PHY2053 Spring 2018 Homework Assignment #1

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Abstract

In this homework assignment, you're going to be solving problems on vectors. These are going to come from end-of-the-chapter problems from Walker, Chapter 3, as well as some problems that I wrote myself. This set of homework set is due **January 17**.

1. Walker, Chapter 3, Conceptual Question 4
2. Walker, Chapter 3, Conceptual Question 6
3. Walker, Chapter 3, Conceptual Question 8
4. Walker, Chapter 3, Problem 12
5. Walker, Chapter 3, Problem 14
6. Walker, Chapter 3, Problem 18
7. Walker, Chapter 3, Problem 20
8. Consider three vectors:

   $$\vec{a} = \hat{i} + 3\hat{j}$$

   $$\vec{b} = -4\hat{i} + 2\hat{j}$$

   $$\vec{c} = 5\hat{j}$$

   Given these vectors, compute the following quantities:

   (a) $\vec{d} = \vec{a} + \vec{b} + \vec{c}$
   (b) θ, the angle between $\vec{a}$ and $\vec{b}$
   (c) ϕ, the angle of $\vec{d}$ measured **counter-clockwise** from the $+x$-axis.

9. Consider the two vectors:

   $$\vec{A} = 3\hat{i} - 2\hat{j}$$

   $$\vec{B} = 6\hat{j} + \hat{k}$$

   Compute the following quantities:

   (a) $|\vec{A} + \vec{B}|$

(b) $\vec{A} \cdot \vec{B}$

(c) $\vec{A} \times \vec{B}$

(d) θ, the angle between $\vec{A}$ and $\vec{B}$

10. Consider the two vectors:

$$\vec{A} = 4\hat{i}$$

$$\vec{B} = 2\hat{i} + 3\hat{j}$$

(a) Draw the two vectors in an xy-coordinate system.

(b) Define the **projection of $\vec{B}$ onto $\vec{A}$** as the length of $\vec{B}$ that runs parallel to $\vec{A}$. What is the projection of $\vec{B}$ onto $\vec{A}$ in this case? To help visualize what the projection of a vector represents, imagine an *actual* projector shining a light on a plank of wood, as shown in the following figure. The shadow of that plank of wood is what the projection projection represents. However, to imagine a vector in this analogy, we'd need the width of the board to be zero; so the projection of a vector (the plank of wood) onto another vector (the wall) is analogous to the *height/length* of the shadow.