Classroom to Campus: Math and Stats Challenge

Grade 12 – MCT4C

Topic B: Polynomial Functions

Analyzing the Acceleration of a Dragster Using Kinematic Equations

In a high school physics class, students are exploring the principles of kinematics by analyzing the performance of a dragster—a specialized racing vehicle designed for rapid acceleration over short distances.

The dragster starts from rest and covers a distance of 500 metres in 15 seconds. Students are tasked with determining the dragster's acceleration using kinematic equations.

The equation relating distance (s in m), initial velocity (v in m/s), acceleration (a in m/s^2), and time (t in s) is:

$$s = vt + \frac{1}{2}at^2$$

a) Calculate the acceleration of the dragster. *(Round your final answer to two decimal places. Provide units.)*

b) How far would the dragster travel if it accelerated for an additional 5 seconds (totaling 20 seconds)? *(Round your final answer to two decimal places. Provide units.)*

c) Determine the final velocity of the dragster after 15 seconds using the calculated acceleration. Hint: $a = \frac{\Delta v}{\Delta t}$ *(Round your final answer to two decimal places. Provide units.)*

d) If the dragster's acceleration increased by 20%, what would be its new acceleration value, and how far would it travel in 15 seconds under this new acceleration? *(Round your final answers to two decimal places. Provide units.)*

e) How does the calculated acceleration, from part a), of this dragster compare to that of real-world dragsters, which can reach top speeds of approximately 145 m/s in about 4.45 s? Hint: $a = \frac{\Delta v}{\Delta t}$ *(Round your final answer to two decimal places. Provide units.)*

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