Objectives:

Students will understand the basic concepts of one-dimensional motion

Students will be able to describe the differences between displacement, velocity, and acceleration

Students will be able to solve physics problems involving displacement, velocity, and acceleration

What is 1-D motion?

Motion in a straight line:

+ / - values:

+ : one direction

− : the other

Frame of reference:

Where is position ∅?

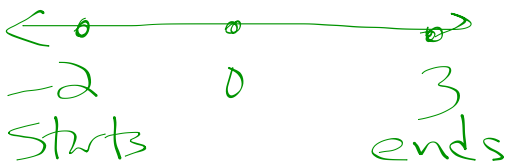
Which direction is positive?

Displacement:

- Measures how far something goes and in what direction (vector quantity)

$d = x - x_0 = \boxed{\Delta x}$

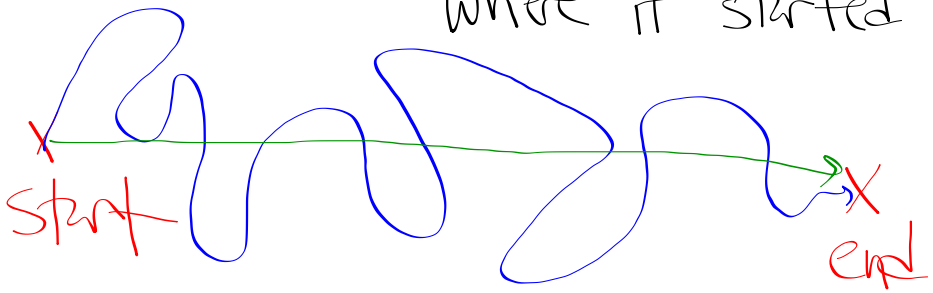
$\Delta x = 3 - -2 = 5$



- Difference between displacement and distance:

Distance: length of the whole path

Displacement: how far an object is from where it started (includes direction)



Velocity:

- Measures how fast something goes and its direction (vector quantity)

$$\text{velocity} = \frac{\text{change in position}}{\text{change in time}}$$ (includes direction)

- Difference between speed and velocity:

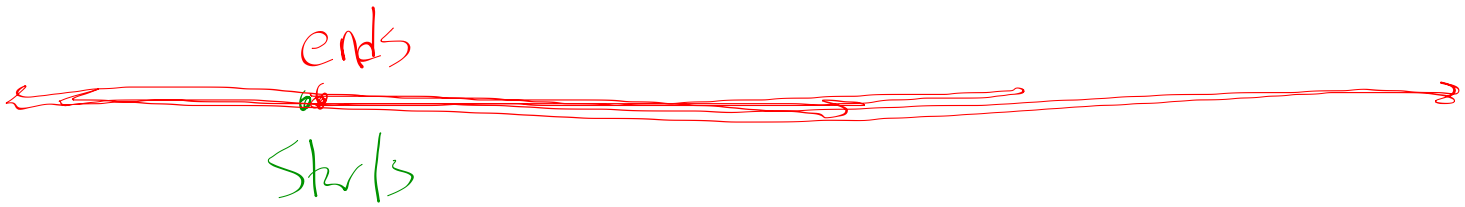
Speed refers to distance and has no direction

velocity refers to displacement (which has direction)

- Difference between average and instantaneous velocity:

$$\bar{v} = \frac{\Delta x}{\Delta t}$$ (average)

$$v = \frac{\Delta x}{\Delta t}$$ (as $\Delta t \to 0$)



velocity = 0

Speed = (more than 0)

Acceleration:

- Measures how fast something's velocity changes (no change = uniform velocity); includes direction (vector quantity)

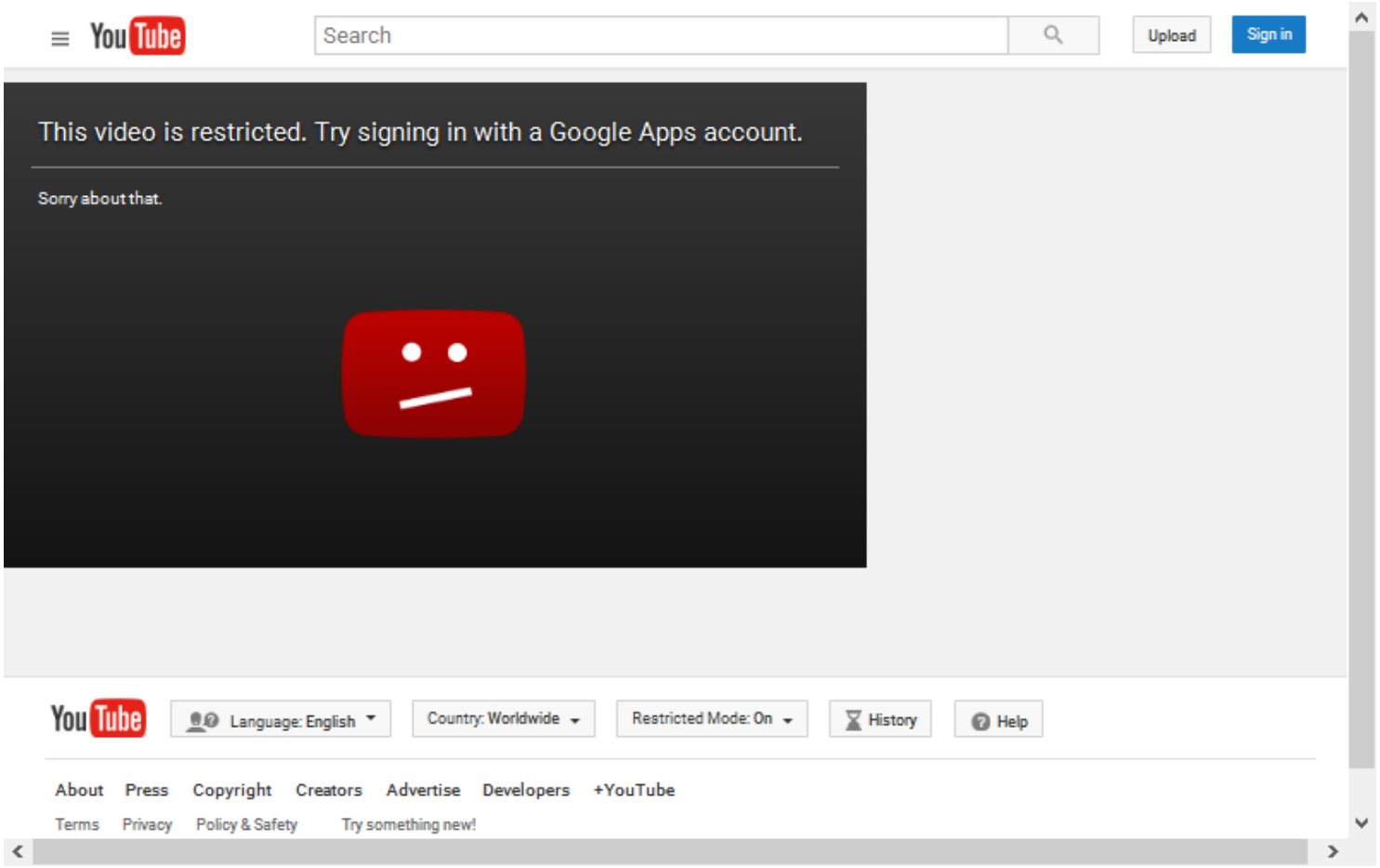
$$\text{acceleration} = \frac{\text{change in velocity}}{\text{change in time}}$$ (includes direction)

- Anytime velocity changes, acceleration is occurring (3 ways)

speed up! slow down! CHANGING DIRECTION!

- Difference between average acceleration and instantaneous acceleration

$$\bar{a} = \frac{\Delta v}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \ (\text{as } \Delta t \to 0)$$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