Phys 111 2023

Review 1

Monday

Class Exam 1 : Mon, Sept 18 in class
50 minutes.

Covers: Ch 1 → 3

Lectures 1 → 12

Discussions 1 → 3

HW 1 → 3

Bring : * Calculator (no communicating devices)

* Single 3" x 5" card /sheet single side.

* Study: PROBLEMS!

- 2016, 2019 Class Ex 1 all questions
- HW questions
- Discussion questions
- Quizzes
- In-class quizzes

Ch 1, Ch 2 Motion in one dimension

$$V_{avg} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$$

$$a_{avg} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

v = slope x vs t

$v > 0 \Rightarrow$ right

$v < 0 \Rightarrow$ left

a = slope v vs t

$$v_f = v_i + a\Delta t$$

$$x_f = x_i + v_i \Delta t + \tfrac{1}{2} a (\Delta t)^2$$

$$v_f^2 = v_i^2 + 2a_y(y_f - y_i)$$

Free fall

$$a = -g = -9.80 m/s^2$$

Quiz 1 typo in option 4 20% — 40%

Quiz 2 30 - 60%

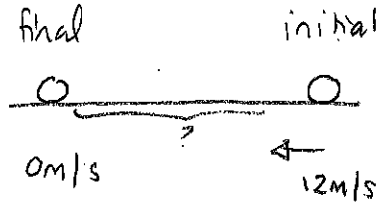
48 Reversing cart

At an initial instant a cart travels to the left with speed 12 m/s. Subsequently the cart's acceleration is 4.0 m/s^2. *(111F2023)*

a) How long does it take for the cart to reverse its direction of travel?

b) How far does the cart travel before it reverses its direction of travel?

Answer: a)



$t_i = 0s$ $\quad$ $t_f =$

$x_i = 0m$ $\quad$ $x_f =$

$v_i = -12m/s$ $\quad$ $v_f = 0m/s$

$a = 4.0m/s^2$

$$V_f = V_i + a\Delta t \Rightarrow 0m/s = -12m/s + 4.0m/s^2 \Delta t$$

$$\Rightarrow 12m/s = 4.0m/s^2 \Delta t$$

$$\Rightarrow \frac{12m/s}{4.0m/s^2} = \Delta t \Rightarrow \Delta t = 3.0s$$

b) $$x_f = x_i + v_{ix}\Delta t + \frac{1}{2}a_x(\Delta t)^2$$

$$= 0m - 12m/s \times 3.0s + \frac{1}{2}(4.0m/s^2)(3.0s)^2$$

$$= -36m + 18m$$

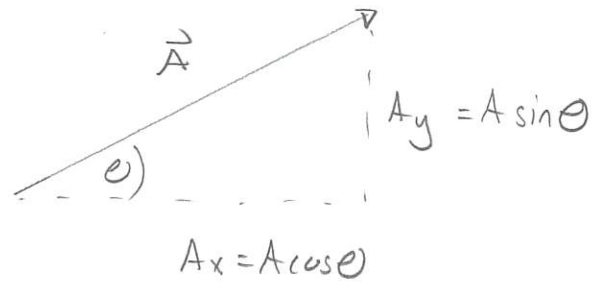
$$= -18m$$

It moves 18m to the left.

Ch3 Vectors, motion in two dimensions

Know: vector addition

vector components



velocity vector

- magnitude = speed
- direction = tangent to trajectory.

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

$$V_{fx} = V_{ix} + a_x \Delta t \qquad V_{fy} = V_{iy} + a_y \Delta t$$

$$x_f = x_i + V_{ix}\Delta t + \tfrac{1}{2} a_x (\Delta t)^2 \qquad y_f = y_i + V_{iy}\Delta t + \tfrac{1}{2} a_y (\Delta t)^2$$

$$V_{fx}^2 = V_{ix}^2 + 2a_x(x_f - x_i) \qquad V_{fy}^2 = V_{iy}^2 + 2a_y(y_f - y_i)$$

Projectiles $\vec{a}\downarrow$ $a_x = 0\,m/s^2$

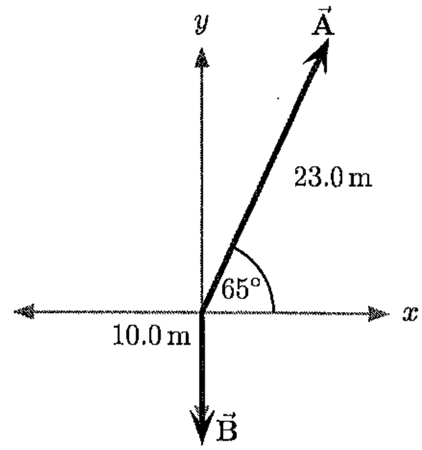
$a_y = -9.8\,m/s^2$

Quiz3

Quiz4 40% – 90%

74 Vector addition: algebraic method, 4

Two displacement vectors, $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are illustrated. *(111F2023)*



a) Determine the components of $\vec{\mathbf{C}} = \vec{\mathbf{A}} + \vec{\mathbf{B}}$.

b) Determine the magnitude of $\vec{\mathbf{C}}$.

Answer: Need components of $\vec{A}, \vec{B}$

$$A_x = A\cos 65° = 23.0\,\text{m}\cos 65° = 9.7\,\text{m}$$

$$A_y = A\sin 65° = 23.0\,\text{m}\sin 65° = 21\,\text{m}$$

$$B_x = 0\,\text{m}$$

$$B_y = -10\,\text{m}$$

$$C_x = A_x + B_x = 9.7\,\text{m} + 0\,\text{m} = 9.7\,\text{m}$$

$$C_y = A_y + B_y = 21\,\text{m} - 10\,\text{m} = 11\,\text{m}$$

b) $$C = \sqrt{C_x^2 + C_y^2} = \sqrt{(9.7\,\text{m})^2 + (11\,\text{m})^2} = 15\,\text{m}$$

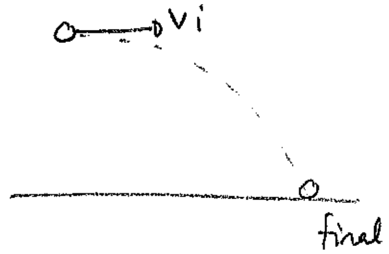
95 Ball thrown horizontally

A ball is thrown, leaving the hand horizontally at a height of 2.0 m above the ground. It lands a horizontal distance of 5.0 m from where it left the hand. *(111F2023)*

a) Determine the time from when the ball leaves the hand until it hits the ground.

b) Determine the speed with which the ball leaves the hand.

Answer a)



$t_i = 0s$ $t_f =$

$x_i = 0m$ $x_f = 5.0m$

$y_i = 2.0m$ $y_f = 0m$

$V_{ix} =$ $V_{fx} =$

$V_{iy} = 0m/s$ $V_{fy} =$

$a_x = 0m/s^2$ $a_y = -9.8m/s^2$

$$y_f = y_i + V_{iy}\Delta t + \frac{1}{2} a_y (\Delta t)^2$$

$$0m = 2.0m + \cancel{0m/s\ \Delta t} + \frac{1}{2}(-9.80m/s^2)(\Delta t)^2$$

$$-2.0m = -4.90m/s^2(\Delta t)^2$$

$$(\Delta t)^2 = \frac{2.0m}{4.90m/s^2} = 0.41s^2 \Rightarrow \Delta t = \sqrt{0.41s^2} \Rightarrow \Delta t = 0.64s$$

b) $$x_f = \cancel{x_i}^{0} + V_{ix}\Delta t + \cancel{\frac{1}{2}a_x}^{0}(\Delta t)^2$$

$$5.0m = V_{ix}\, 0.64s$$

$$V_{ix} = \frac{5.0m}{0.64s} \Rightarrow V_{ix} = 7.8m/s$$