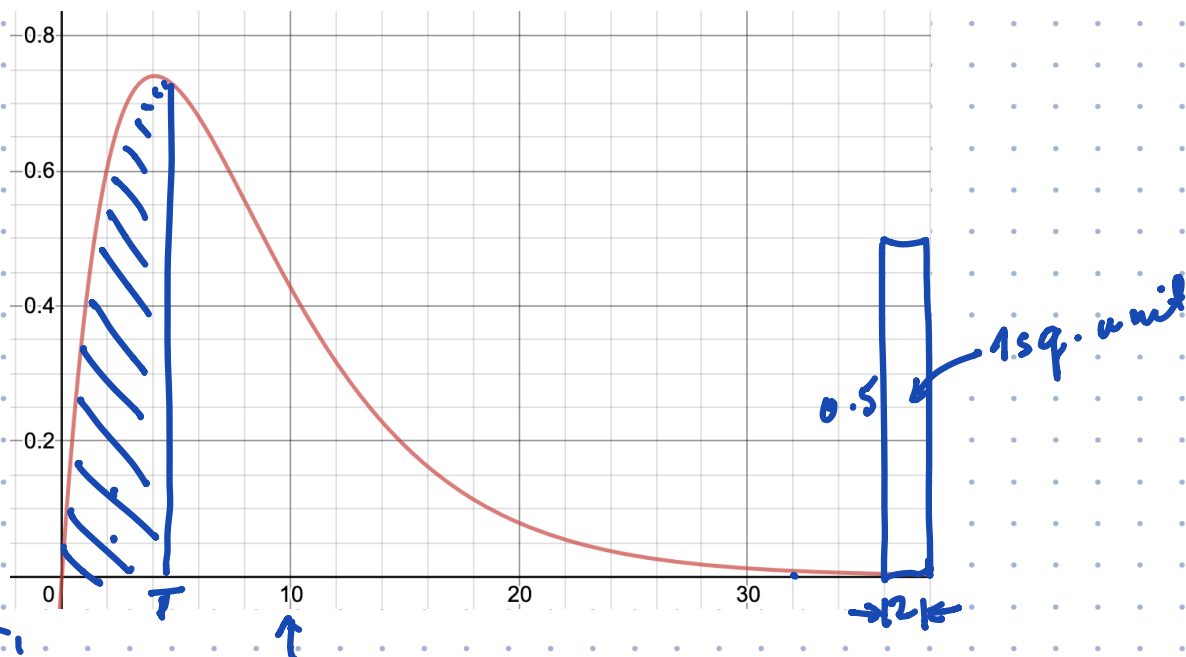


Penicillin Levels

The concentration of penicillin in the blood (in $\mu\text{g/mL}$) varies with time (t in hours) according to the relationship,

$$c(t) = 5e^{-0.2t} - 5e^{-0.3t}$$

- When will the patient have received a cumulative dose of $1 \mu\text{g/mL}$?
- What total dose will the patient receive?



$$C(t) = 5 \int_0^T (5e^{-0.2t} - 5e^{-0.3t}) dt = 1$$

$$= 5 \left[\frac{-e^{-0.2t}}{0.2} + \frac{e^{-0.3t}}{0.3} \right]_0^T = 1$$

$$= 5 \left[\left(\frac{-e^{-0.2T}}{0.2} + \frac{e^{-0.3T}}{0.3} \right) - \left(\frac{-e^{-0.2(0)}}{0.2} + \frac{e^{-0.3(0)}}{0.3} \right) \right] = 1$$

$$= 5 \left[\left(\frac{-e^{-0.2T}}{0.2} + \frac{e^{-0.3T}}{0.3} \right) - \left(\frac{-1}{0.2} + \frac{1}{0.3} \right) \right] = 1$$

$$* = \cancel{5} \left[\frac{-e^{-0.2T}}{0.2} + \frac{e^{-0.3T}}{0.3} + \frac{\cancel{15}}{3} - \frac{\cancel{10}}{\cancel{3}} \right] = \frac{1}{5}$$

$$= \frac{-1}{0.2 \cancel{e^{0.2T}}} + \frac{1}{0.3 \cancel{e^{0.3T}}} + \frac{5}{3} e^{0.3T} = \frac{1}{5}$$

$$= \frac{-e^{0.1T}}{0.2} + \frac{\cancel{10} \cancel{50}}{\cancel{3} \cancel{15}} + \frac{5}{3} e^{0.3T} = \frac{1}{5} \frac{3}{15}$$

$$\frac{5}{3} (e^{0.1T})^3 - 5 e^{0.1T} + \frac{47}{15} = 0$$

$$\square^3 - \square + * = 0$$

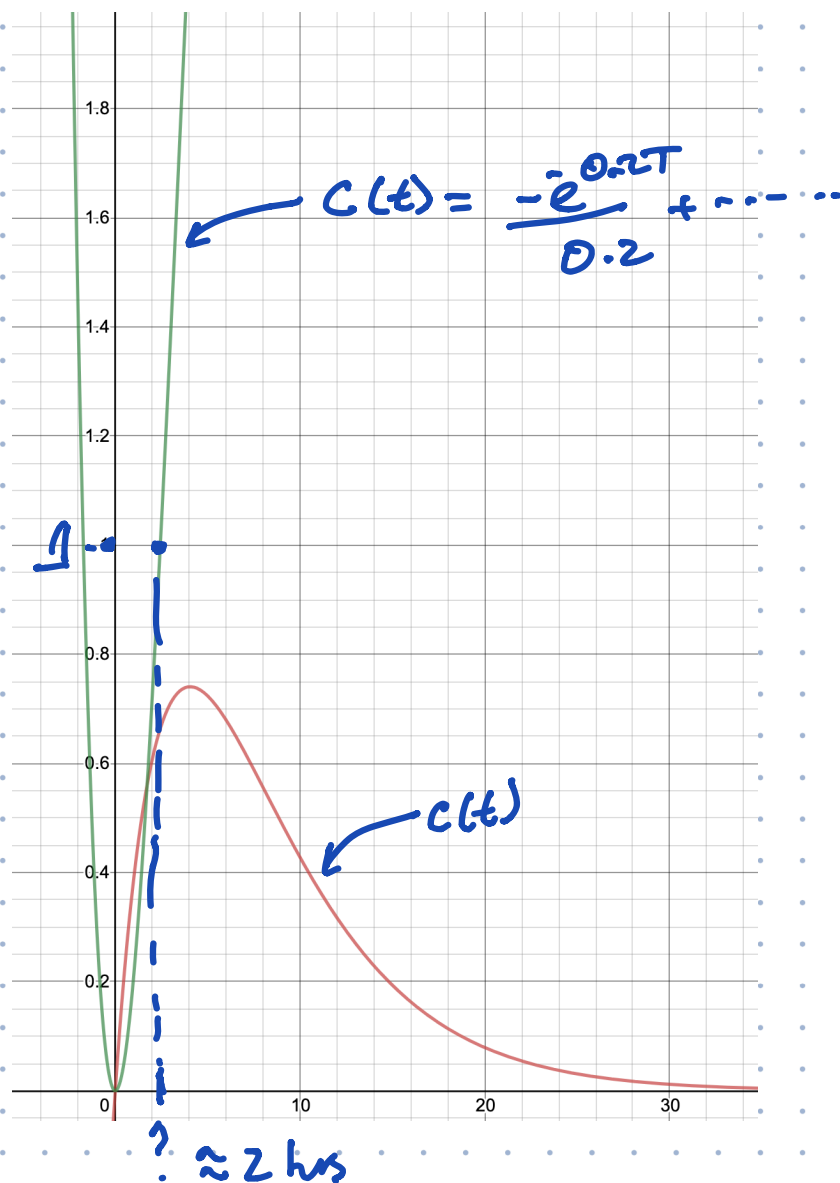
$$x^{-2}$$

$$\frac{1}{x^2}$$

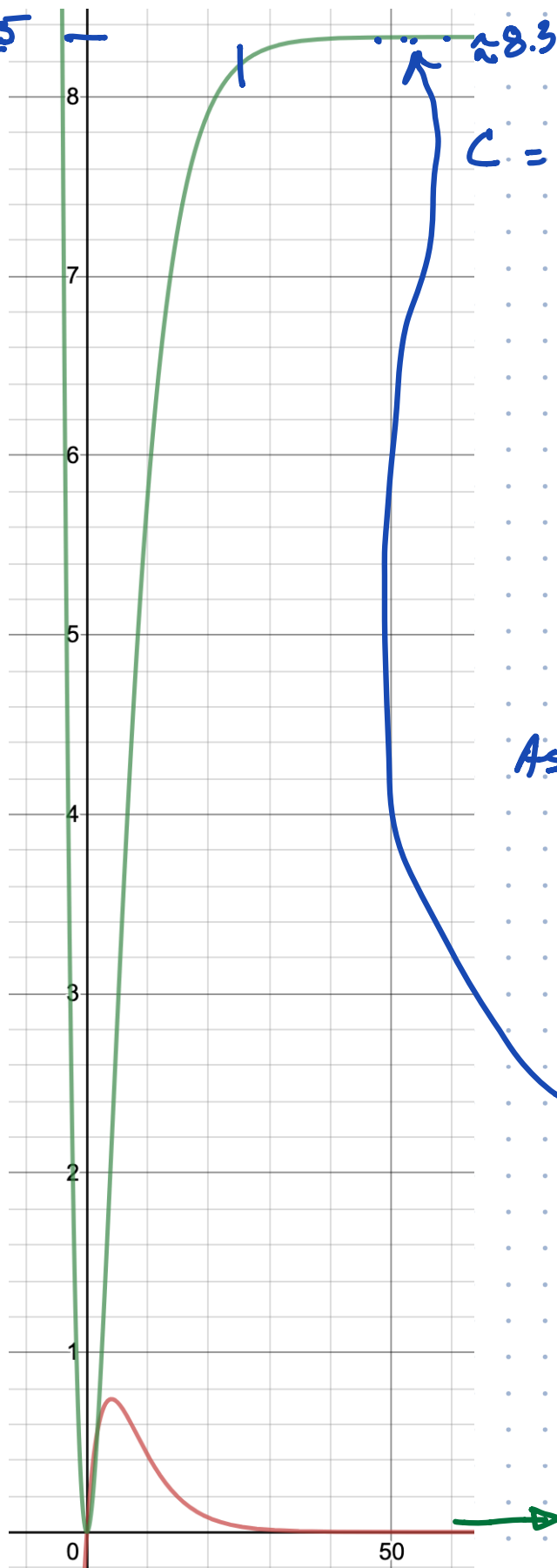
$$x e^{0.3T}$$

$$\frac{1}{x^2}$$

$$\frac{1}{x^2}$$



$\frac{25}{3}$



$\approx 8.3 \mu g$

$$C = 5 \left(\frac{-5}{\cancel{e^{0.025t}}} + \frac{10}{3 \cancel{e^{0.3t}}} + \frac{5}{3} \right)$$

$t \rightarrow \infty$

$$\frac{-5}{10} = -0.5$$

$$\frac{1}{100} = -0.05$$

$$\frac{1}{1000000} = -0.000005$$

As $t \rightarrow \infty$

$$C \rightarrow 5 \left(0 + 0 + \frac{5}{3} \right)$$

$$5 \left(\frac{5}{3} \right)$$

$$\frac{25}{3}$$

$$= 8.33333$$