3) a)

In the cumulative proportional odds logit model, the probabilities of observing a value less than or equal to k for a given observation i can be written as:
$P(Yi \leq k) = 1 / (1 + \exp(-\beta 0k - \beta 1xi1))$
Therefore, the probabilities of observing each of the three possible outcomes can be written as:
$P(Yi = 1) = P(Yi \leq 1) = 1 / (1 + \exp(-\beta 01 - \beta 1xi1))$
$P(Yi = 2) = P(1 < Yi \leq 2) = P(Yi \leq 2) - P(Yi \leq 1) = [1 / (1 + \exp(-\beta 02 - \beta 1xi1))] - [1 / (1 + \exp(-\beta 01 - \beta 1xi1))]$
$P(Yi = 3) = P(Yi > 2) = 1 - P(Yi \leq 2) = 1 - [1 / (1 + \exp(-\beta 02 - \beta 1xi1))]$