

Physics 101

Spring Semester
First Midterm Exam
Sunday, March 9, 2025
8:30 PM – 10:00 PM

Student's Name: Serial Number:

Student's Number:Section:

Choose your Instructor's Name:

Instructors: Drs. Al Dosari, Alkurtass, Al Qattan, Al Refai, Al Smadi, Askar,
Demir, Salameh, Zaman

For Instructors use only

Grades:

| # | SP1 | SP2 | SP3 | SP4 | SP5 | LP1 | LP2 | Q1 | Q2 | Q3 | Q4 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|-------|
| | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 20 |
| Pts | | | | | | | | | | | | |

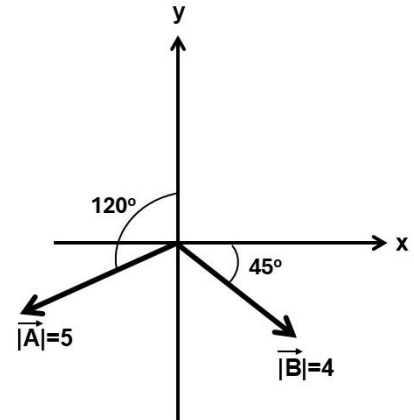
Important:

1. Answer all questions and problems (No solution = no points).
2. Full mark = 20 points as arranged in the above table.
3. **Give your final answer in the correct units.**
4. Assume $g = 10 \text{ m/s}^2$.
5. Mobiles are **strictly prohibited** during the exam.
6. Programmable calculators, which can store equations, are not allowed.
7. **Cheating incidents will be processed according to the university rules.**

GOOD LUCK

Part I: Short Problems (2 points each)

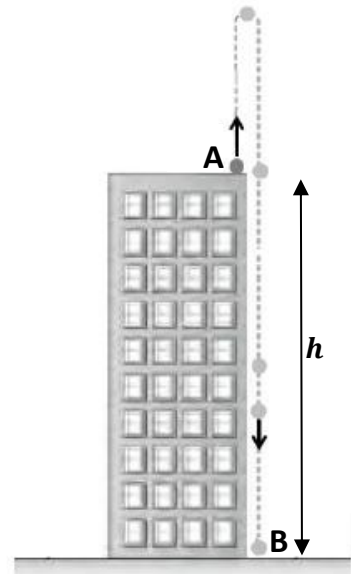
SP1. Two vectors \vec{A} and \vec{B} are shown in the figure. **Write \vec{A} and \vec{B} in unit vector notation.**



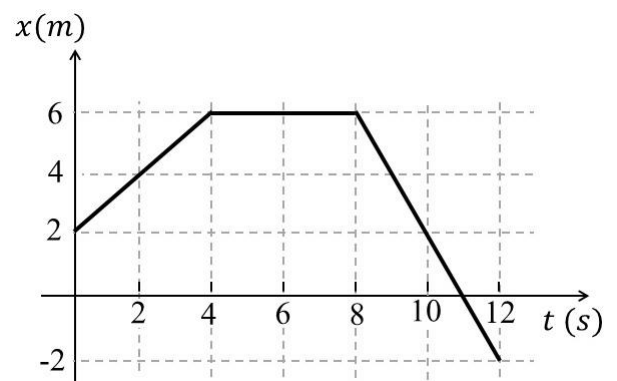
SP2. Given the two vectors $\vec{A} = (2\hat{i} - 4\hat{j})$ and $\vec{B} = (-2\hat{i} + 3\hat{j})$, if $\vec{C} = \vec{A} + 2\vec{B}$, **find the angle between \vec{C} and the $+x$ axis.**

SP3. The position vector of a particle moving in the xy – *plane* is given by: $\vec{r} = (2t - t^3)\hat{i} + (4t^2)\hat{j}$ where t is measured in seconds and \vec{r} is measured in meters. **Find the speed of the particle at $t = 2$ seconds.**

SP4. A ball is thrown **upward** with an initial velocity (v_0) from the top of a building with a height (h). It takes $t = 2\text{ s}$ to reach its maximum height and then hits the ground at point **B** with a speed of 35 m/s . **What is the height of the building (h)?**



SP5. The position-time graph of an object moving along the x-axis is shown in the figure. Find the **average acceleration** between **$t = 2\text{ s}$ and $t = 10\text{ s}$** .



Part II: Long Problems (3 points each)

LP1. Given two vectors: $\vec{A} = (3\hat{i} - 4\hat{j} + 4\hat{k})$ and $\vec{B} = (2\hat{i} + 3\hat{j} - 7\hat{k})$.

(a) Find $\vec{C} = 2\vec{A} - \vec{B}$ in unit vector notation.

(b) Find the vector product $\vec{A} \times \vec{B}$.

(c) Find $\vec{C} \cdot (\vec{A} \times \vec{B})$.

LP2. An object moves along the **x-axis** with its position as a function of time given by: $x(t) = 4t - 0.125t^4$ where x is measured in *meters* and t is measured in *seconds*.

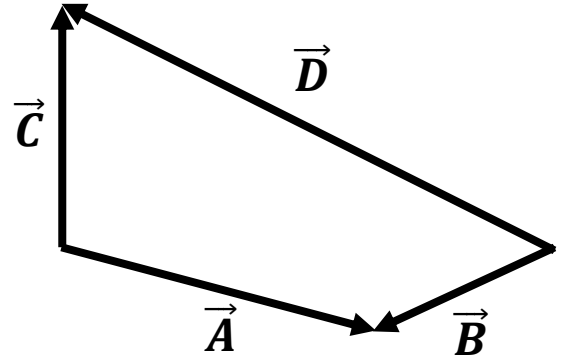
(a) Find the average velocity between $t = 0$ s and $t = 4$ s.

(b) Find the time when the object changes its direction of motion.

(c) Find the **average speed** of the object between $t = 0$ and $t = 4$ s.

Part III: Questions (Choose the correct answer, one point each)**Q1.** Which of the following relations describes the vector \vec{A} in the figure?

- * $\vec{A} = \vec{B} + \vec{C} + \vec{D}$
- * $\vec{A} = \vec{B} + \vec{C} - \vec{D}$
- * $\vec{A} = \vec{B} - \vec{C} - \vec{D}$
- * $\vec{A} = \vec{B} - \vec{C} + \vec{D}$

**Q2.** An object is moving **along a straight line**. Which of the following is true if the object **is speeding up**?

- * $v > 0, a < 0$
- * $v = 0, a = 0$
- * $v < 0, a < 0$
- * $v < 0, a > 0$

Q3. The value of $\hat{i} \cdot (\hat{k} \times \hat{j})$ is

- * -1
- * $+1$
- * 0
- * \hat{i}

Q4. The velocity and acceleration of an object at a certain instant are:

$$\vec{v} = -2\hat{j} \text{ m/s}; \quad \vec{a} = (3\hat{i} + 4\hat{j}) \text{ m/s}^2.$$

At this instant, the object is

- * moving in a straight line and slowing down.
- * moving in a curved path and slowing down.
- * moving in a straight line and speeding up.
- * moving in a curved path and speeding up.