

Answer all questions using complete sentences.

1. Given $P(A) = 0.3$ and $P(B) = 0.4$:

a. If A and B are mutually exclusive events, compute $P(A \text{ or } B)$.

$$\begin{aligned} P(A \text{ or } B) &= P(A) + P(B) \\ &= 0.3 + 0.4 \\ &= \boxed{0.7} \end{aligned}$$

b. If $P(A \text{ and } B) = 0.1$, compute $P(A \text{ or } B)$.

$$\begin{aligned} P(A \text{ or } B) &= P(A) + P(B) - P(A \text{ and } B) \\ &= 0.3 + 0.4 - 0.1 \\ &= \boxed{0.6} \end{aligned}$$

2. Given $P(A) = 0.7$ and $P(B) = 0.4$:

a. Can events A and B be mutually exclusive? Explain.

$$\text{No, } 0.7 + 0.4 > 1$$

b. If $P(A \text{ and } B) = 0.2$, compute $P(A \text{ or } B)$.

$$\begin{aligned} P(A \text{ or } B) &= 0.7 + 0.4 - 0.2 \\ &= \boxed{0.9} \end{aligned}$$

3. Given $P(A) = 0.2$, $P(B) = 0.5$, $P(A|B) = 0.3$, compute $P(A \text{ or } B)$.

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

$$0.3 = \frac{P(A \text{ and } B)}{0.5}$$

$$P(A \text{ and } B) = 0.15$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$= 0.2 + 0.5 - 0.15$$

$$= \boxed{0.55}$$

4. Given $P(A^c) = 0.8$, $P(B) = 0.3$, $P(B|A) = 0.2$, compute $P(A \text{ or } B)$.

$$P(A) = 0.2$$

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$

$$0.2 = \frac{P(A \text{ and } B)}{0.2}$$

$$P(A \text{ and } B) = 0.04$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$= 0.2 + 0.3 - 0.04$$

$$= \boxed{0.46}$$

5. Consider the following events for a college student selected at random:

A = student is female

B = student is majoring in business

Translate each of the following phrases into symbols.

- a. The probability the student is male or is majoring in business.

$$P(A^c \text{ or } B)$$

- b. The probability a female student is majoring in business.

$$P(B|A)$$

- c. The probability a business major is female.

$$P(A|B)$$

- d. The probability the student is female and is not majoring in business.

$$P(A \text{ and } B^c)$$

- e. The probability the student is female and is majoring in business.

$$P(A \text{ and } B)$$

6. M&M plain candies come in various colors. According to the M&M/Mars Department of Consumer Affairs, the distribution of colors for plain M&M candies is

Color	Purple	Yellow	Red	Orange	Green	Blue	Brown
Percentage	20%	20%	20%	10%	10%	10%	10%

Suppose you have a large bag of plain M&M candies and you choose one candy at random. Find:

- a. $P(\text{green candy or blue candy})$. Are these outcomes mutually exclusive? Why?

$$20\% \quad \text{yes.}$$

- b. $P(\text{yellow candy or red candy})$. Are these outcomes mutually exclusive? Why?

$$40\% \quad \text{yes.}$$

- c. $P(\text{not purple candy})$

$$100\% - 20\% = \boxed{80\%}$$

7. You roll two fair dice, a green one and a red one.

a. What is the probability of getting a sum of 6?

$$\begin{array}{r}
 1 \ 5 \quad 4 \ 2 \\
 2 \ 4 \quad 5 \ 1 \\
 3 \ 3
 \end{array}
 \quad
 \left[\frac{5}{36} \right]
 \quad
 \left\{
 \begin{array}{l}
 P(1 \text{ and } 5) + P(2 \text{ and } 4) + P(3 \text{ and } 3) + \\
 P(4 \text{ and } 2) + P(5 \text{ and } 1) = 5 \left(\frac{1}{36} \right) \\
 = \frac{5}{36}
 \end{array}
 \right.$$

b. What is the probability of getting a sum of 4?

$$\begin{array}{r}
 1 \ 3 \\
 2 \ 2 \\
 3 \ 1
 \end{array}
 \quad
 \frac{3}{36} = \left[\frac{1}{12} \right]$$

c. What is the probability of getting a sum of 6 or 4? Are these outcomes mutually exclusive?

$$P(\text{Sum } 6 \text{ or Sum } 4) = \frac{5}{36} + \frac{3}{36} = \frac{8}{36} = \left[\frac{2}{9} \right] \quad \text{yes!}$$

8. *USA Today* gave the information shown in the table about ages of children receiving toys. The percentages represent all toys sold. What is the probability that a toy is purchased for someone

Age (years)	Percentage of Toys
2 and under	15%
3 - 5	22%
6 - 9	27%
10 - 12	14%
13 and over	22%

a. 6 years old or older?

63%

b. 12 years old or younger?

78%

c. between 6 and 12 years old?

41%

d. between 3 and 9 years old?

49%

e. A child between 10 and 12 years old looks at this probability distribution and asks, "Why are people more likely to buy toys for kids older than I am [13 and over] than for kids in my age group [10 - 12]?" How would you respond?

*13 and older contains more age groups than 10-12.
More toys because there are more children.*

