Differentiation of Continuous Functions – Prior Knowledge

For more details on this topic

➢ Go to http://nm.MathForCollege.com

➢ Click on Prerequisites to Numerical Differentiation

$f(x)$

secant line

Q

tangent line

P

x

Δx
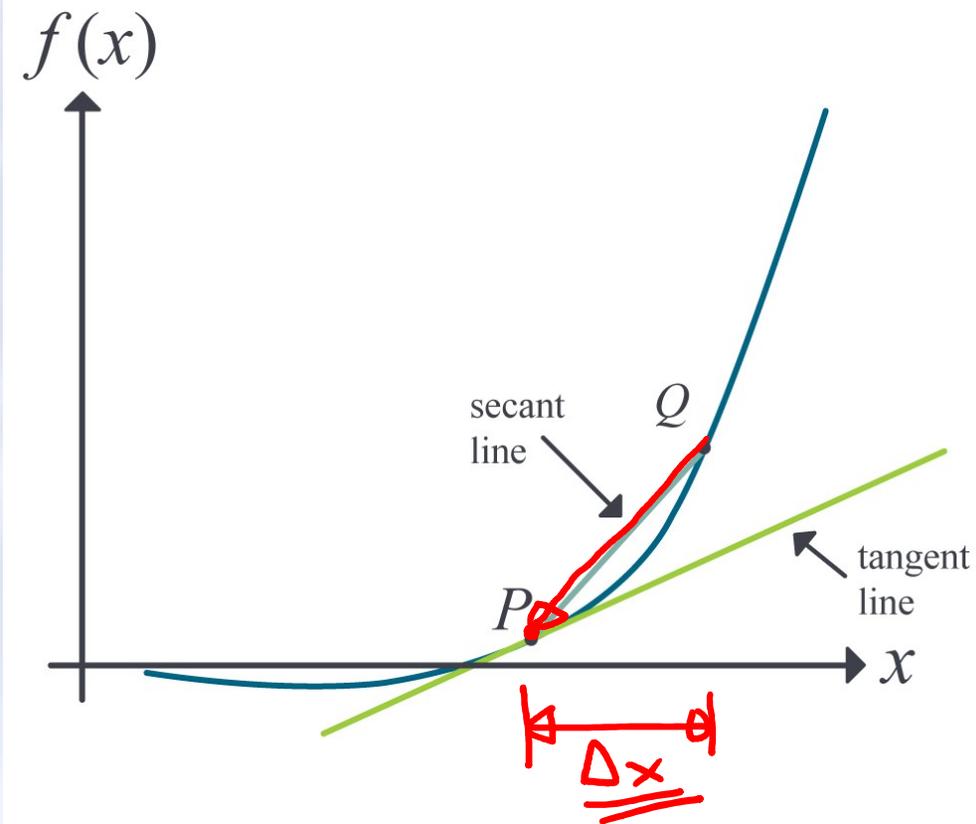
$$\dfrac{f(x+\Delta x)-f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

Example of finding $f'(x)$

For $f(x) = 7x^2$

a) find the true value of $f'(3)$.

b) estimate the approximate value of $f'(3)$ if a secant line were drawn with $\Delta x = 0.5$

a) $f(x) = 7x^2$

$f'(x) = 7(2x)$

$= 14x$

$f'(3) = 14 * 3 = \boxed{42}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$f(x) = 7x^2$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{7(x+\Delta x)^2 - 7x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{7(x^2 + (\Delta x)^2 + 2x\Delta x) - 7x^2}{\Delta x}$$

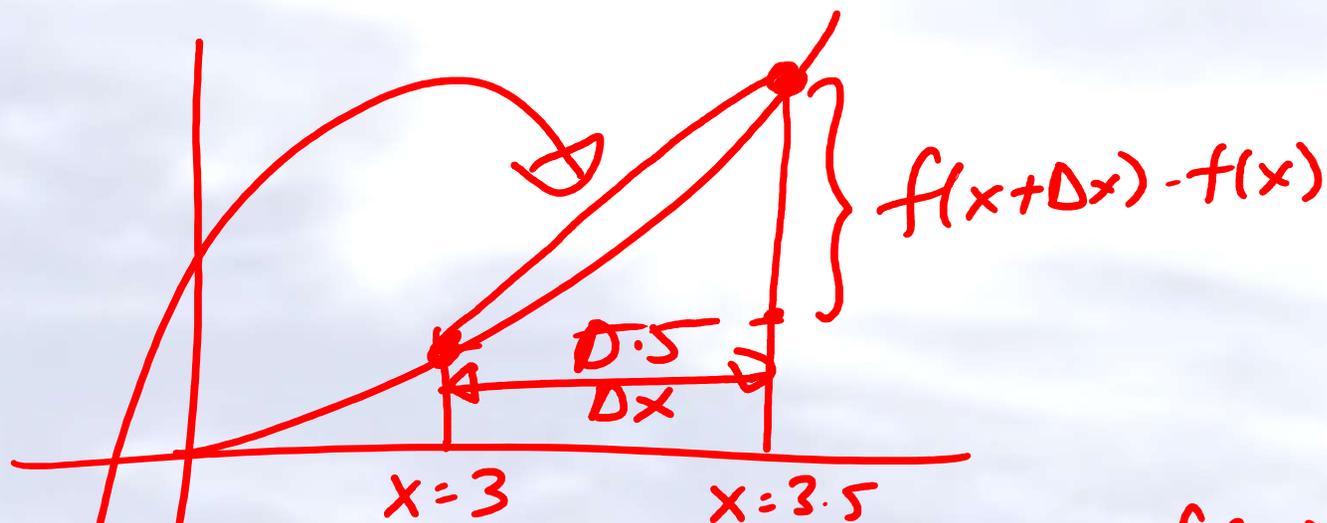$$= \lim_{\Delta x \to 0} \frac{7x^2 + 7(\Delta x)^2 + 14x\Delta x - 7x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} 7(\Delta x) + 14x$$

$$= 14x.$$

$$f'(3) = 14(3) = 42$$

b)

$$\{ \; f(x+\Delta x) - f(x)$$

$$x=3 \qquad x=3.5$$

$$0.5 = \Delta x$$

$$f'(x) \approx \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$f'(3) = \frac{f(3+0.5) - f(3)}{0.5}$$

$$= \frac{f(3.5) - f(3)}{0.5}$$

$$= \frac{7(3.5)^2 - 7(3)^2}{0.5}$$

$$= 45.5$$

END

You are free

- to **Share** – to copy, distribute, display and perform the work
- to **Remix** – to make derivative works

under the following conditions

- **Attribution** — You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work).
- **Noncommercial** — You may not use this work for commercial purposes.
- **Share Alike** — If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

Acknowledgement

This instructional resource is brought to you by
Numerical Methods for STEM undergraduate
http://nm.MathForCollege.com
Committed to bringing numerical methods to the
undergraduate

MathForCollege.com
Open Education Resources

Like what you see - tell your friends.
Subscribe to the NumericalMethodsGuy Channel – help us reach our goal of 100,000 subscribers.