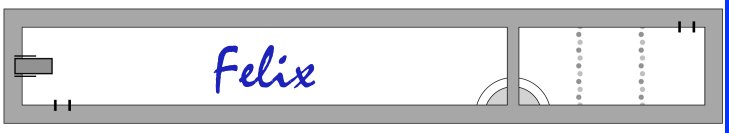
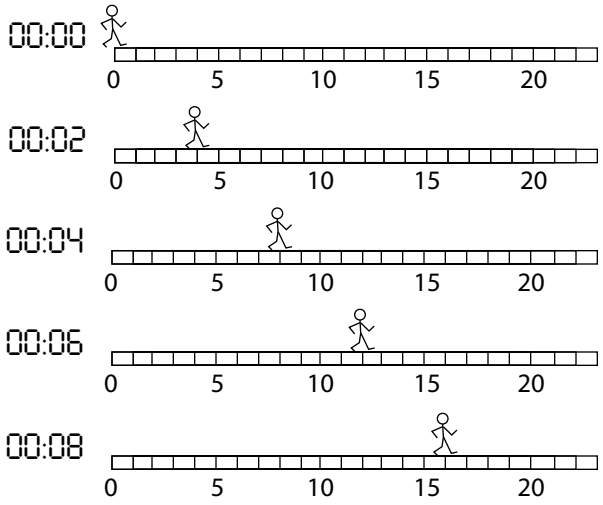
PhyzSpringboard: UM$_1$

Little Dudes 1 - Position



Suppose something is moving. If you collect corresponding clock reading and position measurements, these numbers form ordered pairs that can easily be graphed. Consider the various little dudes shown below. They exist and move along a sidewalk marked in 1-meter increments. We are given snapshots of them at regular time intervals. Follow the instructions given below to construct and analyze position vs. clock reading graphs.

1. Complete the data table to the right based on the diagrams of Walking Dude below.

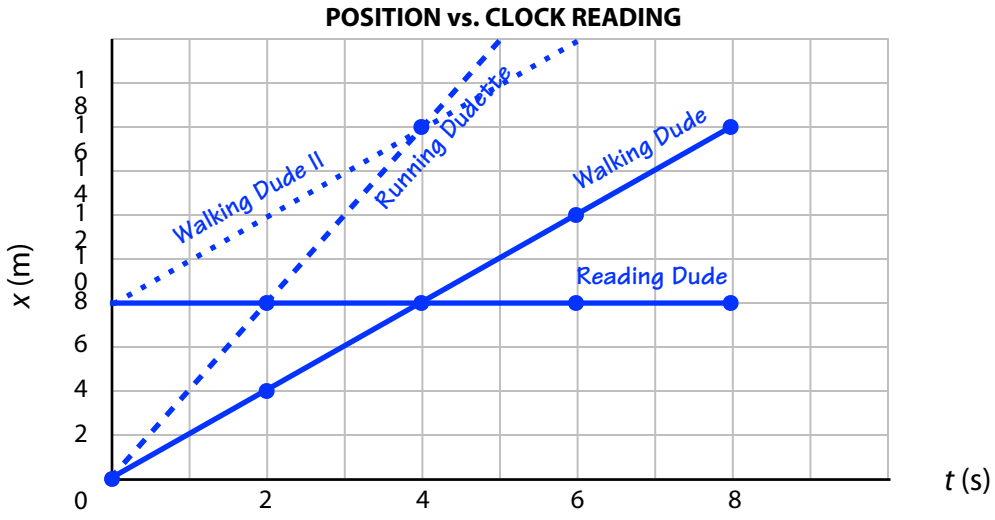


Clock Reading t (s)	Position x (m)
0	0
2	4
4	8
6	12
8	16

2. Write the equation for finding speed (v) when given a **displacement** (difference between two positions x_1 and x_2) and the corresponding **interval** (difference between two clock readings t_1 and t_2). After writing the equation, apply it to find the speed of Walking Dude.

$$v = \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{16\text{ m} - 0}{8\text{ s} - 0} = 2\text{m/s}$$

3. Plot the points from the data table on the graph provided below.



^these are just example numbers, any other two sets of ordered pairs would have worked as well

4. What assumptions about Walking Dude would we have to make if we wanted to connect the dots on the graph to form a straight, continuous line?

The motion is steady and smooth, not jerky.

5. Make those assumptions and draw the line of the graph. Label the line, "Walking Dude."

6. What does the notation Δt mean and what is Δt between 5 s and 8 s?

"change in time" $\Delta t = 3s$

7. What does the notation Δx mean and what is Δx **on the graph** between 5 s and 8 s?

"change in position" $\Delta x = 6m$

8. What relation can you use to find the slope of the graph, in terms of *rise* and *run*?

Slope is rise over run.

9. What quantity represents *rise* on our graph? What represents *run*?

rise = Δx run = Δt

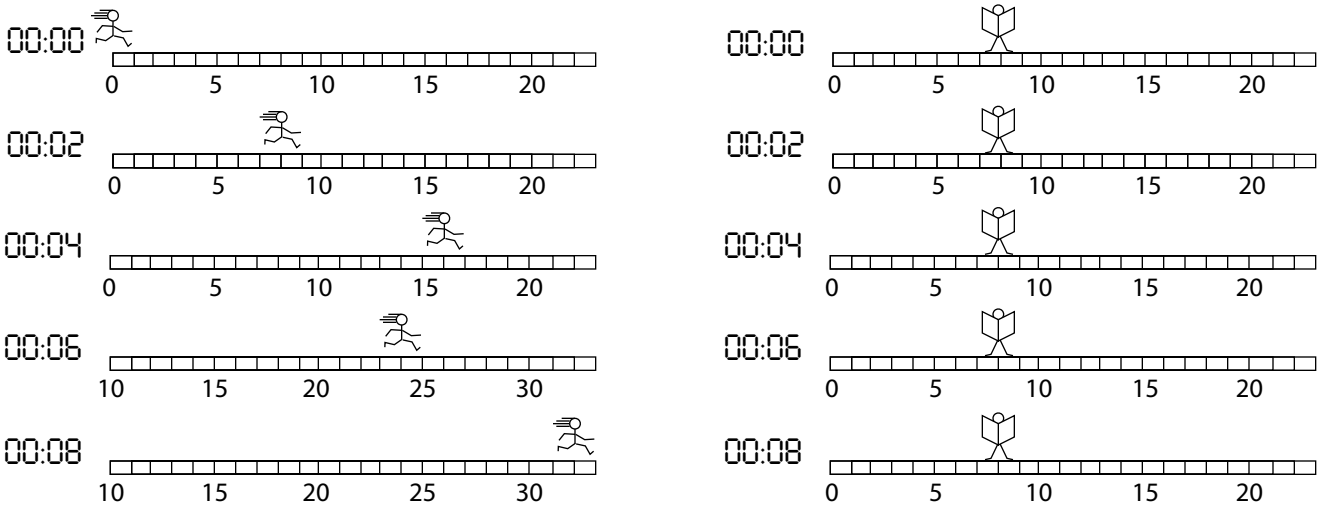
10. What *equation* would you use to determine the slope of a position vs. clock reading graph? (Do not use any numbers yet, simply state the equation.) Does this equation look familiar? If not, it is wrong; if so, where have you seen it before?

$m = \Delta x/\Delta t = v$

11. Apply the equation and determine the slope of Walking Dude's position vs. clock reading graph.

$v = \Delta x/\Delta t = 4m/2s = 2m/s$

12. On the axes on the front, plot position vs. clock reading for the two other little dudes shown below. (Running Dudette starts at 0 m at 0 s; Reading Dude starts at 8 m at 0 s.) Don't forget to label the plots!



13. What would a line with a shallower slope than that of Walking Dude mean?

It would represent a slower dude

14. What would a line with a negative slope mean?

A dude walking in the negative direction (e.g., 16 m to 0, 5 m to –5 m, or 0 to –3 m)

15. What would a vertical line on the position vs. clock reading graph mean?

An infinite speed; all positions at one instant. Not likely!

16. Draw a line parallel to the position vs. clock reading graph of Walking Dude, but starting at (0 s, 8 m). It's the graph for Walking Dude II. What was different about Walking Dude II?

Walking Dude II is 8m in front of the original Walking Dude. Both moving at same speed in same direction.