

Instantaneous velocity, $v(t)$, of the object is the derivative of the position function $s(t)$ with respect to time

Acceleration, $a(t)$, is the derivative of velocity with respect to time

AVERAGE rate of change of $f(x)$ from a to b = slope of secant = $\frac{f(b) - f(a)}{b - a}$

INSTANTANEOUS rate of change of $f(x)$ at $x = c$ = slope of tangent = $f'(c)$

Speed = |velocity|

Displacement = how far you are from where you started

Distance = total amount you have traveled

Ex) If I travel 10 feet to the right and then turn around and travel 3 feet back to the left, my distance is 13 feet but my displacement is 7 feet.

Speed is **increasing** when velocity and acceleration have the **same** sign.

Speed is **decreasing** when velocity and acceleration have **opposite** signs.

Particle Motion

Particle motion (linear motion) describes the object moving along a line (usually along a horizontal line)

$x(t)$ = Position function

$v(t)$ = velocity function

$a(t)$ = acceleration function

Positive velocity indicates _____

Negative velocity indicates _____

When $v(t) = 0$, this indicates _____

A.P. Calculus PVA**Worksheet 2.2a**

A ball is thrown vertically upwards from the edge of a building and it eventually hits the ground next to the building. If the height of the ball at any given time, $t \geq 0$ (seconds), is

$h(t) = -16t^2 + 64t + 80$ (feet), answer the following:

1. Sketch a diagram and label values at important places

2. How tall is the building?

3. When does the ball reach maximum height?

4. What is the maximum height?

5. How long does it take to hit the ground?

6. What was the initial velocity?

7. What is the velocity at $t = 1$ second? At $t = 2$ seconds?

8. What is the height at $t = 3$ seconds?

9. What is the speed when it hits the ground?

10. What is the acceleration at $t = 1$ second? At $t = 2$ seconds?

11. Find the average velocity in $[0, 2]$

12. Find the average acceleration in $[1, 2]$

13. Is the speed increasing or decreasing at $t = 1$ seconds?

14. Is the velocity increasing or decreasing at $t = 3$ seconds?