

## Secant Method

If we do not have an analytic formula for the derivative  $f'(x)$  we cannot use Newton's method. An alternative is to calculate the derivative numerically, using as the 2 points for the derivative  $x$  and  $x'$ . This is the secant method.

### Recipe.

- 1) Start with 2 points  $x_1$  and  $x_2$ , but contrary to the bisection method, we don't need to have  $f(x_1) \cdot f(x_2) < 0$ .
- 2) Use these two points to approximate the derivative of  $f$  at  $x_2$ ,

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$$f'(x_2) \approx \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$f'(x_2) \simeq \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

.) For the Newton's method, the new guess was

$$x' = x - \frac{f(x)}{f'(x)}$$

Now, for the secant method, the new guess  $x_3$  is

$$x_3 = x_2 - f(x_2) \frac{(x_2 - x_1)}{f(x_2) - f(x_1)}$$

So the new guess is based on TWO previous values, while for the Newton's method there was just one.