Applications of the Derivative

Extreme-Value Theorem (informal)

If a function is continuous on a ***closed*** interval, then it must have a max and min value on that ***closed*** interval.

$s(t)$ is position of an object at time t

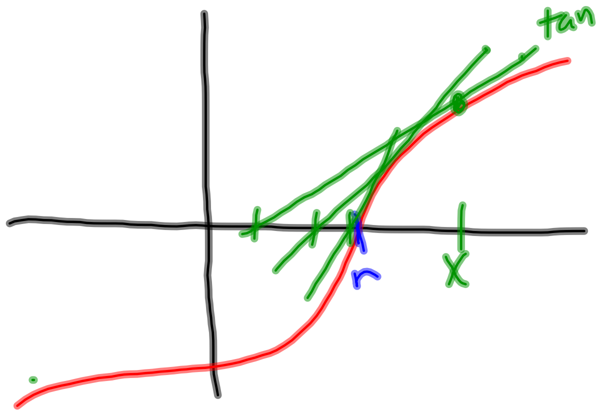
$$v(t) = s'(t) = \frac{ds}{dt}$$

velocity => direction

instantaneous <u>speed</u> $= |v(t)|$

$$a(t) = v'(t) = \frac{dv}{dt} = s''(t) = \frac{d^2s}{dt^2}$$

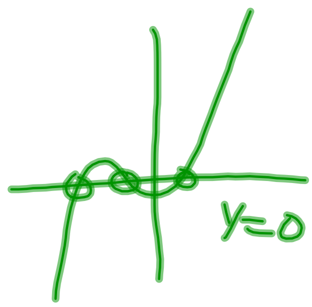
Newton's Method



$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$n = 1, 2, 3, \ldots$

ex1 $x^3 - x - 1 = 0$ $y = x^3 - x - 1$



$f'(x) = 3x^2 - 1$

$x_{n+1} = x_n - \dfrac{x_n^3 - x_n - 1}{3x_n^2 - 1}$

notice $1 < r < 2$

$x_1 = 1.5$

$$x_{n+1} = 1.5 - \frac{(1.5)^3 - (1.5) - 1}{3(1.5)^2 - 1} = 1.34782$$

$$X_2 = 1.347$$

$$X_3 = 1.347 - \frac{(1.347)^3 - (1.347) - 1}{3(1.347)^2 - 1} = 1.3252\ldots$$

$$X_4 = 1.3247\ldots$$

Mean Value Theorem (informal)

A continuous function on an open interval takes on all the values in the Range of the function. Specifically, the value that is the mean of the endpoint values.

HW

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