5.1.1 - $f'(x) = \frac{f(x+h) - f(x)}{h} + \frac{h}{2} f''(c)$

b. $f'(1) = \frac{f(1+.1) - f(1)}{h} = \frac{\ln 1.01 - \ln 1}{.01} = .99503$

$e(1) = \frac{h}{2} f''(c) = \frac{.01}{2} \cdot f''(c) = .005\, f''(c)$

a. $f'(1) = \frac{\ln 1.1 - \ln 1}{.1} = .95310$

$e(1) = \frac{.1}{2} f''(c) = .05 \cdot f''(c)$

c. $f'(1) = \frac{\ln 1.001 - \ln 1}{.001} = .99950$

$e(1) = \frac{.001}{2} f''(c) = .0005 \cdot f''(c)$

5.1.7 - $f(x-h) = f(x) - h f'(x) + \frac{h^2}{2} f''(c)$

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

$f'(x) = \frac{f(x) - f(x-h)}{h} + \frac{h}{2} f''(c)$

$f'(x) \approx \frac{f(x) - f(x-h)}{2}$

$e(x) = \frac{h}{2} f''(c)$

5.2.1. a. $m=1$ $\int_0^1 x^2 dx = \frac{h}{2}\left(y_0 + y_m + 2\sum_{i=1}^{m-1} y_i\right)$ $h = (b-a)/m = (1-0)/1 = 1$

$= \frac{1}{2}(0^2 + 1^2 + 0) = \boxed{\frac{1}{2}}$

$m=2$ $h = (1-0)/2 = \frac{1}{2}$ $\int_0^1 x^2 dx = \frac{1}{4}\left(0^2 + 1^2 + 2 \cdot \sum_{i=1}^{1} \left(\frac{1}{2}\right)^2\right)$

$= \frac{1}{4}\left(1 + 2 \cdot \frac{1}{4}\right) = \frac{1}{4} \cdot \frac{3}{2} = \boxed{\frac{3}{8}}$

$m=4$ $h = (1-0)/4 = \frac{1}{4}$ $\int_0^1 x^2 dx = \frac{1}{8}\left(0^2 + 1^2 + 2 \cdot \left(\frac{1}{4}\right)^2 + 2 \cdot \left(\frac{1}{2}\right)^2 + 2 \cdot \left(\frac{3}{4}\right)^2\right)$

$= \frac{1}{8}\left(1 + \frac{1}{8} + \frac{4}{8} + \frac{9}{8}\right) = \frac{1}{8}\left(\frac{22}{8}\right) = \frac{22}{64} = \boxed{\frac{11}{32}}$

actual $\int_0^1 x^2 dx = \frac{1}{3} x^3 \Big|_0^1 = \frac{1}{3} \cdot 1 - \frac{1}{3} \cdot 0 = \frac{1}{3}$

error $(m=4) = \left|\frac{1}{3} - \frac{11}{32}\right| = \frac{1}{96} = \boxed{.0104}$

error $(m=2) = \left|\frac{1}{3} - \frac{3}{8}\right| = \boxed{.0417}$

error $(m=1) = \left|\frac{1}{3} - \frac{1}{2}\right| = \boxed{.1667}$

b. $m=1$ $h = \left(\frac{\pi}{2} - 0\right)/1 = \frac{\pi}{2}$ $\int_0^{\pi/2} \cos x\, dx = \frac{\pi}{4}\left(\cos 0 + \cos \frac{\pi}{2} + 0\right) = \frac{\pi}{4} = \boxed{.7854}$

$m=2$ $h = \left(\frac{\pi}{2} - 0\right)/2 = \frac{\pi}{4}$ $= \frac{\pi}{8}\left(\cos 0 + \cos \frac{\pi}{2} + 2 \cdot \cos \frac{\pi}{4}\right) = \boxed{.9481}$

$m=4$ $h = \left(\frac{\pi}{2} - 0\right)/4 = \frac{\pi}{8}$ $= \frac{\pi}{16}\left(\cos 0 + \cos \frac{\pi}{2} + 2 \cdot \cos \frac{\pi}{8} + 2 \cdot \cos \frac{\pi}{4} + 2 \cdot \cos \frac{3\pi}{8}\right) = \boxed{.9871}$

actual $\int_0^{\pi/2} \cos x\, dx = \sin x \Big|_0^{\pi/2} = \sin \frac{\pi}{2} - \sin 0 = 1$

error $(m=4) = |1 - .9871| = \boxed{.0129}$

error $(m=2) = |1 - .9481| = \boxed{.0519}$

error $(m=1) = |1 - .7854| = \boxed{.2146}$