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# **DPM CLASSES**

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

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**BASIC NOTES (CBSE/NCERT)**

# **PROBABILITY**

**PART -1 OUT OF 1**

**6<sup>th</sup>, 7<sup>th</sup> & 8<sup>th</sup>**

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# DPM CLASSES

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∴ Probability :-

②. Experimental or empirical probability  $P(E)$  of an event  $E$  is

$$P(E) = \frac{\text{Number of trials in which the event happened}}{\text{Total number of trials (trials)}}$$



③. theoretical probability or classical probability of an event  $E$  written as  $P(E)$ , is defined as

$$P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes of the experiment}}$$

This definition of probability was given by pierre simon Laplace in 1795.

④. The sum of the probabilities of all the elementary events of an experiment is 1. This is true in general.

$$P(E) + P(\bar{E}) = 1$$

$$P(Y) + P(R) + P(B) = 1$$



[E, F, Y, R, B are events]

⑤. In general, it is true that for an event  $E$ ,

$$P(\bar{E}) = 1 - P(E)$$

[E for event,  $\bar{E}$  for not event]

Also called complement of the event  $E$ .

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6th to 10th (Math's &amp; Science), 11th &amp; 12th (Physics, Chemistry, Math's)

∴ Probability :-

①. Impossible event :- The probability of an event which is impossible to occur is 0. Such an event is called an impossible event.

②. Sure event : The probability of an event which is sure (or certain) to occur is 1. Such an event is called a sure event or a certain event.

③. From the definition of the probability  $P(E)$ , we see that the numerator (Number of outcomes favourable to the event  $E$ ) is always less than or equal to the denominator (the number of all possible outcomes) therefore,

$$0 \leq P(E) \leq 1$$

④. Deck :- In a deck have 52 cards, 13 spades, 13 heart, 13 diamond, 13 clubs, 4 ace, king, queen and Jack (each), Red color 26, Black color 26, Kings, queens and Jacks are called face cards.

⑤. Dice :- In a dice has 6 faces 1, 2, 3, 4, 5, 6

Prime numbers are - 2, 3, 5

even numbers are - 2, 4, 6

odd numbers are = 1, 3, 5

less than 5 are = 1, 2, 3, 4

equal to 5 are = 1, 2, 3, 4, 5 etc.

⑥. Coin :- Coin has two parts head and tail.



# DPM CLASSES

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

∴ Probability :-

- Q. A die is thrown once. Find the probability of getting
- (a) a prime number
  - (b) a number lying between 2 and 6
  - (c) an odd number.

Sol.

The possible outcomes when a dice is thrown = (1, 2, 3, 4, 5, 6)

Number of possible outcomes of a dice = 6

(i) Prime numbers on a dice are 2, 3, 5

Total prime numbers on a dice = 3

$$P(\text{getting a prime number}) = \frac{3}{6} = \frac{1}{2}$$

(ii) Number lying between 2 and 6 = 3, 4, 5

Total number lying between 2 and 6 = 3

$$P(\text{getting a number lying b/w 2 and 6}) = \frac{3}{6} = \frac{1}{2}$$

(iii) odd numbers on a dice = 1, 3 and 5

Total odd numbers on a dice = 3

$$P(\text{getting an odd number}) = \frac{3}{6} = \frac{1}{2}$$

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∴ probability :-

Q. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and these are equally likely outcomes. What is the probability that it will point at (Fig 15.5)

- (i) 8 ?                      (iii) a number greater than 2 ?  
 (ii) an odd number ?    (iv) a number less than 9 ?

Sol.

Total number of possible outcomes = 8

$$(i) \quad P(\text{getting } 8) = \frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}} = \frac{1}{8}$$

(ii) Total number of odd numbers on spinner = 4

$$P(\text{getting an odd number}) = \frac{4}{8} = \frac{1}{2}$$

(iii) The number of ~~odd~~ greater than 2 are 3, 4, 5, 6, 7, and 8

Total numbers greater than 2 = 6

$$P(\text{getting a number greater than 2}) = \frac{6}{8} = \frac{3}{4}$$

(iv) The numbers less than 9 are 1, 2, 3, 4, 5, 6, 7, and 8

Total number less than 9 = 8

$$P(\text{getting a number less than 9}) = \frac{8}{8} = 1$$

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Q. Gopi buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female fish. What is the probability that the fish taken out is a male fish?

Sol.

Total number of fishes in a tank

= Number of male fishes + Number of female fishes

= 5 + 8

= 13

$$P(\text{getting a male fish}) = \frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}}$$
$$= \frac{5}{13}$$



# DPM CLASSES

6th to 10th (Math's &amp; Science), 11th &amp; 12th (Physics, Chemistry, Math's)

-: probability :-

Q. A piggy bank contains hundred 50p coins, fifty ₹ 1 coins, twenty ₹ 2 coins and ten ₹ 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin (i) will be a 50p coin? (ii) will not be a ₹ 5 coin?

Sol.

Total number of coins in a piggy bank

$$= 100 + 50 + 20 + 10$$

$$= 180$$



(i) Number of 50p coins = 100

$$P(\text{getting a 50p coin}) = \frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}}$$



$$= \frac{100}{180} = \frac{10}{18} = \frac{5}{9}$$

(ii) Number of ₹ 5 coins = 10

$$P(\text{getting a ₹ 5 coin}) = \frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}}$$

$$= \frac{10}{180} = \frac{1}{18}$$

$$P(\text{not getting a ₹ 5 coin}) = 1 - \frac{1}{18}$$

$$= \frac{18-1}{18} = \frac{17}{18}$$

# DPM CLASSES

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Q. Five cards - the ten, Jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.

(i) What is the probability that the card is the queen?

(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is  
(a) an ace (b) a queen?

Sol.

(i) Total number of cards = 5

Total number of queen = 1

$$P(\text{getting a queen}) = \frac{\text{Number of favorable outcomes}}{\text{Number of total possible outcomes}}$$

(ii) When the queen is drawn and put aside, the total number of remaining cards will be 4

Total number of ace = 1

$$(a) \quad P(\text{getting an ace}) = \frac{1}{4}$$

(b) As queen is already drawn, therefore, the number of queens will be zero

$$P(\text{getting a queen}) = \frac{0}{4} = 0$$



# DPM CLASSES

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Q. one card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting.

- (i) a king of red colour (ii) a face card  
 (iii) a red face card (iv) the jack of hearts  
 (v) a spade (vi) the queen of diamonds

Sol.

Total number of cards in a well-shuffled deck = 52

(i) Total number of kings of red colour = 2

$$P(\text{getting a king of red colour}) = \frac{2}{52} = \frac{1}{26}$$

(ii) Total number of face cards = 12

$$P(\text{getting a face card}) = \frac{12}{52} = \frac{3}{13}$$

(iii) Total number of red face cards = 6

$$P(\text{getting a red face card}) = \frac{6}{52} = \frac{3}{26}$$

(iv) Total number of jacks of hearts = 1

$$P(\text{getting a jack of heart}) = \frac{1}{52}$$

(v) Total number of spade cards = 13

$$P(\text{getting a spade card}) = \frac{13}{52} = \frac{1}{4}$$

(vi) Total number of queen of diamonds = 1

$$P(\text{getting a queen of diamonds}) = \frac{1}{52}$$

# DPM CLASSES

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Q. A lot consists of 144 pens of which 20 are defective and others are good. Nuri will buy a pen if it is a good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that

(i) She will buy it? (ii) She will not buy it?

Sol.

Total number of pens = 144

Total number of defective pens = 20

Total number of a good pens =  $144 - 20 = 124$

$$\begin{aligned} \text{(i) } P(\text{getting a good pen}) &= \frac{124}{144} \\ &= \frac{31}{36} \end{aligned}$$

$$\text{(ii) } P(\text{Nuri buy a pen}) = \frac{31}{36}$$

$$\begin{aligned} P(\text{Nuri will not buy a pen}) &= 1 - \frac{31}{36} \\ &= \frac{1}{1} - \frac{31}{36} \\ &= \frac{36-31}{36} \\ &= \frac{5}{36} \end{aligned}$$

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Q. A game consists of tossing a one rupee coin 3 times and noting its outcomes each time. Harif wins if all the tosses give the same result i.e. three heads or three tails and loses otherwise. Calculate the probability that Harif will lose the game.

Sol.

Total possible outcomes are

(HHH, TTT, HTH, THT, HHT, THH, TTH, HTT)

Number of total possible outcomes = 8

Number of favourable outcomes = 2 (i.e. HHH, TTT)

$$P(\text{Harif will win the game}) = \frac{2}{8} = \frac{1}{4}$$

$$\begin{aligned} P(\text{Harif will lose the game}) &= 1 - \frac{1}{4} \\ &= \frac{4-1}{4} = \frac{3}{4} \end{aligned}$$



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Q. Which of the following arguments are correct and which are not correct? Give reasons for your answers.

(i) If two coins tossed simultaneously - there are three possible outcomes - two heads, two tails or one of each, therefore, for each of these outcomes the probability is  $\frac{1}{3}$

(ii) If a dice is thrown, there are two possible outcomes an odd number or an even number, therefore, the probability of getting an odd number is  $\frac{1}{2}$ .

Sol: (i) incorrect

When two coins are tossed the possible outcomes are (H,H) (H,T) (T,H) and (T,T).

It can be observed that can be one of each in two possible ways - (H,T) (T,H)

Therefore,

$$P(\text{getting of two heads}) = \frac{1}{4}$$

$$P(\text{getting of two tails}) = \frac{1}{4}$$

$$P(\text{getting of one of each}) = \frac{2}{4} = \frac{1}{2}$$

(ii) correct

When a dice thrown possible outcomes 1, 2, 3, 4, 5, 6

odd outcomes are 1, 3, 5 and even outcomes are 2, 4, 6

$$P(\text{getting an odd number}) = \frac{3}{6} = \frac{1}{2}$$

# DPM CLASSES

6th to 10th (Math's &amp; Science), 11th &amp; 12th (Physics, Chemistry, Math's)

- Q. A die is thrown twice. What is the probability that
- 5 will not come up either time?
  - 5 will come up at least once?

Sol.

$$\text{Total number of outcomes} = 6 \times 6 = 36$$

- (i) Total number of outcomes when 5 comes up on either time are (5,1) (5,2) (5,3) (5,4) (5,5) (5,6)  
 or (1,5) (2,5) (3,5) (4,5) (5,5) (6,5)

$$\text{Total number of favourable cases} = 11$$

$$P(5 \text{ will come up either time}) = \frac{11}{36}$$

$$\begin{aligned}
 P(5 \text{ will not come up either time}) &= 1 - \frac{11}{36} \\
 &= \frac{36-11}{36} \\
 &= \frac{25}{36}
 \end{aligned}$$

- (ii) Total number of cases, when 5 can come at least once = 11

$$P(5 \text{ will at least once}) = \frac{11}{36}$$



# DPM CLASSES

6th to 10th (Math's &amp; Science), 11th &amp; 12th (Physics, Chemistry, Math's)

Q. 12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

Sol.

$$\text{Total number of pens} = 12 + 132 = 144$$

$$\text{Total number of good pens} = 132$$

$$P(\text{getting a pen good}) = \frac{132}{144} = \frac{11}{12} \quad (\text{Use formula})$$

Q. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from a lot. What is the probability that this bulb is defective?

(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective?

Sol. (i) Total number of bulbs = 20

$$\text{Total number of defective bulbs} = 4$$

$$P(\text{getting a defective bulb}) = \frac{4}{20} = \frac{1}{5}$$

(ii) Remaining total number of bulbs = 19

$$\text{Remaining total number of non-defective bulbs} = 16 - 1 = 15$$

$$P(\text{getting a non-defective bulb}) = \frac{15}{19}$$



# DPM CLASSES

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Q. A box contains 90 discs which are numbered from 1 to 90. If the disc is drawn at random from the box, find the probability that it bears (i) a two digit number (ii) a perfect square (iii) a number divisible by 5

Sol. Total number of discs = 90

(i) Total number of two digit number b/w 1 and 90 = 81

$$P(\text{getting a two digit number}) = \frac{81}{90} = \frac{9}{10}$$

(ii) perfect square b/w 1 and 90 are 1, 4, 9, 16, 25, 36, 49, 64, 81, therefore,

Total number of perfect square b/w 1 and 90 is 9

$$P(\text{getting a perfect square}) = \frac{9}{90} = \frac{1}{10}$$

(iii) Numbers that are b/w 1 and 90 and divisible by 5 are, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85 and 90, Therefore

Total numbers divisible by 5 = 18

$$P(\text{getting a number divisible by 5}) = \frac{18}{90} = \frac{1}{5}$$