Review

Evaluate the trigonometric expression:

$\sin(-120°) =$ $-\frac{\sqrt{3}}{2}$ $\sec 180° =$ $\frac{1}{\cos 180°} = \frac{1}{-1} = -1$

$\cos 225° =$ $-\frac{1}{\sqrt{2}}$ $\csc 330° =$ -2

$\tan(-270°) =$ undef. $\cot 135° =$ -1

Convert to degrees:

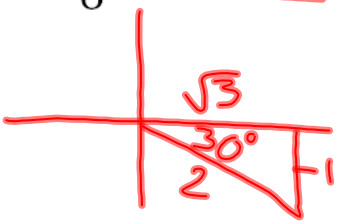
$\frac{3\pi}{4} \cdot \frac{180°}{\pi} = 135°$ $\frac{4\pi}{3} = 240°$

$\frac{11\pi}{6} = 330°$ $-\frac{5\pi}{2} = -450°$

Homework questions?

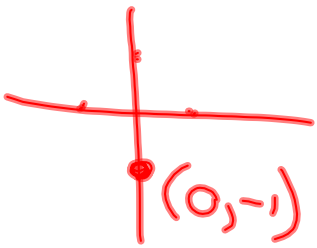
Evaluate the trigonometric function of an angle given in radians

$\cos\frac{11\pi}{6} =$ $\frac{\sqrt{3}}{2}$

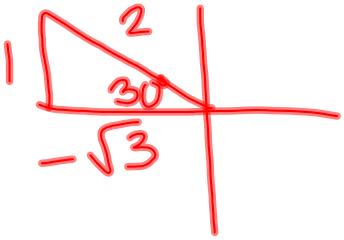


$\sin 329\pi =$ 0

$\tan\frac{7\pi}{2} =$ undef.

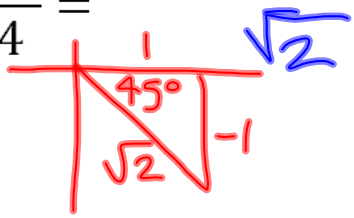


$\sec\frac{5\pi}{6} =$ $-\frac{2}{\sqrt{3}}$

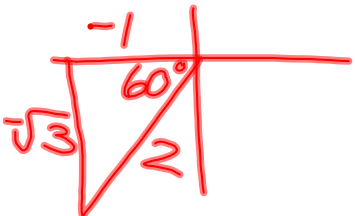


$\cot\frac{3\pi}{4} =$ -1

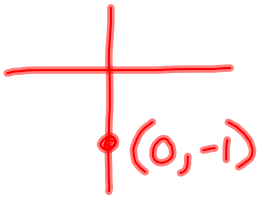
$\sec\frac{7\pi}{4} =$



$\csc\left(-\frac{2\pi}{3}\right) =$ $-\frac{2}{\sqrt{3}}$

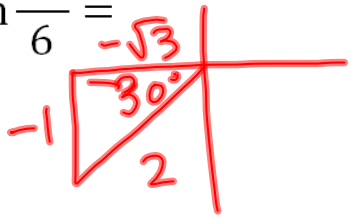


$\csc\frac{3\pi}{2} =$ -1

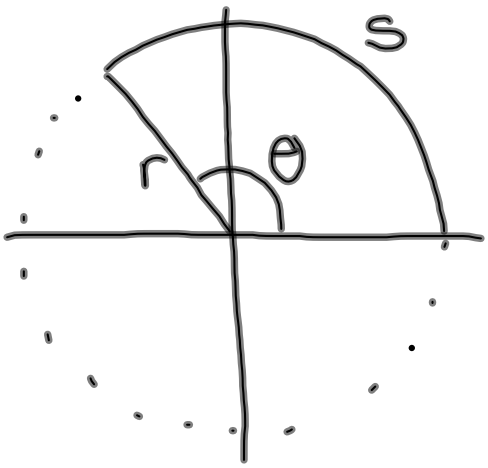


$\sin\frac{4\pi}{3} =$ $-\frac{\sqrt{3}}{2}$

$\tan\frac{7\pi}{6} =$ $\frac{1}{\sqrt{3}}$



5.4 Arc Length & Angular Speed



Arc Length

r = radius or distance from the center of rotation $(in, cm, km, etc.)$

s = arc length or distance traveled along the circumference of a circle $(in, cm, km, etc.)$

θ = angle or amount of rotation $(deg, rad, revolutions, etc.)$

$$\boxed{s = r\theta}$$

1. $r = 5in \;\; ; \;\; \theta = 45° \;\; ; \;\; s = ?\, in$

$s = r\theta = 5in \cdot 45° \cdot \frac{\pi}{180°} = \boxed{\frac{5\pi}{4}\ in}$

4

2. $s = 16yards \;\; ; \;\; \theta = 5 \;\; ; \;\; r = ?\, yards$

$\frac{s}{\theta} = \frac{r\theta}{\theta}$

$r = \frac{s}{\theta} = \boxed{\frac{16\ yd}{5}}$

3. Find the measure of a rotation in radians when a point 2 meters from the center of rotation travels 4 meters.

$\theta = ?\ rad$; $r = 2\ m$; $s = 4\ m$

$$\frac{s}{r} = \frac{\kappa\theta}{\kappa}$$

$$\theta = \frac{s}{r} = \frac{\cancel{4}^{2}\ \cancel{m}}{\cancel{2}\ \cancel{m}} = \boxed{2}$$

Linear Speed

$$v = \frac{s}{t}$$

Angular Speed

$$\omega = \frac{\theta}{t}$$

ω "omega"

Arc Length

$$s = r\theta$$

Relating Linear & Angular Speed

$$v = \frac{s}{t} = \frac{r\theta}{t} = r \cdot \frac{\theta}{t} = r\omega$$

$$\boxed{v = r\omega}$$

r = radius or distance from the center of rotation $(in, cm, km, etc.)$

s = arc length or linear distance along the circumference of a circle $(in, cm, km, etc.)$

θ = angle or amount of rotation $(deg, rad, revolutions, etc.)$

t = time $(sec, min, hours, years, etc.)$

$v = \frac{\text{linear distance}}{\text{time}}$ = linear speed $\left(\frac{km}{s}, \frac{mi}{h}, etc.\right)$

$\omega = \frac{\text{amount of rotation}}{\text{time}}$ = angular speed $\left(\frac{rev}{min}, \frac{deg}{s}, etc.\right)$

Handout Problems:

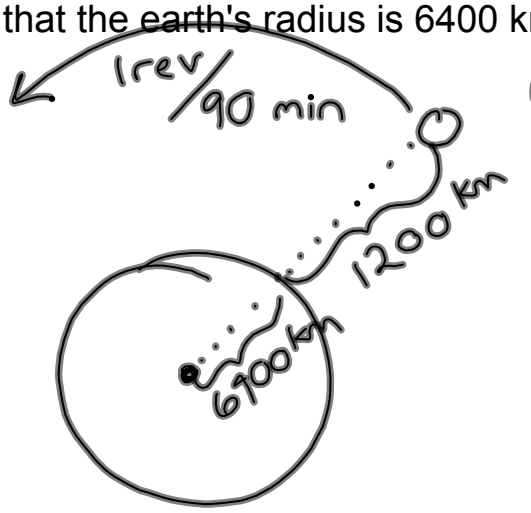
1. A wheel with a 15 inch diameter rotates at a rate of 6 radians per second. What is the linear speed of a point on its rim in feet per minute?

$r = \frac{15}{2}$ in ; $\omega = \frac{6 \text{ rad}}{s}$; $v = ?$ ft/min

$v = r\omega = \frac{15 \text{ in}}{2} \cdot \frac{6 \text{ rad}}{s} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{60 \text{ s}}{1 \text{ min}}$

$= 225$ ft/min

2. An earth satellite in circular orbit 1200 km high makes one complete revolution every 90 minutes. What is its linear speed in km/min, given that the earth's radius is 6400 km?



$\omega = 1 \text{ rev}/90 \text{ min}$; $r = 7600$ km

$v = ?$ km/min

$v = r\omega = 7600 \text{ km} \cdot \frac{1 \text{ rev}}{90 \text{ min}} \cdot \frac{2\pi}{1 \text{ rev}} = \frac{1520\pi}{9}$ km/min

3. Through how many radians does the minute hand of a clock rotate from 12:45pm to 1:25pm?

$\theta = ?\ \text{rad}\ ;\ t = 40\ \text{min}\ ;\ \omega = \frac{2\pi}{60\ \text{min}}$.

$t \cdot \omega = \frac{\theta}{t} \cdot t$

$\theta = \omega t = \frac{2\pi}{60\ \text{min}} \cdot \frac{40\ \text{min}}{1} = \frac{4\pi}{3}$

4. A car travels at 60 miles per hour. Its wheels have a 24 inch diameter. What is the angular speed of a point on the rim of a wheel in revolutions per minute?

$V = \frac{60\ \text{mi}}{\text{h}}\ ;\ r = 12\ \text{in}\ ;\ \omega = ?\ \text{rev/min}$

$\frac{V}{r} = \frac{r\omega}{r}$

$\omega = V \cdot \frac{1}{r} = \frac{60\ \text{mi}}{\text{h}} \cdot \frac{1}{12\ \text{in}} \cdot \frac{1\ \text{h}}{60\ \text{min}} \cdot \frac{12\ \text{in}}{1\ \text{ft}} \cdot \frac{5280\ \text{ft}}{1\ \text{mi}} \cdot \frac{1\ \text{rev}}{2\pi}$

$= \frac{2640}{\pi}\ \text{rev/min}$

Homework:

Evaluating trig functions of angles in radians:

5.5 #7-24 all (**super mega-important hw section!)

HW to be checked on Friday: sections 5.3-5.5

Quiz Friday on trig functions of any angle in degrees (like 5.3#39-58)

In class on Friday/homework to have completed by Monday after the break (go ahead and start working on it now if you don't want too much hw over the break!): Five problems on handout and 5.4#61-79odd