SYLHET ENGINEERING COLLEGE

EEE 305 Term Test: 3

1 Evaluate 4

$$\int_0^3 (x^2 e^x) dx$$

Using multiple application of simpson's 1/3 rule with n=4

→ 1

Use of $$I \cong \underbrace{(b-a)}_{\text{Width}} \underbrace{\frac{f(x_0) + 4\sum_{i=1,3,5}^{n-1} f(x_i) + 2\sum_{j=2,4,6}^{n-2} f(x_j) + f(x_n)}{3n}}_{\text{Average height}}$$

a	0				
b	3				
n	4				
h	0.75				
i	x	fx			I
x0	0	0			99.45683
x1	0.75	1.190813			
x2	1.5	10.0838			
x3	2.25	48.03166			
x4	3	180.7698			

Finding x0 through x4 1

Finding fx's 1

Finding the integration 1

True value=98.42768462

2 Evaluate question 1 using trapezoidal rule with n=4 4

→

Use of $$I = \frac{h}{2}\left[f(x_0) + 2\sum_{i=1}^{n-1} f(x_i) + f(x_n) \right]$$

a	0				
b	3				
n	4				
h	0.75				
i	x	fx			I
x0	0	0			112.2684
x1	0.75	1.190813			
x2	1.5	10.0838			
x3	2.25	48.03166			
x4	3	180.7698			

Finding x0 through x4 1

Finding fx's 1

Finding the integration 1

True value=98.42768462

Total Time: 40 Minutes Total Mark: 20 Marks

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3 Compute the backward difference approximation of $O(h) and\ O(h^2)$ for the first derivative of $y = \sin x$ at $x = \frac{\pi}{4}$ suing a value of $h = \frac{\pi}{12}$. Estimate the true percent relative error for each approximation. 3

→

23.1

	x	f(x)
x_{i-2}	π/12	0.259
x_{i-1}	π/6	0.5
x_i	π/4	0.707
x_{i+1}	π/3	0.866
x_{i+2}	5π/12	0.966

true = cos(π/4) = 0.707

	first order	second order
Forward	0.607 (14.5%)	0.720 (−1.8%)
Back	0.791 (−10.6%)	0.726 (−2.6%)
Center	0.699 (1.1%)	0.7069 (0.014%)

4 Use the Gauss-Seidel method without relaxation to solve the following system to a tolerance of $\varepsilon_a = 10\%$. 5

$$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$$
$$0.1x_1 + 7x_2 - 0.3x_3 = -19.3$$
$$0.3x_1 - 0.2x_2 + 10x_3 = 71.4$$

Assume initial guesses to be 0 for $x_1, x_2, \& x_3$

→ 1

$$x_1 = \frac{7.85 + 0.1x_2 + 0.2x_3}{3}$$
$$x_2 = \frac{-19.3 - 0.1x_1 + 0.3x_3}{7}$$
$$x_3 = \frac{71.4 - 0.3x_1 + 0.2x_2}{10}$$

x1	x2	x3	x1'	x2'	x3'	i	ea1	ea2	ea3
0	0	0	2.616667	-2.79452	7.00561	1	100	100	100
2.616667	-2.79452	7.00561	2.990557	-2.49962	7.000291	2	12.50235	11.79774	0.075978
2.990557	-2.49962	7.000291	3.000032	-2.49999	6.999999	3	0.315843	0.014532	0.004165

Calculating 1st iteration with error 2

Calculating second iteration 1

Calculating 3rd iteration 1

Total Time: 40 Minutes Total Mark: 20 Marks

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5 Find the straight line fitting the points $x_i and\ y_i$ 4

x_i	10	20	30	40	50	60	70	80
y_i	25	70	380	550	610	1220	830	1450

→

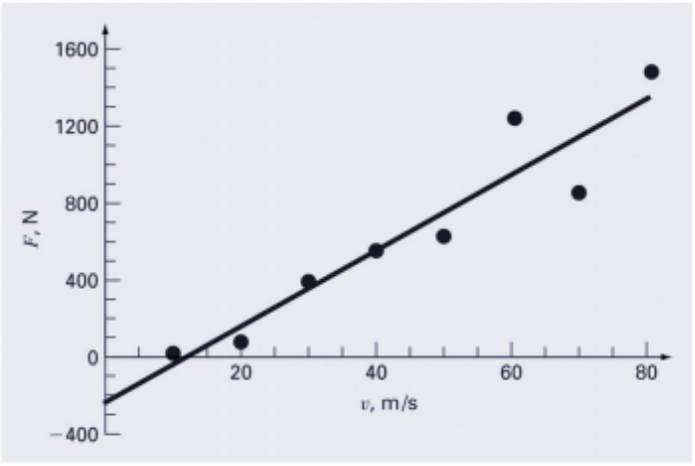
Find the straight line fitting the points x_i and y_i

	V (m/s)	F (N)		
i	x_i	y_i	$(x_i)^2$	$x_i y_i$
1	10	25	100	250
2	20	70	400	1400
3	30	380	900	11400
4	40	550	1600	22000
5	50	610	2500	30500
6	60	1220	3600	73200
7	70	830	4900	58100
8	80	1450	6400	116000
Σ	360	5135	20400	312850

$$a_1 = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{n\sum x_i^2 - \left(\sum x_i\right)^2} = \frac{8(312850) - (360)(5135)}{8(20400) - (360)^2} = 19.47024$$

$$a_0 = \bar{y} - a_1 \bar{x} = 641.875 - 19.47024(45) = -234.2857$$

$$F_{est} = -234.2857 + 19.47024v$$



Finding $(x_i)^2, and\ x_i y_i$ for all 8 terms 1

Finding the sum of $x_i, y_i, (x_i)^2, and\ x_i y_i$ 1

Finding a1 1

Finding a0 1

Total Time: 40 Minutes Total Mark: 20 Marks