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COURSE; ENG 282.

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

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

Using the linear eqn. method,

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

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

$$\int P \cdot dt = 0.025t.$$

$$IF = e^{\int P dt}.$$

$$IF = e^{0.025t}.$$

$$\therefore y \cdot IF = \int Q \cdot IF \, dt.$$

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

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

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

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

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

Using integration by part,

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

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

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

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

$e^{0.025t}\,dt$.

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

$\int e^{0.025t}\sin t = -e^{0.025t}\cos t + 0.025\int e^{0.025t}\cos t + c$.

Hence,

$\int u\,dv = uv - \int v\,dv$.

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

$du = 0.025e^{0.025t}$, $v = \sin t$.

$= -e^{0.025t}\cos t + 0.025\left[e^{0.025t}\cdot\sin t - \int \sin t \cdot 0.025e^{0.025t}\right]$

$Q = \int e^{0.025t}\sin t$.

$\therefore Q = -e^{0.025t}\cos t + 0.025\left[e^{0.025t}\sin t - 0.025Q\right]$.

$Q = -e^{0.025t}\cos t + 0.025e^{0.025t}\sin t - 6.25^{-4}Q$.

$Q + 0.000625Q = -e^{0.025t}\cos t + 0.025e^{0.025t}\sin t$.

$1.000625Q = -e^{0.025t}\cos t + 0.025e^{0.025t}$.

$1.000625Q = e^{0.025t}(\cos t + 0.025)$.

$Q = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + c$.

$Q = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + c$.

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

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

$= 50\left[\frac{e^{0.025t}}{0.025} - \frac{e^{0.025t}}{1.000625}(\cos t - 0.025) + c\right.$

$\int e^{0.025t} = 2000e^{0.025t} - 50\cdot\frac{e^{0.025t}}{1.000625}(\cos t - 0.02$

$+ 50c$.

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

$$y = \frac{2000 - 50}{1.000625}(\cos t - 0.02 \sin t) + 50c\, e^{0.05t}.$$

When $y = 150$

$t = 0$

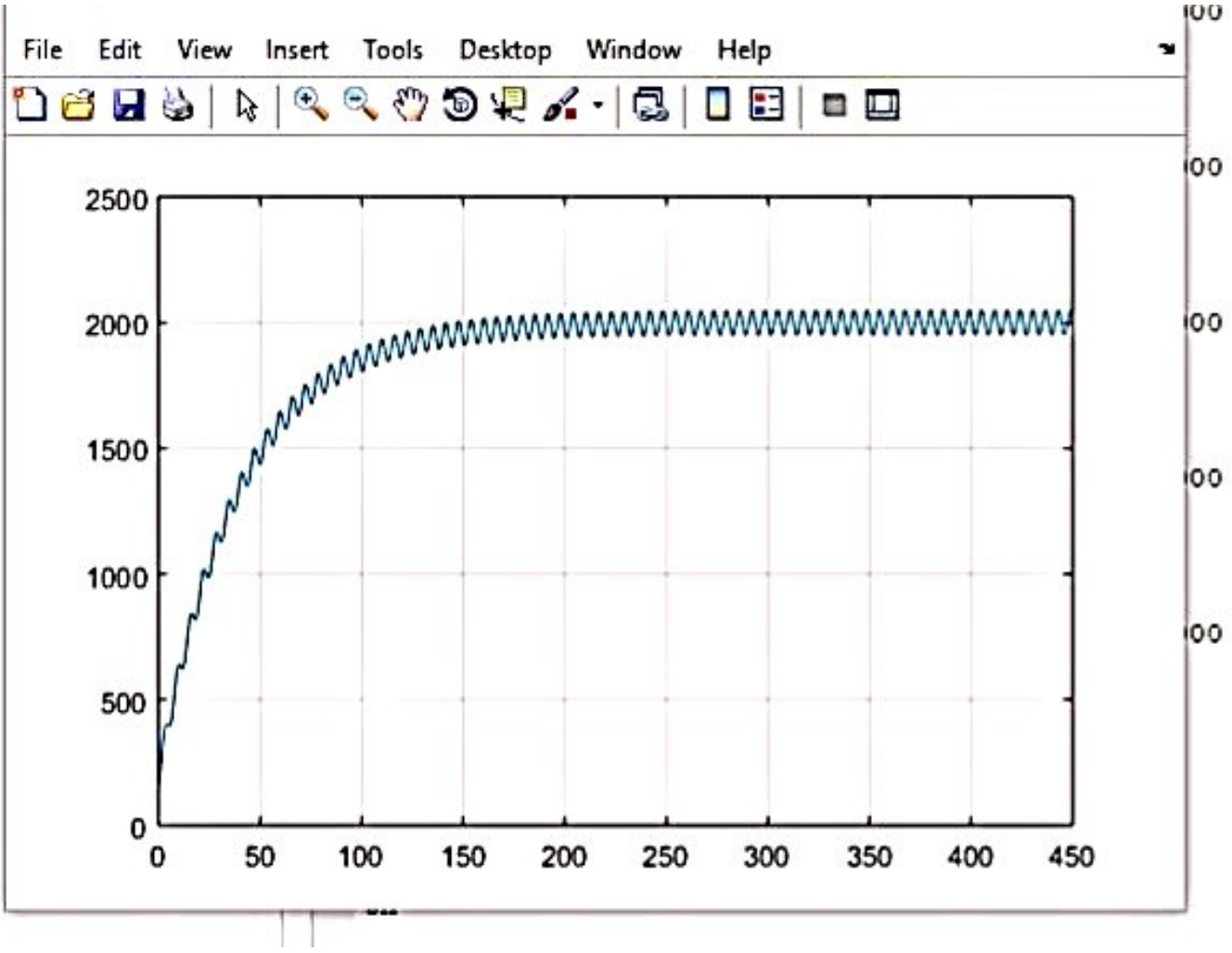
$$150 = \frac{2000 - 50}{1.000625}(1 - 0) + \frac{50c}{1}$$

$$150 = 2000 - 49.968(1) + 50c.$$

$$150 = 1950.032 + 50c.$$

$$-1800.032 = 50c.$$

$$c = -36.00064.$$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