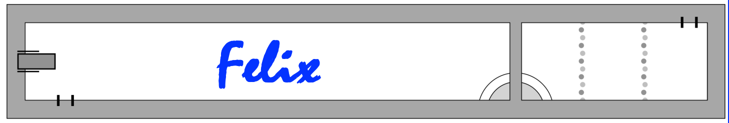
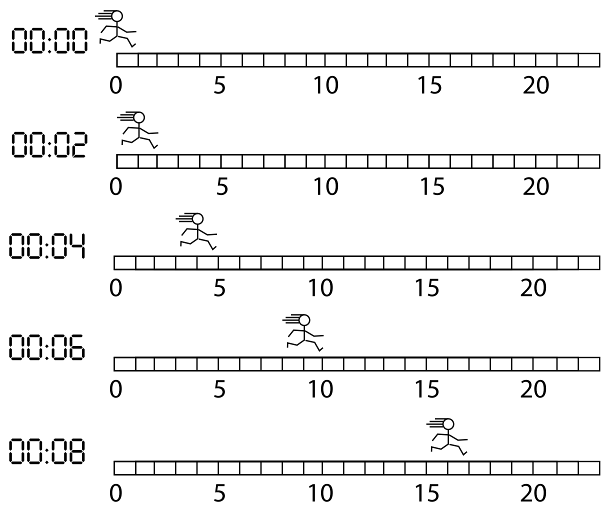
PhyzSpringboard: UAM2

Little Dudes 4 - Acceleration



Suppose something is ...yeah, yeah, you've seen this part a million times now. Let's move on, shall we? Given clock readings and positions, we can plot x vs. t and v vs. t. In our last episode, we invented a groovy new quantity called acceleration and calculated it by finding the slope of the v vs. t graph ($a = \Delta v / \Delta t$). It is now time to plot our final kinematics graph, acceleration vs. clock reading, a vs. t.

1. Complete the t, x, v, and t(avg.) sections of the data table based on the diagrams of Rev-Up Dudette below. Do not complete the Acceleration column yet.

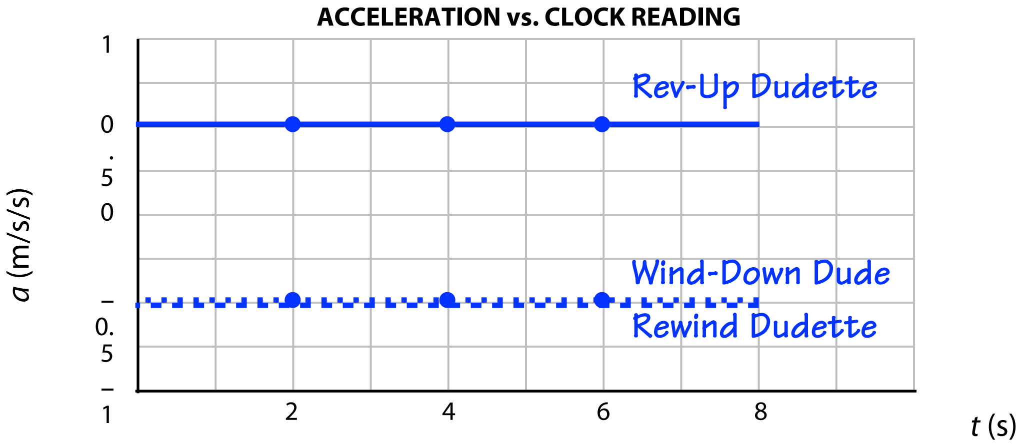


Clock R. t (s)	Position x (m)	Velocity v (m/s)	CR Mid t (s)	Acc. a (m/s/s)
0	0			
		0.5	1	
2	1			0.5
		1.5	3	
4	4			0.5
		2.5	5	
6	9			0.5
		3.5	7	
8	16			

2. Determine the average acceleration of Rev-Up Dudette between average clock readings 1 s and 3 s by dividing the change in velocity that occurred in the interval by the duration of the interval. Record this value on the data table. Calculate average accelerations for the remaining intervals.

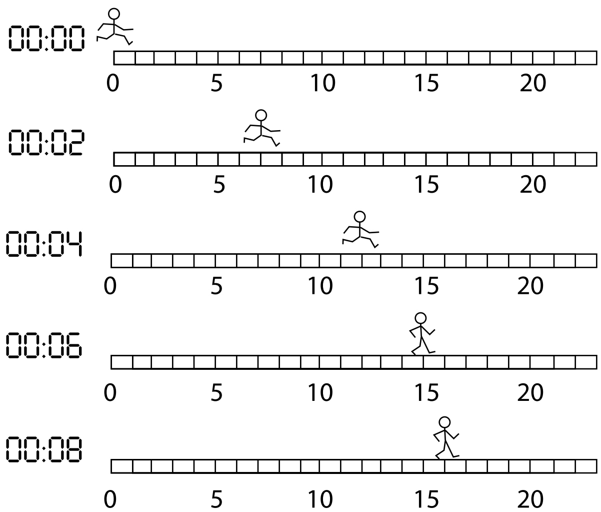
3. Acceleration values are averages across 2 s time intervals. The value of acceleration we calculate is most accurate at the point in time halfway through those intervals. For example the halfway point between 1 s and 3 s is 2 s.

4. Plot acceleration vs. clock reading.



5. 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?

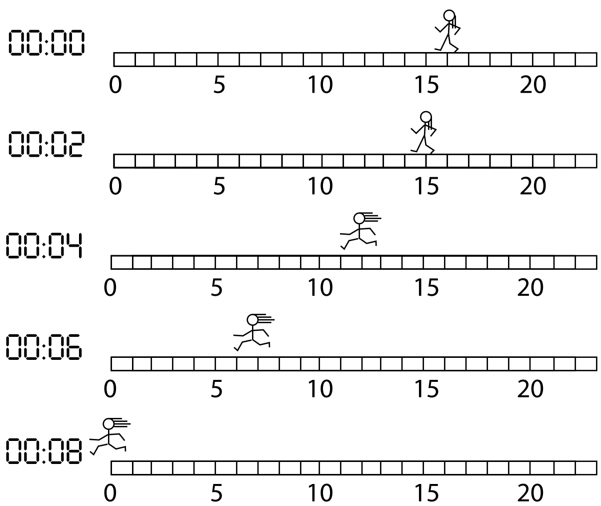
The motion is steady and smooth, not jerky.



Clock R. t (s)	Position x (m)
0	0
2	7
4	12
6	15
8	16

Velocity v (m/s)	CR Mid t (s)
3.5	1
2.5	3
1.5	5
0.5	7

Acc. a (m/s/s)
−0.5
−0.5
−0.5



Clock R. t (s)	Position x (m)
0	16
2	15
4	12
6	7
8	0

Velocity v (m/s)	CR Mid t (s)
−0.5	1
−1.5	3
−2.5	5
−3.5	7

Acc. a (m/s/s)
−0.5
−0.5
−0.5

8. a. What does it mean when an acceleration vs. clock reading graph lies above the time axis?

Speed is increasing in the positive direction or decreasing in the negative direction.

b. What does it mean when an acceleration vs. clock reading graph lies below the time axis?

Speed is decreasing in the positive direction or increasing in the negative direction.

9. Notice all our acceleration vs. clock reading plots yield horizontal lines. What would a non-horizontal (e.g. "diagonal") line on an acceleration vs. clock reading graph mean

a. if it had positive slope?

Acceleration is increasing in the positive direction or decreasing in the negative direction.

b. if it had negative slope?

Acceleration is decreasing in the positive direction or increasing in the negative direction.

10. What would a vertical line on an acceleration vs. clock reading graph mean?

Infinite jerk (all accelerations at one instant). Not likely.