

4.3.2 The Evidence Mounts

Fast Times: Parts 3 & 4



4-106. FAST TIMES, Part Three - The Evidence Mounts

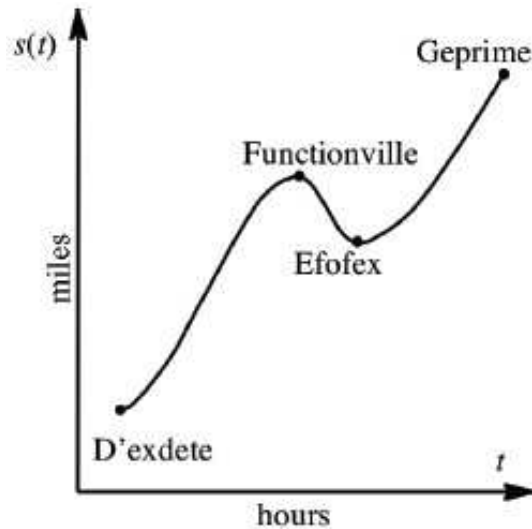
Prosecution: "As you have seen from the overwhelming evidence presented in our prior exhibit, we have irrefutable proof of the irresponsible driving behavior of the defendant. We must stop this callous behavior and make an example of this individual so that other teachers will realize they must abide by the rules of the road. I will now present the second infraction that occurred between D' exdete and Geprime. I would like to call Inspector Knoclew to the stand. Inspector, please inform us of the methods you used and the conclusions you reached."



Inspector Knoclew: "Using cameras located at several key points along the highway between D' exdete and Geprime, we were able to determine the distance vs. time graph shown in *Exhibit C* below. Entering this critical information into our computer system, we have the following function which generates the graph in the exhibit." ($s(t)$ is in miles traveled from Acelerton in t hours.)

$$s(t) = \begin{cases} -291.67t^3 + 1125t^2 - 1360t + 574.67 & \text{for } 1 \leq t < 1.6 \\ 2500t^3 - 12750t^2 + 21600t - 12076 & \text{for } 1.6 \leq t < 1.8 \\ -176t^3 + 1142.4t^2 - 2402t + 1722.6 & \text{for } 1.8 \leq t \leq 2.3 \end{cases}$$

"From this data we found two sections of highway where the defendant was in excess of seventy miles per hour. In addition, we are also able to refute the defense's average velocity argument used earlier since the defendant returned to Efofex after reaching Functionville."



Prosecution Exhibit C

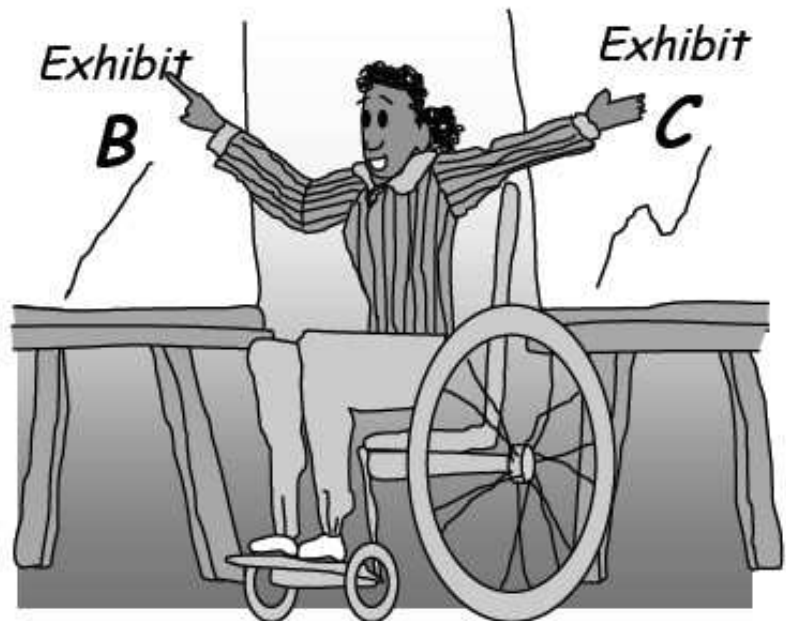
Your task:

- How did the Inspector know that your teacher headed back to Efofex?
- Find the highest speed in each section as defined in the piecewise function to verify or refute the inspector's finding.

4-107. FAST TIMES, Part Four - The Rebuttal Witness

Things look bleak for your teacher and your class. The stress of the trial has already resulted in some difficult quizzes and you could not help but notice the books of unsolved calculus problems that have been added to your instructor's materials. Suddenly, one of your former study team members (clearly someone who is grateful for your past assistance) comes forward with some critical information. She states:

"I have investigated *Exhibit B* and *Exhibit C* and the evidence does not match. I suspect that the prosecution delivered both items separately so that you would not be aware of the problem."



What is she referring to? Investigate the evidence presented in *Exhibits B* and *C*. Write a convincing argument that will require Judge Ironhand to throw out this incriminating evidence. Make sure that you are accurate. Judge Ironhand loves to issue contempt citations for sloppy calculations!

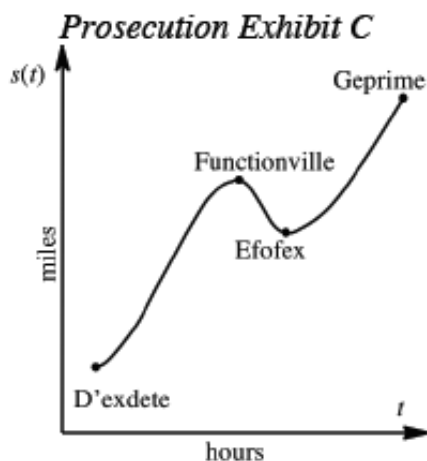
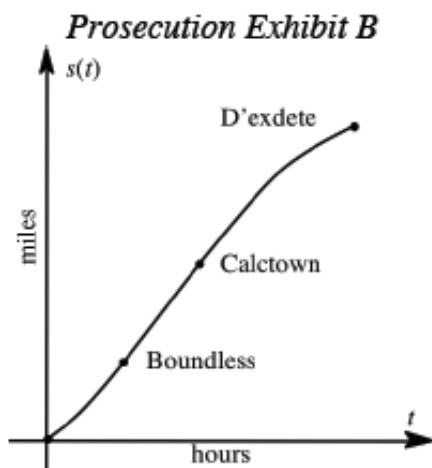


Exhibit B: $s(t) = -93.75t^3 + 93.75t^2 + 45t$

Exhibit C:

$$s(t) = \begin{cases} -291.67t^3 + 1125t^2 - 1360t + 574.67 & \text{for } 1 \leq t < 1.6 \\ 2500t^3 - 12750t^2 + 21600t - 12076 & \text{for } 1.6 \leq t < 1.8 \\ -176t^3 + 1142.4t^2 - 2402t + 1722.6 & \text{for } 1.8 \leq t \leq 2.3 \end{cases}$$



4-108. Examine the following integrals. Consider the multiple tools available for evaluating integrals and use the best strategy for each. After evaluating the integral, write a short description of your method.

Homework Help

a. $\int (2y - 3)^2 dy$

b. $\int_1^2 2^{3x} dx$

c. $\int (9m^{-2} + 7m^{11}) dm$

d. $\int_0^3 \sqrt{9-x^2} dx$

e. $\int \sin(x^2) dx$

4-109. Find the area of the region in the second quadrant under the function $y = x^3 + 2x^2 - 3x$.

[Homework Help](#) 


4-110. Write each of the following integral expressions as a single integral. [Homework Help](#) 

a. $\int_2^9 (f(x))^2 dx - \int_2^9 (g(x))^2 dx$

b. $\int_3^5 f(x) dx + \int_5^9 f(x) dx$

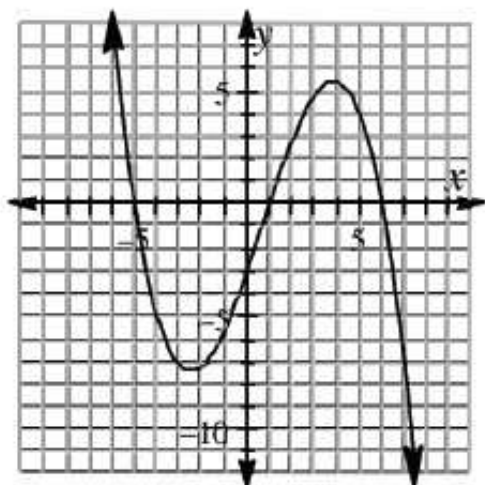
c. $\int_{-2}^1 f(x) dx - \int_4^1 f(x) dx + \int_4^9 f(x) dx$

d. $2 \int_2^8 k(x) dx + \int_2^8 j(x) dx$

4-111. Compare two different methods to find a derivative. [Homework Help](#) 

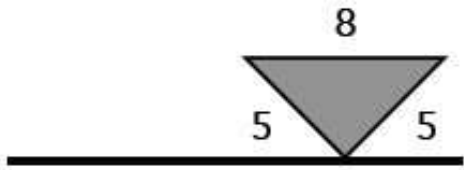
- Use the definition of the derivative as a limit to find the slope function, $f'(x)$, of $f(x) = -x^2 + 3x + 1$.
- Use the Power Rule to find $f'(x)$. Do your answers agree?
- Use your slope function to find $f'(0)$ and $f'(1)$.

4-112. Refer to the graph below of $f'(x)$, the derivative of some function $f(x)$. [Homework Help](#) 




- Where is $f(x)$ increasing? How can you tell?
- Approximate the interval on which $f(x)$ is concave up. Justify your conclusion with the graph.
- Is $f'(0)$ positive or negative? Explain how you know.

4-113. A horizontal flag is shown below. [Homework Help](#) 



- Imagine rotating the flag about its pole and describe the resulting three-dimensional figure. Draw a picture of this figure on your paper.
- Find the volume of the rotated flag.

4-114. Write and evaluate a Riemann sum to estimate the area under the curve $g(x) = x \cdot 2^{x+2}$ for $-4 \leq x \leq 0$ using 20 rectangles. Then use your graphing calculator to compute the sum. [4-114 HW](#)
[eTool\(Desmos\)](#). [Homework Help](#) 

4-115. Let $\int_3^5 h(x) dx = 4$ and $\int_3^5 j(x) dx = 2$. Find $\int_5^3 (h(x) + j(x)) dx$ and $\int_5^7 (h(x-2) + 2) dx$.
[Homework Help](#) 