

PHYS 1050: Mechanics

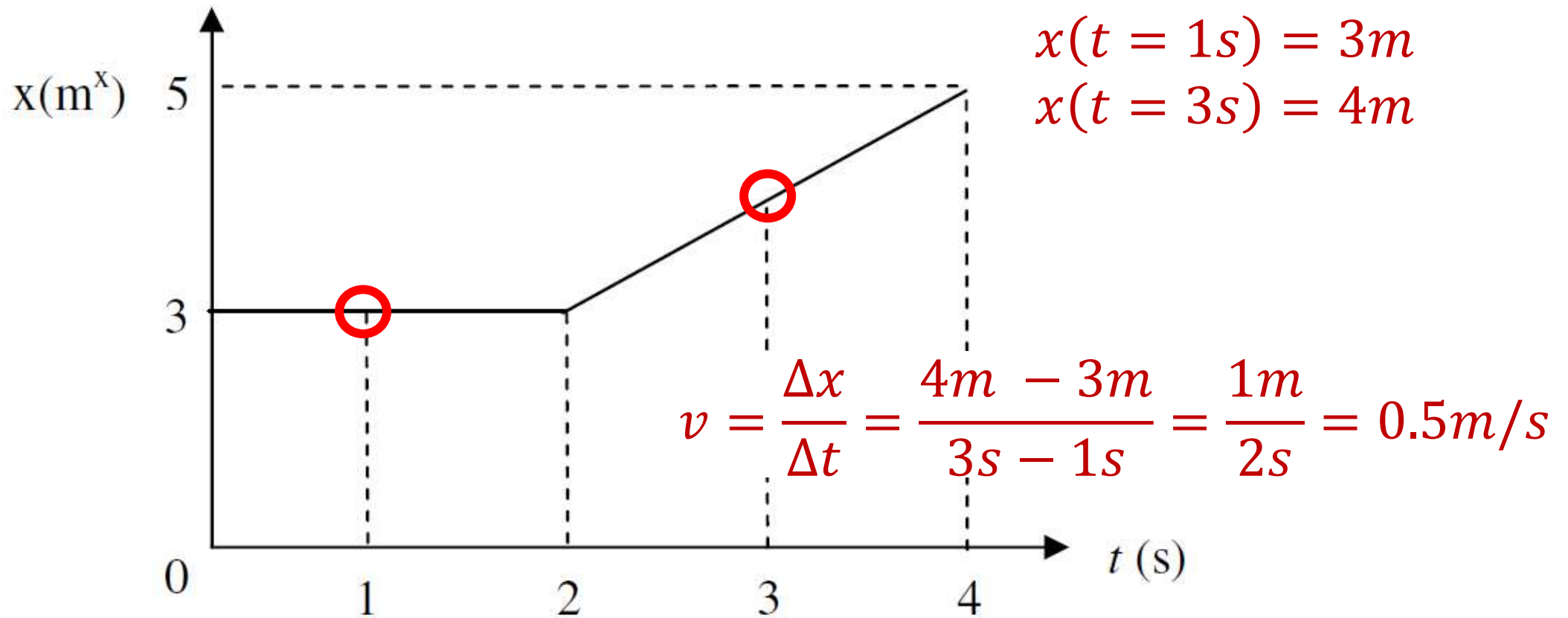
Tutorial 1

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Yutong Zhao

Department of Physics and Astronomy

University of Manitoba



The location of a particle moving along the x-axis is summarized in the accompanying graph. Using the latter, what is the average velocity of the particle between $t = 1s$ and $t = 3s$.

(a) 4 m/s

(b) 1.33 m/s

(c) -1.33 m/s

(d) 0.5 m/s

(e) none of these

$$v = x' = -4 + 2t = 0$$

$$t = 2s$$

The co-ordinate of an object moving along the x-axis is given by:

$$x = 6 - 4t + t^2$$

(where x is in meters and t in seconds). What is the position of this object when it is (instantaneously) at rest?

(a) 0 m

(b) 6 m

(c) 3 m

(d) 1 m

(e) 2 m

$$x = (6 - 4 \times 2 + 2 \times 2)m$$

$$x = 2m$$

$$x(t = 0s) = 7 \times 0 - 3 \times 0^2 = 0m$$

$$x(t = 4s) = 7 \times 4 - 3 \times 4^2 = -20m$$

The coordinate of an object is given as a function of time by $x = 7t - 3t^2$, where x is in meters and t is in seconds. Its average velocity over the interval from $t = 0$ to $t = 4$ s is:

(a) 5 m/s

(b) -5 m/s

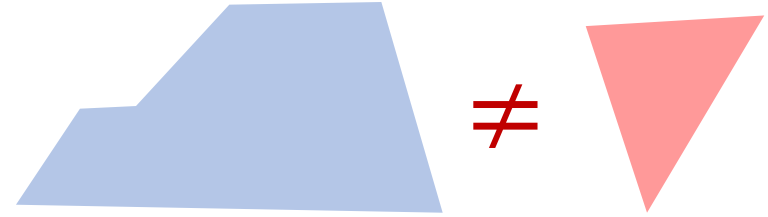
(c) 11 m/s

(d) -11 m/s

(e) -14.5 m/s

$$v = \frac{\Delta x}{\Delta t} = \frac{-20m - 0m}{4s - 0s} = -\frac{20m}{4s} = -5m/s$$

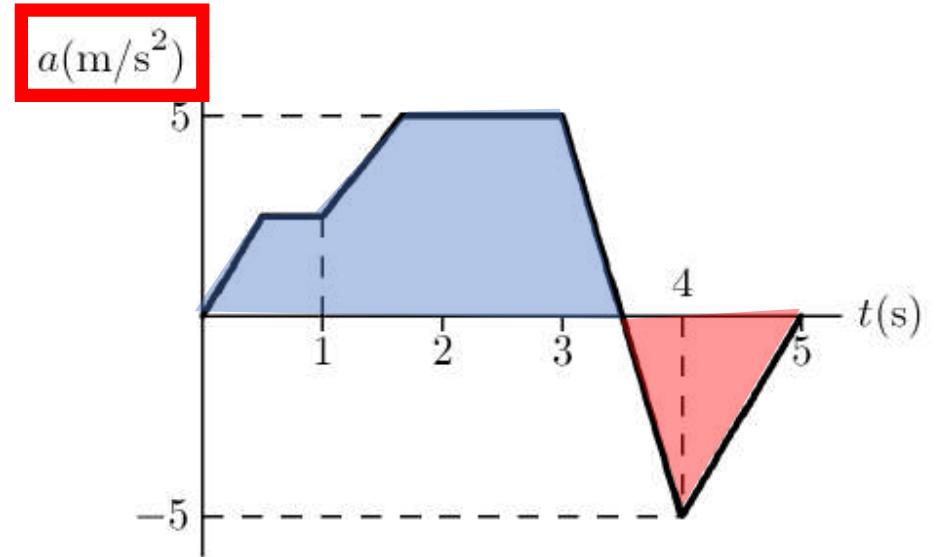
$$\Delta v = \text{area}[f(a)]$$



The acceleration of an object, starting from rest, is shown in the graph below. Other than at $t = 0$, when is the velocity of the object equal to zero?

- (a) During the interval from 1.0 s to 3.0 s
- (b) At $t = 3.5$ s
- (c) At $t = 4.0$ s
- (d) At $t = 5.0$ s

(e) At no other time less than or equal to 5 s



$$= \frac{1.5 \times 5}{2} = 3.75$$

$$> 1 \times 5 = 5$$

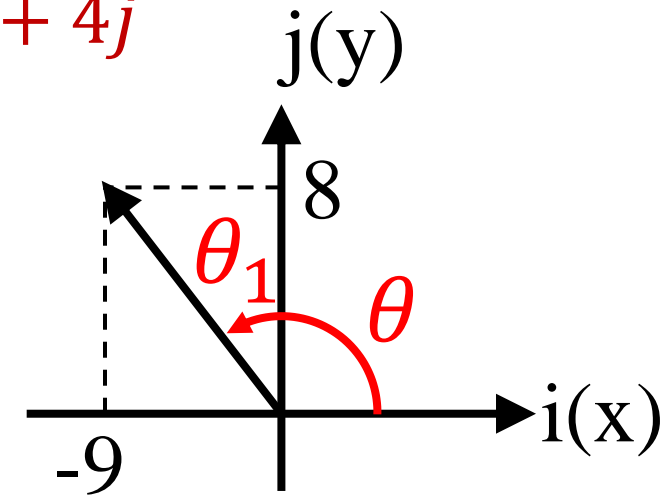
Given:

$$\vec{a} = 3\hat{i} + 4\hat{j}$$

$$\vec{b} = 6\hat{i} - 2\hat{j}$$

$$\begin{aligned}\vec{a} - 2\vec{b} &= 3i + 4j - 2 \times (6i - 2j) \\ &= (3i - 12i) + 4j + 4j \\ &= -9i + 8j\end{aligned}$$

$$\theta_1 = \arctan\left(\frac{9}{8}\right) \approx 48.4^\circ$$



The angle made by the vector $\vec{a} - 2\vec{b}$ (measured counterclockwise from the positive x-direction) is:

(a) 41.6°

(b) 48.4°

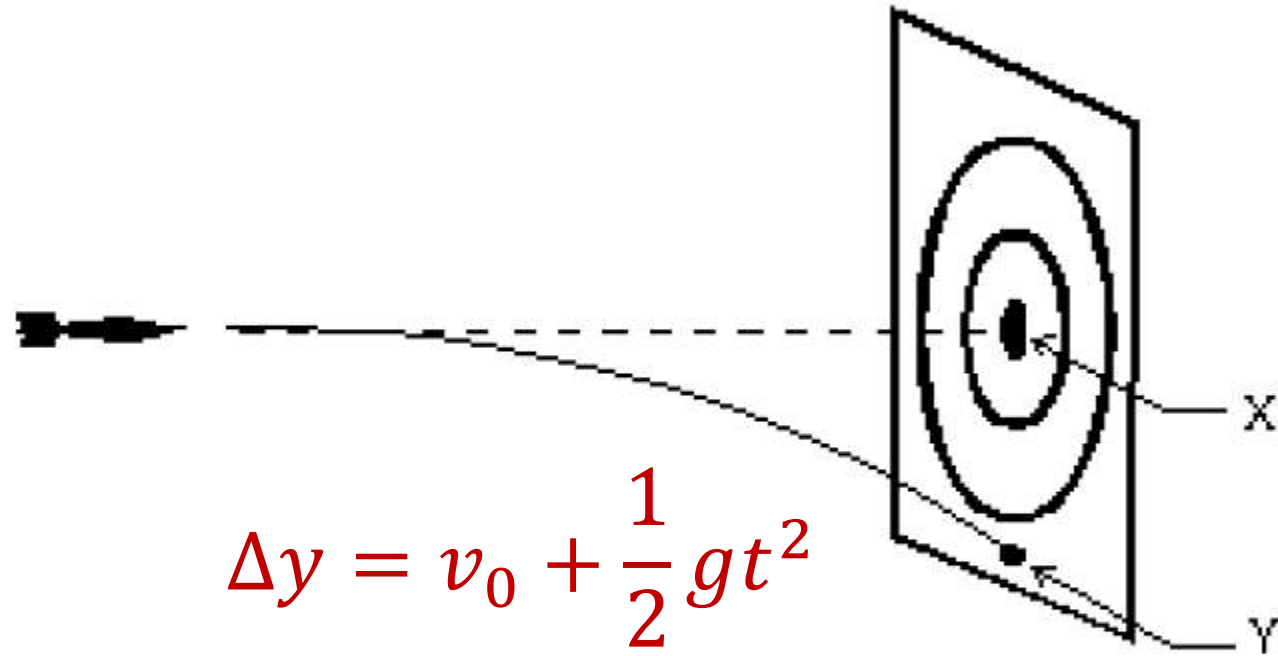
(c) 138.4°

(d) 131.6°

(e) none of these

$$\theta = \theta_1 + 90^\circ = 48.4^\circ + 90^\circ = 138.4^\circ$$

A dart is thrown horizontally toward ~~X~~ at 20 m/s as shown. It hits Y 0.1 s later. The distance XY is:



$$\Delta y = v_0 + \frac{1}{2}gt^2$$

$$= 0 + \frac{1}{2} \times 10 \times 0.1^2$$

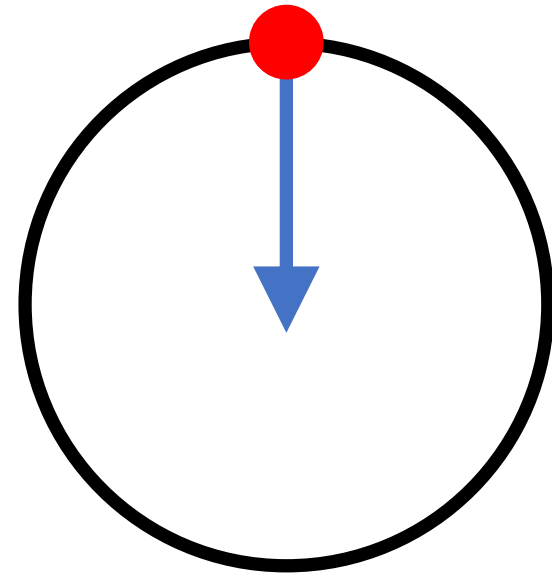
$$= 0.05m$$

- A) 2 m
- B) 1 m
- C) 0.5 m
- D) 0.1 m
- E) 0.05 m

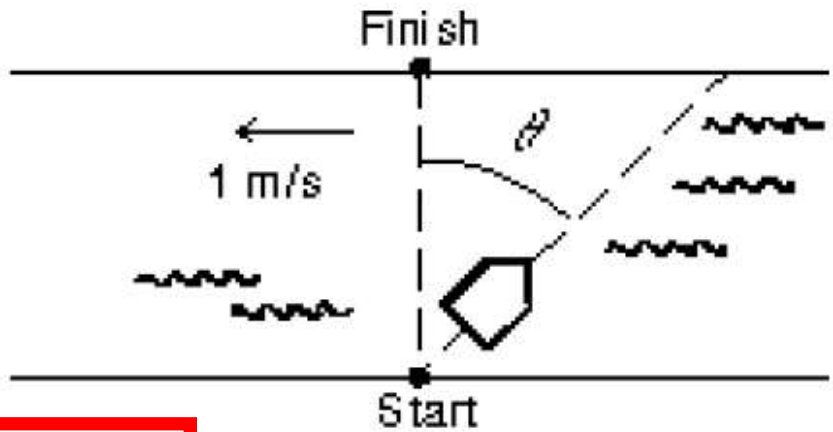
A stone is tied to a 0.50-m string and whirled at a constant speed of 4.0 m/s in ~~a vertical circle~~. Its acceleration at the top of the circle is:

- A) 9.8 m/s^2 , up
- B) 9.8 m/s^2 , down
- C) 8.0 m/s^2 , down
- D) 32 m/s^2 , up
- E) 32 m/s^2 , down

$$\begin{aligned} a &= \frac{v^2}{r} = \frac{(4.0 \text{ m/s})^2}{0.5 \text{ m}} \\ &= \frac{16}{0.5} \text{ m/s}^2 \\ &= 32 \text{ m/s}^2 \end{aligned}$$



A girl wishes to swim across a river to a point directly opposite as shown. She can swim at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ with respect to the line joining the starting and finishing points should she swim?



A) 30°

B) 45°

C) 60°

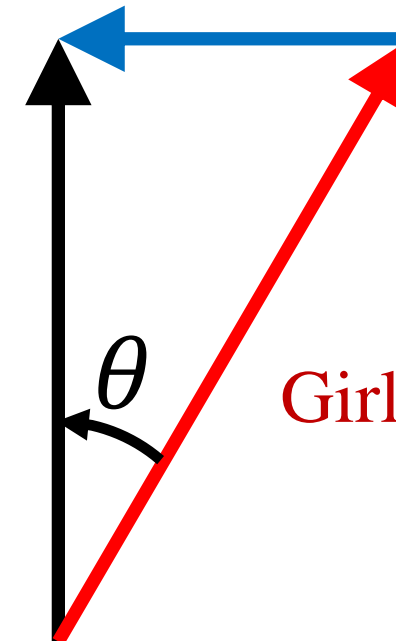
D) 63°

E) 90°

$$\theta = \arcsin\left(\frac{1}{2}\right) = 30^\circ$$

Net speed

River speed = 1 m/s



Girl speed = 2 m/s