



## MATHS

### NCERT - NCERT MATHEMATICS (ENGLISH)

#### PROBABILITY

##### Solved Examples

1. Find the sample space associated with the experiment of rolling a pair of dice (one is blue and the other red) once. Also, find the number of elements of this sample space.

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2. In a relay race there are five teams A, B, C, D and E. (a) What is the probability that A, B and C finish first, second and third, respectively. (b)

What is the probability that A, B and C are first three to finish (in any order) (Assume that all finishing orders are equally likely).

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3. Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) all Kings (ii) 3 Kings (iii) at least 3 Kings.

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4. On her vacations Veena visits four cities ( $A, B, C$  and  $D$ ) in a random order. What is the probability that she visits (i) A before B? (ii) A before B and B before C? (iii) A first and B last? (iv) A either first or second? (v) A just be

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5. A committee of two persons is selected from two men and two women. What is the probability that the committee will have i. no man? ii. one man? iii. two men?



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6. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that (a) Both Anil and Ashima will not qualify the examination. (b) At least one of them will not qualify the examination and (c) Only one of them will qualify the examination.



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7. A bag contains 9 discs of which 4 are red. 3 are blue and 2 are yellow. The discs are similar in shape and size. A disc is drawn at random from

the bag. Calculate the probability that it will be (i) red. (ii) yellow, (iii) blue, (iv) not blue, (v) either red or yellow.

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8. One card is drawn from a well shuffled deck of 52 cards. If each outcome is equally likely, calculate the probability that the card will be (i) a diamond (ii) not an ace (iii) a black card (i.e., a club or a spade) (iv) not a diamond (v) not a black card.

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9. If A, B, C are three events associated with a random experiment prove that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

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10. A coin is tossed three times, consider the following events. A : No head appears, B: Exactly one head appears and C: Atleast two appear. Do they form a set of mutually exclusive and exhaustive events?



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11. Let a sample space be  $S = \{\omega_1, \omega_2, \dots, \omega_6\}$ . Which of the following assignments of probabilities to each outcome are valid? Outcomes  $\omega_1 \omega_2$

$\omega_3 \omega_4 \omega_5 \omega_6$

(a)  $\frac{1}{6} \frac{1}{6} \frac{1}{6} \frac{1}{6} \frac{1}{6} \frac{1}{6}$

(b) 1 0 0 0 0 0



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12. A coin is tossed. If it shows head, we draw a ball from a bag consisting of 3 blue and 4 white balls; if it shows tail we throw a die. Describe the sample space of this experiment.



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13. Consider the experiment in which a coin is tossed repeatedly until a head comes up. Describe the sample space.



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14. Consider the experiment of rolling a die. Let  $A$  be the event 'getting a prime number'.  $B$  be the event 'getting an odd number'. Write the sets representing the events (i)  $A$  or  $B$  (ii)  $A$  and  $B$  (iii)  $A$  but not  $B$  (iv) 'not  $A$ '.



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15. Two dice are thrown and the sum of the numbers which come up on the dice is noted. Let us consider the following events:  $A$  = The sum is even,  $B$  = The sum is multiple of 3,  $C$  = The sum is less than 4,  $D$  = The sum is greater than 11. Which pairs of these events are mutually exclusive?



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**16.** Two coins (a one rupee coin and a two rupee coin) are tossed once.

Find a sample space.



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**17.** Find the sample space associated with the experiment of rolling a pair of dice (one is blue and the other red) once. Also, find the number of elements of this sample space.



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**18.** In each of the following experiments specify appropriate sample space  
(i) A boy has a 1 rupee coin, a 2 rupee coin and a 5 rupee coin in his pocket. He takes out two coins out of his pocket, one after the other.  
(ii) A person is noting down the number of accidents along a busy highway during a year.



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## Miscellaneous Exercise

1. A die has two faces each with number '1' three faces each with number '2' and one face with number '3'. If die is rolled once, determine (i)  $P(2)$  (ii)  $P(1 \text{ or } 3)$  (iii)  $P(\text{not } 3)$



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2. The number lock of a suitcase has 4 wheels, each labelled with ten digits i.e., from 0 to 9. The lock opens with a sequence of four digits with no repeats. What is the probability of a person getting the right sequence to open the suitcase?



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3. In a lottery 10,000 tickets are sold and ten equal prizes are awarded,. What is the probability of not getting a prize if you buy i. 1 ticket ii. two tickets iii. 10 tickets.



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4. 4 cards are drawn from a well - shuffled deck of 52 cards. What is the probability of obtaining 3 diamonds and one spade?



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5. Out of 100 students, two sections of 40 and 60 are formed. If you and your friend are among the 100 students, what is the probability that(a) you both enter the same section?(b) you both enter the different sections?



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6. A and B are two events such that  $P(A) = 0.54$ ,  $P(B) = 0.69$  and  $P(A \cap B) = 0.35$ . Find (i)  $P(A \cup B)$  (ii)  $P(A' \cap B')$  (iii)  $P(A \cap B')$  (iv)  $P(B \cap A')$



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7. Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contains exactly one letter. Find the probability that at least one letter is in its proper envelope.



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8. A box contains 10 red marbles, 20 blue marbles and 30 green marbles. 5 marbles are drawn from the box, what is the probability that (i) all will be blue (ii) atleast one will be green?



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9. If 4-digit numbers greater than 5,000 are randomly formed from the digits 0, 1, 3, 5, and 7. what is the probability of forming a number divisible by 5 when, (i) the digits are repeated? (ii) the repetition of digits is not allowed?



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10. From the employees of a company, 5 persons are selected to represent them in the managing committee of the company. Particulars of five persons are as follows:

S.No.	Name	Sex	Age in years
1.	Harish	M	32.
2.	Rohan	M	33.
3.	Sheetal	F	34.
4.	Alis	F	28.
5.	Salim	M	41.

One person is selected at random from this group to act as a spokesperson. What is the probability that the spokesperson will be either male or over 35 years?



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## Exercise 16 2

1. An experiment involves rolling a pair of dice and recording the numbers that come up. Describe the following events: A: the sum is greater than 8, B: 2 occurs on either die C: the sum is at least 7 and a multiple of 3. Which pairs of these events are mutually exclusive?



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2. Two dice are thrown. The events A, B and C are as follows: A : getting an even number on the first die. B : getting an odd number on the first die. C : getting the sum of the numbers on the dice 5. Describe the events



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3. A die is thrown. Describe the following events:

(i) A : a number less than 7

(ii) B : a number greater than 7

(iii)  $C$ : a multiple of 3

(iv)  $D$ : a number less than 4

(v)  $E$ : a even number greater than 4

(vi)  $F$ : a number not less than 3

Also find

$A \cup B, A \cap B, B \cup C, E \cap F, D \cap E, A - C, D - E, E \cap F', F'$

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4. Refer to question 6 above, state true or false: (give reason for your answer)(i)  $A$  and  $B$  are mutually exclusive.(ii)  $A$  and  $B$  are mutually exclusive and exhaustive.(iii)  $A = B'$ (iv)  $A$  and  $C$  are mutually exclusive.  
(v)  $A$  and  $B$  are mutually exclusive (vi)  $A, B$  and  $C$  are mutually exclusive and exhaustive.

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5. A die is rolled. Let  $E$  be the event “die shows 4” and  $F$  be the event “die shows even number”. Are  $E$  and  $F$  mutually exclusive?



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6. Three coins are tossed once. Let A denote the event ‘three heads show’, B denote the event ‘two heads and one tail show’, C denote the event ‘three tails show’ and D denote the event ‘a head shows on the first coin’. Which events are (i) mutually exclusive? (ii) simple? (iii) Compound?



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7. Three coins are tossed. Describe (i) Two events which are mutually exclusive. (ii) Three events which are mutually exclusive and exhaustive. (iii) Two events, which are not mutually exclusive. (iv) Two events which are mutually exclusive but not exhaustive. (v) Three events which are mutually exclusive but not exhaustive.



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1. An experiment consists of tossing a coin and then throwing it second time if a head occurs. If a tail occurs on the first toss, then a die is rolled once. Find the sample space.



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2. Suppose 3 bulbs are selected at random from a lot. Each bulb is tested and classified as defective (D) or non – defective (N). Write the sample space of this experiment.



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3. A coin is tossed. If the outcome is a head, a die is thrown. If the die shows up an even number, the die is thrown again. What is the sample space for the experiment?



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4. The numbers 1, 2, 3 and 4 are written separately on four slips of paper. The slips are put in a box and mixed thoroughly. A person draws two slips from the box, one after the other, without replacement. Describe the sample space for the experiment.



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5. An experiment consists of rolling a die and then tossing a coin once if the number on the die is even. If the number on the die is odd, the coin is tossed twice. Write the sample space for this experiment.



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6. A coin is tossed. If it shows a tail, we draw a ball from a box which contains 2 red and 3 black balls. If it shows head, we throw a die. Find the sample space for this experiment.



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7. A die is thrown repeatedly until a six comes up. What is the sample space for this experiment?



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8. A box contains 1 red and 3 identical white balls. Two balls are drawn at random in succession without replacement. Write the sample space for this experiment.



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9. An experiment consists of boy girl composition of families with 2 children. i. What is the sample space if we are interested in knowing whether it is a boy or girl in the order of their births? ii. What is the sample space if we are interested in the number of boys in a family?



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**10.** Describe the sample space for the indicated experiment : A coin is tossed four times.

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**11.** Describe the sample space for the indicated experiment : A die is thrown two times.

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**12.** Describe the sample space for the indicated experiment : A coin is tossed three times.

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**13.** Describe the sample space for the indicated experiment : One die of red colour, one of white colour and one of blue colour are placed in a bag.

One die is selected at random and rolled, its colour and the number on its uppermost face is noted. Describe the sample space.

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14. Describe the sample space for the indicated experiment : 2 boys and 2 girls are in Room X, and 1 boy and 3 girls in Room Y. Specify the sample space for the experiment in which a room is selected and then a person.

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15. Describe the sample space for the indicated experiment : A coin is tossed and then a die is rolled only in case a head is shown on the coin.

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16. Describe the sample space for the indicated experiment : A coin is tossed and a die is thrown.



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### Exercise 16 3

1. If  $\frac{2}{11}$  is the probability of an event, what is the probability of the event not A



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2. A fair coin with 1 marked on one face and 6 on the other and a fair die are both tossed, find the probability that the sum of numbers that turn up is (i) 3 (ii) 12



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3. A card is selected from a pack of 52 cards. (a) How many points are there in the sample space? (b) Calculate the probability that the card

is an ace of spades.(c) Calculate the probability' that the card is (i) an ace (ii) black card.

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4. A fair coin is tossed four times, and people win Re 1 for each head and lose Rs 1.50 for each tail that turns up. From the sample space calculate how many different amounts of money you can have after four tosses and the probability' of having each of these amounts.

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5. There are four men and six women on the city council. If one council member is selected for a committee at random how likely is it that it is a woman?

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6. Which of the following cannot be valid assignment of probabilities for outcomes of sample space  $S = \{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7\}$ ?

Assignment	$\omega_1$	$\omega_2$	$\omega_3$	$\omega_4$	$\omega_5$	$\omega_6$	$\omega_7$
(a)	0.1	0.01	0.05	0.03	0.01	0.2	0.6
(b)	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$
(c)	0.1	0.2	0.3	0.4	0.5	0.6	0.7
(d)	-0.1	0.2	0.3	0.4	-0.2	0.1	0.3
(e)	$\frac{1}{14}$	$\frac{2}{14}$	$\frac{3}{14}$	$\frac{4}{14}$	$\frac{5}{14}$	$\frac{6}{14}$	$\frac{15}{14}$



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7. A die is thrown, find the probability of following events:

- (i) A prime number will appear,
- (ii) A number greater than or equal to 3 will appear,
- (iii) A number less than or equal to one will appear,
- (iv) A number more than 6 will appear,
- (v) A number less than 6 will appear.



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8. A coin is tossed twice, what is the probability that atleast one tail occurs?

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9. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that (i) The student opted for NCC or NSS. (ii) The student has opted neither NCC nor NSS. (iii) The student has opted NSS but not NCC.

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10. The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing the English examination is 0.75. What is the probability of passing the Hindi examination?

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11. Three coins are tossed once. Find the probability of getting (i) 3 heads (ii) 2 heads (iii) at least 2 heads (iv) at most 2 heads (v) no head (vi) 3 tails (vii) exactly two tails (viii) no tail (ix) at most two tails



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12. Check whether the following probabilities  $P(A)$  and  $P(B)$  are consistently defined (i)  $P(A) = 0.5$ ,  $P(B) = 0.7$ ,  $P(A \cap B) = 0.6$  (ii)  $P(A) = 0.5$ ,  $P(B) = 0.4$ ,  $P(A \cup B) = 0.8$



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13. Fill in the blanks in following table:  $P(A)$   $P(B)$   $(A \cap B)$   $P(A \cup B)$  (i)  $\frac{1}{3}$   $\frac{1}{5}$   $\frac{1}{15}$  ... (ii) 0.35 ... 0.25 0.6 (iii) 0.5 0.35 ... 0.7



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14. A letter is chosen at random from the word 'ASSASSINATION'. Find the probability that letter is (i) a vowel (ii) a consonant.

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15. In a lottery, a person chooses six different natural numbers at random from 1 to 20, and if these six numbers match with the six numbers already fixed by the lottery committee, he wins the prize. What is the probability of Winning the prize in the game. [Hint order of the numbers is not important.]

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16. Events E and F are such that  $P(\text{not E or not F}) = 0.25$  State whether E and F are mutually exclusive.

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17. A and B are events such that  $P(A) = 0.42$ ,  $P(B) = 0.48$  and  $P(A \text{ and } B) = 0.16$ . Determine (i)  $P(\text{not } A)$ , (ii)  $P(\text{not } B)$  and (iii)  $P(A \text{ or } B)$



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18. Give  $P(A) = \frac{3}{5}$  and  $P(B) = \frac{1}{5}$ . Find  $P(A \text{ or } B)$ , if A and B are mutually exclusive events.



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19. If E and F are events such that  $P(E) = \frac{1}{4}$ ,  $P(F) = \frac{1}{2}$  and  $P(E \text{ and } F) = \frac{1}{8}$ , find (i)  $P(E \text{ or } F)$ , (ii)  $P(\text{not } E \text{ and not } F)$ .



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20. In Class XI of a school 40% of the students study Mathematics and 30% study Biology. 10% of the class study both Mathematics and Biology.

If a student is selected at random from the class, find the probability that he will be studying Mathematics or Biology.

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**21.** In an entrance test that is graded on the basis of two examinations, the probability of a randomly chosen student passing the first examination is 0.8 and the probability of passing the second examination is 0.7. The probability of passing at least one of them is 0.95. What is the probability of passing both?

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