

$$\textcircled{2} (a) E_2(B) = \frac{1}{4} e^2 + m e + 0.1 - \frac{1}{2} e^2 = -\frac{1}{4} e^2 + m e + 0.1$$

$$\frac{\partial}{\partial e} E_2(B) = -\frac{1}{2} e + m = 0 \text{ when } e_H(m) = 2m.$$

Notice that $\frac{\partial^2}{\partial e^2} E_2(B) = -\frac{1}{2} < 0$ so this is a maximum.

(b)

$$E_2(C) = \frac{1}{4} e^2 + m e + 0.1 - \frac{3}{4} e^2 = -\frac{1}{2} e^2 + m e + 0.1$$

$$\frac{\partial}{\partial e} E_2(C) = \frac{1}{2} e - m = 0 \text{ when } e_L(m) = m.$$

Again $\frac{\partial^2}{\partial e^2} E_2(C) = -1 < 0$ so this is a maximum.

(c)

$$\begin{aligned} E_1(\text{Root}) &= \frac{1}{2} \left[3e_H - \frac{1}{4} e_H^2 + m e_H + 0.1 \right] \\ &\quad + \frac{1}{2} \left[e_L - \frac{1}{4} e_L^2 - m e_L - 0.1 \right] \\ &= \frac{1}{2} \left[6m - m^2 - 2m^2 - 0.1 + m - \frac{1}{4} m^2 - m^2 - 0.1 \right] \\ &= \frac{1}{2} \left[7m - \frac{17}{4} m^2 - 0.2 \right] \end{aligned}$$

$$\frac{\partial}{\partial m} E_1(\text{Root}) = \frac{1}{2} \left[7 - \frac{17}{2} m \right] = 0 \text{ when}$$

$$m^* = \frac{14}{17}.$$

$$\frac{\partial^2}{\partial m^2} E_1(\text{Root}) = -\frac{17}{4} < 0 \text{ so this is a maximum.}$$

$$m^* = \frac{14}{17}$$

$$e_H\left(\frac{14}{17}\right) = \frac{28}{17}$$

$$e_L\left(\frac{14}{17}\right) = \frac{14}{17}$$