

# PHYSICS AND CALCULUS

## DISPLACEMENT

The amount of change in position of an object.

Displacement = position at time a minus position at time b.

$$\Delta s$$
$$s(t_b) - s(t_a)$$

## AVERAGE VELOCITY

The average rate of change over a specific change in time.

This is the slope of the secant line, NOT the tangent line. "rise over run"

$$\frac{\text{displacement}}{\text{travel time}} = \frac{\Delta s}{\Delta t}$$

$$\frac{s(t_b) - s(t_a)}{t_b - t_a}$$

## SPEEDING UP OR SLOWING DOWN

When  $a(t)$  and  $v(t)$  have the same sign, then the object is speeding up.

$$a(t) > 0 \ \& \ v(t) > 0$$
$$a(t) < 0 \ \& \ v(t) < 0$$

When  $a(t)$  and  $v(t)$  have different signs, then the object is slowing down.

$$a(t) > 0 \ \& \ v(t) < 0$$
$$a(t) < 0 \ \& \ v(t) > 0$$

## CHANGING DIRECTION

An object changes direction when its velocity switches signs. Look at the zeros of  $v(t)/s'(t)$ .

$v(t) < 0$  to  $v(t) > 0$   
Object moves left/down to right/up

$v(t) > 0$  to  $v(t) < 0$   
Object moves right/up to left/down