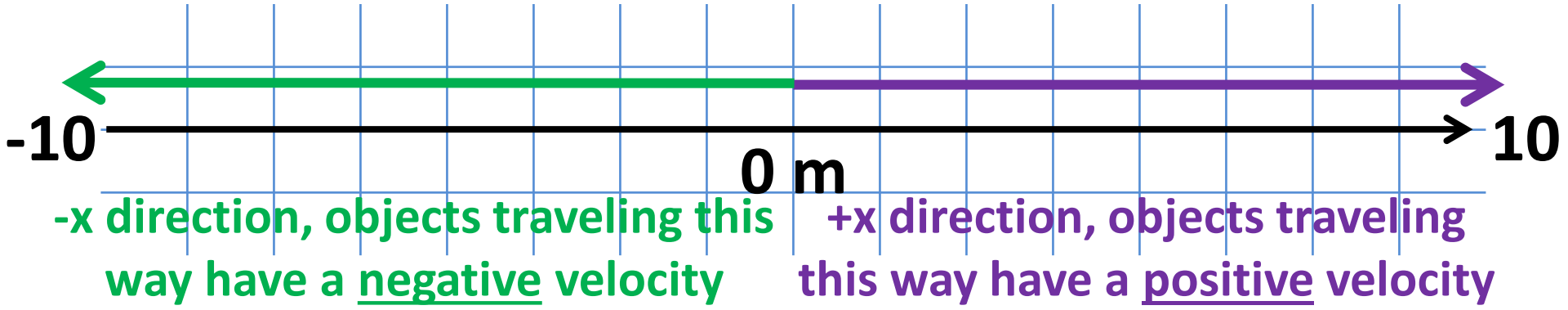
Motion Diagrams and Acceleration

Review of Terms

- **Position** = x
- **Displacement** = $\Delta x = x_f - x_i$
- **Distance** = total distance/length traveled
- **Time of travel** = $\Delta t = t_f - t_i$
- **Velocity** = $v = \Delta x/\Delta t = (x_f - x_i)/(t_f - t_i)$
- **Speed** = distance/Δt
- **Acceleration =** rate of change of the velocity
  - $a = \Delta v/\Delta t = (v_f - v_i)/(t_f - t_i)$ has units of m/s^2

Review: Speed and Velocity



Acceleration

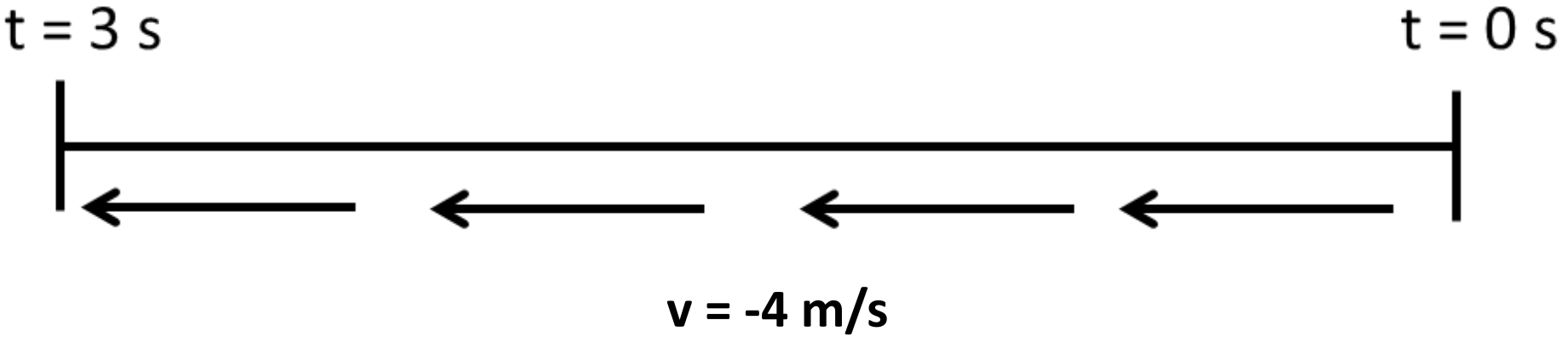
- Acceleration on an object is like it being pushed.
- Acceleration, like velocity, has a directional component and it is important to know the direction of both the velocity and the acceleration.
  - An acceleration can act in the same direction as a velocity: $v = 3$ m/s and $a = 2$ m/s^2
  - An acceleration can act in the opposite direction of a velocity: $v = 3$ m/s and $a = -2$ m/s^2
- If an object is accelerating, its velocity must be changing.

Acceleration

- If an object has a positive velocity and a positive acceleration, its velocity will increase.

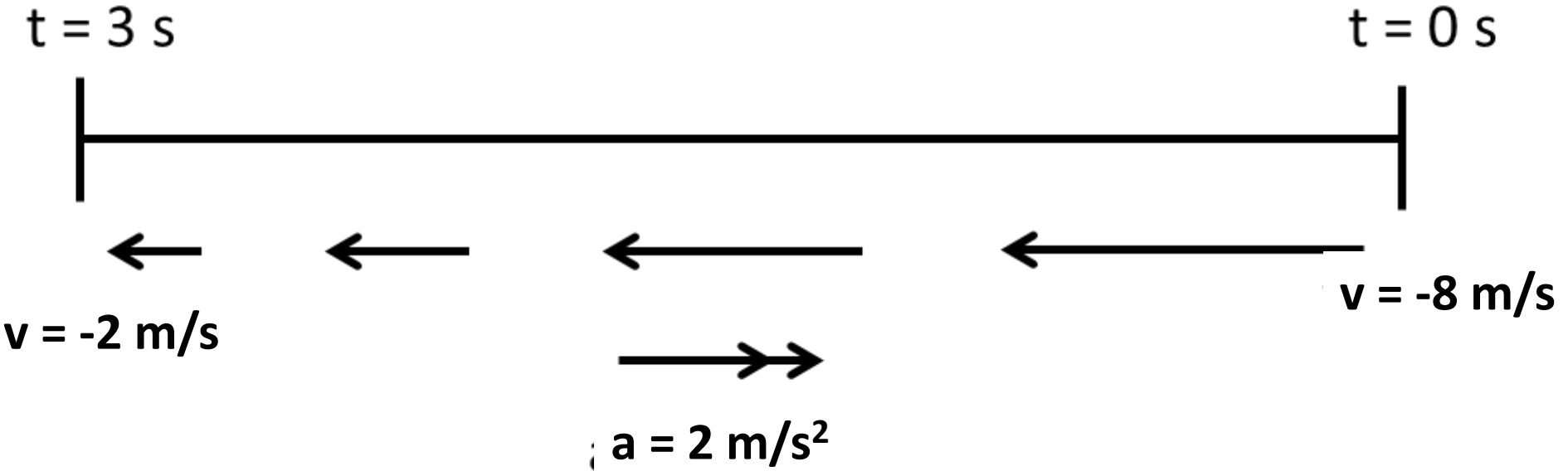
- If an object has a positive velocity and a negative acceleration, its velocity will decrease

Using Motion Diagrams to Show Velocity and Acceleration



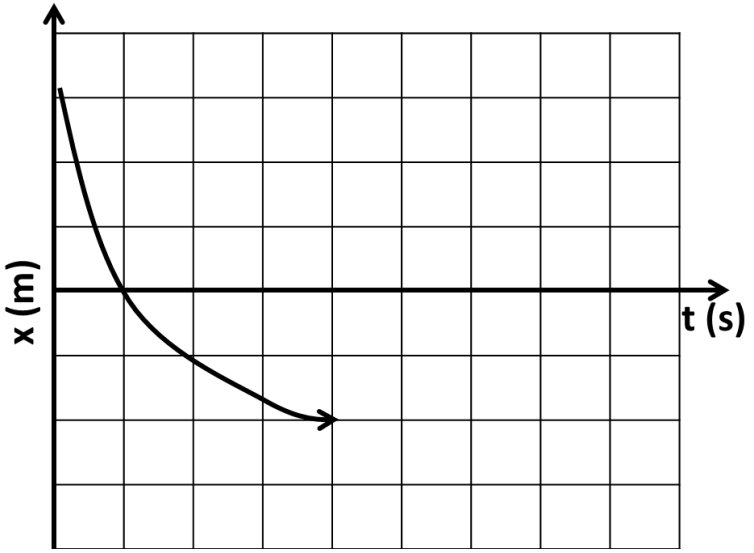
- The arrow's size represent the magnitude and the direction of the velocity.
- The bigger the arrow, the larger the magnitude.

Using Motion Diagrams to Show Velocity and Acceleration



- Velocity is pointing left.
- The acceleration is pointing right.
- The object starts at t = 0 s.
- Is the object's speed increasing or decreasing?

x vs t to Motion Diagram



v vs t to Motion Diagram (and vise versa)