1. (a) \( P[E] = P[E \cap F] + P[E \cap F^C] - P[E|P[F] + P[E \cap F^C] \)
    so that \( P[E \cap F^C] = (1 - P[F])P[E] - P[E|P[F] \)

(b) \( P[A|I] = \frac{1}{2}, P[B|I] = \frac{1}{13}, P[A \cap B] = \frac{1}{52} \)
    Since \( P[A \cap B] = P[A|B], \) so they are independent.

2. By the law of total probabilities
    \begin{align*}
 & = 0.30 \times 0.35 + 0.25 \times 0.65 - 0.2675.
\end{align*}

3. \( P[I|B] = \frac{P[I \cap B]}{P[B]} = \frac{\frac{1}{4} \times \frac{1}{2}}{\frac{1}{4} \times 0 + \frac{1}{4} \times \frac{1}{2} + \frac{1}{4} \times 0 + \frac{1}{4} \times \frac{1}{2} - \frac{1}{2}}.\)

4. (a) Range of \( S_Z = \{ z : 0 \leq z \leq 2 \}. \)
    \begin{align*}
    F_Z(0) & = P[Z \leq 0] = 0, \\
    F_Z(1) & = P[Z \leq 1] = \frac{\text{area of half square bounded below by } x - y}{\text{area of the square}} = \frac{1}{2}, \\
    F_Z(2) & = 1.
\end{align*}
    (b) Since \( F_Z(z) = 0 \) for \( z \leq 0 \) and \( F_Z(z) = 1 \) for \( z \geq 2 \), so \( f_Z(-1) = 0 \) and \( f_Z(3) = 0. \)

5. (a) Average number of call over \( t \) minutes = \( 8t \).
    \( P[\text{at least one call}] = 1 - P[\text{no call}] = 1 - e^{-8t}. \)

(b) \( P[X = 2] = \frac{4^2}{2!}e^{-4}, \)
    where \( \mu = \text{average number of calls over half a minute} = 4. \)