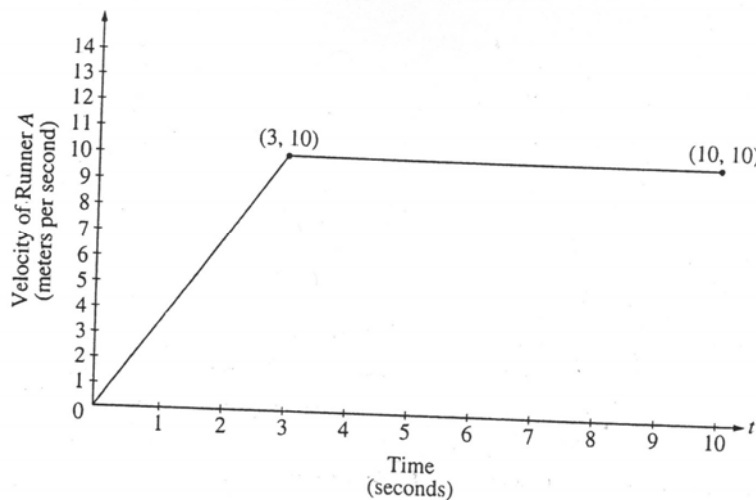


# MOTION, DISTANCE, & DISPLACEMENT

1. A particle, initially at rest, moves along the  $x$ -axis so that its acceleration at any time  $t \geq 0$  is given by  $a(t) = 12t^2 - 4$ . The position of the particle when  $t = 1$  is  $x(1) = 3$ .
- Find the values of  $t$  for which the particle is at rest.
  - Write an expression for the position  $x(t)$  of the particle at any time  $t \geq 0$ .
  - Find the total distance traveled by the particle from  $t = 0$  to  $t = 2$ .

2. A particle moves along the  $y$ -axis with velocity given by  $v(t) = t \sin(t^2)$  for  $t \geq 0$ .
- In which direction (up or down) is the particle moving at time  $t = 1.5$ ? Why?
  - Find the acceleration of the particle at time  $t = 1.5$ . Is the velocity of the particle increasing at  $t = 1.5$ ? Why or why not?
  - Given that  $y(t)$  is the position of the particle at time  $t$  and that  $y(0) = 3$ , find  $y(2)$ .
  - Find the total distance traveled by the particle from  $t = 0$  to  $t = 2$ .

- A particle moves along the  $x$ -axis so that its acceleration at any time  $t$  is given by  $a(t) = 6t - 18$ . At time  $t = 0$  the velocity of the particle is  $v(0) = 24$ , and at time  $t = 1$  its position is  $x(1) = 20$ .
- Write an expression for the velocity  $v(t)$  of the particle at any time  $t$ .
  - For what values of  $t$  is the particle at rest?
  - Write an expression for the position  $x(t)$  of the particle at any time  $t$ .
  - Find the total distance traveled by the particle from  $t = 1$  to  $t = 3$ .



Two runners,  $A$  and  $B$ , run on a straight racetrack for  $0 \leq t \leq 10$  seconds. The graph above, which consists of two line segments, shows the velocity, in meters per second, of Runner  $A$ . The velocity, in meters per second, of Runner  $B$  is given by the function  $v$  defined by  $v(t) = \frac{24t}{2t + 3}$ .

- Find the velocity of Runner  $A$  and the velocity of Runner  $B$  at time  $t = 2$  seconds. Indicate units of measure.
- Find the acceleration of Runner  $A$  and the acceleration of Runner  $B$  at time  $t = 2$  seconds. Indicate units of measure.
- Find the total distance run by Runner  $A$  and the total distance run by Runner  $B$  over the time interval  $0 \leq t \leq 10$  seconds. Indicate units of measure.