1. (8 points) Use the steady-state approximation to determine the rate of formation of products $\frac{d[P]}{dt}$ in terms of $[A]$ based on the following mechanism:

$$A + A \xrightarrow{k_1} A^* + A$$
$$A^* + A \xrightarrow{k_{-1}} A + A$$
$$A^* \xrightarrow{k_2} P$$

Find $A^*$ and

SS-approx

$$\frac{d[A^*]}{dt} = 0 = + k_1 [A]^2 - k_{-1} [A]^2 [A^*] + k_2 [A^*]$$

$$[A^*] = \frac{k_1 [A]^2}{k_{-1} [A] - k_2}$$

$$\frac{d[P]}{dt} = k_2 [A^*]$$

2. (7 points) Determine the rate law expression for the formation of products $\frac{d[P]}{dt}$ in terms of $[R_2], [M]$ for the reaction described by the proposed mechanism.

$$(1) \quad R_2 \xrightarrow{K} 2R$$
$$(2) \quad R + M \xrightarrow{k} P$$

Assume that pre-equilibrium exists for reaction in step (1) and “R” is a reactive intermediate.

$$\frac{[R]^2}{[R_2]} = K$$

$$[R] = K^{1/2} [R_2]^{1/2}$$

$$\frac{d[P]}{dt} = k [R_2][M]^2$$

$$= k K^{1/2} [M] [R_2]^{1/2}$$