Convert $120°$ to radians.

$120° \cdot \frac{\pi}{180°} = \frac{2\pi}{3}$

Convert $\frac{7\pi}{4}$ to degrees.

$\frac{7\pi}{4} \cdot \frac{180°}{\pi} = 315°$

Two angles in radians are:

complementary if they sum to $\frac{\pi}{2} = 90°$

supplementary if they sum to π. $= 180°$

coterminal if they differ by integer multiples of 2π. $= 360°$

Find the complement and supplement of $\frac{5\pi}{12}$.

$C: \frac{\pi}{2} - \frac{5\pi}{12} = \frac{6\pi}{12} - \frac{5\pi}{12} = \frac{\pi}{12}$

$S: \pi - \frac{5\pi}{12} = \frac{12\pi}{12} - \frac{5\pi}{12} = \frac{7\pi}{12}$

0.5

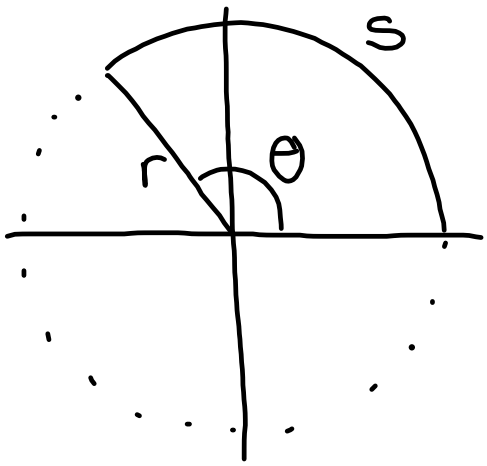
$C: \frac{\pi}{2} - 0.5$

$S: \pi - 0.5$

Find one positive and one negative angle coterminal with $-\frac{3\pi}{4}$.

$\frac{-3\pi}{4} + 2\pi = \frac{-3\pi}{4} + \frac{8\pi}{4} = \frac{5\pi}{4}$; $\frac{-3\pi}{4} - \frac{8\pi}{4} = \frac{-11\pi}{4}$

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

$$s = r\theta$$

$$= \frac{5in}{1} \cdot \frac{45°}{1} \cdot \frac{\pi}{180°} = \boxed{\frac{5\pi}{4} in}$$

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.

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

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

$\theta = \frac{s}{r} = \frac{4\,m}{2\,m} = 2$

Linear Speed

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

Angular Speed

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

Arc Length

$s = r\theta$

Relating Linear & Angular Speed

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

$v = r\omega$

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:

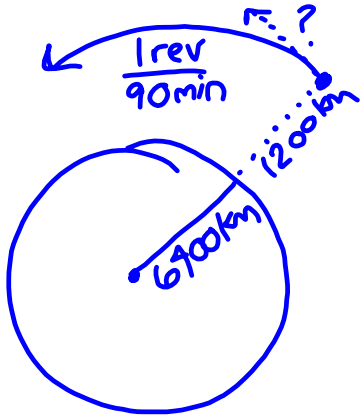
1. A wheel with a 15 inch diameter rotates at a rate of 6 radians per second. What is the linear speed of a point on its rim in feet per minute?

$r = \frac{15\text{in}}{2}$; $\omega = \frac{6\text{rad}}{5}$; $V = ?\ \text{ft/min}$

$$V = r\omega = \frac{15\text{in}}{2} \cdot \frac{\overset{3}{\cancel{6}}\text{rad}}{\cancel{5}} \cdot \frac{1\text{ft}}{\cancel{12}\text{in}} \cdot \frac{\overset{5}{\cancel{60}}\text{s}}{1\text{min}} =$$

$$= 225\ \text{ft/min}$$

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?



$r = 7600\text{km}$

$\omega = \frac{1\text{rev}}{90\text{min}}$

$V = ?\ \frac{\text{km}}{\text{min}}$

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

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

$\theta = ?\,\text{rad}\ ;\ t = 40\,\text{min}\ ;\ \omega = \frac{1\,\text{rot}}{1\,\text{h}}$

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

$\theta = \omega \cdot t = \frac{1\,\text{rot}}{1\,\text{h}} \cdot \frac{40\,\text{min}}{1} \cdot \frac{1\,\text{h}}{60\,\text{min}} \cdot \frac{2\pi}{1\,\text{rot}}$

$= \frac{4\pi}{3}$

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?

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

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

$\omega = \frac{V}{r} = \frac{\frac{60\,\text{mi}}{\text{h}}}{12\,\text{in}}$ $\qquad \omega = \frac{V}{r} = \frac{V}{1} \cdot \frac{1}{r}$

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

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

Homework due this Friday:

Already assigned:

- 5.1 #1, 2, 7-18 all, 31-54 all

New:

- **4 problems on handout**
- **5.1 #55-74 all**

Due next Wednesday, 11/13:

"Do you know enough Algebra..." take-home quiz