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MATRIC NUMBER: 16/ENG01/010

DEPARTMENT: CHEMICAL ENGINEERING

QUESTION 4a

i. Fixed Point

```
commandwindow
clear
clc
format long g
p=0.35;
g = 9.81;
m = 68.1;
t = 10;
v = 40;
for i=1:inf
    iter(i+1) = i;
    p(i+1)=(g*m)/v*(1- exp((-p(i)*t)/m));
    Ea(i+1)=abs((p(i+1)-p(i))/p(i+1))*100);
    if Ea(i+1) <= 1E-11
        break
    end
end
p'
iter'
Ea'
table=[iter',p',Ea']
```

COMMAND WINDOW

ans =

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

ans =

0

58.168

56.669

53.172

45.643

32.384

16.809

6.3246
1.9647
0.56647
0.15956
0.044645
0.012468
0.00348
0.00097117
0.00027102
7.563e-05
2.1105e-05
5.8896e-06
1.6435e-06
4.5865e-07
1.2799e-07
3.5716e-08
9.967e-09
2.7814e-09
7.7617e-10
2.1659e-10
6.044e-11
1.6862e-11
4.7166e-12

table =

0	0.35	0
1	0.83669	58.168
2	1.9309	56.669
3	4.1234	53.172

4	7.5858	45.643
5	11.219	32.384
6	13.486	16.809
7	14.396	6.3246
8	14.685	1.9647
9	14.768	0.56647
10	14.792	0.15956
11	14.799	0.044645
12	14.8	0.012468
13	14.801	0.00348
14	14.801	0.00097117
15	14.801	0.00027102
16	14.801	7.563e-05
17	14.801	2.1105e-05
18	14.801	5.8896e-06
19	14.801	1.6435e-06
20	14.801	4.5865e-07
21	14.801	1.2799e-07
22	14.801	3.5716e-08
23	14.801	9.967e-09
24	14.801	2.7814e-09
25	14.801	7.7617e-10
26	14.801	2.1659e-10
27	14.801	6.044e-11
28	14.801	1.6862e-11
29	14.801	4.7166e-12

ii. Newton Raphson

```
commandwindow
clear
clc
format long g
syms p
g = 9.81;
```

```

v = 40;
t = 10;
m = 68.1;
a = v - (((g*m)/p)*(1- exp((-p*t)/m)))
pretty(a)
q = diff(a)
pretty(q)
p = 0.35;
% p = double(subs(p - (a/q)))
for i= 1:10;
    iter(i+1) = i;
    pf(i) = p;
    p = double(subs(p - (a/q)));
    pf(i+1) = p;
    Ea(i+1) = abs(((pf(i+1)-pf(i))/pf(i+1))*100);
    if Ea(i+1) <= 1E-11
        break
    end
end
end
iter'
pf'
Ea'
table(iter',pf',Ea')

```

a =

$$(2938163350254649*(\exp(-(100*p)/681) - 1))/(4398046511104*p) + 40$$

/ / 100 p \ \

| exp| - ---- | - 1 | 2938163350254649

\ \ 681 / /

----- + 40

$$4398046511104 p$$

q =

$$-(73454083756366225*\exp(-(100*p)/681))/(748767418515456*p) - (2938163350254649*(\exp(-(100*p)/681) - 1))/(4398046511104*p^2)$$

/ 100 p \

/ / 100 p \ \

exp| - ----- | 73454083756366225 | exp| - ----- | - 1 | 2938163350254649

\ 681 / \ \ 681 / /

748767418515456 p

2

4398046511104 p

COMMAND WINDOW

ans =

0

1

2

3

4

5

6

7

ans =

0.35

8.34099580691024

13.3210094965819

14.7172021430025

14.8008605185077

14.8011359420219

14.8011359449913

14.8011359449913

ans =

0
95.8038583389523
37.3846568531425
9.48680756609994
0.565226429913042
0.00186082686707078
2.00616185516846e-08
0

ans =

8×3 table

Var1	Var2	Var3
0	0.35	0
1	8.34099580691024	95.8038583389523
2	13.3210094965819	37.3846568531425
3	14.7172021430025	9.48680756609994
4	14.8008605185077	0.565226429913042
5	14.8011359420219	0.00186082686707078
6	14.8011359449913	2.00616185516846e-08
7	14.8011359449913	0

COMPARING RESULTS

It can be seen that the values obtained from Newton Raphson converges faster than of fixed point iteration.

QUESTION 4B

x	y	dy	h	y0
0	1	-1	0.1	1
0.1	0.9	-0.7		
0.2	0.83	-0.43		
0.3	0.787	-0.187		
0.4	0.7683	0.0317		
0.5	0.77147	0.22853		
0.6	0.794323	0.405677		
0.7	0.834891	0.565109		
0.8	0.891402	0.708598		
0.9	0.962261	0.837739		
1	1.046035	0.953965		
1.1	1.141432	1.058568		
1.2	1.247289	1.152711		
1.3	1.36256	1.23744		
1.4	1.486304	1.313696		
1.5	1.617673	1.382327		

	y	Dy
	1	$=((2*A2)-B2)$
= B2+(\$E\$2*C2)		$=((2*A3)-B3)$
=B3+(\$E\$2*C3)		$=((2*A4)-B4)$
=B4+(\$E\$2*C4)		$=((2*A5)-B5)$
=B5+(\$E\$2*C5)		$=((2*A6)-B6)$
=B6+(\$E\$2*C6)		$=((2*A7)-B7)$
=B7+(\$E\$2*C7)		$=((2*A8)-B8)$
=B8+(\$E\$2*C8)		$=((2*A9)-B9)$
=B9+(\$E\$2*C9)		$=((2*A10)-B10)$
=B10+(\$E\$2*C10)		$=((2*A11)-B11)$
=B11+(\$E\$2*C11)		$=((2*A12)-B12)$
=B12+(\$E\$2*C12)		$=((2*A13)-B13)$
=B13+(\$E\$2*C13)		$=((2*A14)-B14)$

$$\begin{aligned}
 &=B14+(\$E\$2*C14) & &=((2*A15)-B15) \\
 =B15+(\$E\$2*C15) & & &=((2*A16)-B16) \\
 =B16+(\$E\$2*C16) & & &=((2*A17)-B17) \\
 =B17+(\$E\$2*C17) & & &=((2*A18)-B18)
 \end{aligned}$$

QUESTION 4 C

EXCEL

y	x	z	l
0.5	4.5	84	74.8
0.4	3.9	82	34
0.3	3.3	74	32.8
0.4	5.2	81	64
0.5	6.1	76	48.9
0.7	3.2	74	43.1

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.492524
R Square	0.24258
Adjusted R Square	-0.89355
Standard Error	0.188006
Observations	6

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	0.022641	0.007547	0.213514	0.880524
Residual	2	0.070693	0.035346		
Total	5	0.093333			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.623638	1.76937	0.917636	0.45568	-5.98935	9.236624	-5.98935	9.236624
X Variable 1	-0.02866	0.085235	-0.33626	0.768674	-0.3954	0.338076	-0.3954	0.338076
X Variable 2	-0.01639	0.024472	-0.66957	0.572081	-0.12168	0.08891	-0.12168	0.08891
X Variable 3	0.005131	0.007027	0.730102	0.541265	-0.02511	0.035367	-0.02511	0.035367

COMMENT

The value of R^2 is very far from 1, hence the model is not suitable to represent the system

MATLAB

y	x	z	l	c
0.5	4.5	84	74.8	1
0.4	3.9	82	34	1
0.3	3.3	74	32.8	1
0.4	5.2	81	64	1
0.5	6.1	76	48.9	1
0.7	3.2	74	43.1	1

```
commandwindow
clear
clc
format short g
greg = xlsread('testmultiple')
y = greg(:,1)
x1 = greg(:,2)
x0 = greg(:,5)
x2 = greg(:,3)
x3 = greg(:,4)
x = [x0,x1,x2,x3]
beed =regress(y,x)
a0 = beed(1)
a1 = beed(2)
a2 = beed(3)
a3 = beed(4)
ysim = a0 + a1*x1 + a2*x2 + a3*x3
Rvalue = corr(y,ysim)
Rsquare = Rvalue^2
```

COMMAND WINDOW

greg =

0.5	4.5	84	74.8	1
0.4	3.9	82	34	1
0.3	3.3	74	32.8	1
0.4	5.2	81	64	1
0.5	6.1	76	48.9	1
0.7	3.2	74	43.1	1

$y =$

0.5

0.4

0.3

0.4

0.5

0.7

$x_1 =$

4.5

3.9

3.3

5.2

6.1

3.2

$x_0 =$

1

1

1

1

1

1

x2 =

84

82

74

81

76

74

x3 =

74.8

34

32.8

64

48.9

43.1

x =

1 4.5 84 74.8

1 3.9 82 34

1 3.3 74 32.8

1 5.2 81 64

1 6.1 76 48.9

1 3.2 74 43.1

beed =

1.6236

-0.028662

-0.016386

0.0051308

a0 =

1.6236

a1 =

-0.028662

a2 =

-0.016386

a3 =

0.0051308

ysim =

0.50202

0.34265

0.48478

0.4757

0.45436

0.54049

Rvalue =

0.49252

Rsquare =

0.24258

QUESTION 4 d

Microsoft Excel

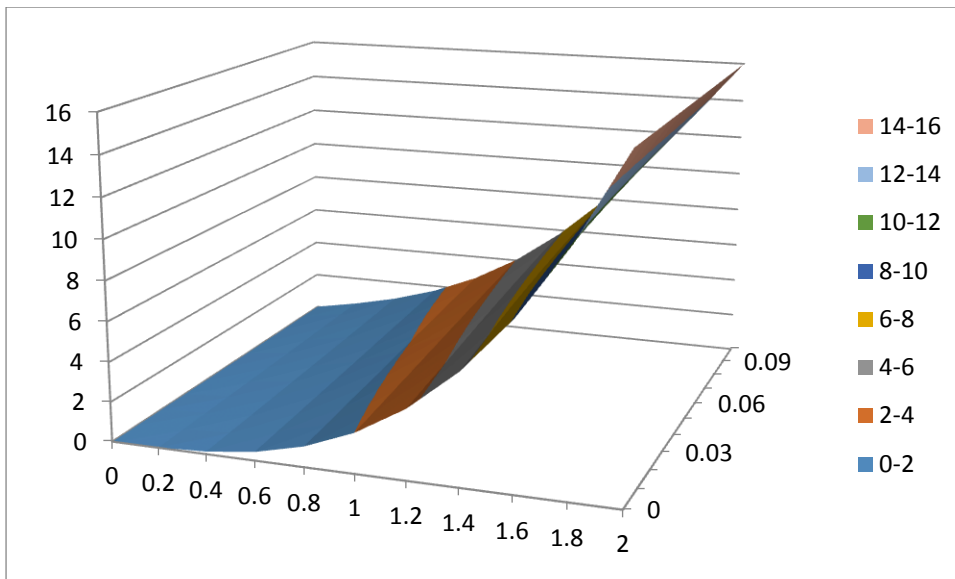
tf	0.1
zf	2
n	11
m	11
dt	0.01
dz	0.2
A	1.79
r	0.4475

t	x	0	1	2	3
		0	0.2	0.4	0.6
0	0	0	0.016	0.128	0.432
1	0.01	0	0.05896	0.21392	0.56088
2	0.02	0	0.10192	0.29984	0.68976
3	0.03	0	0.14488	0.38576	0.81864
4	0.04	0	0.18784	0.47168	0.94752
5	0.05	0	0.2308	0.5576	1.0764
6	0.06	0	0.27376	0.64352	1.20528
7	0.07	0	0.31672	0.72944	1.33416
8	0.08	0	0.35968	0.81536	1.461496
9	0.09	0	0.40264	0.900589	1.587697
10	0.1	0	0.445291	0.985238	1.711258

4	5	6	7	8	9	10
0.8	1	1.2	1.4	1.6	1.8	2
1.024	2	3.456	5.488	8.192	11.664	16
1.19584	2.2148	3.71376	5.78872	8.53568	12.05064	16
1.36768	2.4296	3.97152	6.08944	8.87936	12.24503	16
1.53952	2.6444	4.22928	6.39016	9.13701	12.41924	16
1.71136	2.8592	4.48704	6.652382	9.376594	12.55283	16
1.8832	3.074	4.727572	6.902476	9.578876	12.67407	16
2.05504	3.28109	4.960868	7.126895	9.766288	12.77732	16
2.22343	3.484133	5.178465	7.338726	9.932599	12.87203	16
2.389646	3.678182	5.386968	7.532767	10.08724	12.9564	16
2.550919	3.866244	5.582531	7.715648	10.22806	13.03446	16
2.708485	4.045675	5.769062	7.885384	10.35962	13.10568	16

=2*(G12^3)----- (drag down)

=(E\$8*F13)+(1-(2*\$E\$8))*G13+(E\$8*H13)



MATLAB

```

commandwindow
clear
clc
format short g
t0 = 0;
z0 = 0;
tf = 0.10;
zf = 2;
dz = 0.2;
dt = 0.01;
c = 1.79;
r = c*(dt/(dz^2));
t = [t0:dt:tf]'
z = [z0:dz:zf]
n = (zf-z0)/dz
m = (tf-t0)/dt
T(1:m+1,1) = zeros(m+1,1);
T(1:m+1,n+1) = 16;
T(1,1:n+1) = 2*(z.^3);
for j = 1:m
    for i = 2:n
        T(j+1,i) = r*T(j,i-1) + (1-(2*r))*T(j,i) + r*T(j,i+1)
    end
end
end
T
mesh(z,t,T)

```

COMMANDWINDOW

T =

```

0    0.016    0.128    0.432    1.024    2    3.456    5.488    8.192    11.664

```

16

0	0.05896	0.21392	0.56088	1.1958	2.2148	3.7138	5.7887	8.5357
12.051	16							
0	0.10192	0.29984	0.68976	1.3677	2.4296	3.9715	6.0894	8.8794
12.245	16							
0	0.14488	0.38576	0.81864	1.5395	2.6444	4.2293	6.3902	9.137
12.419	16							
0	0.18784	0.47168	0.94752	1.7114	2.8592	4.487	6.6524	9.3766
12.553	16							
0	0.2308	0.5576	1.0764	1.8832	3.074	4.7276	6.9025	9.5789
12.674	16							
0	0.27376	0.64352	1.2053	2.055	3.2811	4.9609	7.1269	9.7663
12.777	16							
0	0.31672	0.72944	1.3342	2.2234	3.4841	5.1785	7.3387	9.9326
12.872	16							
0	0.35968	0.81536	1.4615	2.3896	3.6782	5.387	7.5328	10.087
12.956	16							
0	0.40264	0.90059	1.5877	2.5509	3.8662	5.5825	7.7156	10.228
13.034	16							
0	0.44529	0.98524	1.7113	2.7085	4.0457	5.7691	7.8854	10.36
13.106	16							

