

Homework No. 12 (Fall 2024)

PHYS 205A-002: UNIVERSITY PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale

Due date: Wednesday, 2024 Nov 13, 2:00 PM, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.
- Links to solutions are provided. Further, links to few variations of the problem are provided that serve as practice problems.
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.
- Additional problems, with hyperlinks to exams, are available in [Lecture Notes](#).
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments). You can replace your PDF file, only the last file is graded.

Problems

1. (10 points.) A circular disc in the xy plane rotates about the z axis. This rotation is described by the angular velocity vector

$$\boldsymbol{\omega} = \hat{\mathbf{z}} \omega, \quad (1)$$

where $\omega = 75$ radians/s is the magnitude of the vector and represents the angular speed. Given the relation,

$$\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}, \quad (2)$$

where \mathbf{r} is the position and \mathbf{v} is the linear velocity of a point on the disc, find the linear velocity of a point on the disc at

$$\mathbf{r} = \hat{\mathbf{x}} 0.20 \text{ m}. \quad (3)$$

[\[Solution\]](#)

2. (10 points.) Starting from rest a wheel rotates with uniform angular acceleration 3.0 rad/s^2 . Determine the instantaneous angular velocity of the wheel after 3.0 s .

[\[Solution\]](#)

3. (10 points.) The angular position of a point on the rim of a rotating wheel is given by $\theta = 4.0t - 2.0t^2 + t^3$, where θ is in radians and t is in seconds.

(a) Determine the angular velocity at $t = 6.0$ s.

(b) Determine the instantaneous angular acceleration at $t = 6.0$ s.

[Solution]

4. (10 points.) A motorcycle accelerates uniformly from rest and reaches a linear speed of 24.0 m/s in a time of 8.00 s. The radius of each tire is 0.300 m. What is the magnitude of the angular acceleration of each tire?

[Solution]