

Rectilinear Motion

$s(t)$ position

$s'(t) = v(t)$ vel

$v'(t) = a(t)$

$v(t) > 0$ up/right

$v(t) < 0$ down/left

$v(t) = 0$ rest

$v(t)$ changes sign —
change in direct.

gravity

Max ht

$$v(t) = 0 \rightarrow t = \star$$

$$s(\star) = \max ht$$

Vel at impact

$$s(t) = 0 \rightarrow t = \Delta$$

$$v(\Delta) = \text{vel impact}$$

$$\text{speed} = |v|$$

- $v > 0 \quad a > 0 \quad \text{vel} \uparrow \quad \text{speed} \uparrow$
 $v > 0 \quad a < 0 \quad \text{vel} \downarrow \quad \text{speed} \downarrow$
 $v < 0 \quad a > 0 \quad \text{vel} \uparrow \quad \text{speed} \downarrow$
- $v < 0 \quad a < 0 \quad \text{vel} \downarrow \quad \text{speed} \uparrow$

$$s(t) = 2t^3 - 4t^2 + 2t - 1, \quad t \geq 0$$

$$v(t) = 6t^2 - 8t + 2$$

$$v(t) = 0 \rightarrow t = \frac{1}{3} \text{ or } t = 1$$

Part moves right on $(0, \frac{1}{3}) \cup (1, \infty)$

because $v(t) > 0$ on $(0, \frac{1}{3}) \cup (1, \infty)$.

Part moves left on $(\frac{1}{3}, 1)$ because $v(t) < 0$ on $(\frac{1}{3}, 1)$.



Part changes dir. at $t = \frac{1}{3}$ because
 $v(t) > 0$ on $(0, \frac{1}{3})$ and $v(t) < 0$ on $(\frac{1}{3}, 1)$.

Part changes dir. at $t = 1$ because
 $v(t) < 0$ on $(\frac{1}{3}, 1)$ and $v(t) > 0$ on $(1, \infty)$.

$$s(t) = -16t^2 + 64t + 100$$

$$v(t) = -32t + 64$$

Max ht

$$v(t) = 0 \rightarrow t = 2$$

$$s(2) = 164$$

$\therefore$ max ht is 164 feet.



Vel at impact

$$s(t) = 0 \rightarrow t = -1.202 \text{ or } t = 5.202$$

$$v(5.202) = -102.450$$

$\therefore$ vel at ground is 102.450 ft/sec down.

$$y^2 = d(y_1(x), x)$$

2nd 8