PhyzJob: Graphing Little Dudes III

POSITION AND VELOCITY DURING ACCELERATION

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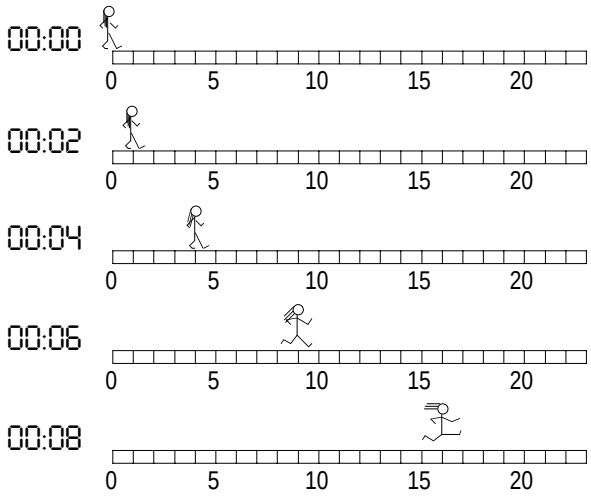
Suppose something is moving. If you collect corresponding clock reading and position measurements, these numbers form ordered pairs that can easily be plotted on a position vs. clock reading graph. Velocities can also be determined and plotted on a velocity vs. clock reading graph. Consider the various little dudes shown below and follow the instructions given below to construct and analyze position vs. clock reading graphs.

1. Complete the data table based on the diagrams of Rev-Up Dudette below.

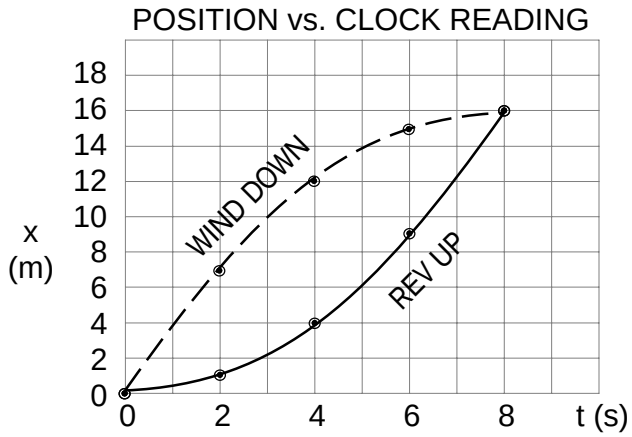


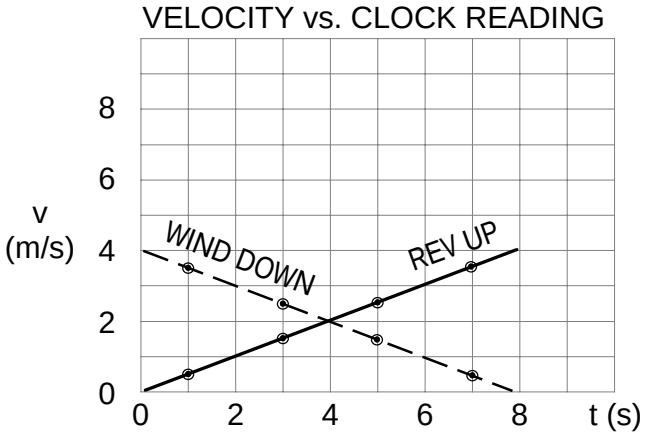
Clock R. t (s)	Position x (m)	Velocity v (m/s)	CR Mid t (s)
0	0		
		0.5	1
2	1		
		1.5	3
4	4		
		2.5	5
6	9		
		3.5	7
8	16		

2. Plot the points from the data table on the graphs provided to the right. For convenience, we use a common time axis for both graphs.

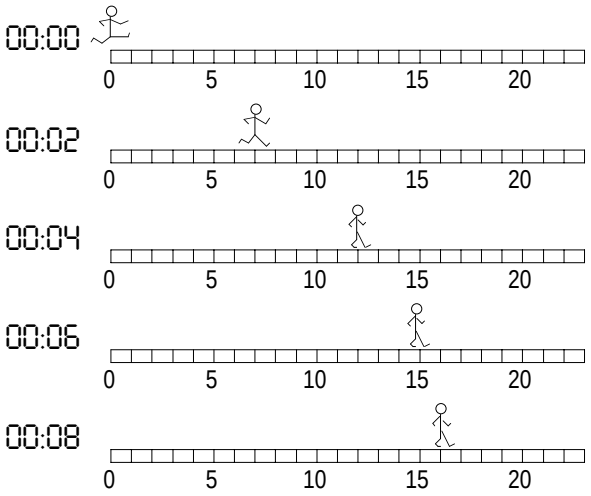
3. Notice the plotted points on the position vs. clock readings graph do not form a straight line. If we assume Rev-Up Dudette's motion is smooth (math word: continuous), we must not connect the plotted points in jerky, "dot-to-dot" fashion. Rather, we must draw a smooth curve that passes through all plotted points. Do this to the best of your ability.

4. Connect the points on the velocity vs. clock readings graph. Doing so *should* form a straight line.





5. Record clock readings and positions, determine velocities and midpoint clock readings, and plot Wind-Down Dude's motion on the position vs. clock reading and velocity vs. clock reading axes on the front. Note that Wind-Down Dude is moving (rapidly) when he crosses the 0m mark at 0s. *Label the plots!*



Clock R. t (s)	Position x (m)	Velocity v (m/s)	CR Mid t (s)
0	0		
		3.5	1
2	7		
		2.5	3
4	12		
		1.5	5
6	15		
		0.5	7
8	16		

6. Who travels a greater **distance** in the 8s time interval: Rev-Up Dudette or Wind-Down Dude? Explain.

16m for both

7. Whose **average speed** (the ratio of total distance to total time) is greater during the 8s time interval: Rev-Up Dudette's or Wind-Down Dude's? Explain.

16m/8s = 2m/s for both

8. Considering your answers to the last two questions, would you agree that the motions of Rev-Up Dudette and Wind-Down Dude are identical? If not, what is different about the two motions?

One speeds up; the other slows down.

In *Little Dudes II*, we found that the slope of the *position* vs. clock readings graph was equivalent to velocity. Let us invent a new quantity and call it **acceleration**; acceleration will be equivalent to the slope of the *velocity* vs. clock reading graph.

9. Look at the velocity vs. clock reading graph. Mark points on Rev-Up Dudette's graph at 3s and 7s. The plotted line has a slope between those two points.
a. What quantity represents the *rise* between those two points? *Identify the name of the quantity, not the numerical value.* Can you represent it with a symbol that includes a Δ?

"change in velocity" Δv

b. What quantity represents the *run* between those two points? *Identify the name of the quantity, not the numerical value.* Can you represent it with a symbol that includes a Δ?

"time interval" Δt

10. Determine the slope of the velocity vs. clock readings plot for Rev-Up Dudette between 3s and 7s.

$m = \Delta v/\Delta t = 2m/s / 4s = 0.5m/s/s$

11. What is Rev-Up Dudette's acceleration between 3s and 7s? What is Wind-Down Dude's acceleration between 3s and 7s? Reconsider question 8.

RUD: $a = 0.5m/s/s$ WDD: $a = -0.5m/s/s$ They differ in *acceleration!*