

Subject – Math AI (Standard Level)
Topic - Function
Year - May 2021 – Nov 2022
Paper -2
Questions

Question 1

[Maximum mark: 17]

The braking distance of a vehicle is defined as the distance travelled from where the brakes are applied to the point where the vehicle comes to a complete stop.

The speed, $s \text{ m s}^{-1}$, and braking distance, $d \text{ m}$, of a truck were recorded. This information is summarized in the following table.

Speed, $s \text{ m s}^{-1}$	0	6	10
Braking distance, $d \text{ m}$	0	12	60

This information was used to create Model A, where d is a function of s , $s \geq 0$.

$$\text{Model A: } d(s) = ps^2 + qs, \text{ where } p, q \in \mathbb{Z}$$

At a speed of 6 m s^{-1} , Model A can be represented by the equation $6p + q = 2$.

- (a) (i) Write down a second equation to represent Model A, when the speed is 10 m s^{-1} .
(ii) Find the values of p and q . [4]
- (b) Find the coordinates of the vertex of the graph of $y = d(s)$. [2]
- (c) Using the values in the table and your answer to part (b), sketch the graph of $y = d(s)$ for $0 \leq s \leq 10$ and $-10 \leq d \leq 60$, clearly showing the vertex. [3]
- (d) Hence, identify why Model A may not be appropriate at lower speeds. [1]

Additional data was used to create Model B, a revised model for the braking distance of a truck.

$$\text{Model B: } d(s) = 0.95s^2 - 3.92s$$

- (e) Use Model B to calculate an estimate for the braking distance at a speed of 20 m s^{-1} . [2]
- The actual braking distance at 20 m s^{-1} is 320 m.
- (f) Calculate the percentage error in the estimate in part (e). [2]

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