

1) Non- Graphing Calculator: A particle is moving with its position defined by

$$s(t) = t^3 - \frac{13}{2}t^2 - 10t + 10 \text{ where } t \text{ is in seconds and } s(t) \text{ is in feet.}$$

- a) What are the particle's velocity and acceleration functions?
- b) What are the position, velocity, and acceleration of the particle at 4 seconds?
- c) What is the displacement and total distance traveled by the particle in the first 4 seconds?
- d) What is the displacement and total distance traveled by the particle in the first 8 seconds?

a)

$$v(t) = 3t^2 - 13t - 10$$

$$a(t) = 6t - 13$$

b)

$$s(4) = (4)^3 - \frac{13}{2}(4)^2 - 10(4) + 10$$

$$s(4) = -70 \text{ ft}$$

$$v(4) = 3(4)^2 - 13(4) - 10$$

$$v(4) = -14 \text{ ft/sec}$$

$$a(4) = 6(4) - 13$$

$$a(4) = 11 \text{ ft/sec}^2$$

c & d) Start

$$s(0) = 10 \text{ ft}$$

turn around

$$v(t) = 0$$

$$0 = 3t^2 - 13t - 10$$

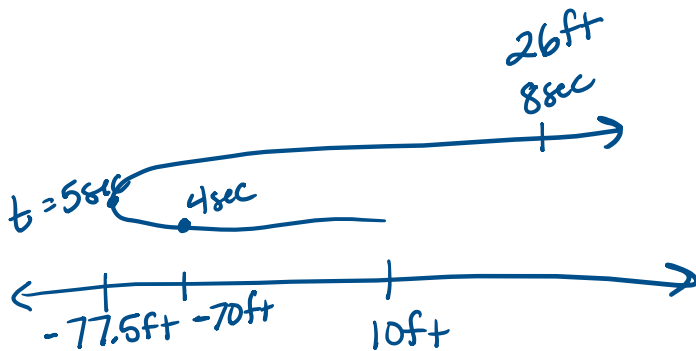
$$0 = (3t + 2)(t - 5)$$

$\underbrace{\quad + 2t \quad}_{-15t}$

$$t = -\frac{2}{3} \quad t = 5$$

no neg. time

$$s(5) = -77.5 \text{ ft}$$



Distance after 4 sec.

$$|10 - (-70)| = 80 \text{ ft}$$

Displacement after 4 sec

$$|10 - (-70)| = 80 \text{ ft to the left of where you started}$$

d) After 8 seconds

$$s(8) = 26 \text{ ft}$$

$$|10 - (-77.5)| + |(-77.5) - 26|$$

$$87.5 + 103.5 = 191 \text{ ft}$$

2) **Calculator:** The position (feet) at any time t (seconds) of a moving body moving along a line is given by $s(t) = t^3 - 6t^2 + 9t + 5$.

- What are the velocity and acceleration function?
- What is the velocity of the particle when its position is 8 feet?
- What is the position of the particle when the acceleration is 3.5 feet per sec²?
- Find the displacement & the total distance traveled in the first 4 seconds.

$$v(t) = 3t^2 - 12t + 9$$

$$a(t) = 6t - 12$$

$$c) a(t) = 3.5$$

$$3.5 = 6t - 12$$

$$\frac{15.5}{6} = \frac{6t}{6}$$

$$t = 2.583$$

$$s(2.583) = 5.449 \text{ ft}$$

$$b) s(t) = 8$$

$$8 = t^3 - 6t^2 + 9t + 5$$

2nd trace - "calc"
intersection

$$t = .468$$

$$t = 1.653$$

$$t = 3.879$$

$$v(.468) = 4.041 \text{ ft/sec}$$

$$v(1.653) = -2.639 \text{ ft/sec}$$

$$v(3.879) = 7.592 \text{ ft/sec}$$

d) start

$$s(0) = 5 \text{ ft}$$

turn arounds

$$v(t) = 0$$

zeros in calc
or factorable

$$t = 1 \text{ sec}$$

$$t = 3 \text{ sec}$$

$$s(1) = 9 \text{ ft}$$

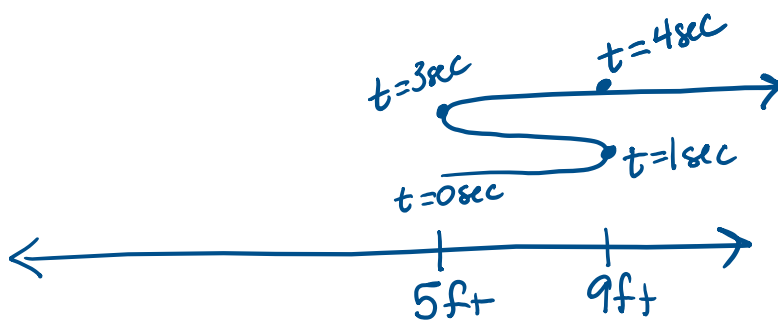
$$s(3) = 5 \text{ ft}$$

First 4 seconds so...

$$s(4) = 9 \text{ ft}$$

Displacement
start & end

$$|9 - 5| = 4 \text{ ft to the right}$$



Distance

$$\begin{array}{ccccccc} |5-9| & + & |9-5| & + & |5-9| & & \\ 4 & + & 4 & + & 4 & = & 12 \text{ feet} \end{array}$$

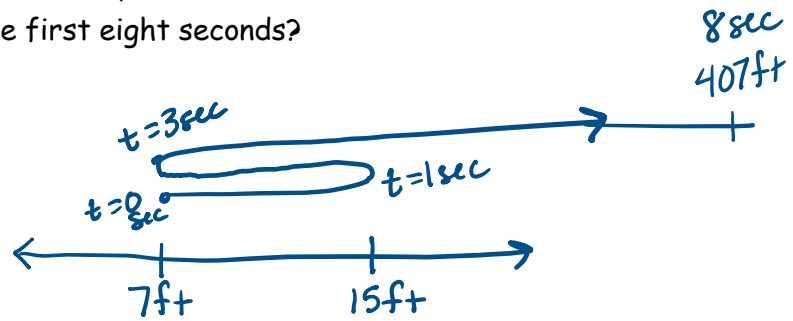
1) **Non-Graphing Calculator:** A particle is moving with its position defined by

$$s(t) = 2t^3 - 12t^2 + 18t + 7 \quad \text{where } t \text{ is in seconds and } s \text{ is in feet.}$$

- What are the particle's velocity and acceleration functions?
- What is the total distance traveled by the particle in the first three seconds?
- What is the displacement of the particle after the first eight seconds?

$$v(t) = 6t^2 - 24t + 18$$

$$a(t) = 12t - 24$$



b) Start

$$s(0) = 7ft$$

turn around

$$v(t) = 0$$

$$0 = 6t^2 - 24t + 18$$

$$0 = 6(t^2 - 4t + 3)$$

$$0 = 6(t-3)(t-1)$$

$$t = 3 \quad t = 1$$

$$s(1) = 15ft$$

$$s(3) = 7ft$$

Distance in 3sec

$$|7-15| + |15-7|$$

$$8 + 8 = 16ft$$

(Note Displacement is 0ft)

c) Distance in 8sec

$$s(8) = 407ft$$

$$|7-15| + |15-7| + |7-407| = 8 + 8 + 400 = 416ft$$

2) **Non-Graphing Calc:** A coin is dropped from a building that is 1,296 feet in height. Time is in seconds.

- What are the silver dollar's height, velocity and acceleration functions?
- When does the silver dollar hit the ground and what is its impact velocity?
- How far does the silver dollar travel between 1 and 2 seconds?

$$h(t) = -16t^2 + 0t + 1296$$

$$h(t) = -16t^2 + 1296$$

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

$$a(t) = -32$$

b) Hit the ground?

$$h(t) = 0$$

$$0 = -16t^2 + 1296$$

$$0 = -16(t^2 - 81)$$

$$t = 9sec \quad t = -9$$

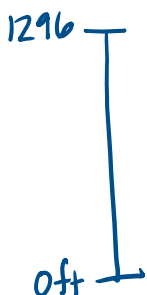
no neg time

$$v(9) = -32(9)$$

$$v(9) = -288 ft/sec$$

Impact Velocity

c) start



$$h(1) = 1280ft$$

$$h(2) = 1232$$

$$|1280 - 1232|$$

$$48ft$$

3) **Graphing Calc:** The displacement in feet of a body moving along a line at any time t in seconds is given by $s(t) = \frac{4}{3}t^3 - 7t^2 - 8t + 4$.

- a) What are the velocity and acceleration functions?
 b) Find the total distance traveled in the first 5 seconds.
 c) What is the velocity of the body when the position is 8 feet?

$$v(t) = 4t^2 - 14t - 8$$

$$a(t) = 8t - 14$$

b) Start

$$s(0) = 4 \text{ ft}$$

turn arounds

$$v(t) = 0$$

$$0 = 4t^2 - 14t - 8$$

Zeros in calculator

$$t = 4 \text{ sec}$$

$$s(4) = -54.667 \text{ ft}$$

at 5 sec

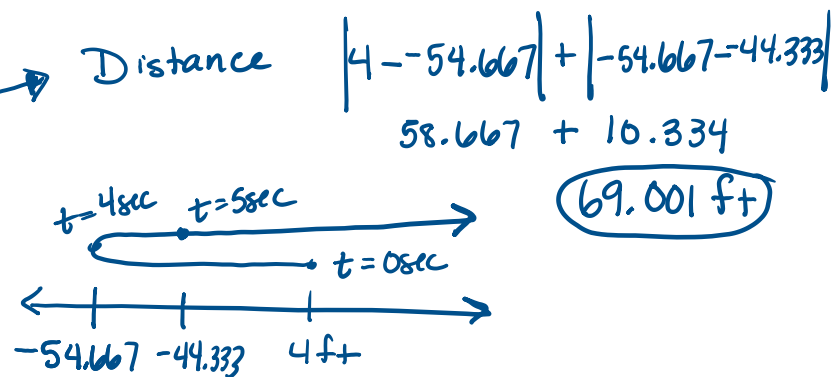
$$s(5) = -44.333 \text{ ft}$$

$$c) s(t) = 8$$

intersection in calculator

$$t = 6.28 \text{ sec}$$

$$v(6.281) = 61.87 \text{ ft/sec}$$



4) **Graphing Calc:** A marble is thrown straight down from the top of a 220-foot building. Its initial velocity was 22 feet per second.

- a) What are the marble's height, velocity, and acceleration functions?
 b) When does the marble hit the ground and what is its impact velocity?
 c) What are the velocity and position at three seconds?
 d) What is its velocity after falling 108 feet?

$$h(t) = -16t^2 - 22t + 220$$

$$v(t) = -32t - 22$$

$$a(t) = -32$$

b) Hit the ground?

$$h(t) = 0$$

Zeros in calc

$$t = 3.084$$

$$v(3.084) = -120.688 \text{ ft/sec}$$

$$c) v(3) = -118 \text{ ft/sec}$$

$$h(3) = 10 \text{ ft}$$

d) falling 108 ft

start at 220

$$-108$$

$$\hline 112 \text{ ft}$$

New Position

$$h(t) = 112$$

$$t = 2 \text{ sec}$$

$$v(2) = -86 \text{ ft/sec}$$

5) **Graphing Calc:** An object has its position defined by $s(t) = t^3 - 8t^2 + 5t + 2$ in feet. Time is in seconds.

- What are the velocity and acceleration functions?
- What is the total distance traveled by the object during the first eight seconds?
- What is the displacement of the object after the first eight seconds?
- What is the position when the velocity is 3.1 feet per second?
- What is the velocity when the acceleration is -2.7 feet per second²?

$$v(t) = 3t^2 - 16t + 5$$

$$a(t) = 6t - 16$$

b) start

$$s(0) = 2 \text{ ft}$$

turn around

$$v(t) = 0$$

zeros in calc

$$t = .333 \quad s(.333) = 2.815 \text{ ft}$$

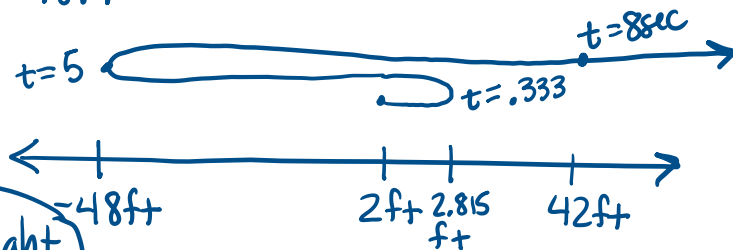
$$t = 5 \quad s(5) = -48 \text{ ft}$$

first 8 seconds

$$s(8) = 42 \text{ ft}$$

c) Displacement

$$|42 - 2| = 40 \text{ ft to the right}$$



$$d) v(t) = 3.1$$

$$t = .122 \text{ sec}$$

$$t = 5.212 \text{ sec}$$

$$s(.122) = 2.493 \text{ ft}$$

$$s(5.212) = -47.676 \text{ ft}$$

$$e) a(t) = -2.7$$

$$-2.7 = 6t - 16$$

$$t = 2.217$$

$$v(2.217) = -15.727 \frac{\text{ft}}{\text{sec}}$$

Distance

$$|2 - 2.815| + |2.815 - 48| + |-48 - 42|$$

$$.815 + 50.815 + 90$$

$$141.63 \text{ ft}$$

6) **Non-Graphing Calculator:** A bag of sugar is launched vertically upward from a height of 160 feet with an initial velocity of 48 feet per seconds.

- What are the bag's height, velocity, and acceleration functions?
- What is the position of the bag when the velocity is -16 feet per second?
- When will the bag hit the ground? What is its impact velocity?
- When will the bag reach its maximum height? What is its maximum height?
- What is the velocity of the bag the second time the bag is 160 feet above the ground?

$$h(t) = -16t^2 + 48t + 160$$

$$v(t) = -32t + 48$$

$$a(t) = -32$$

$$b) v(t) = -16$$

$$-16 = -32t + 48$$

$$-64 = -32t$$

$$t = 2 \text{ sec} \quad h(2) = 192 \text{ ft}$$

c) Hit the ground?

$$h(t) = 0$$

$$0 = -16t^2 + 48t + 160$$

$$0 = -16(t^2 - 3t - 10)$$

$$0 = -16(t - 5)(t + 2)$$

$$t = 5 \quad t = -2$$

$$v(5) = -32(5) + 48$$

$$v(5) = -112 \text{ ft/sec}$$

d) Max Height?

$$v(t) = 0$$

$$0 = -32t + 48$$

$$\frac{-48}{-32} = \frac{-32t}{-32}$$

$$1.5 = t$$

$$t = 1.5 \text{ sec}$$

$$h(1.5) = -16(1.5)^2 + 48(1.5) + 160$$

$$h(1.5) = 196 \text{ ft}$$

e) $h(t) = 160$

$$160 = -16t^2 + 48t + 160$$

$$0 = -16t^2 + 48t$$

$$0 = -16t(t - 3)$$

$$t = 0 \quad t = 3 \text{ sec}$$

$$v(3) = -48 \frac{\text{ft}}{\text{sec}}$$