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17/ENG02/1063
COMPUTER ENGINEERING

Assignment 4.

A. Let y be the amount of air at time t in (ft^3) in the room.

$\frac{dy}{dt}$ => Air inflow rate - fress air outflow rate

fresh air inflow = $100 ft^3/min$
fresh air outflow = 600

$2000 = 0.03 min$

The amount flowing out of the room is a functio of the amount in the room

$= 0.03y \ ft^3/min.$

$\frac{df}{dt} = 600 - 0.03y = -0.03y + 600 = -0.03(y - 20,000$

Equation can be resolved as

$\frac{dy}{dt} = -0.03(y - 20,000)$

$\frac{dy}{y-20,000} = -0.03dt \quad \therefore \ln(y - 20,000) = -0.03t + C$

$y - 20,000 = e^{-0.03t + C}$

$y - 20,000 = e^{-0.03t} \cdot e^{C}$ [According to rules of Indices].

At $t=0$, $y(t)=0$. Since no fresh air was contained in the room initially.

$y - 20,000 = (e^{-0.03(0)}$

$0 - 20,000 = C$

$C = -20,000$

Sub $C = -20,000$

$y - 20,000 = e^{-0.03t} - 20000$

$y = 20000(1 - e^{-0.03t})$

This is the model for the amount of fresh air in the room

B. Calculate the time at when 90% of the air in the room will become fresh.

$$90\% = \frac{90}{100} = 0.9$$

$y = 0.9$ of $20{,}000$

$18000\,ft^3 = 0.9 \times 20000$

$\therefore 18000 = 20000\,(1 - e^{-0.03t})$

$18000 = 20000\,(1 - e^{-0.03t})$

$0.9 = 1 - e^{-0.03t}$

$e^{-0.03t} = 1 - 0.9 = 0.1$

$-0.03t = \ln(0.1)$

$t = 77\ min.$

C.

```
Command window
Clear
Clc
Close all
Syms t
y = 20000 * (1-exp(-0.03*t))
t = 0:5:360
yn = Subs(y)
plot (t, yn)
xlabel ('Time (min')
Grid on
Grid minor
Axis tight.
```