AKPOMUDJERE OGHENETEKEVWE OBRUCHE
18/ENG06/006
MECHANICAL ENGINEERING
(a)

(a) $\frac{dy}{dx} + [illegible] = [illegible]$

$\frac{dy}{dt} = y_{in} - y_{out}$

$M_{in} = \frac{50\ gal}{min} \times \frac{(1+\sin t)\ lb}{gal} = \frac{50(1+\sin t)\ lb}{min}$

$M_{out} = \frac{30\ gal}{1200\ gal} = 0.025m$

$\therefore \frac{dm}{dt} = M_{in} - M_{out}$

$\frac{dm}{dt} = 50(1+\sin t) - 0.025m$

$\frac{dm}{dt} + 0.025m = 50(1+\sin t)$

Using Integrating Factor Method

$P = 0.025 \quad \int P\,dt = 0.025t$

$\therefore IF = e^{0.025t}$

But $m(IF) = \int Q(IF)\,dt$

$m(e^{0.025t}) = \int 50(1+\sin t)(e^{0.025t})\,dt$

Using integration by parts

Where $u = 1+\sin t \quad dv = e^{0.025t}$

$du = \cos t \quad v = e^{0.025t} / 0.025$

$\therefore m(e^{0.025t}) = 50\left[(1+\sin t)\left(\frac{e^{0.025t}}{0.025}\right) - \int \frac{e^{0.025t}}{0.025}\,dt\right]$

$m(e^{0.025t}) = 50\left[\frac{(1+\sin t)(e^{0.025t})}{0.025} - \frac{1}{0.025}\int e^{0.025t}\,dt\right]$

$$m(e^{0.025t}) = 2000\left[(1+\sin t)(e^{0.025t}) - 5e^{0.025t}\cdot\cos t\cdot dt\right)$$

Applying Integration by parts

$u = \cos t$ $\quad dv = e^{0.025t}$

$dy = -\sin t$ $\quad v = e^{0.025t}/0.025$

$$m(e^{0.025t}) = 2000\left[(1+\sin t)(e^{0.025t}) - \left[\cos t\left(\frac{e^{0.025t}}{0.025}\right) - \left[\frac{e^{0.025t}}{0.025}(-\sin t)\right]\right]\right]$$

$$m(e^{0.025t}) = 2000\left[(1+\sin t)(e^{0.025t}) - \frac{(\cos t)(e^{0.025t})}{0.025} - \frac{1}{0.025}\int e^{0.025t}\cdot\sin t\, dt\right]$$

when ~~simplify~~ Simplify

$$m(t) = \left(\frac{2000}{1601}\right)(\sin t - 40\cos t + 1601 - 1800e^{-1.6})$$

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Figure 1

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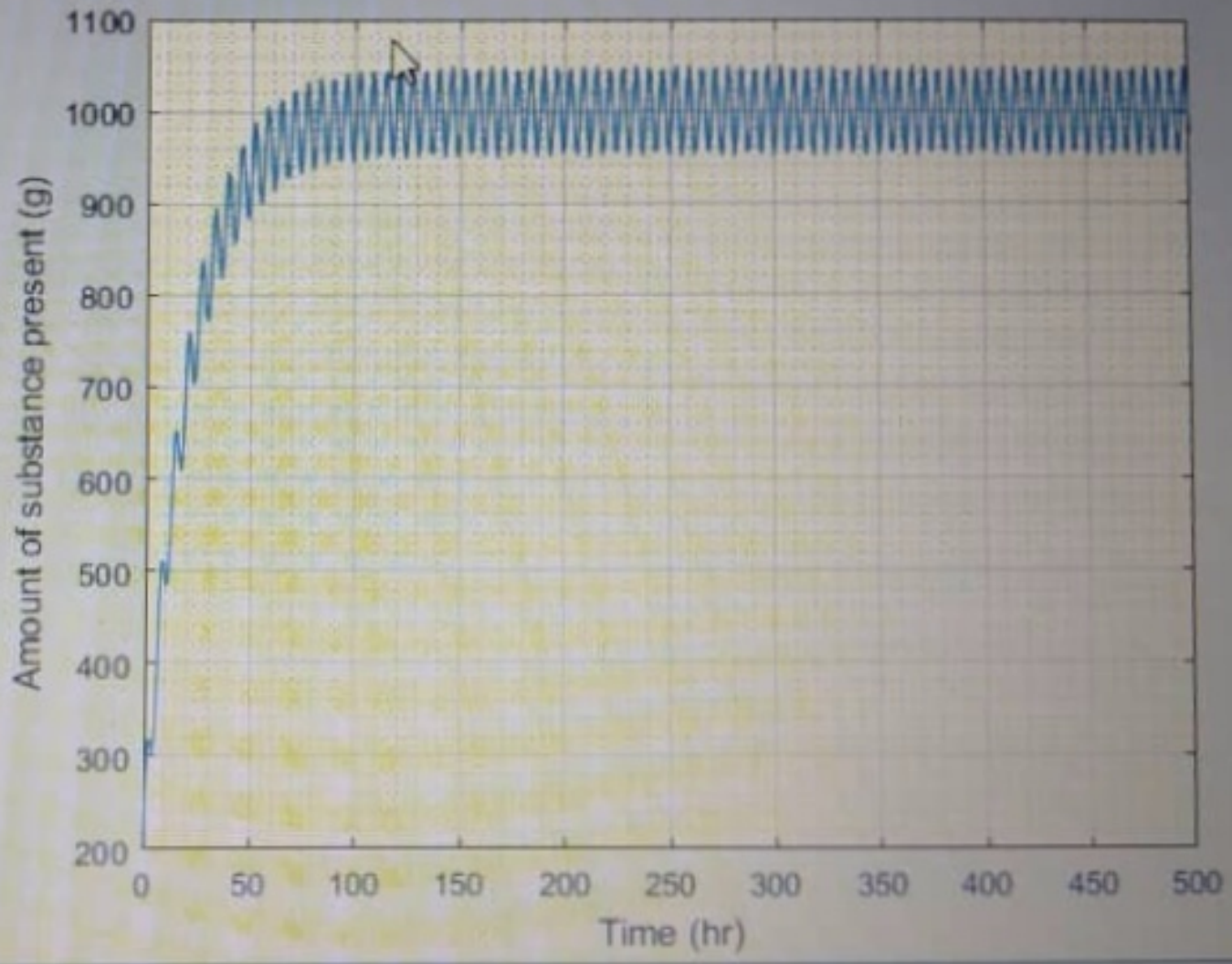

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LOLOLOL.m

```
1 -  clc
2 -  close
3 -  clearv
4 -  b=0:1:
5 -  tstep
6 -  t = 0:
7 -  x =((1
8 -  plot(t
9 -  xlabel
10 -  ylabel
11 -  grid
12 -  grid
```

Command Window

LOLOLOL.m | MATeq1.m | secondmodel.m | dsolvee.m | combined1.m | plotofdsolve1.m | +

```
1 -    clc
2 -    close all
3 -    clearvars
4 -    y=dsolve('Dy=50*(1+sin(t))-0.025*y','t')
5 -    t=[0:0.5:7.5]
6 -    ezplot(y,t)
7 -    grid on
8 -    grid minor
```

Command Window

```
y =

C2*exp(-t/40) - (2000*1601^(1/2)*cos(t + atan(1/40)))/1601 + 2000


t =
```

fx

<

LOLOLOL.m | MATeq1.m | secondmodel.m | dsolvee.m | combined1.m | plotofdsolve1.m

```
1 -  clc
2 -  close all
3 -  clearvars
4 -  b=0:1:500;
5 -  tstep = rem(b,2)==0
6 -  t = 0:tstep:500;
7 -  x =((1000)+(49.88)*(sin(t))+(2.49)*(cos(t))-802.49*exp(-0.05*t));
8 -  plot(t,x)
9 -  xlabel('Time (hr)')
10 -  ylabel('Amount of substance present (g)')
11 -  grid on
12 -  grid minor
```

Command Window

```
  Columns 481 through 501

     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1
```

LOLOLOL.m | MATeq1.m | secondmodel.m | dsolvee.m | combined1.m | plotofdsolve1.m

```
1 -  clc
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8 -  plot(t,x)
9 -  xlabel('Time (hr)')
10 -  ylabel('Amount of substance present (g)')
11 -  grid on
12 -  grid minor
```

Command Window

```
  Columns 481 through 501

     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1     0     1
```

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LOLOLOL.m | MATeq1.m

```
1 -  clearvars
2 -  clc
3 -  close all
4 -  t = 0:0.5:7.5;
5 -  y =0.0769*exp(-t/40
6 -  plot(y,t)
7 -  xlabel('Time (hr)')
8 -  ylabel('Amount of s
9 -  grid on
10 -  grid minor
```

Value
1x16 double
1x16 double

Command Window

```
Columns 1 through 12

    1.9501    1.9568    1.9741    1.9978    2.0220    2.0409    2.0497    2.0464    2.0318    2.009

Columns 13 through 16

    1.9517    1.9515    1.9632    1.9839
```

Figure 1

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