

Differentiation of Continuous Functions – Prior Knowledge



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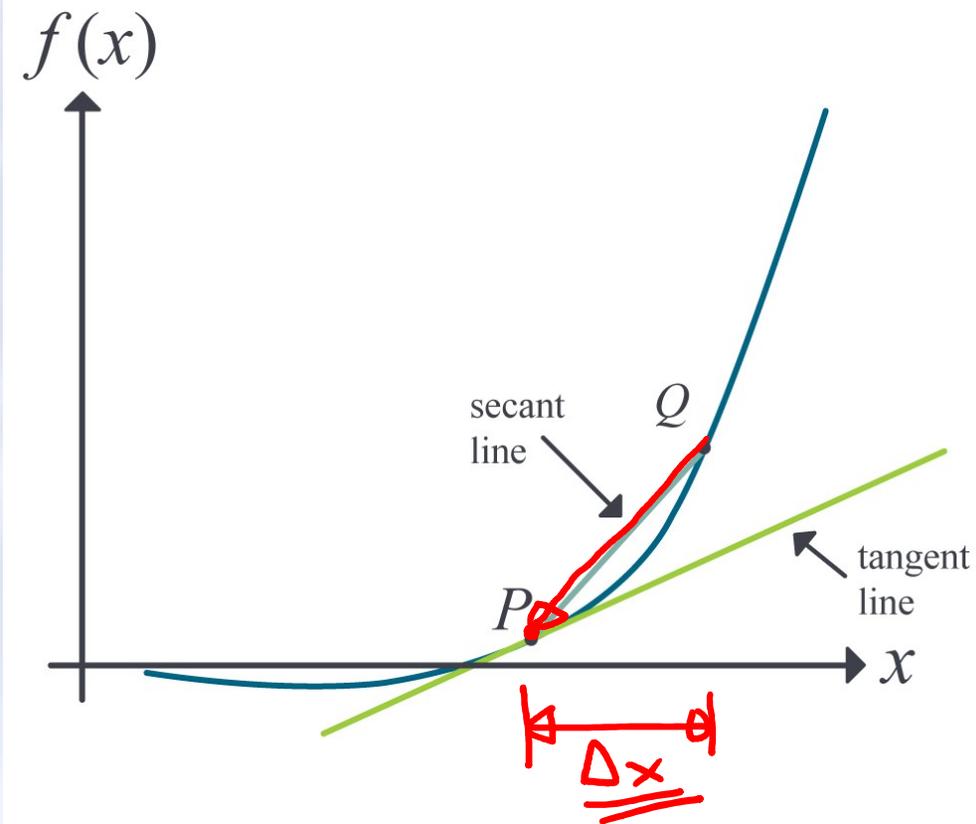
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Transforming Numerical Methods Education for STEM Undergraduates

For more details on this topic

- Go to <http://nm.MathForCollege.com>
- Click on Prerequisites to Numerical Differentiation





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

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



Example of finding $f'(x)$

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

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



$$a) \quad f(x) = \underline{\underline{7x^2}}$$

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

$$= \underline{\underline{14x}}$$

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



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

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

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

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

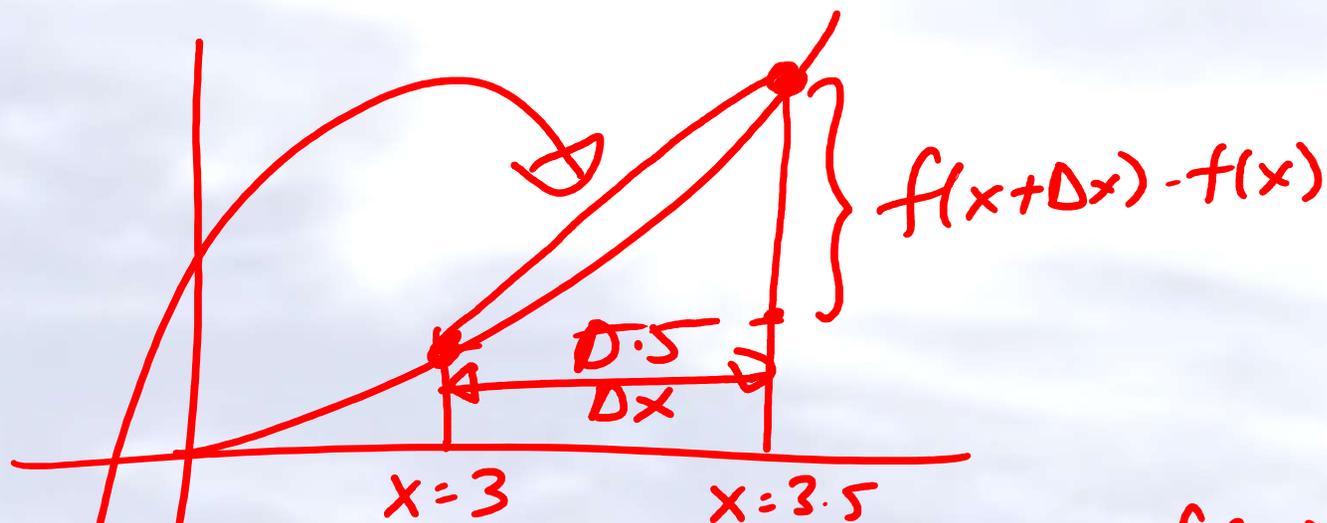
$$= \lim_{\Delta x \rightarrow 0} \frac{\cancel{7x^2} + 7(\Delta x)^2 + 14x\Delta x - \cancel{7x^2}}{\Delta x}$$

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

$$= 14x.$$

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

b)



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

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

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

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

$$= 45.5$$

END

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Committed to bringing numerical methods to the
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