Mathematics

Course Work

Dominique Albert-Weiss

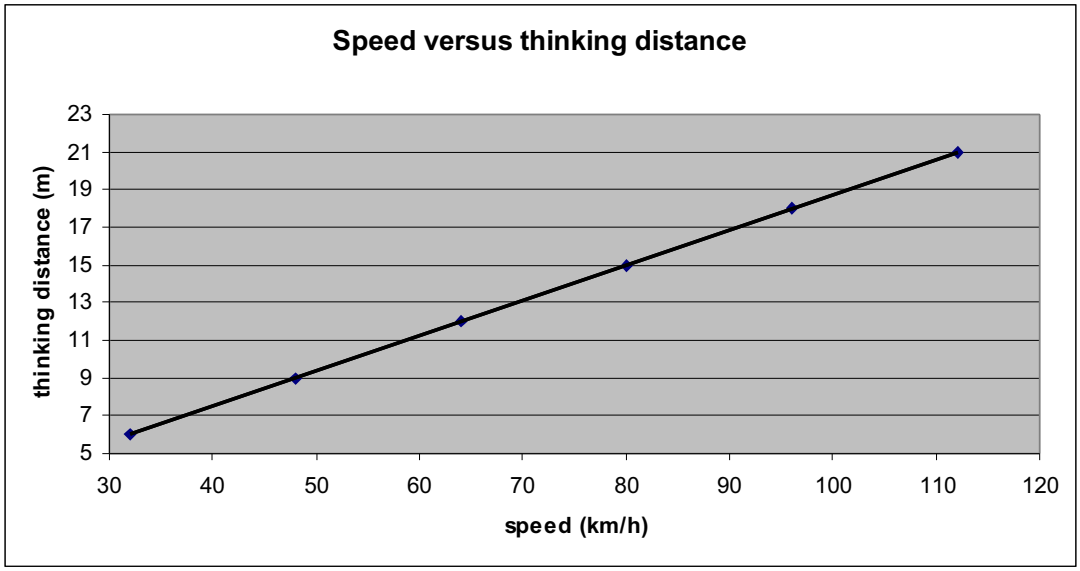
“Stopping disntances”

Table 1

Speed v (km/h)	Thinking distance (m)	Braking distance (m)
32	6	6
48	9	14
64	12	24
80	15	38
96	18	55
112	21	75

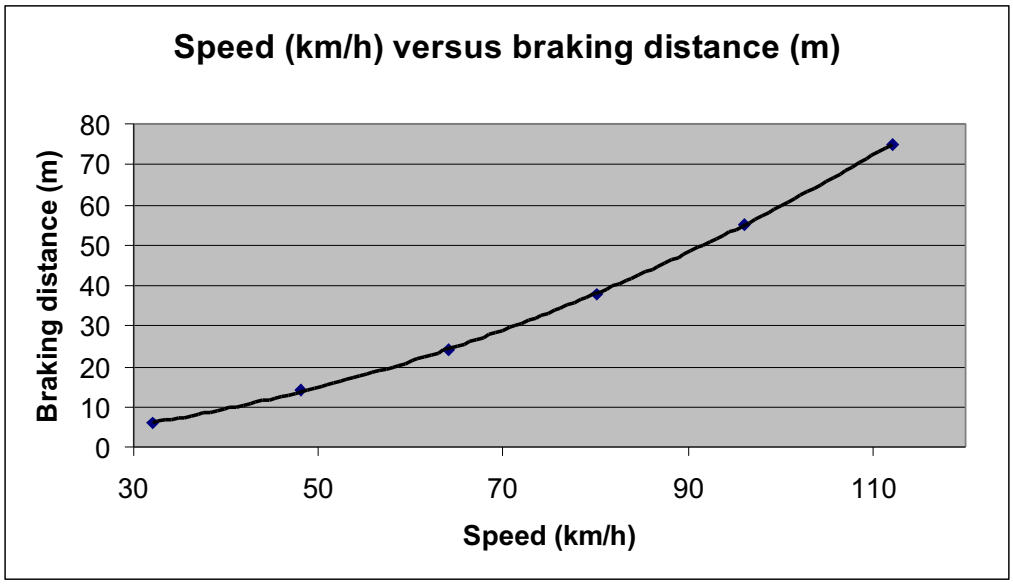
1.) Use a GDC or graphing software to create two data plots: speed versus thinking distance and speed versus braking distance. Describe your results.

Graph 1



The given values in Table 1 of speed (km/h) and thinking distance (m) were plotted against each other in this graph. With close observation, it is noticeable that the speed is proportional to the thinking distance. In other words: the points construct a straight line that is going through the origin.
In this example, we are able to assume that the more the driver increases his/her speed, the more time it takes him/her to apply the brakes.

Graph 2



In graph 2, the values of Table 1 of speed (km/h) and braking distance (m) were plotted against each other in this graph. Unfortunately, no straight line can be drawn as the thinking distance is increasing more than proportional. From the 1st point to the 2nd point it is increasing by 8, from the 2nd to the 3rd by 10, from the 3rd to the 4th by 14....and so on.
The conclusion of this graph is that the faster the car is moving, the longer it takes the car to brake.

2.) Using your knowledge of functions, develop functions that model the behaviours noted in step 1. Explain your work.

Function for graph 1 (speed vs. thinking distance):
To find the function of a graph, the slope has to be found first. This can be done by deviding the change of two y-intercepts over the change of two x-intercepts.

$\Delta y/\Delta x = 9\text{-}6/48\text{-}32 = 3/16 = 0.1875$

Afterwards the formula "y=slopex + y-intercept" should be used to give the final function:

$y = 0.1875x$

Function for graph 2 (speed vs. braking distance):
One way to find out the function of the graph to is by using the quadratic regression method. This can only be done on the GDC (Graphic Calculator) and gives you the result:

$y = 0.0061x^2 - 0.0232x + 0.6$

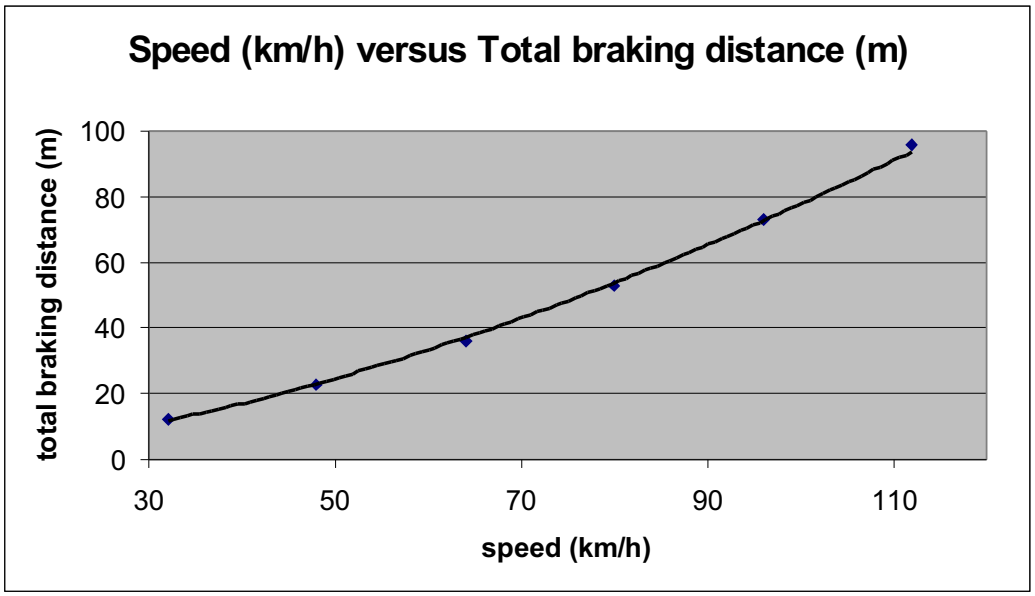
3.) The overall stopping distance is obtained from adding the thinking distance to the braking distance. Create a data table of speed and overall stopping distance. Graph this data nad describe the results.

Total braking distance = thinking distance + braking distance

Table 2

Speed (km/h)	Thinking distance (m)	Braking distance (m)	Total braking distance (m)
32	6	6	12
48	9	14	23
64	12	24	36
80	15	38	53
96	18	55	73
112	21	75	96

Graph 3



Therefore that the braking distance was added with the thinking distance, it is logical that the y-intercepts of graph 3 are higher than the ones of graph 1 and 2. It is also important to remark that the line of best fit will be a curve as graph 2 is a curve too.

4.) Develop a function that models the relationship between speed and overall stopping distance. How is this function related to the function obtained in step 2?

To find the function of graph 3, your life can be simplified by using excel.
Excel will give the function

y = 0,0379x^1,6559

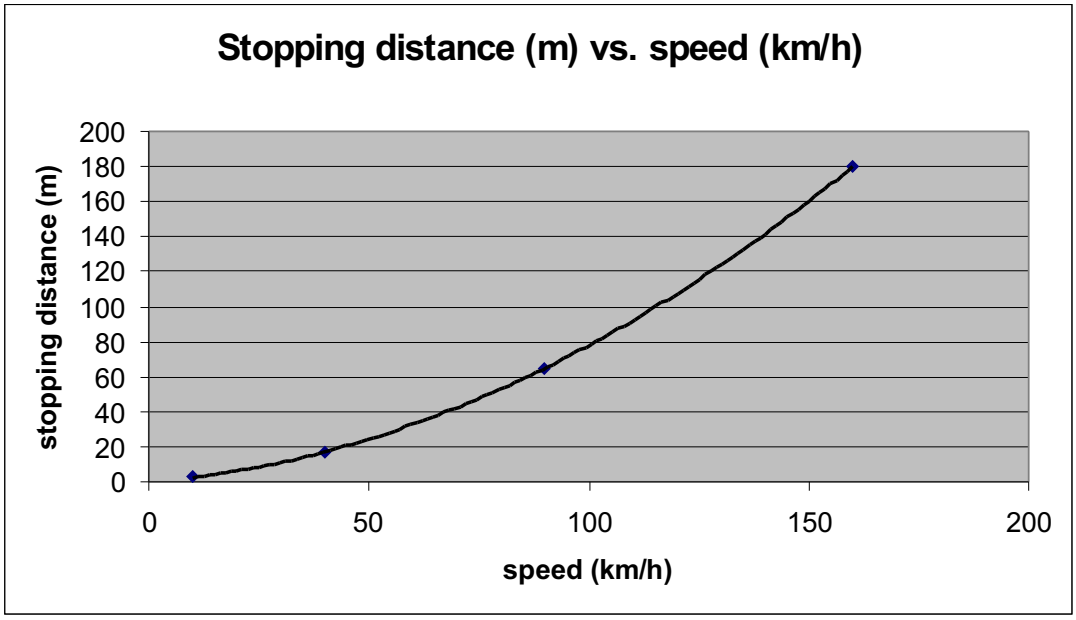
If you compare the graphs and function of graph 1,2 and 3, you will be able to notice that the value of graph 3 is much higher than in graph 1. This is due because the values of graph 3 are the sum of graph 1 and 2. In addition to that graph 3 won't represent a constant, decent, proportional line because of the influence of the braking-distance-values.

5.) Overall stopping distances for other speeds are given below. Discuss how your model fits this data, and what modifications might be necessary.

Table 3

Speed (km/h)	Stopping distance (m)
10	2.5
40	17
90	65
160	180

Graph 4



Graph 4 represents the stopping distance and the time that were given in the table.

The function of speed vs. thinking distance which is $y = 0.1875x$, where x is equal the speed.

Speed (km/h)	Stopping distance (m)	Thinking distance (m)
10	2.5	1.875
40	17	7.5
90	65	16.875
160	180	30

The same is done with the function of speed vs. braking distance which is $y = 0.0061x^2 - 0.0232x + 0.6$.

Speed (km/h)	Stopping distance (m)	Braking distance (m)
10	2.5	0.978
40	17	9.432
90	65	47.922
160	180	153.048

It is shown that the results that were given at the beginning (thinking and braking distance) are both much lower than the results of the stopping distance.