Question 2
(a) Math lab Solution
Command window
clear
clc
close all
syms m t
ans = dsolve('Dm + 0.025*m = 80 + 50*sin(t)', 'm(0) = 150')

t = 0:0.5:450
fn = subs(ans, t)
Plot (t, fn)
grid on

$\int e^{0.025t} \sin t = \frac{e^{0.025t}}{1.000625}(\cos t - 0.025) + C$

since $\int e^{0.025t} \sin t = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + C$

$\therefore -ye^{0.025t} = -50\left[\frac{e^{0.025t}}{0.025} - \frac{e^{0.025t}}{1.000625}(\cos t - 0.025)\right] + C$

$ye^{0.025t} = 2000e^{0.025t} - 50 \cdot \frac{e^{0.025t}}{1.000625}(\cos t - 0.025) + C$

DTB $e^{0.025t}$

$\Rightarrow y = 2000 - \frac{50}{1.000625}(\cos t - 0.025) + \frac{50C}{e^{0.025t}}$

$y = 2000 - \frac{50}{1.000625}(\cos t - 0.025\sin t) + \frac{50C}{e^{0.025t}}$

when $y = 150$

$t = 0$

$150 = 2000 - \frac{50}{1.000625}(1 - 0) + \frac{50C}{1}$

$150 = 2000 - 49.988(1) + 50C$

$150 = 1950.032 + 50C$

$+1800.032 = 50C$

$C = -36.00064$

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Assignment

Question [redacted]

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

$\therefore \frac{dy}{dt} + 0.025y = 50(1+\sin t)$

Using the linear equation method,

$\frac{dy}{dx} + Py = Q$

$\therefore P = 0.025, \quad Q = 50(1+\sin t)$

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

$I.F = e^{\int P dt}$

$I.F = e^{0.025t}$

$\therefore y \cdot I.F = \int Q \cdot I.F\,dt$

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

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

$ye^{0.025t} = 50\int e^{0.025t} + e^{0.025t}\sin t\,dt$

$ye^{0.025t} = 50\int e^{0.025t}\,dt + \int e^{0.025t}\sin t\,dt$

$ye^{0.025t} = 50\frac{e^{0.025t}}{0.025} + \int e^{0.025t}\sin t\,dt$

Using integration by part

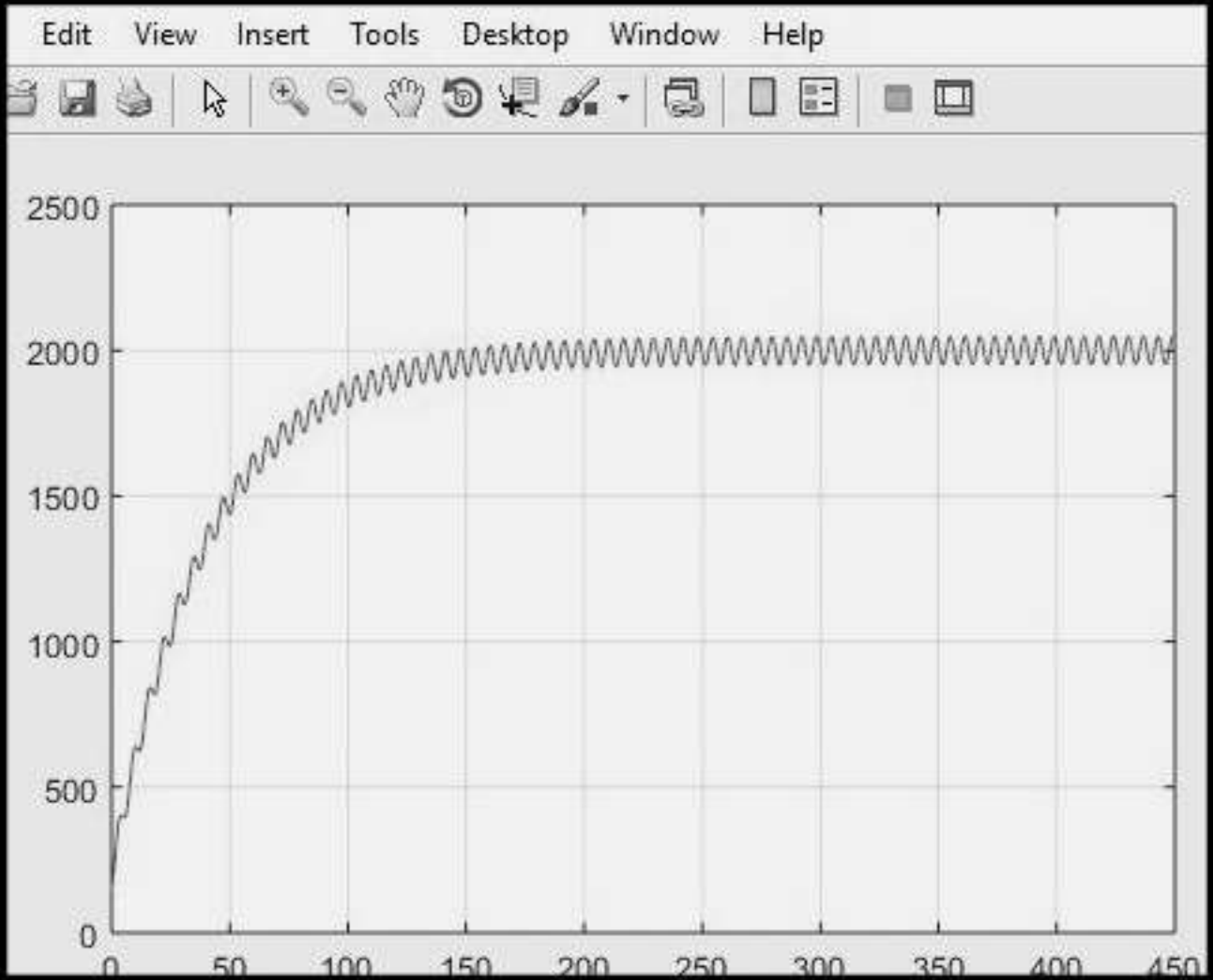
$\int e^{0.025t} \cdot \sin t \cdot dt$

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

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

$\therefore \int e^{0.025t}\sin t = e^{0.025t} \cdot -\cos t - \int -\cos t \cdot 0.025t$

$Q = \frac{-e^{0.025t}}{1 - 0.00625}(\cos t - 0.025) + c$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