Rectilinear Motion

$s(t)$ position

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

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

$v(t) > 0$ up / right

$v(t) < 0$ down / left

$v(t) = 0$ rest

$v(t)$ must change sign for a change in direct.

gravity

Max height

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

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

Vel at impact

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

$v(t) =$ vel at impact

speed $= |v|$

- $v > 0$ $a > 0$ vel ↑ speed ↑
  $v > 0$ $a < 0$ vel ↓ speed ↓
  $v < 0$ $a > 0$ vel ↑ speed ↓
- $v < 0$ $a < 0$ vel ↓ speed ↑

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

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

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

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 $(1, \infty)$.

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

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

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

Max ht

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

$s(2) = 164$

∴ max ht is 164 feet.

Vel at ground

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

$v(5.202) = -102.450$

∴ vel at ground is 102.450 ft/sec downward