USING LINEAR MODELS AND REGRESSION

When travelling long distances on the highway, drivers will often set the car on cruise control. This allows the car to travel at a constant speed for a period of time.

Learning Goal: To determine when a vehicle is accelerating and when it is travelling at a constant speed; to determine the relationship between the time elapsed and the distance travelled for a vehicle moving at a constant speed.

Steps

1. Form a track that is 10 m long. Mark the starting line with masking tape.
2. Start the vehicle at the start line. Every second the vehicle has travelled, put a chalk mark on the floor, locating the vehicle.
3. Measure these distances and record them in the table below.
4. Complete the table by finding the first differences.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time (s) | Distance (m) | First Differences | Time (s) | Distance (m) | First Differences |
| 0 |  |  | 11 |  |  |
| 1 |  | 12 |  |
| 2 |  | 13 |  |
| 3 |  | 14 |  |
| 4 |  | 15 |  |
| 5 |  | 16 |  |
| 6 |  | 17 |  |
| 7 |  | 18 |  |
| 8 |  | 19 |  |
| 9 |  | 20 |  |
| 10 |  | 21 |  |

Questions

1. Graph the information from your table.
2. Examining the graph, when is the vehicle accelerating? How do you know?
3. Examining the graph, when is the vehicle travelling at a constant rate? How do you know?
4. How could you have used the First Differences to determine when the vehicle was accelerating and when it was travelling at a constant rate?

Consolidation

1. Use Linear Regression to determine the equation for the linear portion of the graph. (Hint: you will need to extend the linear line back to the y-axis to find the y-intercept.)
2. Use your equation to predict how long it will take the vehicle to travel 50 m.
3. If you started your vehicle at 2.5 m instead of 0 m, how would your Linear Regression equation change? Write the new equation and use it to predict how long it will take the vehicle to travel 50 m.
4. If you started your vehicle 5.0 m before the starting line, how would your Linear Regression equation change? Write the new equation and use it to predict how long it will take the vehicle to travel 50 m.