Approximating derivatives

- A parallel problem to approximating definite integrals is approximating derivatives of functions.

x	$f(x)$	$f'(x) \simeq ?$
—	—	
—	—	
—	—	
—	—	
—	—	
—	—	
—	—	
—	—	

- This is especially important in cases where $f(x)$ is not known in functional form (ie, only a table of values is known). We will look at this case later.

- All derivative approximations start from the same basic idea

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

if Δx is "small enough", then

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

should be a good approximation.

- The problem of approximating $f'(x)$ for a known $f(x)$ is straight forward, but we also need to input Δx.

- Tabulate $f(x)$ given a, b, n
- at each x, compute $f'(x) \approx \dfrac{f(x+\Delta x) - f(x)}{\Delta x}$ given Δx

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a = ~~
b = ~~
n = ~~
dx = ~~
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$$f(x) = xe^{-x}$$

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h = (b-a)/n

Do i = 1,n+1
    x = a + (i-1)*h           ——→  x coordinate
    f = x * EXP(-x)           ——→  function value
    x1 = x + dx               ——→  get x + dx
    f1 = x1 * EXP(-x1)        ——→  get f(x+dx)
    fp = (f1 - f)/dx          ——→  fp = (f(x+dx) - f(x))/dx
ENDDO
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