a. $\Pi_M = p(12-p) \Rightarrow \max_p$

$\frac{\partial \Pi_M}{\partial p} = 12 - 2p = 0$

$p = 6, q = 6, \Pi_M = 6(12-6) = 36$

b. $\begin{cases} \Pi_M = q_M(12 - q_E - q_M) \Rightarrow \max\limits_{q_M} \\ \Pi_E = q_E(12 - q_E - q_M) \Rightarrow \max\limits_{q_E} \end{cases}$

$Q^C_{M+E} = 8\,, P = 12 - 8 = 4, \Pi_M = \Pi_E = 4 * 4 = 16$

c. $Reaction\ function\ of\ E: q_E = 6 - \frac{q_M}{2}$

$\Pi_M = q_M(12 - q_M - \left(6 - \frac{q_M}{2}\right)) \Rightarrow \max\limits_{q_M}$

$q_M = 6$

$q_E = 6 - \frac{6}{2} = 3$

$Q^S_{M+E} = 6 + 3 = 9, P = 12 - 9 = 3, \Pi_M = 6 * 3 = 18, \Pi_E = 3 * 3 = 9$

d. *If Entrant does not enter the market his/hers profit is 0. If he/she enters and firms compete under Cournot, Entrant's profit 16. So,* $f^C_{max} = 16$.

e. *If Entrant does not enter the market his/hers profit is 0. If he/she enters and firms compete under Stackelberg, Entrant's profit 9. So,* $f^S_{max} = 9$.

f. $\Pi_E = K_E(12 - K_M - K_E)$

$\frac{\partial \Pi_E}{\partial K_E} = 12 - K_M - 2K_E = 0$

$K_E = \frac{12 - K_M}{2} = 6 - \frac{K_M}{2}\ (RFe)$

$M\ deters\ entrant\ and\ sets\ K^*_M\ such\ that\ K^*_E(12 - K^*_M - K^*_E) = f$

$$K^*_M = 12 - 2\sqrt{f}, (f \leq 36)$$

g. $M\ will\ deter\ entrance\ iff\ profit\ from\ deterence\ is\ higher\ than\ profit\ from\ accomdation\ (IC\ constraint)$

$If\ M\ accomodates\ entrance:$

$\Pi_M = 6(12 - 6 - 3) = 6 * 3 = 18$

$M\ decides\ to\ deter\ entrance\ iff:$

$$(12 - 2\sqrt{f}) * \left(12 - (12 - 2\sqrt{f})\right) > 18$$

$$0.77 < f < 26.2$$

Deterrence also has an additional cost: M could not charge more than

$$p^D_M < p_M; 2\sqrt{f} < 6; f < 9$$

$$\begin{cases} deters, if\ 0.79 < f\ (when\ f \geq\ 9\ stars\ behaiving\ as\ monopolist\ setting\ p_M = 6) \\ accomodates, otherwise \end{cases}$$

h. $if\ M\ deters\ loss\ is\ 36 - \left(12 - 2\sqrt{f}\right)2\sqrt{f}\ (for\ 0.79 < f < 9)$

$if\ f\ is\ high\ enough\ (9 \leq f)\ monopolistic\ price\ is\ feasible, so\ there\ is\ no\ losses$

$if\ M\ accomodates\ loss\ is\ 36 - 18 = 18\ and\ it\ does\ not\ depend\ on\ f$