Linear Spline Interpolation

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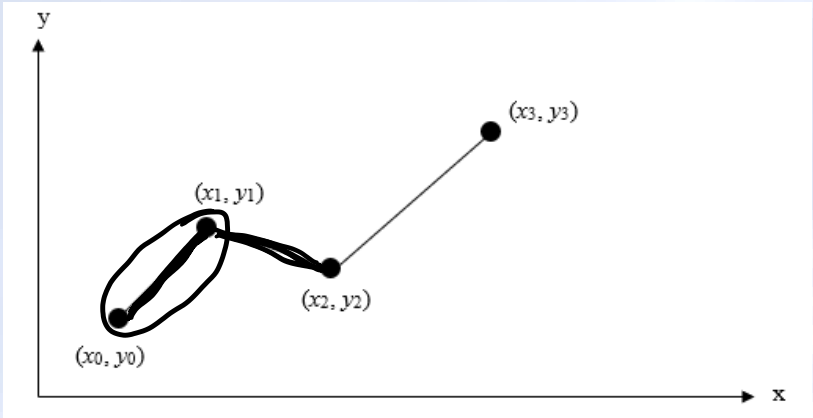
Linear Spline Interpolation

Given $(x_0, y_0), (x_1, y_1), \ldots\ldots, (x_{n-1}, y_{n-1}), (x_n, y_n)$, find the interpolating linear spline to the data.



$$f(x) = f(x_0) + \frac{f(x_1) - f(x_0)}{x_1 - x_0}(x - x_0), \quad x_0 \le x \le x_1,$$

$$= f(x_1) + \frac{f(x_2) - f(x_1)}{x_2 - x_1}(x - x_1), \quad x_1 \le x \le x_2,$$

$$\vdots$$

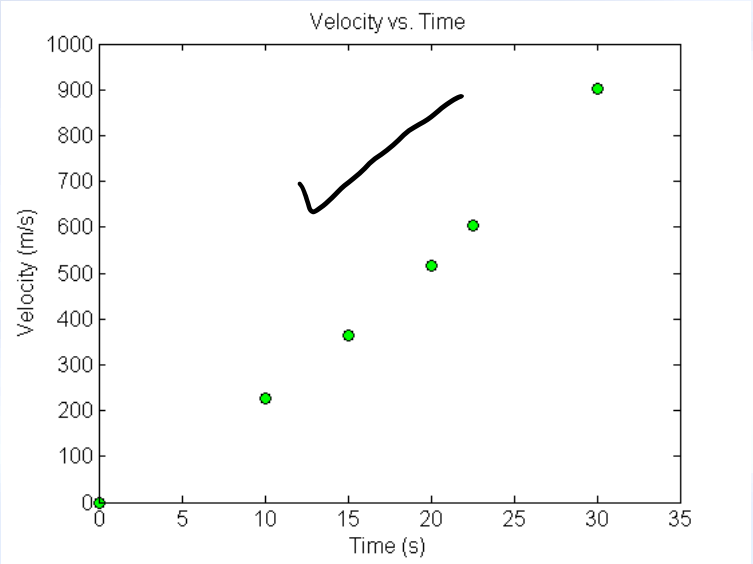
$$= f(x_{n-1}) + \frac{f(x_n) - f(x_{n-1})}{x_n - x_{n-1}}(x - x_{n-1}), \quad x_{n-1} \le x \le x_n.$$

Example Statement

The upward velocity of a rocket is given as a function of time. Find the velocity at t=16 seconds using linear spline interpolation.

$v(16)$

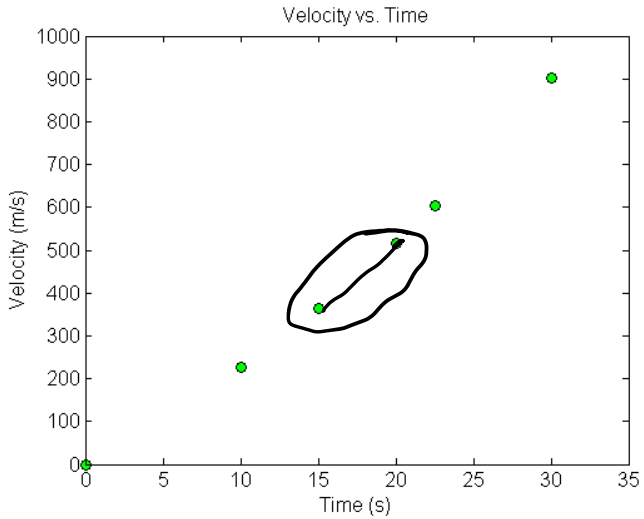
t (s)	$v(t)$ (m/s)
0	0
10	227.04
15	362.78
20	517.35
22.5	602.97
30	901.67



Solution

$t_0 = 15,\ v(t_0) = 362.78$

$t_1 = 20,\ v(t_1) = 517.35$



$$v(t) = v(t_0) + \frac{v(t_1) - v(t_0)}{t_1 - t_0}(t - t_0)$$

$$= 362.78 + \frac{517.35 - 362.78}{20 - 15}(t - 15)$$

$$= 362.78 + 30.913(t - 15),\ 15 \le t \le 20$$

$$v(16) = 362.78 + 30.913(16 - 15)$$

$$= 393.7\ m/s$$

END

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Acknowledgement

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