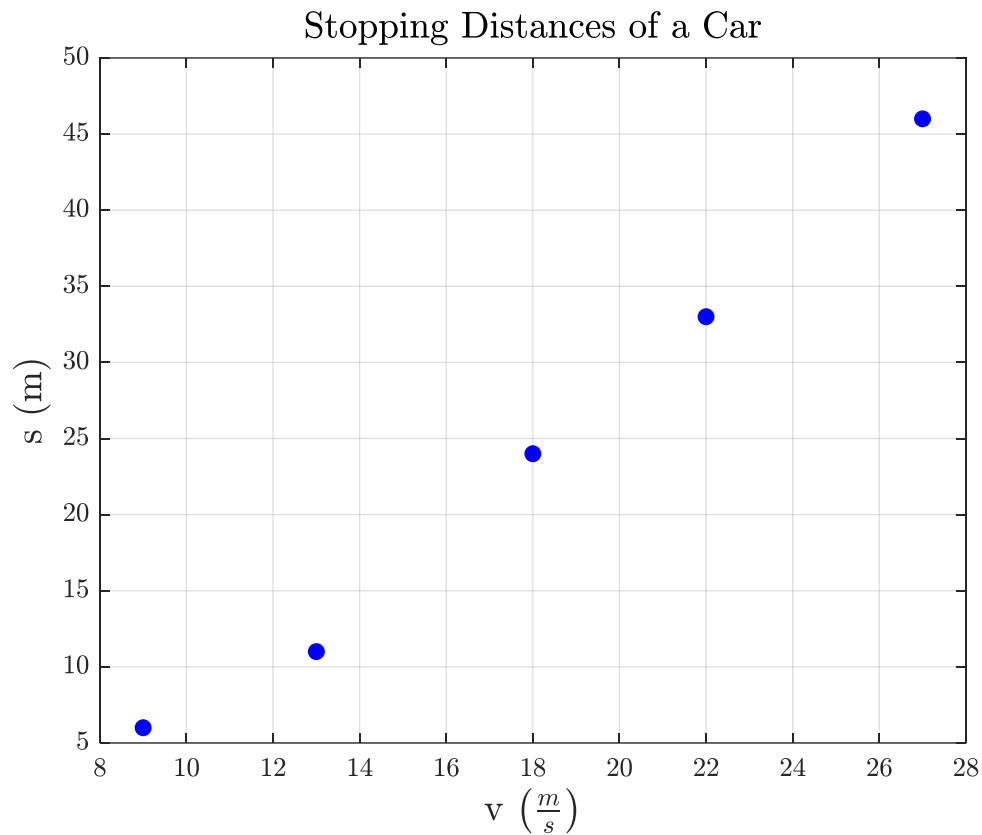


Calculus: Stopping Distances

The following data is given for the stopping distance of a car as a function of the speed at which it begins braking:

Velocity, v $\left(\frac{m}{s}\right)$	9	13	18	22	27
Stopping Distance, s (m)	6	11	24	33	46

Compute the rate of change of the stopping distance for all of the given speeds. Use the forward difference at the first data point, the backward difference at the last data point, and the central difference at the interior data points. Indicate each derivative on the provided plot.

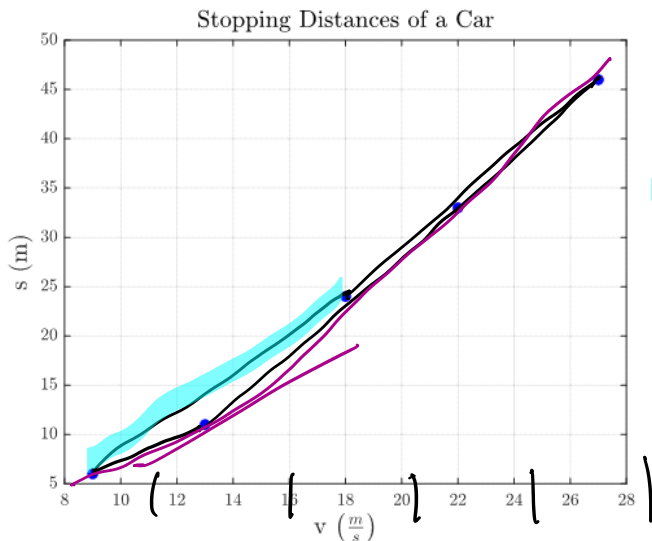


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$$FD = \frac{f(x_{i+1}) - f(x_i)}{x_{i+1} - x_i} + O(h)$$

$$CD = \frac{f(x_{i+1}) - f(x_{i-1}))}{x_{i+1} - x_{i-1}} + O(h^2)$$

$$BD = \frac{f(x_i) - f(x_{i-1}))}{x_i - x_{i-1}} + O(h)$$

$$\left. \frac{ds}{dv} \right|_{v=9} = \frac{11-6}{13-9} = 1.25 \text{ s}$$

$$\left. \frac{ds}{dv} \right|_{v=13} = \frac{24-6}{18-9} = 2 \text{ s}$$

$$\left. \frac{ds}{dv} \right|_{v=18} = \frac{33-11}{22-13} = 2.44 \text{ s}$$

$$\left. \frac{ds}{dv} \right|_{v=22} = \frac{46-24}{27-18} = 2.44 \text{ s}$$

$$\frac{ds}{dv} \Big|_{v=27} = \frac{46-33}{27-22} = 2.6$$