to Radians Multiply degree measure by $\frac{\pi \text{ radians}}{180°}$	**Radians to Degrees** Multiply radian measure by $\frac{180°}{\pi \text{ radians}}$

1. Degrees to Radians:

a. 90°

$$\cancel{90°} \times \frac{\pi \text{ rad}}{180\cancel{°}} = \frac{90\pi}{180} = \frac{\pi}{2} \text{ radians}$$

b. 262°

$$262° \times \frac{\pi \text{ rad}}{180°} = \frac{262\pi}{180} = \boxed{\frac{131\pi}{90} \text{rad}}$$

c. - 50°

$$-50° \times \frac{\pi \text{ rad}}{180°} = -\frac{50\pi}{180} = \boxed{-\frac{5\pi}{18}}$$

d. - 300°

$$-300° \times \frac{\pi \text{ rad}}{180°} = -\frac{300\pi}{180} = \boxed{-\frac{5\pi}{3} \text{rad}}$$

2. Radians to Degrees

a. $\frac{\pi}{10}$

$$\frac{\cancel{\pi}}{10} \times \frac{180°}{\cancel{\pi}} = \frac{180}{10} = \boxed{18°}$$

b. $\frac{3\pi}{5}$

$$\frac{3\cancel{\pi}}{5} \times \frac{180}{\cancel{\pi}} = 108°$$

c. $-\pi$

$$-\cancel{\pi} \times \frac{180}{\cancel{\pi}} = \boxed{-180°}$$

d. $-\frac{5\pi}{4}$

$$-\frac{5\cancel{\pi}}{4} \times \frac{180}{\cancel{\pi}} = \boxed{-225°}$$

PART III: Using a calculator to evaluate trig functions.

Check your MODE!

a. $\sin\frac{\pi}{4} \approx .71$

b. $\sec\frac{\pi}{9}$ $\quad \frac{1}{\left(\cos\frac{\pi}{9}\right)} \approx 1.06$

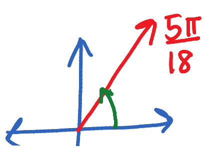
c. $\cos\frac{\pi}{6}$ $\quad \approx .87$

d. $\csc\frac{4\pi}{15}$ $\quad \frac{1}{\left(\sin\frac{4\pi}{15}\right)} \approx 1.35$

PART IV: Angles Measures in Radians

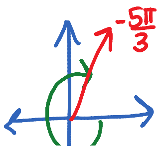
Draw an angle with the given measure in standard position. Then find a positive angle and negative angle (in radians) that are coterminal with the given angle.

a. $\frac{5\cancel{\pi}}{\cancel{18}} \times \frac{\cancel{180}^{10}}{\cancel{\pi}} = 50°$



$$\frac{5\pi}{18} + 2\pi = \boxed{\frac{41\pi}{18}}$$

b. $-\frac{5\cancel{\pi}}{3} \times \frac{180}{\cancel{\pi}} = -300°$



$$-\frac{5\pi}{3} + 2\pi$$

$$-\frac{5\pi}{3} + \frac{6\pi}{3} = \boxed{\frac{\pi}{3}}$$

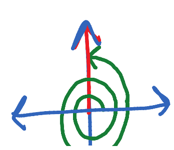
c. $\frac{9\cancel{\pi}}{2} \times \frac{180}{\cancel{\pi}} = 810°$

-360 ①

450

-360 ②

$90° = \boxed{\frac{\pi}{2}}$



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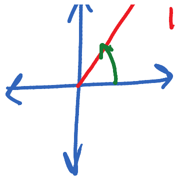
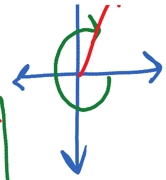


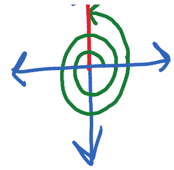
$\frac{5\pi}{18} + 2\pi = \boxed{\frac{41\pi}{18}}$

$\frac{5\pi}{18} - 2\pi = \boxed{-\frac{31\pi}{18}}$



$-\frac{5\pi}{3} + \frac{6\pi}{3} = \boxed{\frac{\pi}{3}}$

$-\frac{5\pi}{3} - \frac{6\pi}{3} = \boxed{-\frac{11\pi}{3}}$



$-360(2)$

$90^\circ = \boxed{\frac{\pi}{2}}$

$\boxed{-\frac{3\pi}{2}}$