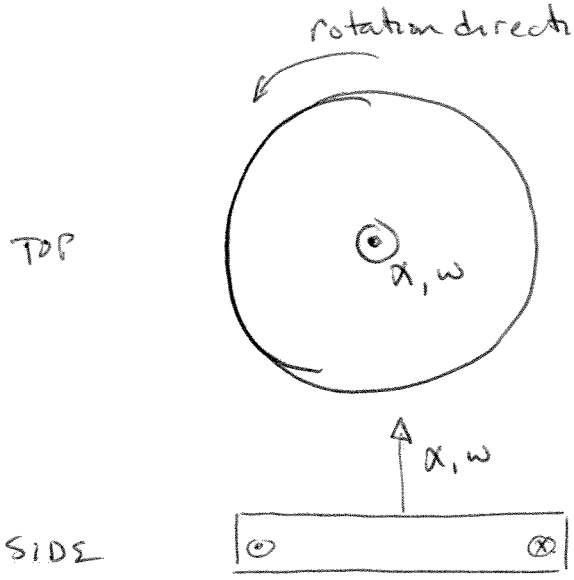
General Problem Solving Guide

Name:	KEY
Lab Time:	
Date:	
Test Code:	PROBLEM 11
Problem #:	

List given information, define variables, sketch picture:



$\omega_0 = 0 \frac{rad}{sec}$

$2\pi\ rad = 1\ rev$

Given $\Delta\theta$ and Δt to rotate that amount

Assume α is constant.

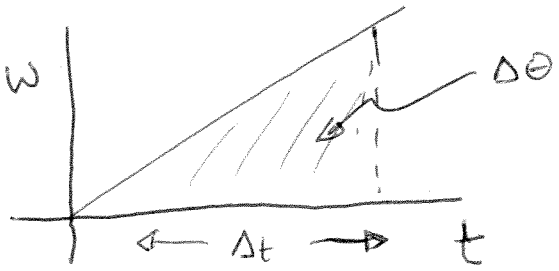
Simplify question, list target quantity:

Find $\omega(t)$

List all related quantitative relationships:

1) $\omega = \omega_0 + \alpha t$

2) $\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$



Outline approach, sketch diagrams if needed (or sketch next to pictures above):

Find α from ~~combining~~ equations (2) ~~and (1)~~

Use α to find general equation for $\omega(t)$ from equation (1)

Obtain a general solution:

$\Delta\theta = \frac{1}{2}\alpha\Delta t^2$

since $\omega_0 = 0 \frac{rad}{sec}$

$\alpha = \left(\frac{2\Delta\theta}{\Delta t^2}\right)$

$\omega = \alpha t$

$\omega = \left(\frac{2\Delta\theta}{\Delta t^2}\right) t$

Check Units: _____.

$\frac{rad}{sec} = \frac{rad}{(sec)^2} sec = \frac{rad}{sec}$ ✓

Check Limiting Cases: _____.

- ✓ $\Delta\theta \uparrow$ $\omega \uparrow$ further distance in same time
- ✓ $\Delta t \uparrow$ $\omega \downarrow$ longer time needed to go same distance

Obtain a numeric solution: _____.
(i.e. plug in the numbers)

A $\omega(4sec) = \frac{4\pi}{2} \frac{rad}{sec} = \frac{1}{4} \frac{rev}{sec}$ $\left(0.25 \frac{rev}{sec}\right)$

B $\omega(2sec) = 0.49\pi \frac{rad}{sec} = \frac{1}{4} \frac{rev}{sec}$ $\left(0.245 \frac{rev}{sec}\right)$

C $\omega(5sec) = 0.74\pi \frac{rad}{sec} = \frac{3}{8} \frac{rev}{sec}$ $\left(0.37 \frac{rev}{sec}\right)$

Why is solution reasonable? Explain.

- units check
- $\Delta\theta \uparrow$ $\omega \uparrow$ (Further distance in same time)
- $\Delta t \uparrow$ $\omega \downarrow$

A $\Delta\theta = 2 rev = 4\pi rad$
$\Delta t = 8 sec$
$\omega(4s) = \frac{2(4\pi rad)}{(8s)^2} \cdot 4s = \frac{4\pi}{2} \frac{rad}{sec}$

B $\Delta\theta = 3 rev = 6\pi rad$
$\Delta t = 7 sec$
$\omega(2s) = \frac{2 \cdot (6\pi rad)}{(7s)^2} \cdot 2s = \frac{1}{2}\pi \frac{rad}{sec}$

C $\Delta\theta = 3 rev = 6\pi rad$
$\Delta t = 9 sec$
$\omega(5s) = \frac{2(6\pi rad)}{(9s)^2} \cdot (5s) = \frac{3}{2}\pi \frac{rad}{sec}$