

Motion Basics

- Scalars and vectors
- Distance and displacement
- Average velocity and speed
- Average acceleration

Scalars and Vectors

Scalar = Just a number with no direction.

Either no direction was given or no direction would make sense.

200 cm 5 liters
40 $\frac{m}{s}$

Vector = A number with direction.

200 cm to the R.
 $v_x = 40 \frac{m}{s}$

Distance and Displacement

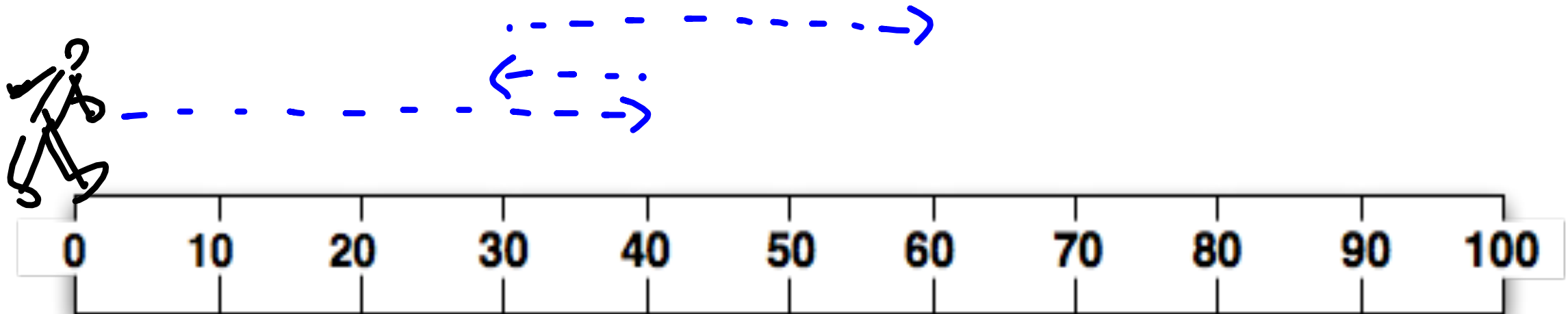
Distance is a scalar. It adds up without regard to direction.

d

Displacement is a vector. It is defined as the change in position: final position minus initial position with no regard for what happened in between.

$$\Delta X = X_f - X_i$$

EX: Distance and Displacement



$$d = 40\text{m} + 10\text{m} + 30\text{m} = 80\text{m}$$

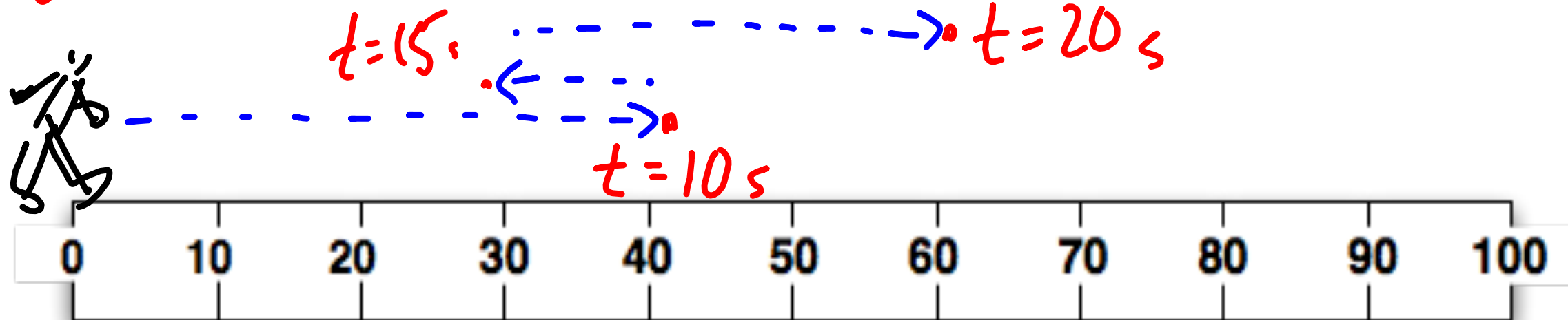
$$\Delta X = 60\text{m} - 0\text{m} = 60\text{m}$$

Average Speed and Average Velocity

Speed is a scalar. Average speed is total distance traveled divided by elapsed time.

Velocity is a vector. Average velocity is displacement or change in position from start to finish divided by elapsed time.

$t = 0$ s. EX: Average Speed and Average Velocity



Find the average speed and the average velocity in the x-direction between $t = 10$ s and $t = 20$ s.

$$d = 10\text{ m} + 30\text{ m} = 40\text{ m}$$

$$\text{Speed} = \frac{40\text{ m}}{10\text{ s}} = 4\frac{\text{m}}{\text{s}}$$

$$\Delta x = 60\text{ m} - 40\text{ m} = 20\text{ m}$$


$$v_x = \frac{20\text{ m}}{10\text{ s}} = 2\frac{\text{m}}{\text{s}}$$


Average Acceleration


Acceleration is a vector. Average acceleration is the change in velocity divided by elapsed time.

$$a = \frac{\Delta v}{\Delta t}$$

EX: Average Acceleration

$$t=0$$
$$v=0$$


$$t=5s$$
$$v=5\frac{m}{s}$$


$$t=10s$$
$$v=20\frac{m}{s}$$


Find the average acceleration in the x-direction between $t = 5$ s and $t = 10$ s.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i} = \frac{20\frac{m}{s} - 5\frac{m}{s}}{5s} = \frac{15\frac{m}{s}}{5s} = 3\frac{m}{s^2}$$

