

PHYSICS 1030

Homework #3

(Due Sept. 30, 2024, 6:00 pm)

- (Serway 3-23) Consider the two vectors $\mathbf{A} = 3\mathbf{i} - 2\mathbf{j}$ and $\mathbf{B} = -\mathbf{i} - 4\mathbf{j}$. Calculate (a) $\mathbf{A} + \mathbf{B}$, (b) $\mathbf{A} - \mathbf{B}$, (c) $|\mathbf{A} + \mathbf{B}|$, (d) $|\mathbf{A} - \mathbf{B}|$, (e) $\mathbf{A} \cdot \mathbf{B}$, and (f) the directions of $\mathbf{A} + \mathbf{B}$ and $\mathbf{A} - \mathbf{B}$.
- Add vectors $\mathbf{A} = 2\angle 35^\circ$ and $\mathbf{B} = 5\angle 145^\circ$. Give your answer in polar form.
- (Serway 3-32) Vector \mathbf{A} has x and y components of -8.70 cm and 15.0 cm, respectively; vector \mathbf{B} has x and y components of 13.2 cm and -6.60 cm, respectively. If $\mathbf{A} - \mathbf{B} + 3\mathbf{C} = \mathbf{0}$, what are the components of \mathbf{C} ?
- Show how to find vectors \mathbf{A} and \mathbf{B} , given the vectors $\mathbf{C} = \mathbf{A} + \mathbf{B}$ and $\mathbf{D} = \mathbf{A} - \mathbf{B}$. (That is, find expressions for \mathbf{A} and \mathbf{B} in terms of \mathbf{C} and \mathbf{D} .)
- (Serway 4-7) The vector position of a particle varies in time according to the expression $\mathbf{r} = (3.00\mathbf{i} - 6.00t^2\mathbf{j})$, where \mathbf{r} is in meters and t is in seconds. (a) Find an expression for the velocity of the particle as functions of time. (b) Determine the acceleration of the particle as a function of time. (c) Calculate the particle's position and velocity at $t = 1.00$ s.
- (Serway 4-15) A projectile is fired in such a way that its horizontal range is equal to three times its maximum height. What is the angle of projection?
- A canon in use during the American Revolution would have a typical maximum range of 250 meters. Given this maximum range, (a) what would be the muzzle velocity v_0 ? (b) At what angle θ above the horizontal would you aim the canon to hit a target 140 meters away? (Use the smallest angle possible.) (c) What is the maximum height reached by the projectile in this case? (d) What is another possible solution to part (b)?
- A .22 rifle bullet is fired in a horizontal direction with a muzzle velocity of 900 ft/sec. In the absence of air resistance, how far will it have dropped in traveling a horizontal distance of (a) 50 yd? (b) 100 yd? (c) 150 yd? (d) How far will it drop in one second?