8.1

$$\frac{dE}{dt} = k_2[ES] + k_3[ES] - k_1[E][S]$$

$$\frac{dS}{dt} = k_2[ES] - k_1[E][S]$$

$$\frac{dES}{dt} = k_1[E][S] - k_2[ES] - k_3[ES]$$

$$\frac{dP}{dt} = k_3[ES]$$

8.2

Given $\bar{E} = 1\,\mu M$, $S = 10\,\mu M$, $\bar{ES} = P = 0\,\mu M$

$k_1 = 100/\mu M/min$, $k_2 = 600/min$, $k_3 = 150/min$

$$\frac{dE}{dt} = 600 \times 0 + 150 \times 0 - 100 \times 1 \times 10$$

$$= -1000$$

$$\frac{dS}{dt} = 600 \times 0 - 100 \times 1 \times 10$$

$$= -1000$$

$$\frac{dES}{dt} = 100 \times 1 \times 10 - 600 \times 0 - 150 \times 0$$

$$= 1000$$

$$\frac{dP}{dt} = 150 \times 0 = 0$$

8.3

$$\frac{dES}{dt} = 0$$

$$[E]_0 = [E] + [ES] \Rightarrow [E] = [E]_0 - [ES]$$

$$k_1 [E][S] = k_2 [ES]$$

$$\Rightarrow k_1 ([E]_0 - [ES]) [S] = k_2 [ES]$$

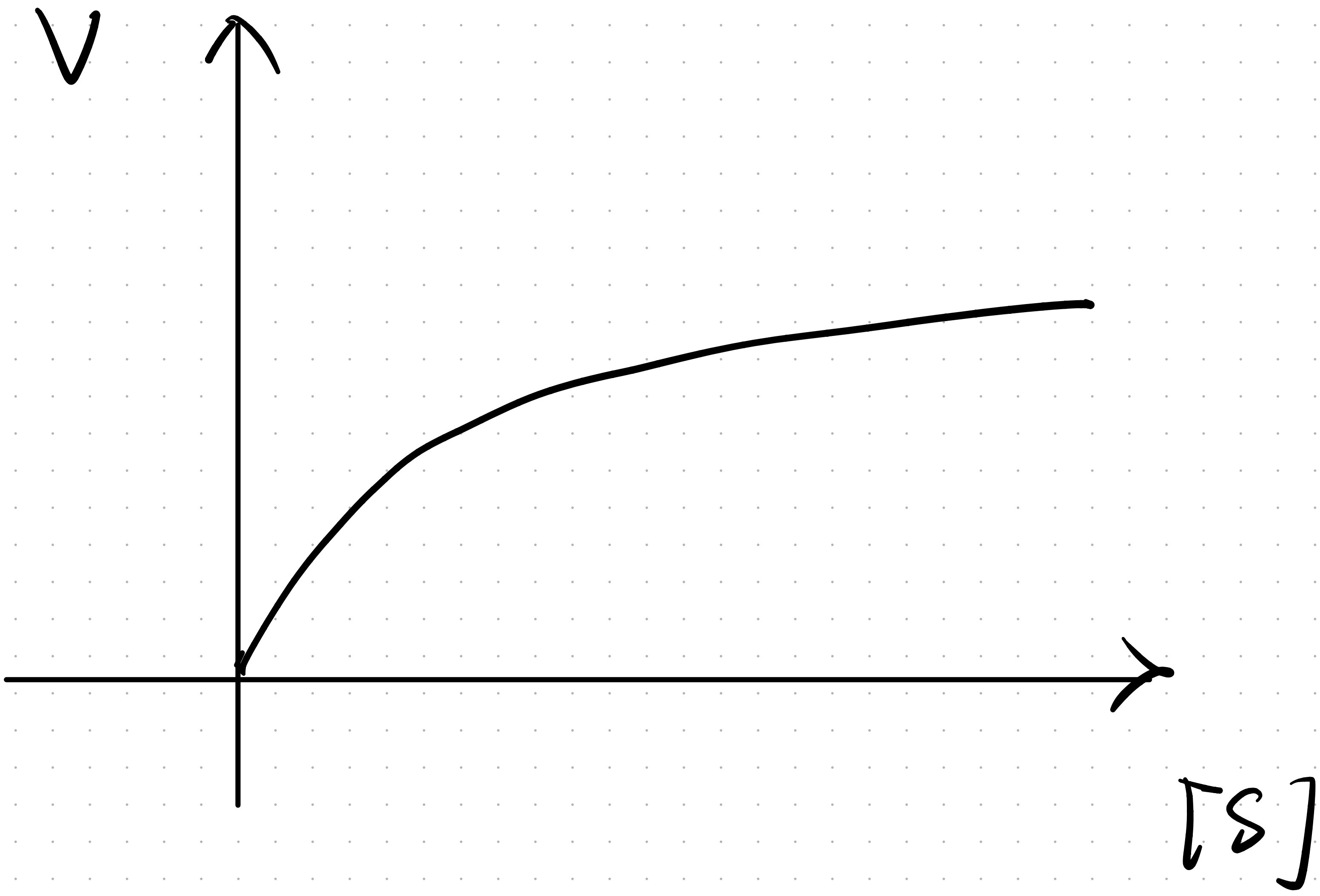
$$\Rightarrow [ES] = \frac{k_1 [E]_0 [S]}{k_2 + k_1 [S]}$$

We define that $V = \frac{d[P]}{dt} = k_3 [ES]$

$$= \frac{k_3[E]_0[S]}{\frac{k_2}{k_1} + [S]} = V_m \frac{[S]}{\frac{k_2}{k_1} + [S]}$$

$$V_m = k_3 [E]_0$$

Plot of $[S] - V$:



Here, $V = V_m \frac{[S]}{\frac{k_2}{k_1} + [S]}$