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CPE-201

1) a). 4V ; Centered Divided - Difference

$$\begin{aligned}f'(4)_{h=2} &= \frac{f(4+2) - f(4-2)}{2(2)} \\&= \frac{f(6) - f(2)}{4} \\&= \frac{2.381 - 0.522}{4}\end{aligned}$$

$$f'(4)_{h=2} = -1.0353 \text{ pF/V}$$

b). 10V ; Backward Divided - Difference

$$\begin{aligned}f'(10)_{h=2} &= \frac{f(10-2(2)) - 4f(10-2) + 3f(10)}{2(2)} \\&= \frac{f(6) - 4f(8) + 3f(10)}{4} \\&= \frac{2.381 - 4(1.807) + 3(1.456)}{4}\end{aligned}$$

$$f'(10)_{h=2} = -0.1198 \text{ pF/V}$$

$$2). \int_0^{\pi/4} (\cos x - \sin x) dx$$

a). Trapezoidal Rule

$$I = \left(\frac{\pi}{4} - 0\right) \left( \frac{(\cos 0 - \sin 0) + (\cos \pi/4 - \sin \pi/4)}{2} \right)$$

$$I = \pi/8 \text{ or } 0.3927$$

b). Simpson's  $1/3$  rule

$$h = \frac{\pi/4 - 0}{2} = \frac{\pi}{8}$$

$$x_0 = 0$$

$$x_1 = 0 + \pi/8 = \pi/8$$

$$x_2 = \pi/8 + \pi/8 = \pi/4$$

$$I = \frac{1}{3} \left( \frac{\pi}{8} \right) \left( \cos 0 - \sin 0 \right) + 4 \left( \cos \pi/8 - \sin \pi/8 \right) + \left( \cos \pi/4 - \sin \pi/4 \right)$$

$$I = 0.4143$$

c). Simpson's  $3/8$  rule

$$h = \frac{\pi/4 - 0}{3} = \pi/12$$

$$x_0 = 0$$

$$x_1 = 0 + \pi/12 = \pi/12$$

$$x_2 = \pi/12 + \pi/12 = \pi/6$$

$$x_3 = \pi/6 + \pi/12 = \pi/4$$

$$I = \frac{3}{8} \left( \frac{\pi}{12} \right) \left[ (\cos 0 - \sin 0) + 3(\cos \pi/12 - \sin \pi/12) + 3(\cos \pi/6 - \sin \pi/6) + (\cos \pi/4 - \sin \pi/4) \right]$$

$$I = 0.4142$$