a) $Pr[resp_i=0] = 1 - Pr[resp_i=1]$

$$\frac{\partial Pr[resp_i=1]}{\partial age_i} - \frac{\partial Pr[resp_i=0]}{\partial age_i} = \frac{\partial Pr[resp_i=1]}{\partial age_i} - \frac{\partial(1-Pr[resp_i=1])}{\partial age_i} = \frac{\partial Pr[resp_i=1]}{\partial age_i} - \frac{\partial Pr[resp_i=1]}{\partial age_i} = 0$$

b) $$\frac{Pr[resp_i=1]}{Pr[resp_i=0]} = \underbrace{\exp(\beta_0+\beta_1 male_i+\beta_2 active_i+\beta_3 age_i \cdot \beta_4 (age_i/10)^2)} = \frac{Pr[resp_i^{new}=0]}{Pr[resp_i^{new}=1]}$$

$$\frac{Pr[resp_i^{new}=1]}{Pr[resp_i^{new}=0]} = \frac{1}{\exp(\beta_0+\beta_1 male_i+\beta_2 active_i+\beta_3 age_i+\beta_4 (age_i/10)^2}$$

c) (1) adding variables $male_i \times age_i$ and $male_i \times \left(\frac{age_i}{10}\right)^2$ to logit specification

$$\frac{\exp(\beta_0+\beta_1 male_i+\beta_2 active_i+\beta_3 age_i+\beta_4\left(\frac{age_i}{10}\right)^2+\beta_5 male_i age_i+\beta_6 male_i\left(\frac{age_i}{10}\right)^2}{1+\exp(\beta_0+\beta_1 male_i+\beta_2 active_i+\beta_3 age_i+\beta_4\left(\frac{age_i}{10}\right)^2+\beta_5 male_i age_i+\beta_6 male_i\left(\frac{age_i}{10}\right)^2}$$

(2) replacing $\beta_3 age_i+\beta_4 (age_i/10)^2$ in logit probability by

$$\beta_3 male_i age_i+\beta_4 male_i\left(\frac{age_i}{10}\right)^2+\beta_5(1-male_i)age_i+\beta_6(1-male_i)\left(\frac{age_i}{10}\right)^2$$

(3) split up sample in males and females
estimate the logit model for both groups
NOTE: one assumes β_2 is different for males and females