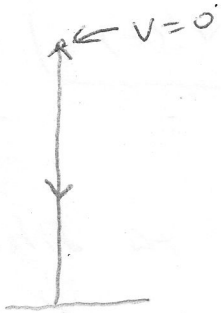
A dynamite blast propels a heavy rock straight up w/ a launch velocity of 160 ft/s. It reaches a height of $s = 160t - 16t^2$

a) How high does the rock go?

b) what is the velocity and speed of the rock when it is 256 ft above the ground on the way up? on the way down?

c) what is the acceleration of the rock at any time t during its flight?

d) when does the rock hit the ground.



a) Abs max of s function ($v = 0$)

$s(t) = 160t - 16t^2$

$v(t) = s'(t) = 160 - 32t = 0$

$32t = 160$

$t = 5$

$160(5) - 16(5)^2 = 400$ ft

b) $256 = 160t - 16t^2$

$16t^2 - 160t + 256 = 0$

$16(t^2 - 10t + 16) = 0$

$16(t-8)(t-2) = 0$

$t = 8, t = 2$

on way up $t = 2$

$v(t) = 160 - 32t$

$v(2) = 160 - 32(2)$

$= 160 - 64$

$= 96$ ft/s

on way down $t = 8$

$v(8) = 160 - 32(8)$

$= -96$ ft/s

speed = 96 ft/s in both cases

(extra examples)

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

$a(t) = -32 \text{ ft/s}^2$ always negative or downward b/c when rock is rising it is slowing down when rock is falling it is speeding up

d) $s = 160t - 16t^2$

$0 = 160t - 16t^2$

$0 = 16t(10 - t)$

$t = 0$ or $t = 10s$

Ex. 5 orange book p. 131

Ex 2: A particle moves along a line so that its position @ any time $t \geq 0$ is given by the function

$s(t) = t^2 - 4t + 3$ where s is in meters and t in sec.

a) Find the displacement of the particle during the first 2 seconds.

b) Find the average velocity of the particle during the first 4 seconds.

c) Find the instantaneous velocity of the particle when $t = 4$.

d) Find the acceleration of the particle when $t = 4$.

e) Describe the motion of the particle. At what values of t does the particle change direction?

a) $s(t) = t^2 - 4t + 3$ ——— particle moves along a line

$s(0) = 0 - 0 + 3 = 3$

$s(2) = 4 - 8 + 3 = -1$

displacement $= \Delta s = s(2) - s(0) = -1 - 3 = -4$ → neg means that the particle is 4 units to the left of where it started

(over interval)

$v_{av} = \dfrac{\text{displacement}}{\Delta t}$

$s(4) = 4^2 - 4(4) + 3 = 3$

$v_{av} = \dfrac{s(4) - s(0)}{4 - 0} = \dfrac{3 - 3}{4} = \dfrac{0}{4} = 0 \text{ m/s}$

c) $v(t) = s'(t) = 2t - 4$

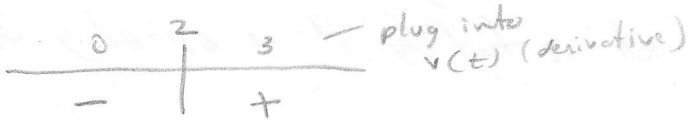
$v(4) = 2(4) - 4 = 4 \text{ m/s}$

d) $a(t) = v'(t) = s''(t) = 2 \text{ m/s}$

e) $v(t) = 2t - 4$

$0 = 2t - 4$

$t = 2$



For $0 \le t \le 2$ particle is moving to the left (s is decreasing)

$t \ge 2$ " " " " " " right (s is increasing)

The particle changes direction at $t = 2$ when $v = 0$