Homework No. 12 (Fall 2025)

PHYS 205A-002: UNIVERSITY PHYSICS

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

Due date: Monday, 2025 Nov 10, 2 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.
- Practice problems are available at Binapani Academy. It is a free service and requires a one-time registration. (Code: SIUC2025)
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assesments → Assignments). You can replace your PDF file as many times as you like, only the last file is graded. The deadline has an (undisclosed) buffer period, so do not hesitate to try submissions after the deadline.

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

$$\boldsymbol{\omega} = \hat{\mathbf{z}}\,\omega, \tag{1}$$

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

$$\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}, \tag{2}$$

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

$$\mathbf{r} = \hat{\mathbf{x}}\,0.20\,\text{m}. \tag{3}$$

[**Solution**]

2. (**10 points.**) Starting from rest a wheel rotates with uniform angular acceleration $3.0\,\mathrm{rad/s^2}$. 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 $\theta = 4.0\,t - 2.0\,t^2 + t^3$, where θ is in radians and t is in seconds.

   (a) Determine the angular velocity at $t = 6.0\,\mathrm{s}$.

   (b) Determine the instantaneous angular acceleration at $t = 6.0\,\mathrm{s}$.

   [**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**]