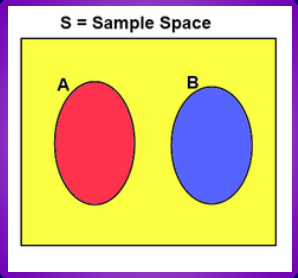
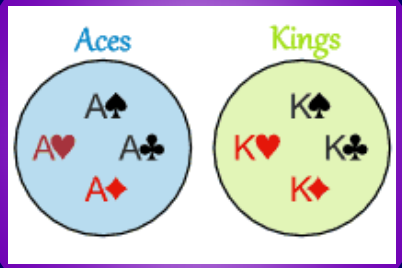
Probability





Mutually Exclusive Events

Mutually Exclusive Outcomes

Outcomes are **mutually exclusive** if they cannot happen at the same time.

For example, when you toss a single coin *either* it will land on heads *or* it will land on tails. There are two mutually exclusive outcomes.

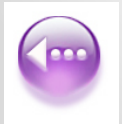
Outcome A: Head

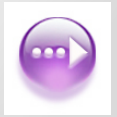
Outcome B: Tail

When you roll a dice *either* it will land on an odd number *or* it will land on an even number. There are two mutually exclusive outcomes.

Outcome A: An odd number

Outcome B: An even number





Mutually Exclusive Outcomes

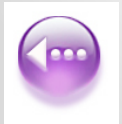
A pupil is chosen at random from the class. Which of the following pairs of outcomes are mutually exclusive?

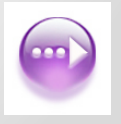
> Outcome A: the pupil has brown eyes.
>
> Outcome B: the pupil has blue eyes.

These outcomes are mutually exclusive because a pupil can *either* have brown eyes, blue eyes *or* another colour of eyes.

> Outcome C: the pupil has black hair.
>
> Outcome D: the pupil wears glasses.

These outcomes are ***not*** mutually exclusive because a pupil could have *both* black hair *and* wear glasses.





Adding Mutually Exclusive Outcomes

If two outcomes are mutually exclusive, then:

P(A or B) = P(A) + P(B)

For example, a game is played with the following cards:

What is the probability that a card is a moon or a sun?

P(moon) = $\frac{1}{3}$ and P(sun) = $\frac{1}{3}$

Drawing a moon and drawing a sun are mutually exclusive outcomes so,

P(moon **or** sun) = P(moon) + P(sun) = $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

Adding Mutually Exclusive Outcomes

If two outcomes are mutually exclusive then their probabilities can be added together to find their combined probability.

For example, a game is played with the following cards:

What is the probability that a card is yellow or a star?

P(yellow card) = $\frac{1}{3}$ and P(star) = $\frac{1}{3}$

Drawing a yellow card and drawing a star are ***not*** mutually exclusive outcomes because a card could be yellow and a star.

P (yellow card or star) cannot be found by adding.

Non-Mutually Exclusive Outcomes

If two outcomes are **NOT** mutually exclusive, then

P(A or B) = P(A) + P(B) – P(A and B)

For example, a game is played with the following cards:

What is the probability that a card is yellow or a star?

$P(\text{yellow}) = \frac{1}{3}$ $P(\text{star}) = \frac{1}{3}$ $P(\text{yellow and star}) = \frac{1}{9}$

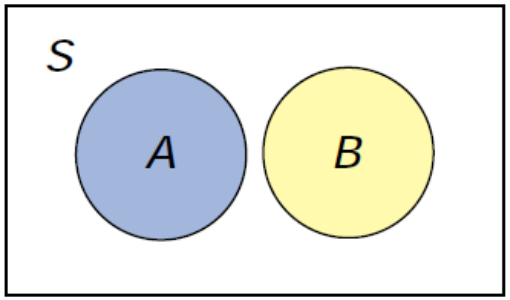
Drawing a yellow card and drawing a star are *not* mutually exclusive outcomes because a card could be yellow and a star.

$$P(\text{yellow card or star}) = \frac{1}{3} + \frac{1}{3} - \frac{1}{9} = \frac{5}{9}$$

Mutually vs. Non-Mutually Exclusive

If two events **are** mutually exclusive, then:

P(A or B) = P(A) + P(B)



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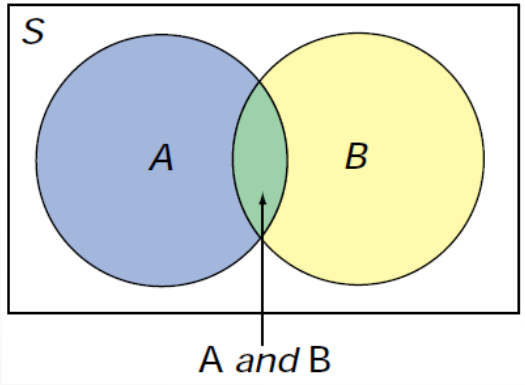

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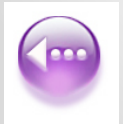
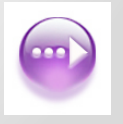
Tom has to choose what type of pants he would like to wear. He is most comfortable wearing either khaki or blue jeans. If there are 5 dress pants, 3 blue jeans and 4 khaki pants to choose from, what is the probability that he will receive a pair of pants that he likes?





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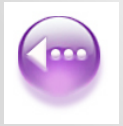
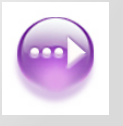
$$\frac{7}{12}$$





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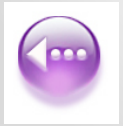
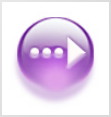
A card is randomly selected from a deck of cards. What is the probability that either a spade or a 7 is selected?





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A card is randomly selected from a deck of cards. What is the probability that either a spade or a 7 is selected?

$$\frac{16}{52} = \frac{4}{13}$$

Sum of All Mutually Exclusive Outcomes

The sum of all mutually exclusive outcomes is 1.

For example, a bag contains red counters, blue counters, yellow counters and green counters.

P(blue) = 0.15 P(yellow) = 0.4 P(green) = 0.35

What is the probability of drawing a red counter from the bag?

P(blue, yellow ***or*** green) = 0.15 + 0.4 + 0.35 = 0.9

P(red) = 1 – 0.9 = 0.1

Sum of All Mutually Exclusive Outcomes

A box contains bags of chips. The probability of drawing out the following flavours at random are:

P(salt and vinegar) = $\frac{2}{5}$ P(salted) = $\frac{1}{3}$

The box also contains sour cream and onion chips.

What is the probability of drawing a bag of sour cream and onion chips at random from the box?

P(salt and vinegar ***or*** salted) = $\frac{2}{5} + \frac{1}{3} = \frac{6+5}{15} = \frac{11}{15}$

P(sour cream and onion) = $1 - \frac{11}{15} = \frac{4}{15}$

Sum of All Mutually Exclusive Outcomes

A box contains bags of chips. The probability of drawing out the following flavours at random are:

P(salt and vinegar) = $\frac{2}{5}$ P(salted) = $\frac{1}{3}$

The box also contains sour cream and onion chips.

There are 30 bags in the box. How many are there of each flavour?

Number of salt and vinegar = $\frac{2}{5}$ of 30 = 12 packets

Number of salted = $\frac{1}{3}$ of 30 = 10 packets

Number of sour cream and onion = $\frac{4}{15}$ of 30 = 8 packets