Exercise 3.2.4

First we need to find P^2.

$$P^2 = P \cdot P = \begin{bmatrix} 49/100 & 28/100 & 23/100 \\ 43/100 & 22/100 & 35/100 \\ 47/100 & 20/100 & 33/100 \end{bmatrix}.$$

Then

$$P(X_2 = 2) = \sum_{k=0}^{2} P(X_2 = 2 \mid X_0 = k) P(X_0 = k)$$

$$= P(X_2 = 2 \mid X_0 = 1)$$

$$= \cancel{(P^2)_{12}} \quad (P^2)_{23} = \frac{35}{100}.$$