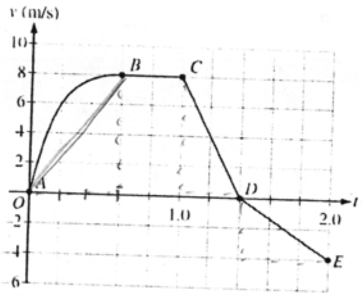
Questions 1-2 refer to the following information.



A cart is constrained to move along a straight line. A varying net force along the direction of motion is exerted on the cart. The cart's velocity v as a function of time t is shown in the graph above. The five labeled points divide the graph into four sections.

1. Which of the following correctly ranks the magnitude of the average acceleration of the cart during the four sections of the graph?

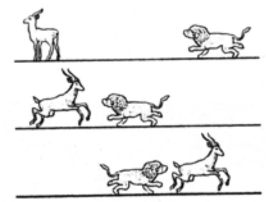
(A) $a_{CD} > a_{AB} > a_{BC} > a_{DE}$
(B) $a_{BC} > a_{AB} > a_{CD} > a_{DE}$
(C) $a_{AB} > a_{BC} > a_{DE} > a_{CD}$
(D) $a_{CD} > a_{AB} > a_{DE} > a_{BC}$

$\bar{a} = \frac{\Delta V}{\Delta t} = \text{Slope}$

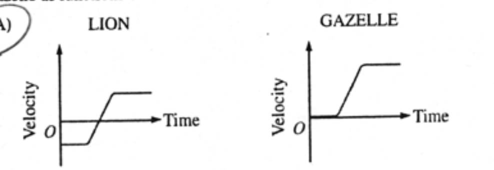
2. For which segment does the cart move the greatest distance?

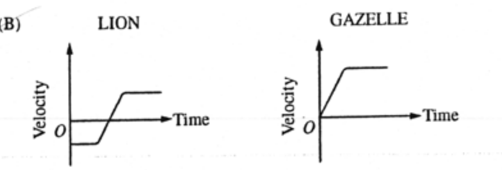
(A) AB
(B) BC
(C) CD
(D) DE

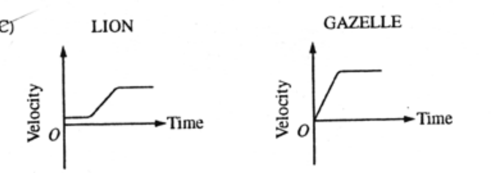
Area = displacement

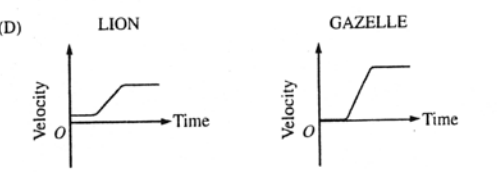


17. A lion is running at constant speed toward a gazelle that is standing still, as shown in the top figure above. After several seconds, the gazelle notices the lion and accelerates directly toward him, hoping to pass the lion and force him to reverse direction. As the gazelle accelerates toward and past the lion, the lion changes direction and accelerates in pursuit of the gazelle. The lion and the gazelle eventually each reach constant but different speeds. Which of the following sets of graphs shows a reasonable representation of the velocities of the lion and the gazelle as functions of time?

(A)


(B)


(C)


(D)


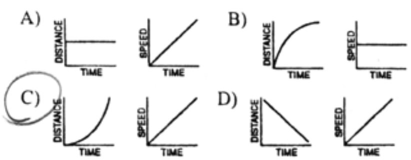
GO ON TO THE NEXT PAGE.

$$\Delta x = V_0 t + \frac{1}{2} a t^2$$

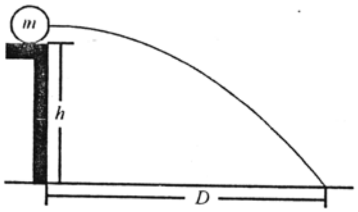
1) A car is traveling along a straight road with a velocity of 10 m/s. It begins to accelerate uniformly at time $t = 0$ and covers a distance of 300 m in 5 s. What is the magnitude of the acceleration?

A) 10 m/s² B) 12 m/s²
C) 20 m/s² D) 24 m/s²
E) 60 m/s²

2) Which pair of graphs represents the same 1-dimensional motion?



3) Base your answer to the following question on the following diagram, in which a ball of mass m is rolled horizontally off a table of height h and lands a distance D from the edge of the table.



$$V_{0x} = \frac{D}{\sqrt{\frac{2h}{g}}}$$

What is the initial horizontal velocity of the ball?

A) $\frac{D}{\sqrt{2h/g}}$ B) $D\sqrt{2h/g}$
C) $2Dh/g$ D) Dhg
E) $\frac{g}{Dh}$

x-axis

$$\Delta x = V_{0x} \cdot t$$

$$V_{0x} = \frac{\Delta x}{t}$$

$$V_{0x} = \frac{D}{t}$$

y-axis

$$\Delta y = \cancel{V_{0y}t} - \frac{1}{2} g t^2$$

$$\sqrt{\frac{2\Delta y}{-g}} = t$$

$$\sqrt{\frac{2h}{g}} = t$$

4) An object moving horizontally with speed v falls off the edge of a vertical cliff and lands a distance d from the base of the cliff. If it had landed a distance $2d$ from the base of the cliff, how fast would the object had to have been moving?

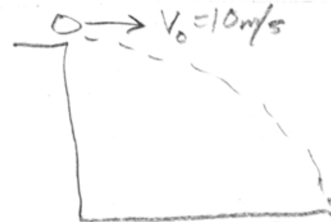
A) v
B) $\sqrt{2}v$
C) $2v$
D) $4v$
E) It cannot be determined unless the height of the cliff is known

$$\Delta x = V_{0x} \cdot t$$

$$d = v t$$

$$(2d) = (2v) t$$

Example 2.21 An object is thrown horizontally off a cliff with an initial speed of 10 m/s. How far will it drop in 4 seconds assuming it does not hit the ground first?



$\boxed{h = 80m}$

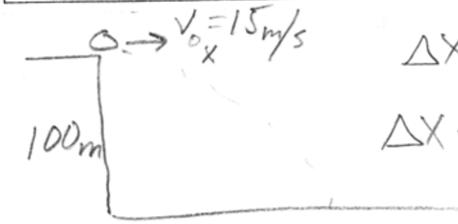
y-axis

$$V_{0y} = \emptyset$$

$$\Delta y = \cancel{V_{0y}t} - \frac{1}{2} g t^2$$

$$h = \frac{1}{2}(10)(4_s)^2 = \boxed{80m}$$

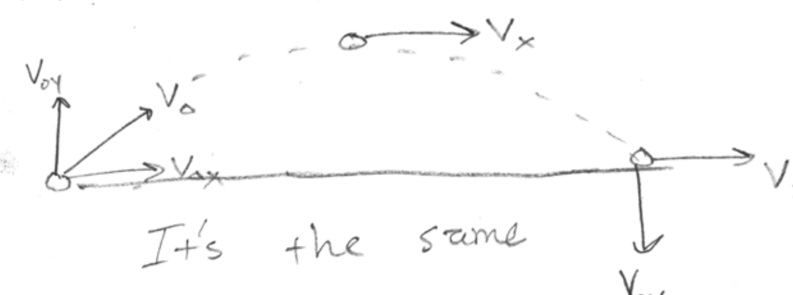
Example 2.22 From a height of 100 m, a ball is thrown horizontally with an initial speed of 15 m/s. How far does it travel horizontally in the first 2 seconds?



$$\Delta x = V_{0x} \cdot t$$

$$\Delta x = 15_{m/s}(2_s) = \boxed{30_m}$$

Example 2.23 A projectile is traveling in a parabolic path for a total of 6 seconds. How does its horizontal velocity 1 s after launch compare to its horizontal velocity 4 s after launch?



It's the same

$$a_x = \emptyset$$

$$V_{0x} = V_x \text{ (constant)}$$