

Al Hosn Secondary School	Subject	Teacher
10- General	Probabilities of Mutually Exclusive Events	Moustafa Abdelaziz

Objectives

To Find probabilities of events that are mutually exclusive and events that are not mutually exclusive.

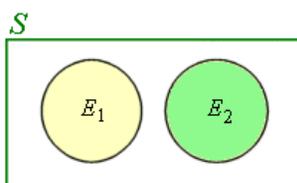
To Find probabilities of complements.

Vocabulary:

Mutually Exclusive Events	complement
أحداث منفصلة (متباعدة)	متمة

starter

- E_1 = male students
- E_2 = female students
- E_1, E_2 are Mutually Exclusive Events



$P(A \text{ and } B) = P(A \cap B) \Rightarrow$ Indicates an intersection of two sample spaces.

$P(A \text{ or } B) = P(A \cup B) \Rightarrow$ Indicates a union of two sample spaces.

Determine whether the events are mutually exclusive or not mutually exclusive. Explain your reasoning.

- a. a junior winning the election or a senior winning the election.

These events are mutually exclusive (no common outcomes)
a student cannot be both a junior and a senior.

- b. a sophomore winning the election or a female winning the election.

These events are not mutually exclusive.
A female student who is a sophomore is an outcome that both events have in common.

- c. drawing an ace or a club from a standard deck of cards.

Since the ace of clubs represents both events, they are not mutually exclusive.

- d. selecting a number at random from the integers from 1 to 100 and getting a number divisible by 5 or a number divisible by 10.

not mutually exclusive events

- e. drawing a card from a standard deck and getting a 5 or a heart.

not mutually exclusive events



- f. getting a sum of 6 or 7 when two dice are rolled.

mutually exclusive events

Probability of Mutually Exclusive Events:

If two events A and B are mutually exclusive, then the probability that A or B occurs is the sum of the probabilities of each individual event.

Example: If two events A or B are mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B)$.

① Two dice are rolled. What is the probability that doubles are rolled or that the sum is 9?

6	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)
5	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)
4	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)
3	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)
2	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)
1	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)
	1	2	3	4	5	6

The number of possible outcomes = $6 \cdot 6 = 36$

$n(S) = 36$

A: Getting a double $P(A) = \frac{6}{36}$

B: Getting a sum of 9 $P(B) = \frac{4}{36}$

Two events are mutually exclusive

$$P(A \text{ or } B) = P(A) + P(B) = \frac{6}{36} + \frac{4}{36} = \frac{10}{36} = \frac{5}{18}$$

② If you win the ring toss game at a certain carnival, you receive a stuffed animal. If the stuffed animal is selected at random from among 15 ponies, 16 kittens, 14 frogs, 25 snakes, and 10 unicorns, what is the probability that a winner receives a pony, a kitten, or a unicorn?

pony	kitten	Frog	Snake	unicorn
15	16	14	25	10

These events are mutually exclusive events.

A: pony $P(A) = \frac{15}{80}$

B: kitten $P(B) = \frac{16}{80}$

C: unicorn $P(C) = \frac{10}{80}$

$$P(A \text{ or } B \text{ or } C) = P(A) + P(B) + P(C) = \frac{15}{80} + \frac{16}{80} + \frac{10}{80} = \frac{41}{80}$$

Probability of Events That Are Not Mutually Exclusive

If two events A and B are not mutually exclusive, then the probability that A or B occurs is the sum of their individual probabilities minus the probability that both A and B occur.

If two events A and B are not mutually exclusive, then

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

① What is the probability of drawing a king or a diamond from a standard deck of 52 cards?

These events are not mutually exclusive events.

K: a king

D: a diamond

Deck of cards	King	diamond	K and D
52	4	13	1

$$P(K \text{ or } D) = P(K) + P(D) - P(K \text{ and } D) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$$

2. The table shows the number and type of paintings Yasmin has created. If she randomly selects a painting to submit to an art contest, what is the probability that she selects a portrait or an oil painting?

These events are not mutually exclusive events.

A: Portrait

B: Oil

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

$$= \frac{10}{30} + \frac{6}{30} - \frac{3}{30} = \frac{13}{30}.$$

Yasmin paintings			
Media	Still life	portrait	landscape
Watercolor	4	5	3
Oil	1	3	2
acrylic	3	2	1
pastel	1	0	5

Probability of the Complement of an Event

The probability that an event will not occur is equal to 1 minus the probability that the event will occur.

For an event A, $P(\text{not } A) = 1 - P(A)$.

- 1 Tarek bought 20 football cards, hoping to get the only card with his favorite player. If a total of 300 football cards were sold and contained one card with the player, what is the probability that Tarek will not get the card?

A: Tarek's cards containing the player.

$$P(A) = \frac{20}{300} = \frac{1}{15}$$

$$P(\text{not } A) = 1 - P(A) = 1 - \frac{1}{15} = \frac{14}{15}.$$

- 2 If the chance of rain is 70%, what is the probability that it will not rain?

A: chance of rain $P(A) = 70\% = 0.7$

$$P(\text{not } A) = 1 - P(A) = 1 - 0.7 = 0.3$$

- 3 According to an online poll, 35% of American motorists routinely use their cell phones while driving. Three people are chosen at random from a group of 100 motorists. What is the probability that?

A. at least two of them use their cell phone while driving?

A: Use their cell phones $\Rightarrow P(A) = 0.35$

B: doesn't use their cell phones $\Rightarrow P(B) = 1 - 0.35 = 0.65$

$$P(\text{at least two of them}) = 0.35 \cdot 0.35 \cdot 0.35 + 0.35 \cdot 0.35 \cdot 0.65 + 0.35 \cdot 0.65 \cdot 0.35 + 0.65 \cdot 0.35 \cdot 0.35 = 0.28175.$$

B. no more than one uses their cell phone while driving.

$$P(\text{no more than one use}) = (0.35 \cdot 0.65 \cdot 0.65) \cdot 3 + 0.65 \cdot 0.65 \cdot 0.65 = 0.71825$$

- 4 Determine whether the events are mutually exclusive or not mutually exclusive.

1. drawing a card from a standard deck and getting a jack or a club

not mutually exclusive events - A jack of clubs is both a jack and a club

2. adopting a cat or a bird

mutually exclusive events - A cat cannot be a dog, and a dog cannot be a cat.