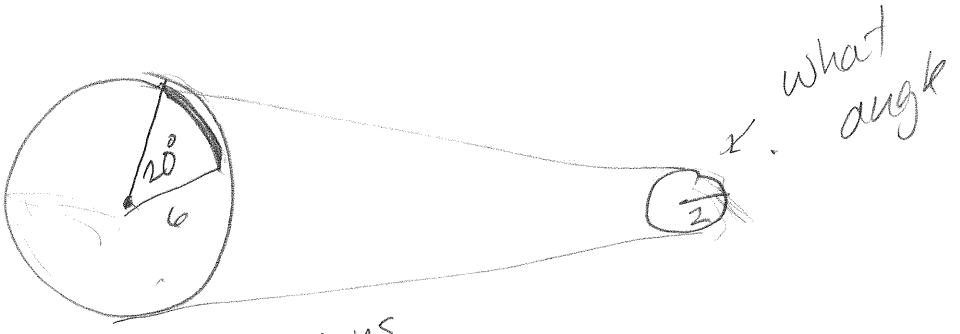
9/5/2012 - Sec 1.3

Math 1060

Pg 64
#100



$S = \alpha r$ ← radians

$20° = \pi/9$ rad

$\frac{20°}{180°} \cdot \pi = \frac{1}{9}\pi$

big circle

$S = \frac{\pi}{9} \cdot \frac{6^2}{1}$

$S = \frac{2\pi}{3}$

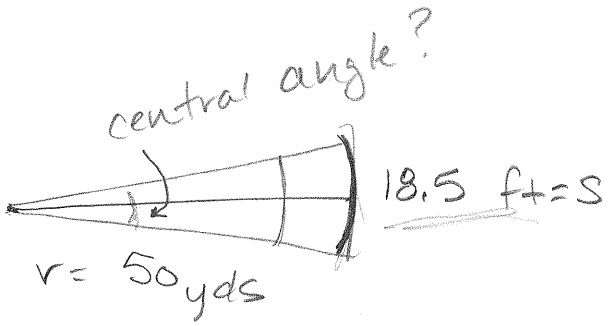
Small circle

$\frac{1}{2} \cdot \frac{2\pi}{3} = \alpha(2) \cdot \frac{1}{2}$

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

$\frac{\pi}{3} \cdot \frac{180°}{\pi} = \boxed{60°}$

#98



50 yds = 150 ft

20 yds = 60 ft

$s = \alpha r$

$\frac{18.5}{150} = \frac{\alpha(150)}{150}$

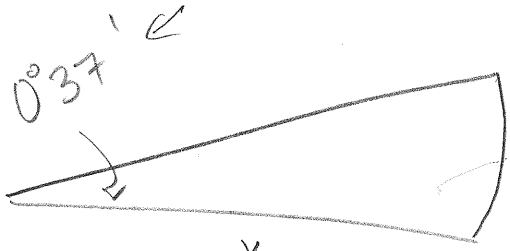
$0.123\overline{3}$ rad $= \alpha$

$\alpha = 0.123\overline{3} \cdot \frac{180^\circ}{\pi \text{ rad}} = 7.05^\circ$

3.525°

3.53°

#96



$= 6 \text{ ft } 2 \text{ in}$ ← convert to feet only

$6 + \frac{2}{12}$

$s = \alpha r$

$6 + \frac{2}{12} = (\quad) x$ ← Radian form of 37'

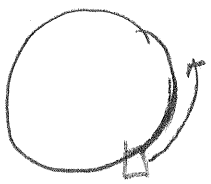
Sec 1.3 Angular and Linear Velocity

Defn: <u>Velocity</u> is the Rate at which the location of an object is changing with Respect to time

$$65\text{mph} = \frac{65 \text{ mile}}{1 \text{ hr}}.$$

An object in motion on a circle has two types of velocity.

1. Angular Velocity
2. Linear Velocity



<u>Angular Velocity</u>: the Rate at which the angle is changing (unit: $\frac{\text{Rad}}{\text{sec}}$, °/min, rpm = Rev/min)

$$45 \text{ rpm} = \frac{45 \text{ Rev}}{\text{min}} \cdot \frac{2\pi \text{ Rad}}{1 \text{ Rev}} = 90\pi \text{ rad/min}$$

ω = omega

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

α ← central angle measure

t ← time to go through the angle

ω → angular velocity

Dimension Analysis Review

1. List your starting info (always include units in fraction form)
2. Multiply by a conversion factor that takes care of starting unit
   Reminder: 5,280 ft = 1 mi
3. Repeat as needed to get our desired unit

Convert:

$$\frac{120 \text{ Rev}}{\text{hr}} \rightarrow ? \frac{\text{rad}}{\text{min}}$$

$1 \text{ Rev} = 2\pi \text{ rad}$

$1 \text{ hr} = 60 \text{ min}$

$$\frac{120 \text{ Rev}}{\text{hr}} \cdot \frac{2\pi \text{ rad}}{1 \text{ Rev}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} = \frac{120 \cdot 2\pi \text{ rad}}{60 \text{ min}}$$

$$= \boxed{4\pi \text{ rad/min}}$$

Linear Velocity: the rate at which the distance is changing

Note: on a circle the distanced traveled is the arc length

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

s ← arc length of circle

t ← time to go that length

V ↗ Linear velocity

Recall: $s = \alpha r$ (α ↙ Radians)

$$V = \frac{\alpha r}{t} = \frac{\alpha}{t} \cdot r = \omega r$$

$\frac{\alpha}{t}$ → angular velocity

Ex: What is the linear velocity in miles per hour, of the tip of a 22-inch lawn mower blade that is Rotating at 2500 Rev per min

$r = 11$ in

$\omega = 2500$ Rev per min

Goal

V in miles per hour

doesn't have to be written anymore

$$V = \frac{2500 \text{ rev}}{1 \text{ min}} \cdot \frac{11 \text{ in}}{1} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \cdot \frac{60 \text{ min}}{1 \text{ hr}}$$

$$\hookrightarrow \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}}$$

$$V = \frac{2500 \cdot 11 \cdot 2\pi \cdot 60}{12 \cdot 5280} \frac{\text{mi}}{\text{hr}}$$

$$= \frac{625\pi}{12} \frac{\text{mi}}{\text{hr}}$$

$$= 163.62 \text{ mph}$$