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Big City Police Department
Constabulary Avenue
Big City, PU 11235

Dear Officer Kovalevskia,

I am extremely sorry to hear about the death of Peter Moss, and I promise to help you out the best of my ability to solve this case. By analyzing the two statements provided by the occupants of the stopped train, it is possible to deduce that Gaston Olson Overby-Fitzpatrick is the liar and therefore the murderer. Although Walter Moss’ scenario checks out, Overby-Fitzpatrick’s story does not, and so I must conclude that he is the murderer. Let me explain how I reached this verdict.

Although they are not drawn to scale, I have devised a set of timelines to illustrate each suspect’s statement about the train crash.

Gaston Olson Overby-Fitzpatrick’s Account

Overby-Fitzpatrick claimed that the distance from where he was pushed out of the moving train to where the train came to a complete stop was 420 feet. According to his story, Overby-Fitzpatrick also made it clear that he was forced to exit the vehicle previous to Moss' pushing of the "decel" button. It is known for a fact that the train
was traveling at 60 miles per hour, and at such a speed, it would have taken twelve seconds for the train to stop once the "decel" button was pressed. Of course, it must be assumed that the train was traveling at 60 miles per hour the entire time before the "decel" button was pressed.

Walter Moss' Testimony

Walter Moss told a different story. He said the distance from where Overby-Fitzpatrick jumped from the moving train to where the train stopped was 420 feet, but in this account, Overby-Fitzpatrick did not exit the train until after the "decel" button was pushed.

In order to find out who was telling the truth, I needed to determine the stopping distance, which is the distance it took from the time the "decel" button was pressed to when the train stopped. Regardless of the fact that both engines were totaled, I could still determine this stopping distance of the train through algebraic calculations.

In order to find the stopping distance of the train, I needed two pieces of information.

The first facet of information required was how fast the train was traveling, and the second was how long it took for the train to stop once the "decel" button was pressed. I knew that the train was traveling at a rate of 60 miles per hour and that it took twelve seconds for the train to stop once the button was pressed. A diagram below shows how I used these two values to find the stopping distance.
This graph assumes that the train was going at a rate of 60 miles per hour when the "decel" button was pressed and that the train then slowed down at a constant rate. I drew the velocity versus time graph by plotting 60 miles per hour on the vertical axis and twelve seconds on the horizontal axis. Then I drew a line through these two points, which formed a triangle. I drew this triangle so I could find the area under the velocity curve. This area is important because, according to Calculus by Hughes-Hallett et al, the area under the velocity curve equals the distance traveled. I calculated the area of the triangle using the well-known formula

\[
\text{area} = \frac{1}{2} \text{base} \times \text{height}.
\]

When calculating this area, I needed to keep the units of measurement consistent. The velocity was measured in miles per hour and so I had to consider time in hours rather than in seconds. The value for the base when converted from seconds to hours was 1/300 hours. This conversion can be seen through the following calculation:

\[
(12 \text{ seconds}) \times \left(\frac{1 \text{ minute}}{60 \text{ seconds}}\right) \times \left(\frac{1 \text{ hour}}{60 \text{ minutes}}\right) = \frac{1}{300} \text{ hours}.
\]

Finally, the area of the triangle could be calculated. By first multiplying 1/300 hours by 60 miles per hour and then multiplying that answer by one-half, the calculated area was found to equal 0.1 miles. This answer was then converted into feet by multiplying 0.1 miles by 5280 feet. I found the value of the stopping distance of the train to be 528 feet.
Now it is effortless to see that Overby-Fitzpatrick was lying because his story said the distance from the time the "decel" button was pressed to when the train was stopped was only 420 feet, but in reality the distance was 528 feet. I would like to conclude with a note of gratitude towards my professor of calculus, Dr. Crannell, and some of my fellow classmates, including Sam Krass and Elon Walter, for all the help and support they provided throughout the process of answering your inquiry. I would also like to wish you the best of luck with the prosecution of this case.

Yours truly,

Dawn Mara Patel

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