1. Two dice are rolled. Let E be the event "at lease one die is a 4" and let F denote the event "the sum of the dice is 9."

   (a) Are the events E and F mutually exclusive? Explain. *(2 points)*

   No. The $\{4,5\}$ outcome is common to both events, so $E \cap F \neq \phi$.

   (b) Find $P(E)$ and $P(F)$. *(6 points)*

   $$P(E) = \frac{11}{36} \approx .31$$

   $$P(F) = \frac{4}{36} = \frac{1}{9} \approx .11$$

2. If E and F are two events in a sample space with $P(E) = 0.36$, $P(E \cup F) = 0.68$, and $P(E \cap F) = 0.21$, find the value of $P(F)$. Show your work. *(5 points)*

   $$P(E \cup F) = P(E) + P(F) - P(E \cap F)$$

   $$0.68 = 0.36 + P(F) - 0.21$$

   $$P(F) = 0.68 - 0.36 + 0.21$$

   $$P(F) = 0.53$$

3. If three dice are rolled, find the probability that at least two of the dice match. Explain your work. *(7 points)*

   $$P(2 \text{ or more match}) = 1 - P(\text{none match})$$

   $$= 1 - \frac{6 \cdot 5 \cdot 4}{6 \cdot 6 \cdot 6}$$

   $$= 1 - \frac{20}{36}$$

   $$= \frac{16}{36} = \frac{4}{9} \approx .44$$