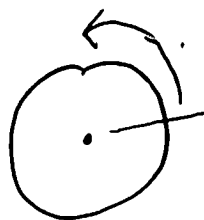
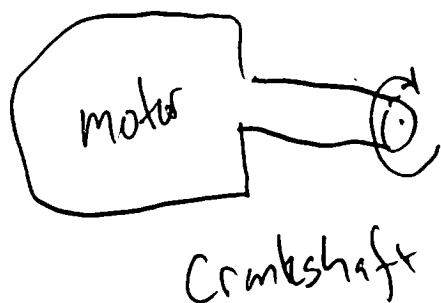


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## Example 7.3 Crankshaft Speed

Spinning @  
3000 RPM

Find angular speed

$$f = 3000 \frac{\text{rev}}{\text{min}} \left| \frac{1 \text{ min}}{60 \text{ sec}} \right| = 50 \frac{\text{rev}}{\text{sec}}$$

 $f = \text{frequency} = \text{how many revs per second}$ 
 $T = \text{period} = \text{time it takes for 1 revolution; [sec]}$ 

$$f = \frac{1}{T}$$

$$\text{angular speed} = \omega = 2\pi \text{ rad } f = \frac{\Delta\theta}{\Delta t} = \frac{\text{change in angle}}{\text{change in time}}$$

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

$$\omega = 2\pi \text{ rad} \left( 50 \frac{\text{rev}}{\text{sec}} \right)$$

$$= 100\pi \frac{\text{rad}}{\text{sec}}$$

$$= 315 \frac{\text{rad}}{\text{sec}}$$

$$315 \text{ radians} \left| \frac{57.3 \text{ deg}}{\text{rad}} \right| = \sim 18000 \frac{\text{degrees}}{\text{sec}}$$

$$= \frac{\sim 18000 \text{ deg}}{360 \frac{\text{deg}}{\text{rev}}} = 50 \frac{\text{rev}}{\text{sec}}$$

check



## RESEARCH ASSISTANT APPLICATION

Dear New & Returning Science, Technology, Engineering & Math students,

*Please read the entire application there are several changes to our Research Assistant contracts.*

We are seeking new and continuing STEM students with strong interpersonal skills to be involved in mentored research activities **and math tutoring**. Research assistants work closely with OLC faculty and staff on ongoing research projects and STEM outreach including K-12 STEM outreach, and the annual reservation-wide Science Fair. **The Math Tutoring Program is new this semester, and is an opportunity for new students to get involved with the department, and continuing RAs to receive additional financial support through tutoring.**

**Math Tutor Benefits:**

- \$1000 in financial support for providing three 3-hour tutoring sessions a week (one daytime, one evening, and one weekend) and feedback to the STEM department.
- Opportunities to advance to a research assistantship

**Research Assistant Benefits:**

- Provides up to \$3,000/yr. in financial support - *paid out mid-semester, so please use PELL or the Textbook loan program to purchase textbooks.*
- Work for up to 19 hr. /wk. during the academic year and up to 35 hr. /wk. during the summer and holidays for up to 990 hours per year without exception.

**Table 1. Pay schedule for OLC STEM Research Assistants**

Freshman	\$11.00
Sophomore	\$12.00
Junior	\$13.00
Senior	\$14.00

- Research Assistants are eligible for **South Dakota Space Grant**: South Dakota Space Grant provides educational stipends ranging from \$1000 - \$2500 and research stipends up to \$7000.

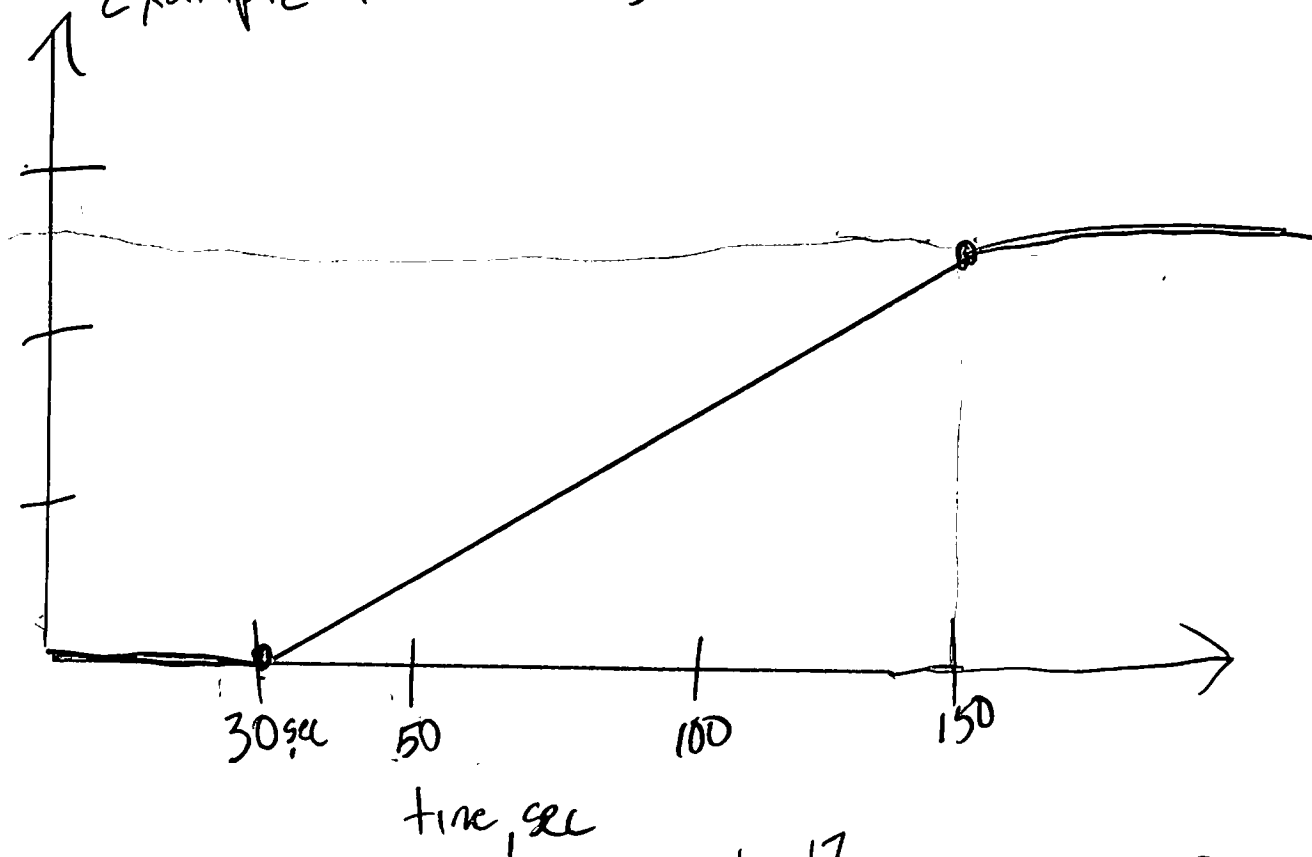
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# Example 7.4 Graphing a biker's



What is the graph about?

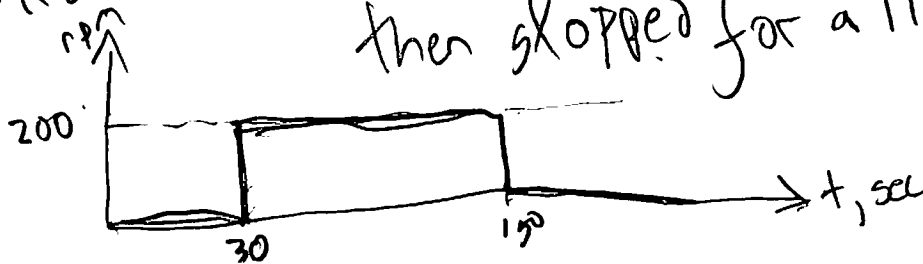
$$\omega = \frac{\Delta \theta}{\Delta t}$$

0-30 linear  
from 30 to 150 sec  
it is linear  
150 → linear

$$\frac{\theta_f - \theta_i}{t_f - t_i} = \frac{\Delta \theta}{\Delta t} = \omega = \frac{2500 - 0}{150 - 30} = \frac{2500}{120} = 20.8 \frac{\text{rad}}{\text{sec}}$$

$$\omega = 20.8 \frac{\text{rad}}{\text{sec}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \approx 200 \frac{\text{rev}}{\text{min}}$$

Biker waited for light, sped up quickly for 2 min then stopped for a light





## RESEARCH ASSISTANT APPLICATION

**Section 3. Work-related Information:**

**Math Tutoring Applicants:** Please fill out your class schedule and tutoring schedule for this semester, three 3-hour sessions, one daytime (AM or PM), one evening, and one weekend time.

**RA Applicants:** Please fill out your class schedule and **work schedule** for this semester<sup>3</sup>, up to 19 hr/wk and the time for a weekly 30-minute meeting with your Mentor.

Faculty Mentor(s): \_\_\_\_\_ RA Collaborators: \_\_\_\_\_

<u>Monday</u>	<u>Tuesday</u>	<u>Wednesday</u>	<u>Thursday</u>	<u>Friday</u>	<u>Saturday</u> <u>Tutoring</u>	<u>Sunday</u> <u>Tutoring</u>
<u>Morning</u>				Mandatory RA Writing & Stats Workshop 10:00 – 12:30		
<u>Afternoon</u>				Mandatory Student Meeting – 3 <sup>rd</sup> Week 1:00-2:00  Mentor meeting - Every week		
<u>Evening</u>						

**Concurrence:** By signing and dating below, I certify that all information provided and attached documentation is true to the best of my knowledge and belief, and I know that any falsehood or misrepresentation later disclosed will be sufficient grounds for loss of support. I also agree to follow the internship policies outlined herein and all other applicable OLC policies:

Your Signature \_\_\_\_\_ Today's Date \_\_\_\_\_

<sup>3</sup> Beginning Spring 2017 continuing RAs will be evaluated on professionalism, which includes keeping to a schedule.  
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CD spinning in a CD player  
 $f = 540 \frac{\text{rev}}{\text{sec}}$   
 Find: Speed @  $r = 3 \text{ cm}$  ;  
 $r = 6 \text{ cm}$

Find  $f$  in seconds  
 $T$  in seconds

$$f = 540 \frac{\text{rev}}{\text{min}} \left| \frac{1 \text{ min}}{60 \text{ sec}} \right| = 9 \frac{\text{rev}}{\text{sec}}$$

$$T = \frac{1}{f} = \frac{1}{9} \text{ sec}$$

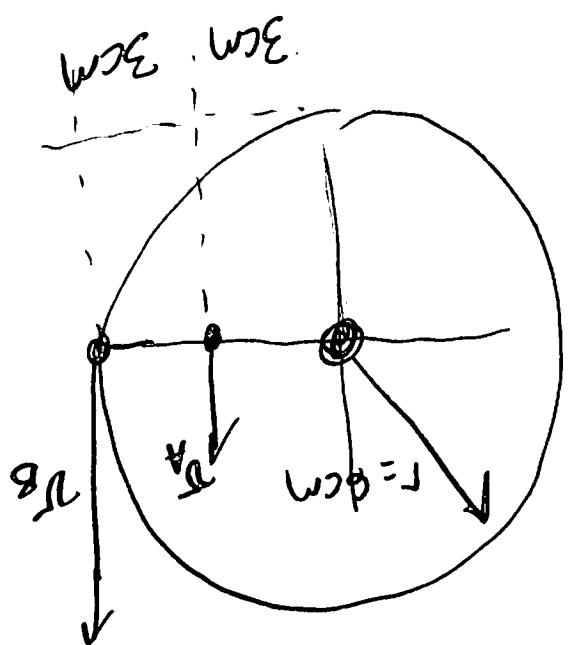
$$w = 2\pi \frac{\text{rev}}{\text{sec}} f = 2\pi \text{ rad} \left( 9 \frac{\text{rev}}{\text{sec}} \right) = 18\pi \frac{\text{rad}}{\text{sec}} = 56.5 \frac{\text{rad}}{\text{sec}}$$

linear velocity = angular velocity  $\cdot$  radius

$$v = w r$$

$$v_A = w r_A = 56.5 \frac{\text{rad}}{\text{sec}} (3 \text{ cm}) = 170 \frac{\text{cm}}{\text{sec}}$$

$$v_B = w r_B = 56.5 \frac{\text{rad}}{\text{sec}} (6 \text{ cm}) = 34 \frac{\text{cm}}{\text{sec}}$$

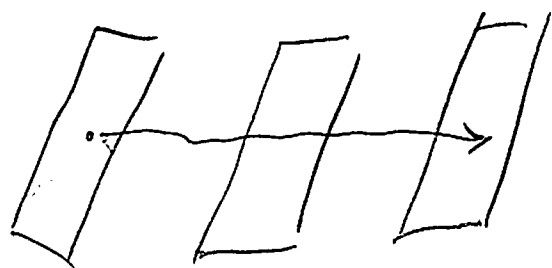




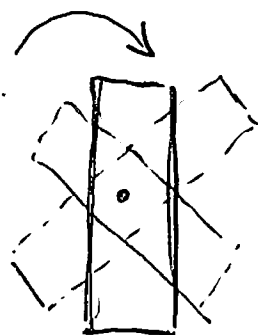
**Continuing Research Assistants:** Please provide the following information with your application.

- Unofficial transcripts showing Fall 2016 classes from Jenzebar;
- A list of the MST meetings / outreach events you attended last semester (includes AISES meetings and official positions);
- A list of your research presentations from last semester (*please indicate the date(s), and places you presented*);
- Assurance from the STEM Archivist that you provided digital copies of presentations, posters, and data;
- An updated 4-year Degree/Career Plan showing your progress towards a Bachelor of Science (B.S.) Degree in a Science, Technology, Engineering or Mathematics (STEM) field.
- Acknowledgement that you understand and agree to Fall 2016 RA Handbook.

## Rigid Bodies



translational



Rotational

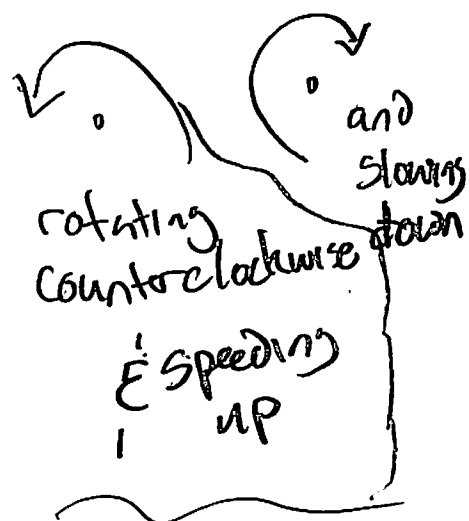


combination

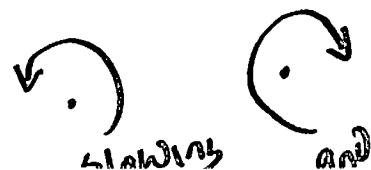
## Angular Acceleration

$$\alpha = \frac{\Delta \omega = \omega_f - \omega_i}{\Delta t = t_f - t_i}$$

$$\alpha = +$$



$$\alpha = (-)$$





## RESEARCH ASSISTANT APPLICATION

**RA Application Section 2. Additional Required Information:**

**New and Returning Research Assistants:** Please provide the following information. Note that OLC work-related forms are provided at [http://warehouse.ols.edu/local\\_links/personnel/docs/](http://warehouse.ols.edu/local_links/personnel/docs/)

- Signed W-4 and I-9 forms
- Signed Confidentiality Agreement form;
- Substance Abuse form (a pre-employment substance abuse test is required);
- Copy of your driver's license and social security card (must be readable);
- Photograph in .jpg format, preferably an "in action" picture of you in lab or field;
- Two recommendation letters from outside of the MST STEM Department discussing your academic attributes and how you will benefit from being a Research Assistant.
- Please provide a current official transcript from the Registrar and a Declaration of Major form— *your cost is \$5.*
- A 4-year Degree/Career Plan showing your progress towards a Bachelor of Science (B.S.), Degree in a Science, Technology, Engineering or Mathematics (STEM) field. *The ANSLAMP website has degree/career plan examples.*
- Acknowledgement that you understand and agree to Fall 2016 RA Guidelines (see below)

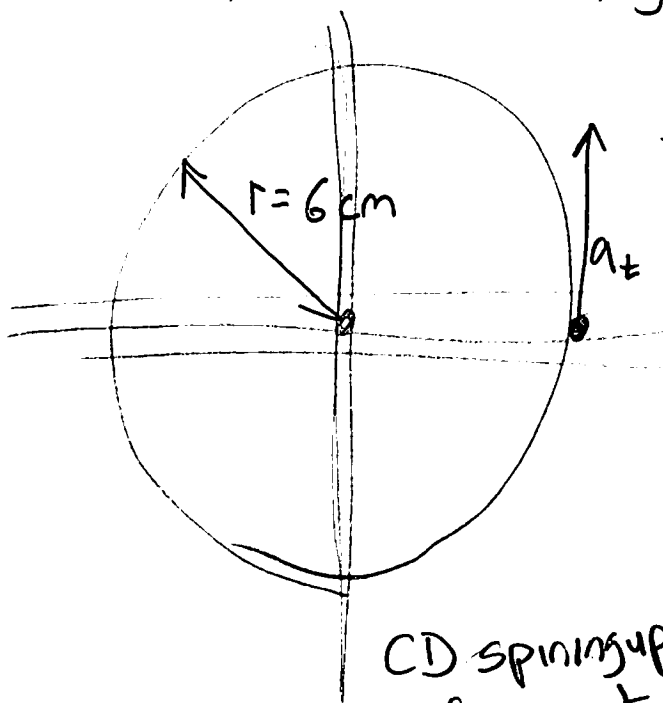


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CD spinning up  
from rest

	$t_{(sec)}$	$f_{rpm}$	$\int \ddot{\theta} \text{ rev/sec}$	$\omega_{rad/sec}$
init	0	$\emptyset$	$\emptyset$	$\emptyset$
final	2.00	5400	90	565

Find:  $\alpha [0-2]$ ;  $a_{t \text{ edge}}$   
how many revs occurred  
between  $t [0, 2]$  sec

Consider:  $\Delta \theta = \omega_i \Delta t + \frac{1}{2} \alpha (\Delta t)^2$   
is like  $\Delta x = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$   
this:

$$\frac{90 \text{ revs}}{\text{sec}} \left| \frac{2\pi \text{ rad}}{\text{rev}} \right| = 565 \frac{\text{rad}}{\text{sec}} \quad \text{tangential accel}$$

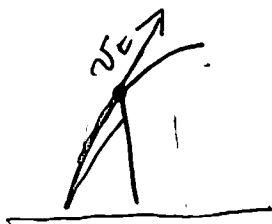
$$\alpha = \frac{\Delta \omega}{\Delta t} = \frac{\omega_f - \omega_i}{\Delta t}$$

$$= \frac{565 - 0 \left( \frac{\text{rad}}{\text{sec}} \right)}{2}$$

$$\alpha = \underline{\underline{282.5 \frac{\text{rad}}{\text{sec}}}}$$

$$a_t = \alpha r = 282.5 \frac{\text{rad}}{\text{sec}} (0.06 \text{ m})$$

$$a_t = \underline{\underline{17 \text{ m/sec}^2}}$$



$$a_t = \frac{\Delta v}{\Delta t} \quad v = \omega r$$

$$= \frac{\Delta \omega r}{\Delta t} = \frac{\Delta \omega}{\Delta t} r$$

$$a_t = \alpha r \quad \left( \frac{\Delta \omega}{\Delta t} \right) = \alpha$$



## RESEARCH ASSISTANT APPLICATION

**RA Application Section 1. Contact and Personal Information:**

Name: \_\_\_\_\_

Last

Maiden

First

Middle

Gender: ☐ Male ☐ Female Birthdate \_\_\_\_\_ Mentor \_\_\_\_\_

Social Security # \_\_\_\_\_ Home /Cell Phone # \_\_\_\_\_

(for business office / student services use only)

Address: \_\_\_\_\_

Mailing address

City

State

Zip Code

E-Mail Address(s) (personal is OK but must also have OLC email as well): \_\_\_\_\_

Ethnicity (check one): Native American ☐ Hispanic/Latino ☐ Native Hawaiian or Pacific  
Islander ☐ African American/Black ☐ Caucasian ☐Declared Major \_\_\_\_\_ Currently pursuing: AA ☐ BS ☐ CIP Code: \_\_\_\_\_

(See RA Handbook for STEM disciplines and approvable CIP codes):

Semester First Enrolled at OLC (Sem. &amp; Year) \_\_\_\_\_ Credit Hours Attempted: \_\_\_\_\_ Completed: \_\_\_\_\_

Highest Math Class completed \_\_\_\_\_ Last Semester GPA \_\_\_\_\_ Cumulative GPA.: \_\_\_\_\_

Expected Date of Graduation \_\_\_\_\_ Credits taken this semester: \_\_\_\_\_ Fulltime? Yes / No

If you are currently enrolled in an AA-program, what four-year institution do you plan to attend?

List any awards, scholarships, internships you have received in the past 2 years.

Describe your career goal. Specify how your academic program and your overall educational plans will assist you in achieving your goals (100 words or less).

Describe a leadership experience in which you made a difference on campus or in the community (100 words or less).

Describe your research experience. Indicate how the experience will assist you in achieving your goals (100 words or less).

Please list community service you did in the last semester. (100 words or less)

Any additional information you wish to share with the review committee? (100 words or less)

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How many revs occurred between  
0 and 2 sec

$$\Delta\theta = \cancel{\omega_0 \Delta t} + \frac{1}{2} \alpha (\Delta t)^2$$

$$\begin{aligned}\Delta\theta &= \frac{1}{2} \alpha (\Delta t)^2 \\ &= \frac{1}{2} (282.5 \frac{\text{rad}}{\text{sec}^2}) (2 \text{ sec})^2 \\ &= \frac{1}{2} (282.5 \frac{\text{rad}}{\text{sec}^2}) (4 \text{ sec}^2)\end{aligned}$$

$$\Delta\theta = 565 \text{ rad}$$

$$\# \text{ revs} = \frac{565 \text{ rad}}{2\pi \text{ rad/rev}} = 90 \text{ revs}$$

So, the disk makes  
90 revolutions  
between 0 and 2 sec



RESEARCH ASSISTANT APPLICATION

- Research Assistants are eligible for the **ANSLAMP Scholar Program**. The ANSLAMP Scholar has the following benefits<sup>12</sup>:
  - GPA of 3.5 and above: \$2,100 per student per academic year (\$1,050 per semester);
  - GPA of 2.5 up to a 3.0: \$900 per student per academic year (\$450 per semester);
  - GPA of 3.0 up to a 3.5: \$1,500 per student per academic year (\$750 per semester).
- AMP Scholars are also eligible to participate in research opportunities including the Costa Rica Research Experience and other Research Experiences for Undergraduate (REU) programs.

**Continuing Research Assistants:** Please provide the following information with your application. You should refer to the Research Assistant Handbook for how this section will be evaluated.

What is your research question? – *(Suggested 1-2 paragraphs describing what you are researching and the supporting peer-reviewed literature)*

Describe your last semester's work – *(Suggested 3-5 paragraphs describing the data you collected and compiled for analysis, the results of your exploratory analysis, interpretation comparison, and implications of your results, what you tried last semester and you learned)*

Research objective and milestones: *(One paragraph on what you plan to complete by the end of the semester with clear steps describing you will need to do to meet your research objective):*

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<sup>1</sup> If you have a bill with OLC, Student Accounts will apply up to half of the scholarship award towards your bill;

<sup>2</sup> Because of changes in funding status to the AMP Program, only the top two academic students will be awarded with Fall 2016 AMP Scholarships.