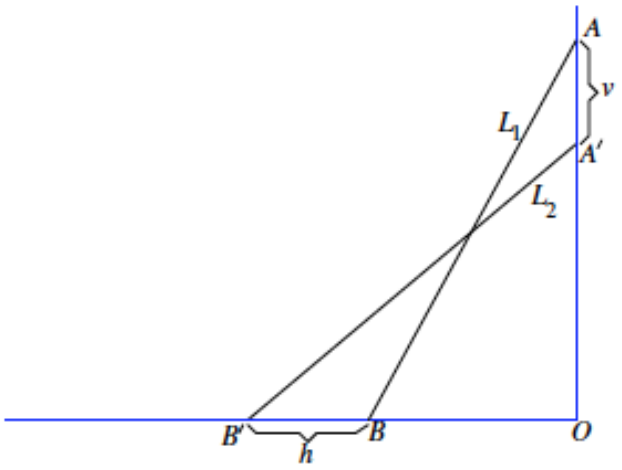
Lesson 23: Nonlinear Motion

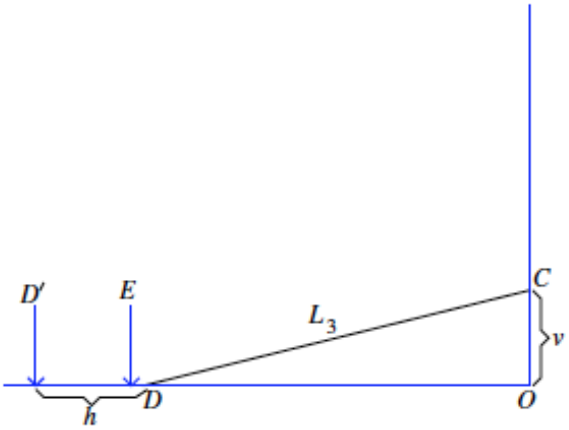
Classwork

Exercise

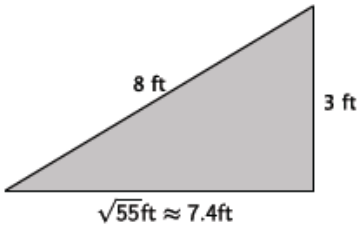
A ladder of length L ft. leaning against a wall is sliding down. The ladder starts off being flush (right up against) with the wall. The top of the ladder slides down the vertical wall at a constant speed of v ft. per second. Let the ladder in the position L_1 slide down to position L_2 after 1 second, as shown below.

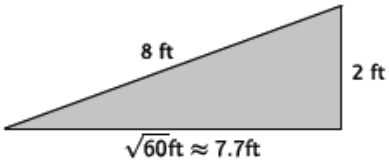


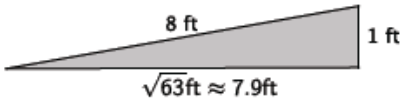
Will the bottom of the ladder move at a constant rate away from point O?

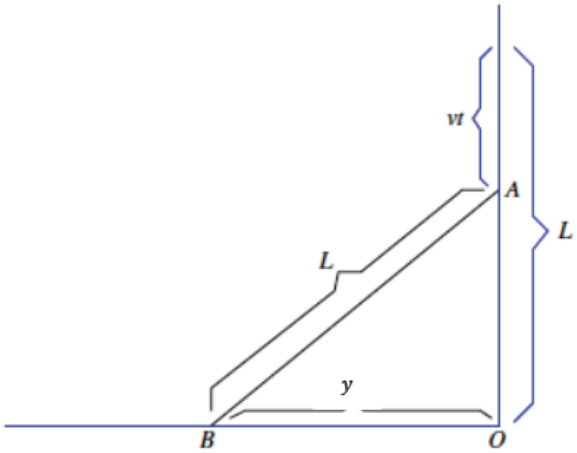


Consider the three right triangles shown below. Specifically the change in the length of the base as the height decreases in increments of 1 ft.









Input t	Output $y = \sqrt{t(30-t)}$
0	
1	
3	
4	
7	
8	
14	
15	

Problem Set

1. Suppose the ladder is 10 feet long, and the top of the ladder is sliding down the wall at a rate of 0.8 ft. per second. Compute the average rate of change in the position of the bottom of the ladder over the intervals of time from 0 to 0.5 seconds, 3 to 3.5 seconds, 7 to 7.5 seconds, 9.5 to 10 seconds, and 12 to 12.5 seconds. How do you interpret these numbers?

Input t	Output $y = \sqrt{0.8t(20 - 0.8t)}$
0	
0.5	
3	
3.5	
7	
7.5	
9.5	
10	
12	
12.5	

2. Will any length of ladder, $\boldsymbol{L}$, and any constant speed of sliding of the top of the ladder $\boldsymbol{v}$ ft. per second, ever produce a constant rate of change in the position of the bottom of the ladder? Explain.