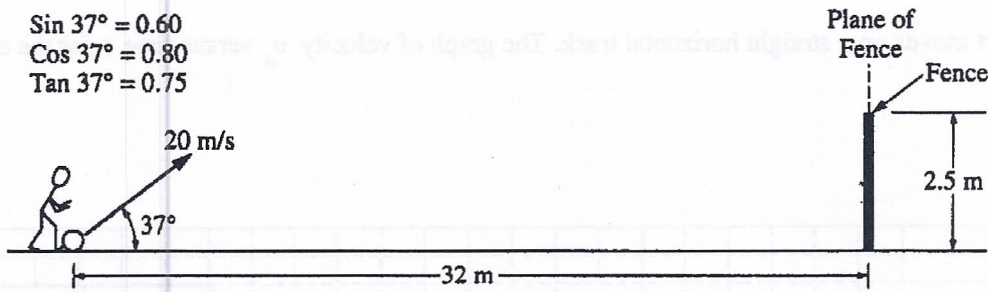


$$\begin{aligned}\sin 37^\circ &= 0.60 \\ \cos 37^\circ &= 0.80 \\ \tan 37^\circ &= 0.75\end{aligned}$$



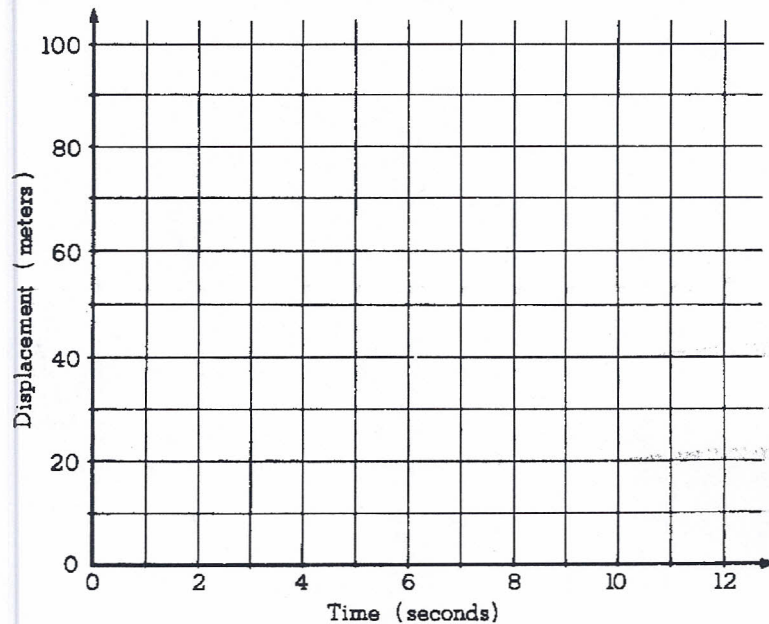
Note: Diagram not drawn to scale.

1. A ball of mass 0.5 kilogram, initially at rest, is kicked directly toward a fence from a point 32 meters away, as shown above. The velocity of the ball as it leaves the kicker's foot is 20 meters per second at an angle of 37° above the horizontal. The top of the fence is 2.5 meters high. The kicker's foot is in contact with the ball for 0.05 second. The ball hits nothing while in flight and air resistance is negligible.

- Determine the magnitude of the average net force exerted on the ball during the kick.
- Determine the time it takes for the ball to reach the plane of the fence.
- Will the ball hit the fence? If so, how far below the top of the fence will it hit? If not, how far above the top of the fence will it pass?

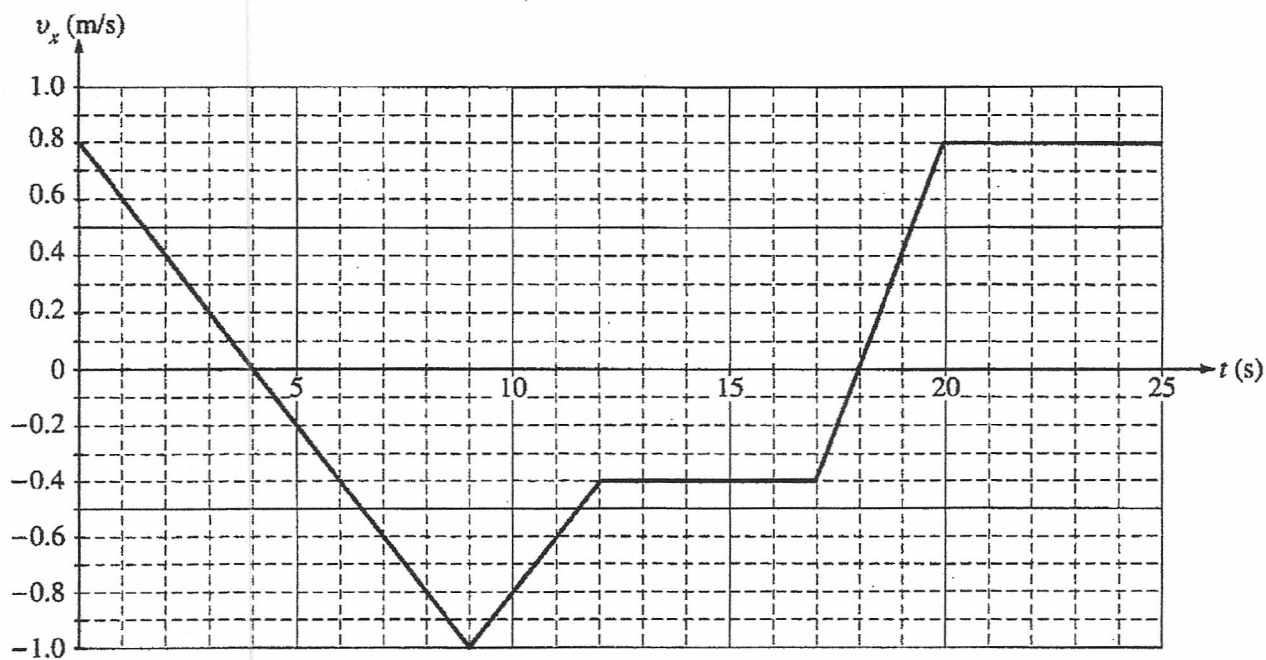
1. The first 10 meters of a 100-meter dash are covered in 2 seconds by a sprinter who starts from rest and accelerates with a constant acceleration. The remaining 90 meters are run with the same velocity the sprinter had after 2 seconds.

- Determine the sprinter's constant acceleration during the first 2 seconds.
- Determine the sprinter's velocity after 2 seconds have elapsed.
- Determine the total time needed to run the full 100 meters.
- On the axes provided below, draw the displacement vs. time curve for the sprinter.



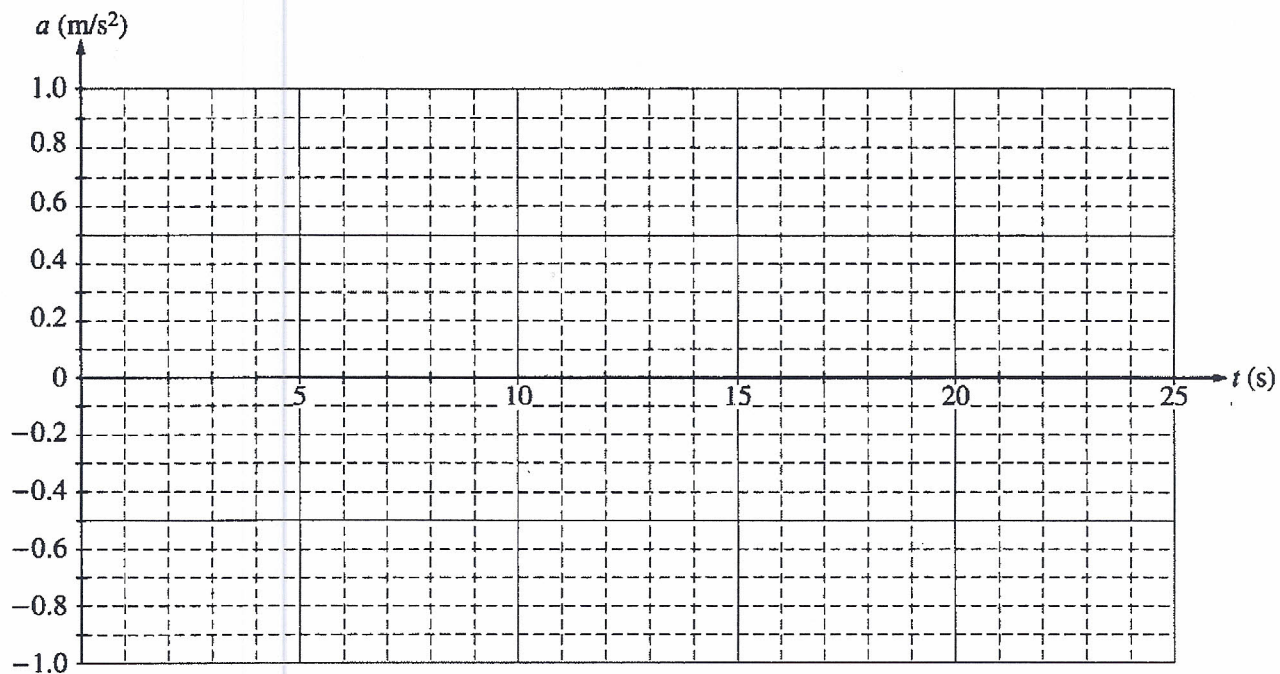
1. (15 points)

A 0.50 kg cart moves on a straight horizontal track. The graph of velocity v_x versus time t for the cart is given below.



- Indicate every time t for which the cart is at rest.
- Indicate every time interval for which the speed (magnitude of velocity) of the cart is increasing.
- Determine the horizontal position x of the cart at $t = 9.0$ s if the cart is located at $x = 2.0$ m at $t = 0$.

(d) On the axes below, sketch the acceleration a versus time t graph for the motion of the cart from $t = 0$ to $t = 25$ s.



- (e) From $t = 25$ s until the cart reaches the end of the track, the cart continues with constant horizontal velocity. The cart leaves the end of the track and hits the floor, which is 0.40 m below the track. Neglecting air resistance, determine each of the following.
- The time from when the cart leaves the track until it first hits the floor
 - The horizontal distance from the end of the track to the point at which the cart first hits the floor