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P223 8.1 $f(x) = \ln x$ $f'(x) = \frac{1}{x}$ $f'(1) = 1$

(a) $f'(1) = \frac{f(1.1) - f(1)}{0.1} = \frac{\ln 1.1}{0.1} = 0.95310$ $e = |1 - 0.95310| = 0.046898$

(b) $f'(1) = \frac{f(1.01) - f(1)}{0.01} = \frac{\ln 1.01}{0.01} = 0.995033$ $e = |1 - 0.995033| = 0.004967$

(c) $f'(1) = \frac{f(1.001) - f(1)}{0.001} = \frac{\ln 1.001}{0.001} = 0.999500$ $e = |1 - 0.999500| = 0.000500$

13. $f(x+3h) = f(x) + 3hf'(x) + \frac{9h^2}{2}f''(x) + o(h^3)$

$f(x-h) = f(x) - hf'(x) + \frac{h^2}{2}f''(x) + o(h^3)$

$\Rightarrow f(x+3h) - 9f(x-h) = -8f(x) + 12hf'(x) + o(h^3)$

13. $\Rightarrow f'(x) = \frac{f(x+3h) + 8f(x) - 9f(x-h)}{12h} + o(h^2)$

14. (a) $F(x) = \frac{4f(h/2) - f(h)}{4-1} = \frac{4}{3} \frac{f(x+\frac{3}{2}h) + 8f(x) - 9f(x-\frac{h}{2})}{6h}$

$-\frac{f(x+3h) + 8f(x) - 9f(x-h)}{12h} \Bigg] / 3 = \frac{-f(x+3h) + 8f(x+\frac{3}{2}h) + 56f(x) - 72f(x-\frac{h}{2}) + 9f(x-h)}{36h}$