Question 2

8.1

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

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

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

$$\frac{d[P]}{dt} = k_3[ES]$$

8.2

In question_2.py

8.3

First, when come to steady state,

Lead to $\frac{d[ES]}{dt} = 0$

According to conservation,

$[E]_t = [E]_{total} = [E] + [ES]$

And, we know: $k_1[E][S] = k_2[ES]$

so, $k_1([E]_t - [ES])[S] = k_2[ES]$

$\therefore [ES] = \frac{[E]_t[S]k_1}{k_2 + k_1[S]}$

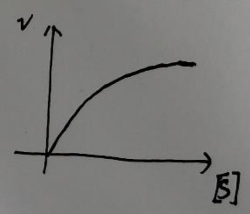
From the problem, $v = \frac{d[P]}{dt} = k_3[ES]$

$\therefore v = \frac{k_1 k_3 [E]_t [S]}{k_2 + k_1[S]}$

because k_1, k_2, k_3, $[E]_t$ are constants,

$v = k_3[E]_t \cdot \frac{[S]}{\frac{k_2}{k_1} + [S]}$

The graph of v matches the description.



$\therefore V_{max} = k_3 \cdot [E]_t = k_3([E] + [ES])$