

Probability Problems involving Rolling a Dice

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Following is covered in the video

- ▣ What is Probability of an Event ?
- ▣ Probability: Rolling 1 Fair Dice
- ▣ Probability: Rolling 2 Fair Dice
- ▣ Example Problems on Rolling 2 Fair Dice

Theory

What is Probability of an Event?

- Probability of an Event is the Likelihood of occurrence of that event.
- Probability that an Event, E, will occur is denoted by $P(E)$

$P(E) = \text{"No. of successful Outcomes"} / \text{"Total number of Outcomes"}$

Probability: Rolling 1 Fair Dice

Fair dice is a dice which has equal probability of getting any of the six numbers.

When we roll one dice or when we roll a dice one time then

- Total Number of Outcomes = 6 (We can get any number from 1 to 6)
- Outcomes are { 1, 2, 3, 4, 5, 6 }
- Probability of Getting a one, $P(1) = \frac{1}{6}$ (As there are ONLY one way out of 6 in which we can get a 1)
- Similarly, $P(2) = P(3) = P(4) = P(5) = P(6) = \frac{1}{6}$
- Probability of Getting a number greater than 3, $P(>3) = \frac{3}{6} = \frac{1}{2}$ (As there are 3 numbers greater than out of 6 i.e. 4, 5 and 6)
- $P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = \text{Total Probability} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = 1$

- Probability of Getting a number greater than 3, $P(>3) = P(4) + P(5) + P(6) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$
- Probability of Getting an Odd number, $P(\text{Odd}) = \frac{3}{6} = \frac{1}{2}$ (As there are 3 odd numbers out of the 6 numbers i.e. 1, 3 and 5)
- Probability of Getting an Even number, $P(\text{Even}) = \frac{3}{6} = \frac{1}{2}$ (As there are 3 even numbers out of the 6 numbers i.e. 2, 4 and 6)
- Probability of Getting a Prime number, $P(\text{Prime}) = \frac{3}{6} = \frac{1}{2}$ (As there are 3 prime numbers out of the 6 numbers i.e. 2, 3 and 5)

Probability: Rolling 2 Fair Dice

When we roll two dice or when we roll a dice two times then

- Total Number of Outcomes = $6^2 = 36$ (As we can get any number from 1 to 6 in each of the two rolls => $6 * 6 = 36$)
- Outcomes are

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

In each of the two places __ any number from 1 to 6 can come.

Example Problems on Rolling 2 Fair Dice

Q1. Find the probability that both the outcomes are Odd, P(Both outcomes are Odd)?

Solution: We have two places __ , in each of the two places any of the three odd numbers (1, 3, 5) can come.
 => We have $3 * 3 = 9$ ways possible
 => $P(\text{Both outcomes are Odd}) = \frac{9}{36} = \frac{1}{4}$

Q2. Find the probability that both the outcomes are Even, P(Both outcomes are Even)?

Solution: We have two places __ , in each of the two places any of the three even numbers (2, 4, 6) can come.
 => We have $3 * 3 = 9$ ways possible
 => $P(\text{Both outcomes are Even}) = \frac{9}{36} = \frac{1}{4}$

Q3. Find the probability that both the outcomes are Prime, P(Both outcomes are Prime)?

Solution: We have two places __, in each of the two places any of the three Prime numbers (2, 3, 5) can come.
=> We have $3 * 3 = 9$ ways possible
=> $P(\text{Both outcomes are Prime}) = \frac{9}{36} = \frac{1}{4}$

Q4. Find the probability that sum of the two outcomes is Odd, P(Sum of the two outcomes is Odd)?

Solution: Given that it is a fair dice so there is an equal probability of getting the sum as odd or even
=> $P(\text{Sum of the two outcomes is Odd}) = \frac{1}{2}$

Let's solve using one more method

We have two places __ and for the sum to be odd, one of them has to be odd and other has to be even

Odd Even -> Number of cases = 3 (for first odd) * 3 (for second even) = 9

Even Odd -> Number of cases = 3 (for first even) * 3 (for second odd) = 9

Total cases = 9 + 9 = 18

=> $P(\text{Sum of the two outcomes is Odd}) = \frac{18}{36} = \frac{1}{2}$

Q5. Find the probability that sum of the two outcomes is Even, P(Sum of the two outcomes is Even)?

Solution: Given that it is a fair dice so there is an equal probability of getting the sum as odd or even
=> $P(\text{Sum of the two outcomes is Even}) = \frac{1}{2}$

Let's solve using one more method

We have two places __ and for the sum to be odd, either both of them should be odd or both should be even

Odd Odd -> Number of cases = 3 (for first odd) * 3 (for second odd) = 9

Even Even -> Number of cases = 3 (for first even) * 3 (for second even) = 9

Total cases = 9 + 9 = 18

=> $P(\text{Sum of the two outcomes is Even}) = \frac{18}{36} = \frac{1}{2}$

Q6. Find the probability that sum of the two outcomes is a prime number, P(Sum of the two outcomes is Prime)?

Solution: We know that between 2 (1+1) and 12 (6+6) we have 2, 3, 5, 7, 11 as the prime numbers.

Let's list down the cases in which sum of the two outcomes will be a Prime number.

(1,1), (1,2), (1,4), (1,6)

(2,1), (2,3), (2,5)

(3,2), (3,4)

(4,1), (4,3)

(5,2), (5,6)

(6,1), (6,5)

=> Total cases = 15

=> $P(\text{Sum of the two outcomes is Prime}) = \frac{15}{36} = \frac{5}{12}$

Q7. Find the probability that sum of the two outcomes is a multiple of 3, P(Sum of the two outcomes is a multiple of 3)?

Solution: Let's list down the cases in which sum of the two outcomes will be a multiple of 3

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

=> Total cases = 12

=> $P(\text{Sum of the two outcomes is a multiple of 3}) = \frac{12}{36} = \frac{1}{3}$

Q8. Find the probability that sum of the two outcomes is a multiple of 5, P(Sum of the two outcomes is a multiple of 5)?

Solution: Let's list down the cases in which sum of the two outcomes will be a multiple of 5

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

=> Total cases = 7

=> $P(\text{Sum of the two outcomes is a multiple of 5}) = \frac{7}{36}$

Q9. Find the probability that product of the two outcomes is a prime number, P(Product of the two outcomes is Prime)?

Solution: Let's list down the cases in which product of the two outcomes will be a Prime number.

(1,2), (1,3), (1,5)
(2,1)
(3,1)
(5,1)

=> Total cases = 6

=> $P(\text{Product of the two outcomes is Prime}) = \frac{6}{36} = \frac{1}{6}$

Q10. Find the probability that product of the two outcomes is a multiple of 3, P(Product of the two outcomes is a multiple of 3)?

Solution: Let's list down the cases in which product of the two outcomes will be a multiple of 3

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

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

=> Total cases = 20

=> $P(\text{Product of the two outcomes is a multiple of 3}) = \frac{20}{36} = \frac{5}{9}$

Q11. Find the probability that product of the two outcomes is a multiple of 5, P(Product of the two outcomes is a multiple of 5)?

Solution: Let's list down the cases in which product of the two outcomes will be a multiple of 5

(1,5)

(2,5)

(3,5)

(4,5)

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

(6,5)

=> Total cases = 11

=> $P(\text{Product of the two outcomes is a multiple of 5}) = \frac{11}{36}$

Hope it helps!

Good Luck!