Sample exam problems

Attached here is a set of sample exam questions from past terms in the course. These problems were chosen from past terms without regard to the specific questions that will appear on your exam. Please do not use these questions as an indication of which specific topics will appear on this term's midterm.

Please use these questions to help you prepare for the midterm this term. We will *not* be providing solutions for these questions, as we want you to use the questions to prepare under the exam-like situation of not knowing the answer, and you working through ways to check your work on your own, rather than looking at the answer to check your work. If you have questions regarding the solution of these problems, please check with your instructor and/or the TAs.

Please note that Weekly Joys has a good number of sample exam questions from past terms for which solutions are provided.

ME 274 – Summer 2015 ***Name*** _____

Examination No. 2

PROBLEM NO. 1 – 20 points

Given: Particle P travels within the x-y plane along a path given by $y(x) = \frac{x^2}{2} - 10x$, where x and y are given in feet. The y-component of the position for P is increasing at a *constant* rate of 10 ft/sec.

Find: For the position of P corresponding to x = 9 ft:

a) determine the *velocity vector* of P.

b) determine the *acceleration vector* of P.

c) determine the *rate of change of speed* of P.

d) determine the *radius of curvature* for the path of P.

ME 274 – Summer 2013 ***Name*** _____

Examination No. 1

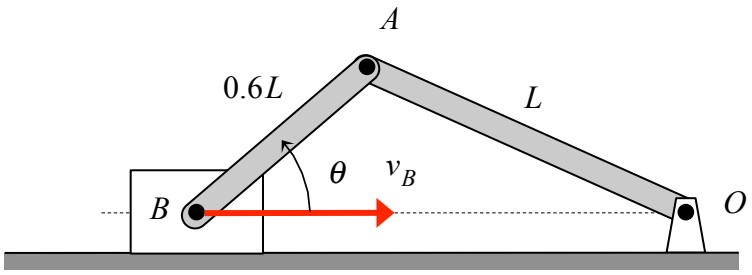
PROBLEM NO. 2 – 20 points

Given: The mechanism shown below is made up of links AB and AO, with the lengths of AB and AO given by 0.6L and L, respectively. Block B is attached to end B of link AB, with B being constrained to move along a straight path with a constant speed of v_B.

Find: For the instant when $\theta = 90°$:

a) Determine the angular velocities of links AB and AO. *Write your answers as vectors in terms of L and v_B only.*

b) Determine the angular accelerations of links AB and A). *Write your answers as vectors in terms of L and v_B only.*



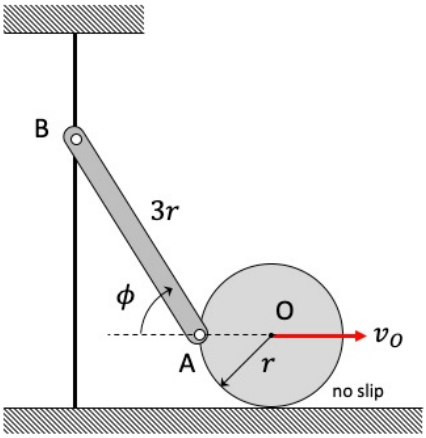
Work appearing above this line will NOT be graded

ME 274 - Spring 2002 ***Name*** _____
Examination No. 1

PROBLEM NO. 3

Given: A disk having a radius of r is rolling without slipping on a rough horizontal surface to the right with its center O moving at a *constant* speed of v_O. A rigid bar having a length of $3r$ is attached to point A on the circumference of the disk. End B is constrained to moving on a vertical guide. At the position shown, point A is on the same horizontal line as point O.

Find: At the position shown, determine the velocity and acceleration of end B of the bar.



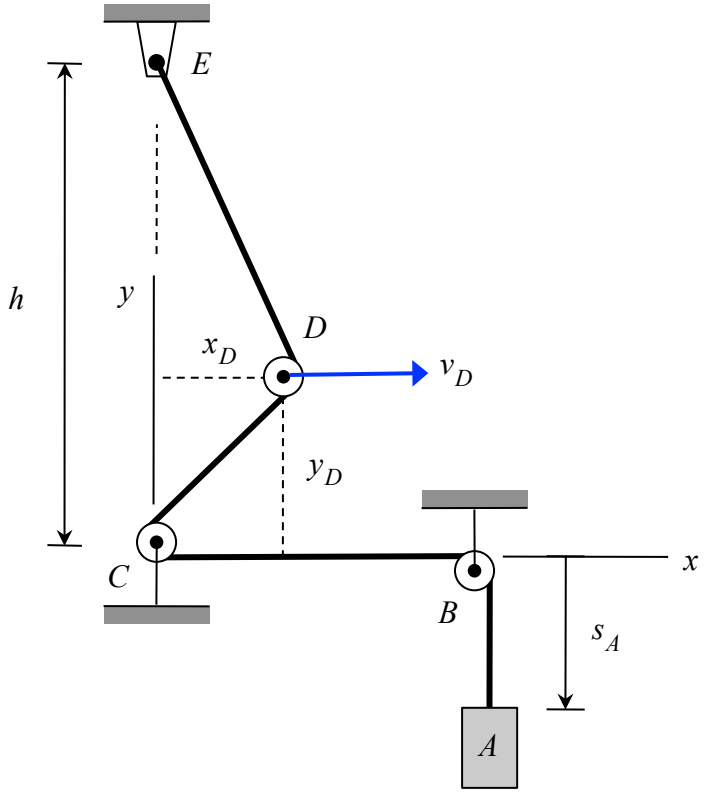
ME 274 – Summer 2015 ***Name*** _____

Examination No. 2

PROBLEM NO. 3

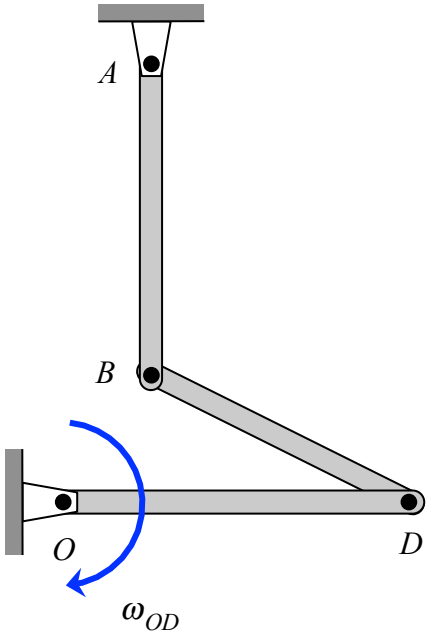
PART A – 6 points

An inextensible cable connects block A to ground at E, with the cable being wrapped around two fixed pulleys at B and C, and a moveable pulley at D. When pulley D is at the location $(x_D, y_D) = (0.3, 0.4)\, m$, the center of pulley D is known to have a velocity of $\vec{v}_D = (2\hat{i})\, m/s$. Determine the speed of block A at that instant. Use $h = 0.8\, m$. Assume the pulleys to have small radii.



PART B – 6 points

Use a STRAIGHT EDGE in any drawings that you make for this problem. You must provide a JUSTIFICATION for your answers below.



The mechanism shown above has been drawn to scale. Let $\vec{\omega}_{AB}$, $\vec{\omega}_{BD}$ and $\vec{\omega}_{OD}$ represent the angular velocity vectors of links AB, BD and OD, respectively.

- Circle the correct answer below regarding the relative sizes of $|\vec{\omega}_{BD}|$ and $|\vec{\omega}_{OD}|$:

$|\vec{\omega}_{BD}| > |\vec{\omega}_{OD}|$ $\quad$ $|\vec{\omega}_{BD}| = |\vec{\omega}_{OD}|$ $\quad$ $|\vec{\omega}_{BD}| < |\vec{\omega}_{OD}|$

- Circle the correct answer below regarding the relative sizes of $|\vec{\omega}_{AB}|$ and $|\vec{\omega}_{BD}|$:

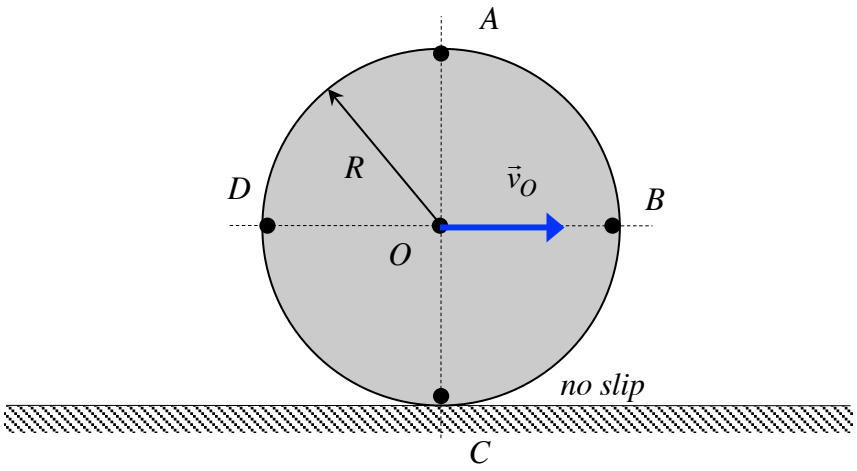
$|\vec{\omega}_{AB}| > |\vec{\omega}_{BD}|$ $\quad$ $|\vec{\omega}_{AB}| = |\vec{\omega}_{BD}|$ $\quad$ $|\vec{\omega}_{AB}| < |\vec{\omega}_{BD}|$

ME 274 – Summer 2015 ***Name*** _____

Examination No. 2

PROBLEM NO. 3 (continued)

PART C – 8 points



A circular disk with an outer radius of R rolls without slipping on a horizontal surface with its center O moving with a speed of v_O.

- On the figure above, draw the velocity vectors for points A, B and D on the circumference of the disk.
- Let v_O, v_A, v_B and v_C denote the speeds of points O, A, B and C, respectively, on the disk. Rank these speeds in order of increasing magnitude.

- On the figure above, locate a point on the circumference of the disk that has the same speed as point O.

ME 274 – Summer 2013 ***Name*** _____

Examination No. 1

PROBLEM NO. 3 (continued)

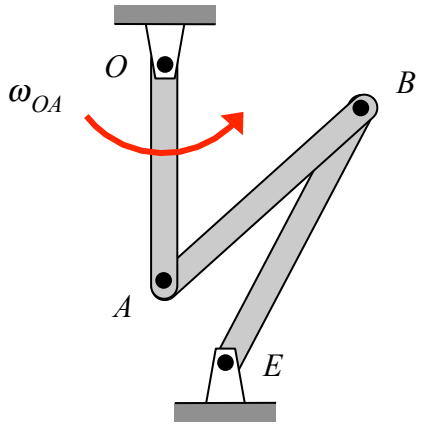
PART D – 4 points

The mechanism shown below has been drawn to scale. For the position shown:

i) What is the sense of rotation for link AB: *clockwise*, *counterclockwise* or *stationary*?

ii) Which is larger: the angular speed of link BE, $|\omega_{BE}|$, or the angular speed of link AB, $|\omega_{AB}|$?

HINT: Locate the instant center for link AB.

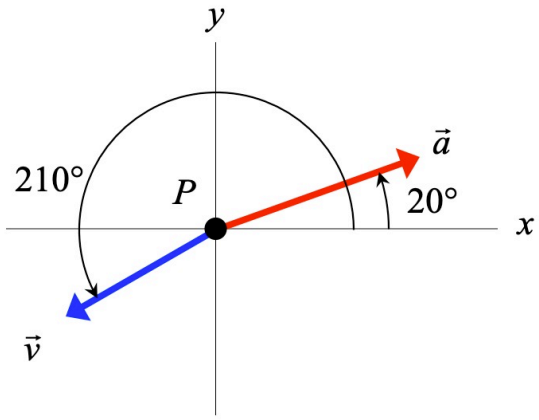


ME 274 – Summer 2022 ***Name*** _____

Examination No. 1 (ALTERNATE)

PROBLEM NO. 3 – 20 points TOTAL

NOTE: You are not required to show your work on Problem 3. There is no partial credit awarded for the different parts of the problem.



The velocity and acceleration of point P are shown above with $|\vec{v}| = 25 m/s$ and $|\vec{a}| = 15 m/s^2$

PART A (2 points) – circle the correct response

a) Point P is moving with *increasing* speed.

b) Point P is moving with *constant* speed.

c) Point P is moving with *decreasing* speed.

PART B (2 points)

What is the radius of curvature of the path of P?