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3450:221-007

Function review/Calculating speed

Fall 2003

Please write your name on the **top line** above. Then work on the problems below with two other students. **Each of you will submit your own sheet on Friday with every participating group member's first and last name on it.** To receive full credit, you must show your work, and all your explanations must use complete sentences.

Humbard's tower in Cuyahoga Falls is 494 feet tall. Your learning assistant dropped a ball off the top of the tower. (He won't say how he got up there.) After t seconds the ball had fallen approximately

$$s(t) = 16t^2 \text{ feet, } 0 \leq t \leq \sqrt{30.875}.$$

(Our mathematical model neglects air resistance.)

0. What is your learning assistant's name?
1. How far did the ball fall after 5 seconds?

2. How long did it take the ball to fall halfway to the ground?

3. Assuming we only consider the function for physically-realistic values of t and $s(t)$, what is the range of the function? Why is the domain given as $[0, \sqrt{30.875}]$?

4. What was the approximate average speed of the ball in the last second before it hit the ground?

5. Briefly explain why Problem 4 does not give the exact speed the ball was traveling when it hit the ground.

(OVER)

6. Suppose we use the answer to Problem 4 as an *estimate* of how fast the ball was falling when it hit the ground. Suggest any way you can think of to improve the estimate.

7. Suggest any way you can think of to come up with the exact speed the ball was falling when it hit the ground.

8. Is the function $s(t)$ a polynomial or an exponential function? Briefly explain the difference.

9. Graph the function $s(t)$ over the domain. Label the axes and show the scale.

10. Does the point $(2.5, 100)$ lie on the graph? Briefly explain your answer.

11. Is it true that for this function, whenever t_1 is less than t_2 then $s(t_1)$ is greater than $s(t_2)$? Briefly explain why or why not. Use the term “increasing function” and/or “decreasing function” in your answer. Assume t_1 and t_2 are in the interval $(0, \sqrt{30.875})$.

12. The ball hit the ground at time t^* . State the values $s(t^*)$ and $s(t^* - 1)$. (You already know all these numbers.) Label the points $(t^*, s(t^*))$ and $(t^* - 1, s(t^* - 1))$ on the graph of $s(t)$. Calculate the slope of the line through the two points. Your answer should come out the same as in Problem 4. Briefly explain why.