Lecture 2.2: Nonlinear equations – Root finding

- Objective: Solve *f(x) = 0* f: nonlinear function
- Newton-Raphson Method:

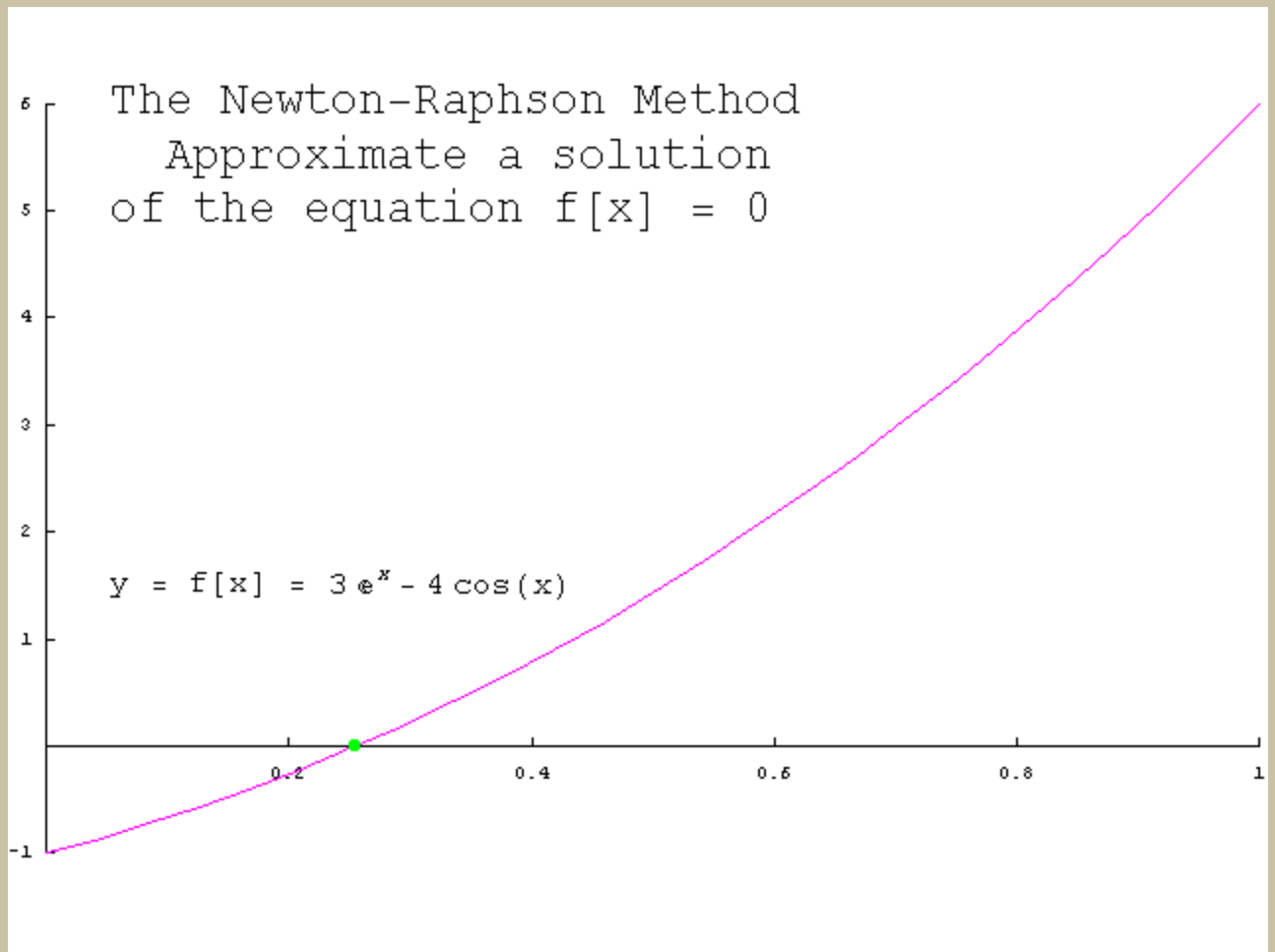
$$f(x_{i+1}) = f(x_i) + f'(x_i)(x_{i+1} - x_i) + f''(x_i)(x_{i+1} - x_i)^2$$

if $f(x_{i+1})$ is a root of *f(x)*, set left-side equal to zero. Neglecting 2nd order terms:

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

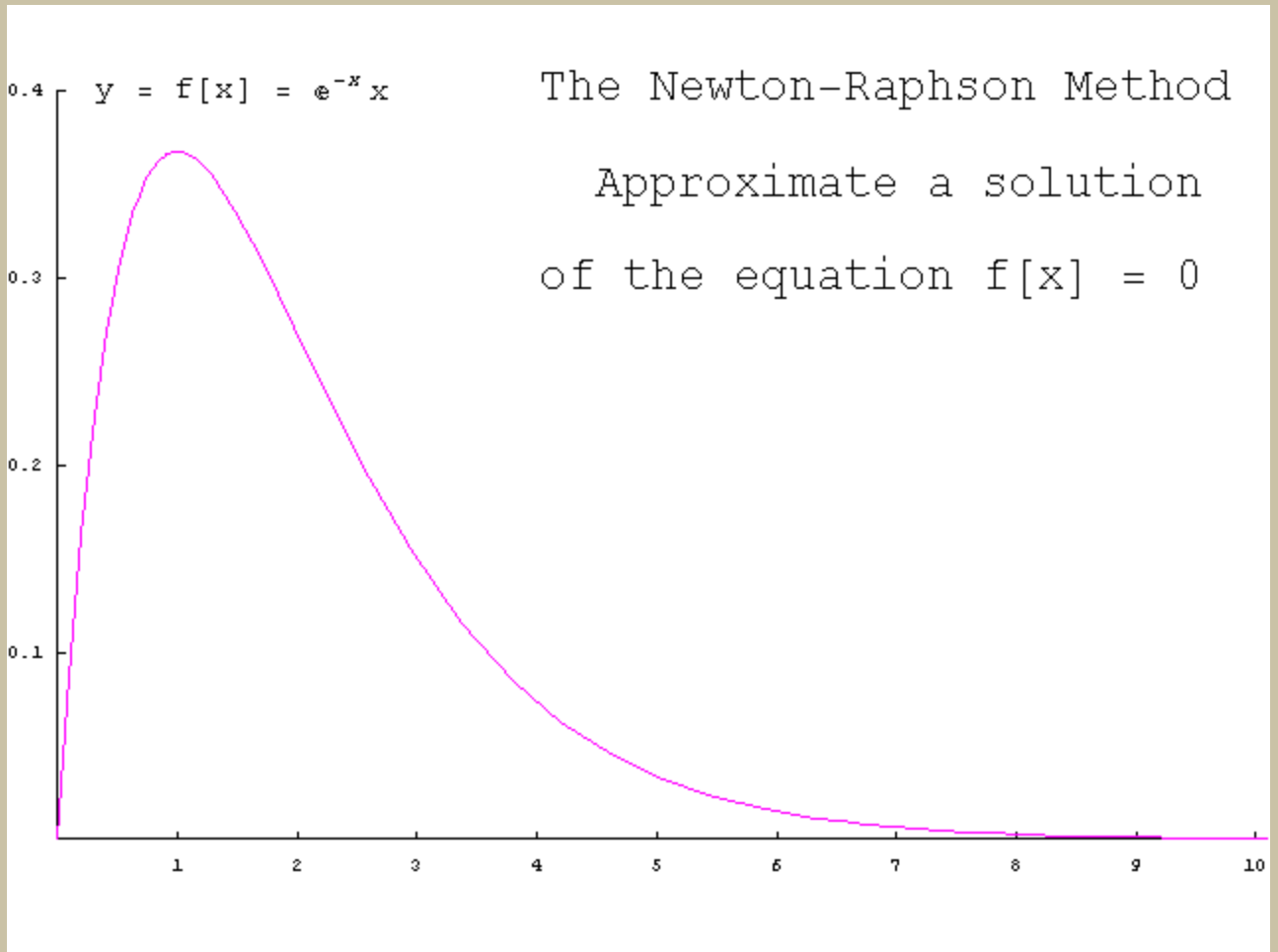
Newton-Raphson Method

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$



Newton-Raphson Method

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$



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- Objective: Solve *f(x) = 0* f: nonlinear function
- Secant Method:

$$f(x_{i+1}) = f(x_i) + f'(x_i)(x_{i+1} - x_i) + f''(x_i)(x_{i+1} - x_i)^2$$

if $f(x_{i+1})$ is a root of $f(x)$, set left-side equal to zero.

Neglecting 2nd order terms, and approximating the derivative by a finite difference scheme:

$$f'(x_i) = \frac{f(x_i) - f(x_{i-1})}{x_i - x_{i-1}}$$

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

The Secant method

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