$\qquad$
4-2 Sines, Cosines, and Tangents
Date $\qquad$
Goal: Estimate the sine and cosine of any number by referring to their definitions.


Warm Up: Give the exact values of the sine, cosine and tangent of $\theta$
Questions for each diagram.


## Unit Circle and Trigonometric Ratios

The unit circle is the circle with the center at $\qquad$ and with a radius of $\qquad$ .

If the point starts at $(1,0)$, then the segment from the origin has an angle measure of $\qquad$ As the point rotates $\left(R_{\theta}\right)$ about the center, the segment makes a larger angle until it reaches
$\qquad$ and repeats.


## Definition of Cosine and Sine

For all real numbers $\theta,(\cos \theta, \sin \theta)$ is the image of the point $(1,0)$ under a rotation of $\theta$ about the origin. That is, $(\cos \theta, \sin \theta)=R_{\theta}(1,0)$.

## Questions

Example 1: Evaluate $\cos \pi$ and $\sin \pi$.
On the unit circle $(\cos \pi, \sin \pi)=R_{\pi}\left(\_, \quad-\quad\right)$. Use a calculator to check.

Now, let's add the quarters to the unit circle, the corresponding points and signs of each quadrant.



Definition of Tangent
For all real numbers $\theta$, provided $\cos \theta \neq 0, \tan \theta=\frac{\sin \theta}{\cos \theta}$. When $\cos \theta=0$, then $\tan \theta$ is undefined.

In other words, $\tan \theta$ is the $\qquad$ of the segment to the point. Not to be confused with $\qquad$ .

Example 2: Give exact values of each.

1. a. $\sin 270^{\circ}$ $\qquad$ 2. a. $\sin -3 \pi$ $\qquad$ 3. a. $\sin 0$ $\qquad$
b. $\cos 270^{\circ}$ $\qquad$ b. $\quad \cos -3 \pi$ $\qquad$ b. $\cos 0$ $\qquad$
c. $\tan 270^{\circ}$ $\qquad$ c. $\tan -3 \pi$ $\qquad$ c. $\tan 0$ $\qquad$
Activity
2. Label point $A(1,0)$.
3. Use a protractor to rotate $A$ under $R_{50^{\circ}}$ and label this
point $P_{1}$.
4. Using the grid, estimate the coordinates of $P_{1}$ to find

## Questions

4. Now estimate using your calculator $\cos 50^{\circ} \approx$ $\qquad$ $\sin 50^{\circ} \approx$ $\qquad$ , $\tan 50^{\circ} \approx$ $\qquad$
5. Use a protractor to rotate $A$ under $R_{155^{\circ}}$ and label this point $P_{2}$.
6. Using the grid, estimate the coordinates of $P_{1}$ to find $\cos 155^{\circ} \approx$ $\qquad$ $\sin 155^{\circ} \approx$ $\qquad$ , $\tan 155^{\circ} \approx$ $\qquad$
7. Now estimate using your calculator $\cos 155^{\circ} \approx$ $\qquad$ , $\sin 155^{\circ} \approx$ $\qquad$ $\tan 155^{\circ} \approx$ $\qquad$


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[^0]:    Summary:

