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17/Eng01/019

CHEMICAL ENGINEERING

$y(t) = 20,000 - 20,000 e^{-0.03t}$
① when 90% of car will become firm
when $y = 20,000 \times 20,000 = 10,000$
 $10,000 = 20,000 - 20,000 e^{-0.03t}$
 $-10,000 = -20,000 e^{-0.03t}$
 $e^{-0.03t} = 0.5$
 $\ln 0.5 = -0.03t$
 $-0.693 = -0.03t$
 $t = 23.1$
 $t = 23.1 \text{ months}$
② steady state value of y when $t \rightarrow \infty$
③ the value of y at $t = 20$ months
④ comment on the value of y at $t = 20$
⑤ $\frac{dy}{dt} = 0$
⑥ $y = 20,000$
⑦ $y = 20,000 - 20,000 e^{-0.03 \times 20}$
⑧ $y = 20,000 (1 - e^{-0.6})$
⑨ $y = 20,000 (1 - 0.5188)$
⑩ $y = 9624$

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① $\frac{dy}{dt} = y - 20,000$
 $\frac{dy}{dt} = 100 - \frac{100}{20,000} y$
 $\frac{dy}{dt} = -\frac{100}{20,000} (y - 20,000)$
 $\frac{dy}{dt} = -\frac{100}{20,000} (y - 20,000)$
 $\int \frac{1}{y - 20,000} dy = \int -\frac{100}{20,000} dt$
 $\ln(y - 20,000) = -0.005t + c$
 $y - 20,000 = e^{-0.005t - c}$
 $y - 20,000 = e^{-0.005t} \cdot e^{-c}$ let $e^{-c} = b$
 $y(t) = 20,000 + b e^{-0.005t}$
At initial condition, $y(0) = 0$ and $t = 0$
 $y(0) = 0 = 20,000 + b e^{-0.005 \times 0}$
 $0 = 20,000 + b$
 $b = -20,000$