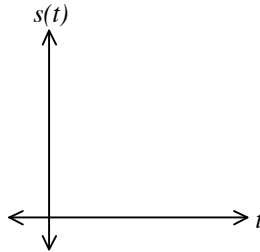


## Rectilinear Motion

1. An object is tossed vertically from the ground such that its height in feet above the ground after  $t$  seconds is given by  $s(t) = -16t^2 + 96t$ .

- a) Complete the table of values and make a rough sketch of the graph  $s(t)$ .      b) Find the average velocity from  $t = 0$  to  $t = 3$ .

$t$	$s(t)$
0	
1	
2	
3	



c) Find the *instantaneous velocity* at  $t = 2$ .

d) Find the *acceleration* at  $t = 2$ .

**Definition:** If  $s(t)$  is the position function of a particle moving on a coordinate line, then the **instantaneous velocity** at time  $t$  is defined by

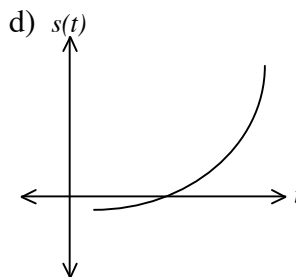
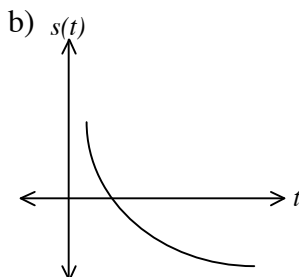
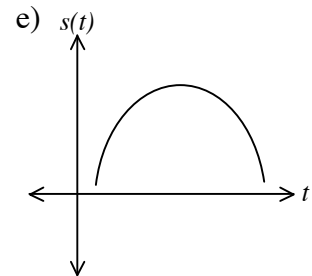
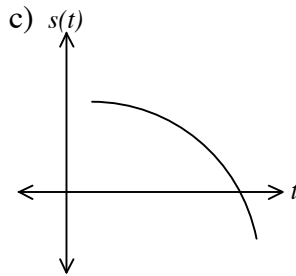
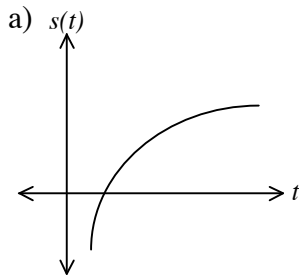
$$v(t) = s'(t) = \frac{ds}{dt} \text{ and the } \mathbf{\textit{instantaneous speed}}$$

at time  $t$  is defined by  $|v(t)| = |s'(t)| = \left| \frac{ds}{dt} \right|$ .

**Definition:** If  $v(t)$  is the instantaneous velocity at time  $t$  of a particle moving on a coordinate line, then the **instantaneous acceleration** at time  $t$  is defined

$$\text{by } a(t) = v'(t) = \frac{dv}{dt} \text{ or } a(t) = s''(t) = \frac{d^2s}{dt^2}.$$

2. Let  $s(t)$  be the position function of a particle moving on a coordinate line. Determine the sign of  $v(t)$  and  $a(t)$  for all  $t$ .



3. Let  $s(t) = t^4 - 8t^2$  be the position function of a particle moving on a coordinate line, where  $t$  is in seconds and  $s$  is in feet. Find the velocity and acceleration of the particle at times  $t = 1$ ,  $t = 2$ , and  $t = 3$ .
4. The position function of a particle moving on a coordinate line is given by  $s(t) = 2t^3 - 21t^2 + 60t + 3$ , where  $s$  is in feet and  $t$  is in seconds. Describe the motion of the particle for  $t \geq 0$ .