

Homework No. 03 (Spring 2026)

PHYS 205A-001: UNIVERSITY PHYSICS

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

Due date: Monday, 2026 Feb 02, Noon, 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 Assessments → 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 on Vectors

0. (**Notation:**) Quantities in boldface represent vectors. For example, the vector quantity \mathbf{A} in typography, when written on your notebook or on a blackboard, is represented as \vec{A} . Many textbooks use the combined representation $\vec{\mathbf{A}}$. The quantity A stands for the magnitude of the vector $\vec{\mathbf{A}}$ (in textbooks, or \mathbf{A} in typography, or \vec{A} on your notebook).
1. (**10 points.**) Two vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ have equal magnitudes of 5.00 m. Vector $\vec{\mathbf{A}}$ is pointing along the negative x axis, and vector $\vec{\mathbf{B}}$ makes an angle of 60° with positive x axis. Determine the magnitude and direction of the vector $\vec{\mathbf{A}} + \vec{\mathbf{B}}$.

[\[Solution\]](#)

2. (**10 points.**) Given that vector $\vec{\mathbf{A}}$ has magnitude $A = |\vec{\mathbf{A}}| = 15$ m and direction $\theta_A = 30.0^\circ$ counterclockwise w.r.t x -axis, and that vector $\vec{\mathbf{B}}$ has magnitude $B = |\vec{\mathbf{B}}| = 20.0$ m and direction $\theta_B = 45.0^\circ$ counterclockwise w.r.t x -axis. Determine the magnitude and direction of the sum of the vectors.

[\[Solution\]](#)

3. (10 points.) An explorer is caught in a whiteout (in which the snowfall is so thick that the ground cannot be distinguished from the sky) while returning to base camp. He was supposed to travel due north for 4.4 km, but when the snow clears, he discovers that he actually traveled 7.8 km at 54° north of due east.
- (a) How far must he now travel to reach base camp?
- (b) In what direction must he travel?

[Solution]

4. (10 points.) A golfer takes two strokes to putt a golf ball into a hole. On the first stroke, the ball moves 5.0 m at an angle 60° West of North. On the second, it moves 3.0 m at an angle 70° South of West. If the golfer had instead hit the ball directly into the hole on the first stroke, what would have been the magnitude and direction of the ball's displacement?

[Solution]

5. (10 points.) If three vectors satisfy the relations

$$\vec{A} - \vec{B} = 2\vec{C}, \quad (1)$$

$$\vec{A} + \vec{B} = 4\vec{C}, \quad (2)$$

where

$$\vec{C} = 3\hat{i} + 4\hat{j}, \quad (3)$$

then what are \vec{A} and \vec{B} in component form?

[Solution]

Problems on Galilean relativity

1. (10 points.) A boat is able to move through still water at 20.0 m/s. It makes a round trip to a town 3.0 km downstream. Assume all motion to be along a straight line. That is, the boat first travels in the direction of river and while returning travels against the direction of river. If the river flows at 5.0 m/s, determine the time required for this round trip.

[Solution]

2. (10 points.) A car travels due east with a speed of 40.0 km/h. Raindrops are falling at a constant speed vertically with respect to the ground. The traces of the rain on the side windows of the car make an angle of 76.0° with the vertical.
- (a) Find the speed of the rain with respect to the ground.
- (b) Find the speed of the rain with respect to the car.

[Solution]

3. (10 points.) The wind is flowing at a speed of 20 m/s in the direction 30° North of West with respect to the ground. Determine the direction and speed of the aeroplane should head (with respect to the wind) such that the aeroplane heads North (with respect to the ground) with speed 80.0 m/s.

[Solution]