Physics 2314, Homework #1 (due 1/24)

Multiple choice questions

M1 Vector $\mathbf{A}$ has a magnitude of 2 m, and vector $\mathbf{B}$ has a magnitude of 5 m. Mark all possible values for the magnitude of $\mathbf{A} - \mathbf{B}$.

A. $-3$ m
B. 0
C. 5 m
D. 10 m

M2 Which of the following is true? (There can be more than one correct answer.)

A. Position is the first derivative of velocity.
B. Velocity is the first derivative of position.
C. Acceleration is the first derivative of velocity.
D. Acceleration is the second derivative of velocity.
E. Position is the second derivative of acceleration.

M3 A particle is moving along the $x$ axis. Its position is given by the equation $x = t^3$, where $t$ is in seconds, and $x$ is in meters. What can you say about its acceleration at $t = 1$ s?

A. The acceleration is zero (a particle under constant velocity).
B. The acceleration is positive.
C. The acceleration is negative.
Problems

P1 Given two vectors \( \mathbf{A} = i + 2j \) and \( \mathbf{B} = 2i + 2j \), calculate (a) \( \mathbf{A} + \mathbf{B} \), (b) \( \mathbf{A} - \mathbf{B} \), (c) \( |\mathbf{A} + \mathbf{B}| \), (d) \( |\mathbf{A} - \mathbf{B}| \), (e) directions of \( \mathbf{A} + \mathbf{B} \) and \( \mathbf{A} - \mathbf{B} \).

P2 Given vectors \( \mathbf{A} = i + 2j \), \( \mathbf{B} = 3i + j \), \( \mathbf{C} = -i + 3j \), find numbers \( a \) and \( b \) such that a linear combination of vectors \( \mathbf{A} \) and \( \mathbf{B} \) with coefficients \( a \) and \( b \) is equal to \( \mathbf{C} \):

\[ a\mathbf{A} + b\mathbf{B} = \mathbf{C} \]

P3 (a) A particle moves along the \( x \) axis. Its position is given by the equation

\[ x = 1 + 2t + t^2, \]

where \( x \) is in meters and \( t \) is in seconds. Find position, velocity, and acceleration of the particle at \( t = 2 \) s.

(b) A particle moves along the \( x \) axis. Its position is given by the equation

\[ x = 1 + 2t, \]

where \( x \) is in meters and \( t \) is in seconds. Find position, velocity, and acceleration of the particle at \( t = 2 \) s.

P4 A particle is moving with a constant acceleration \( a_x = 2 \text{ m/s}^2 \) from point \( x_i = 1 \) m to point \( x_f = 3 \) m. At point \( x_f \) the velocity of the particle is 3 m/s. What was the velocity of the particle at point \( x_i \)?