Important Questions for Class 10

Maths

Chapter 15 - Probability

1. An integer is chosen at random from the first two hundreds digit. What is the probability that the integer chosen is divisible by 6 or 8.

Ans: First 200 integers that are multiplies of 6 are listed as

$6, 12, 18, \underline{24}, 30, 36, 42, \underline{48}, 54, 60, 66, \underline{72}, 78, 84, 90, \underline{96}, 102, 108, 114, \underline{120}, 126, 132, 138, \underline{144}, 150, 156, 162, \underline{168}, 174, 180, 186, \underline{192}, 198.$

First 200 integers that are multiples of 8 are listed as

$8, 16, \underline{24}, 32, 40, \underline{48}, 56, 64, \underline{72}, 80, 88, \underline{96}, 104, 112, \underline{120}, 128, 136, \underline{144}, 152, 160, \underline{168}, 176, 184, \underline{192}, 200.$

Thus, there is total 50 numbers which are multiples of 6 or 8.

So, the probability that the integer chosen is divisible by 6 or 8 is $=\frac{50}{200}=\frac{1}{4}$.

2. A box contains 12 balls out of which x are black. if one ball is drawn at random from the box what is the probability that it will be a black ball? If 6 more black balls are out in the box. the probability of drawing a black ball is now double of what it was before. Find x.

Ans: When some balls are drawn randomly, then it ensures equal likely outcomes.

There is total 12 balls.

So, 12 possible outcomes can occur.

Now, let there are x balls, which are black.

Thus, the probability that a ball drawn is black

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{x}{12}$$

Since, 6 more black balls are out in the box, so there will be total $x+6$ black balls out of the total balls $12+6=18$.

By the given condition, the probability obtained for drawing black ball in the

second case $=2\times$ the probability obtained for drawing of black ball in the first case.

$$\frac{x+6}{18} = 2\times\frac{x}{12}$$

$$\Rightarrow \frac{x+6}{18} = \frac{x}{6}$$

$$\Rightarrow 6x+36 = 18x$$

$$\Rightarrow x = 3$$

Thus, there is 3 black balls in the box.

3. A bag contains 8 red balls and x blue balls, the odd against drawing a blue ball are $2:5$. What is the value of x?

Ans: Since, there is x blue balls and 8 red balls, so the total number of balls $= x+8$.

Therefore, the probability that a blue ball is drawn $= \frac{x}{x+8}$

The probability that a red ball is drawn $= \frac{8}{x+8}$.

So, by the given condition, we have

$$\frac{8}{x+8}:\frac{x}{x+8}=2:5$$

$$\Rightarrow 2\left(\frac{x}{x+8}\right)=5\left(\frac{8}{x+8}\right)$$

$$\Rightarrow 2x=40$$

$$\Rightarrow x=20$$

Thus, the value of x is 20.

4. A card is drawn from a well shuffled deck of cards.

i) What are the odds in favour of getting spade?

Ans: There are 52 cards in a deck and among these 13 are spades.

So, the number of cards remain is 39.

Therefore, the odds in favour of getting spade is $\frac{13}{52}:\frac{39}{52}=1:3$.

ii) What are the odds against getting a spade?

Ans: The odds against getting a spade are 39.

iii) What are the odds in favour of getting a face card?

Ans: The odds of obtaining a face card are 12 to 52. The odds of not getting a face card are 40 to 52.

The odds in favour of getting a face card $=\frac{12}{52}:\frac{40}{52}=3:10$.

iv) What are the odds in favour of getting a red king

Ans: The odds of obtaining a red king are 2 to 52.

The odds of not getting a red king are 50 to 52.

Thus, the odds in favour of getting a red king $= \frac{2}{52} : \frac{50}{52} = 1:25$.

5. A die is thrown repeatedly until a six comes up. What is the sample space for this experiment? HINT: $A = \{6\}$, $B = \{1,2,3,4,5,\}$.

Ans: The sample space for the given experiment is

$\{A, BA, BBA, BBBA, BBBBA\}$.

6. Why is tossing a coin considered to be a fair wav of deciding which team should get the ball at the beginning of a football match?

Ans: Tossing a coin gives equally likely outcomes since they are mutually exclusive events. That's why tossing a coin considered to be a fair wav of deciding which team should get the ball.

7. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball. determine the number of blue balls in the bag.

Ans: Suppose that, the number of blue balls in the bag is x.

Therefore, the number of total balls contained in the bag $= x + 5$.

Then, the probability that a blue ball is drawn, $= \frac{x}{x+5}$.

Also, the probability that a red ball is drawn, $= \frac{5}{x+5}$.

Now, by the given condition,

$$\Rightarrow \frac{x}{x+5} = 2 \cdot \frac{5}{x+5}$$
$$\Rightarrow x = 10$$

Thus, the number of blue balls in the bag is 10.

8. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box. what is the probability that it will be a black ball? If 6 more black balls are out in the box the probability of drawing a black ball is now double of what it was before. Find x?

Ans: The total number of possible outcomes is 12.

Suppose that, the number of favourable outcomes on the event of drawing black ball is x.

Thus, the probability of getting a black ball $=\frac{x}{12}$.

If 6 more black balls are removed from the box, then the number of possible outcomes $=12+6=18$.

Then, the number of black balls $=x+6$.

Thus, the probability of drawing a black ball is $\frac{x+6}{18}$.

Now, by the given condition,

$$\frac{x+6}{18}=2\left(\frac{x}{12}\right)$$

Therefore, $x=3$.

9. If 65% of the populations have black eyes. 25% have brown eyes and the remaining have blue eyes. What is the probability that a person selected at random has

(i) Blue eves

Ans: The number of black eyes $=65$.

The number of Brown eyes $=25$

The number of blue eyes $=10$.

Thus, there is total 180 eyes.

Therefore, the probability of having blue eyes $=\frac{10}{100}=\frac{1}{10}$.

(ii) Brown or black eves

Ans: The probability of having brown or black eyes $=\frac{90}{100}=\frac{9}{10}$

(iii) Blue or black eves

Ans: The probability of having blue or black eyes $=\frac{10}{100}=\frac{1}{10}$.

(iv) neither blue nor brown eves

Ans: The probability of having neither blue nor brown eyes $=\frac{65}{100}=\frac{13}{20}$.

10. Find the probability of having 53 Sundays in

i) a non-leap year

Ans: We know that, there are 365 days in an ordinary year containing 52 weeks and 1 day.

This day may be any one of the 7 days of the week.

Thus, the probability that this day is Sunday $=\frac{1}{7}$.

Hence, the probability that an ordinary year has 53 Sunday $=\frac{1}{7}$.

ii) a leap year

Ans: It is known that, there is 366 days in a leap year containing 52 weeks and 2 days.

These two days can be $(MT),(TW),(W\ Th),(Th\ F),(FS),(SS),(SM)$. Now, since, 52 weeks contain 52 Mondays, so the remaining Monday can be obtained if the two days are (MT) or (SM), that is, 2 out of 7 cases. Thus, the probability of having 53 Mondays in a leap year $=\frac{2}{7}$.

11. Five cards - the ten. Jack, queen, king and ace, 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?

Ans: The number of total possible outcomes is 5.

Since, the number of Queen is 1, so

the number of favourable outcomes $=1$.

Thus, the probability of getting a Queen card $=\frac{1}{5}$.

(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?

Ans: Since, one card is put aside, so now, number of total possible outcomes is $5-1=4$.

(a) Since, there is only one ace card, so the number of favourable outcomes is 1.

Thus, the probability of getting an ace card $=\frac{1}{4}$.

(b) Since, there is no queen card left after the first pick up, so the number of favourable outcomes is 0.

Thus, the probability of getting a Queen card $=\frac{0}{4}=0$.

12. A number x is chosen at random from the numbers $-3,-2,-1,0,1,2,3$. What is the probability that $|x|<2$.

Ans: x can have the value among the 7 given values.

Now, for $|x|<2$, x can be $-3,-2,-1,0,1$.

So, the required probability, $P(|x|<2)=\frac{5}{7}$.

13. A number x is selected from the numbers $1,2,3$ and then a second number y is randomly selected from the numbers $1,4,9$, What is the probability that the product xy of the two numbers will be less than 9?

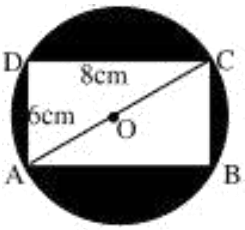
Ans: Number x can be chosen in three different ways, and number y can be chosen in three different ways as well. So, the two numbers can be chosen in 9 ways such that,

$(1,1),(1,4),(2,1),(2,4),(3,1)$.

Therefore, the number of favourable occurrences is 5.

Thus, the probability that the product will be less than 9 is $=\frac{5}{9}$.

14. In the adjoining figure a dart is thrown at the dart board and lands in the interior of the circle. What is the probability that the dart will land in the shaded region?



Ans: It is given that,

$AB = CD = 8$ and $AD = BC = 6$.

Then, by the Pythagorean Theorem on the triangle ABC, gives

$AC^2 = AB^2 + BC^2$

$\Rightarrow AC^2 = 82 + 62 = 100$

$\Rightarrow AC = 10$

$\Rightarrow OA = OC = 5$ [since, the point O is the midpoint of AC]

Therefore, the area of the circle is $= \pi(OA)^2 = 25\pi$ sq. units.

Also, the area of $ABCD = AB \times BC = 8 \times 6 = 48$ sq. units.

Thus, the area of the shaded region = Area of circle − Area of the rectangle ABCD

That is, Area of shaded region $= (25\pi - 48)$ sq. units.

Thus, the probability dart will land in the shaded region $= \dfrac{\text{area of shaded region}}{\text{area of circle}}$

$= \dfrac{25\pi - 48}{25\pi}$

15. In the fig points A,B,C, and D are the centres of four circles. each having a radius of 1 unit. If a point is chosen at random from the interior of a square ABCD. what is the probability that the point will be chosen from the shaded region?

Ans: It is given that the radius of the circle is 1 unit.

Therefore, area of the circle $=$ Area of 4 sector.

Thus, side of the square $ABCD$ is 2 units.

Therefore, the area of square $=2\times2=4$ units.

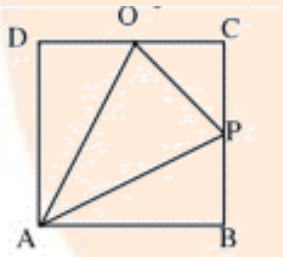
So, the area of the shaded region

$=$ area of square $-4\times$ area of the sectors.

$=4-\pi$.

Hence, the required probability $=\dfrac{4-\pi}{4}$.

16. In the adjoining figure $ABCD$ is a square with sides of length 6 units points P & O are the mid points of the sides BC & CD respectively. If a point is selected at random from the interior of the square what is the probability that the point will be chosen from the interior of the triangle APO.



Ans: The area of the $\Delta POC=\dfrac{1}{2}\times3\times3=\dfrac{9}{2}=4.5$ sq. units.

The area of the $\Delta ABP=\dfrac{1}{2}\times6\times3=9$ sq. units.

The area of the $\Delta ADQ=\dfrac{1}{2}\times6\times3=9$ sq. units.

Therefore, the area of the $\Delta APO=$ area of the square $-$(Area of the ΔPQC + area of the $\Delta ABP+$ area of the ΔABP)

$= 36 - (18 + 4.5)$

$= 36 - 22.5$

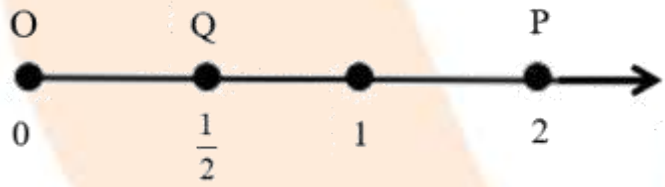
$= 13.5$

Hence, the probability that the point will be selected from the interior of ΔAPO $= \frac{13.5}{36} = \frac{135}{360} = \frac{3}{8}$.

17. In a musical chair same the person playing the music has been advised to stop playing the music at any time within 2 minutes after she starts playing. What is the probability that the music will stop within the half minute after starting?

Ans: All the numbers between 0 and 2 are conceivable outcomes here. As illustrated in picture, this is the section of the number line from 0 to 2.

Let A be the event in which "the music is turned off during the first half minute." Then there are all points on the number line that are favourable to occurrence A. i.e.



The points on the number line from Q to P represent the total number of outcomes. that is, from 0 to 2.

The required probability, $P(A) = \frac{\text{length of } OQ}{\text{length of } OP} = \frac{\frac{1}{2}}{2} = \frac{1}{4}$.

18. A jar contains 54 marbles each of which is blue. green or white. The probability of selecting a blue marble at random from the jar is $\frac{1}{3}$ and the

probability of selecting a green marble at random is $\frac{4}{9}$. How many white marbles does the jar contain?

Ans: Suppose that $b, g,$ and w denotes the number of blue, green and white marbles respectively in the jar.

Therefore, $b + g + w = 54$. ..... (i)

So, the probability of choosing a blue marble $= \frac{b}{54}$.

Since, the probability of choosing a blue marble $= \frac{1}{3}$, so

$$\frac{1}{3} = \frac{b}{54}$$
$$\Rightarrow b = 18$$

Again, the probability of choosing a green marble $= \frac{4}{9}$.

Therefore,

$$\frac{g}{54} = \frac{4}{9}$$
$$\Rightarrow g = 24$$

Now, putting the obtained values of b and g into the equation (i), yields $18 + 24 + w = 54$

$\Rightarrow w = 12$.

Hence, there is total 12 white marbles in the jar.

Very Short Answer Questions **1 Mark**

1. Complete the statements:

(i) Probability of event E + Probability of event "not E" = _____.

Ans: Probability of event E + Probability of event "not E" $= 1$.

(ii) The probability of an event that cannot happen is _____. Such an event is called _____.

Ans: The probability of an event that cannot happen is 0. Such an event is called impossible event.

(iii) The probability of an event that is certain to happen is_____. Such an event is called _____.

Ans: The probability of an event that is certain to happen is 1. Such an event is called sure or certain event.

(iv) The sum of the probabilities of all the elementary events of an experiment is _____.

Ans: The sum of the probabilities of all the elementary events of an experiment is 1.

(v) The probability of an event is greater than or equal to _____ and less than or equal to _____.

Ans: The probability of an event is greater than or equal to 0 and less than or equal to 1.

2. Which of the following cannot be the probability of an event:

(A) $\frac{2}{3}$
(B) -1.5
(C) 15%
(D) 0.7

Ans: By the definition of probability, the maximum and minimum value of probability are 1 and 0 respectively.

Therefore, -1.5 cannot be the probability of an event.

Thus, option (B) is the correct answer.

3. If $P(E) = 0.05$, what is the probability of 'not E'?

Ans: It is known that, $P(E) + P(\text{not } E) = 1$

$\Rightarrow P(\text{not } E) = 1 - P(E)$

$= 1 - 0.05$

$= 0.95$

4. It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?

Ans: Suppose that E represents the event that the students have the same birthday.

Then, $P(E) = 0.992$.

It is known that, $P(E) + P(\overline{E}) = 1$

$\Rightarrow P(E) = 1 - P(\overline{E})$

$= 1 - 0.992$

$= 0.008$

Thus, the probability that the 2 students have the same birthday is 0.008.

5. 12 defective pens are accidently 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.

Ans: The number of total favourable outcomes $=132+12=144$.

There is 132 favourable outcomes.

Thus, the probability of getting a good pen $=\frac{132}{144}=\frac{11}{12}$.

6. Which of the following is polynomial?

(a) $\mathbf{x^2-6\sqrt{x}+2}$

(b) $\mathbf{\sqrt{x}+\frac{1}{\sqrt{x}}}$

(c) $\mathbf{\frac{5}{x^2-3x+1}}$

(d) none of these

Ans: (d) none of these.

7. Polynomial $\mathbf{2x^4+3x^3-5x^2-5x^2+9x+1}$ **is a**

(a) linear polynomial
(b) quadratic polynomial
(c) cubic polynomial
(d) bi-quadratic polynomial

Ans: Since, the degree of the polynomial $2x^4+3x^3-5x^2-5x^2+9x+1$ is 4, so it is a bi-quadratic polynomial.

Thus, option (d) is correct answer.

8. If α **and** β **are zeros of** $\mathbf{x^2+5x+8}$**, then the value of** $\mathbf{(\alpha+\beta)}$ **is**

(a) 5

(b) –5
(c) 8
(d) –8

Ans: Since, α and β are the zeroes of x^2+5x+8, so the value of $\alpha+\beta=-5$.

Thus, option (b) is the correct answer.

9. The sum and product of the zeros of a quadratic polynomial are 2 and –15 respectively. The quadratic polynomial is

(a) $x^2 - 2x + 15$
(b) $x^2 - 2x - 15$
(c) $x^2 + 2x - 15$
(d) $x^2 + 2x + 15$

Ans: The polynomial with the sum of zeroes 2 and product of zeroes –15 is given by $x^2-(2)x+(-15)$, that is, $x^2-2x-15$.

So, option (b) is the correct answer.

10. Cards each marked with one of the numbers 4,5,6,…,20 are placed in a box and mixed thoroughly. One card is drawn at random from the box, what is the probability of getting an even prime number?

(a) 0
(b) 1
(c) 2
(d) 3

Ans: The number of possible outcomes is 17.

Now, the only number which is even and prime is 2, but it does not belong to the list $4,5,6,...,20$.

So, the probability of getting an even prime $=\frac{0}{17}=0$.

Thus, option (a) is the correct answer.

11. A bag contains 5 red and 4 black balls. A ball is drawn at random from the bag. What is the probability of getting a black ball?

(a) $\frac{1}{3}$

(b) $\frac{2}{9}$

(c) $\frac{4}{9}$

(d) None of these

Ans: There is total $5+4=9$ bags and from them, 4 are black.

Therefore, the probability of getting a black ball $=\frac{4}{9}$.

Thus, option (c) is the correct answer.

12. A dice is thrown once, what is the probability of getting a prime number?

(a) 1

(b) $\frac{1}{2}$

(c) $\frac{3}{2}$

(d) 0

Ans: The number of possible outcomes while throwing one dice, is 6.

Now, the list of 3 prime numbers is $2,3,5$.

Therefore, the probability of getting a prime number is $=\frac{3}{6}=\frac{1}{2}$.

Thus, option (b) is the correct answer.

13. What is the probability that a number selected from the numbers $1,2,3,\ldots,15$ is a multiple of 4?

(a) $\frac{1}{5}$

(b) $\frac{1}{2}$

(c) $\frac{2}{3}$

(d) 1

Ans: The number of total possible outcomes is 15.

The list of 3 numbers from 1 to 15,that are multiple of 4 is given by $4,8,12$.

Therefore, the probability of selecting a number that is multiple of 4 $=\frac{3}{15}=\frac{1}{5}$.

Thus, option (a) is the correct answer.

14. Cards marked with the numbers 2 to 51 are placed in a box and mixed thoroughly. One card is drawn from this box, find the probability that the number on the card is an even number.

(a) $\frac{1}{2}$

(b) 1

(c) $\frac{3}{2}$

(d) None of these

Ans: From 2 to 51, there is total 50 numbers and so the total number of outcomes is 50.

The number of evens from 2 to 51 is $\frac{50}{2}=25$.

Thus, the probability of getting card with an even number $=\frac{25}{50}=\frac{1}{2}$.

Hence, option (a) is the correct answer.

15. The king, queen and jack of clubs are removed from a deck of 52 playing cards and then well shuffled. One card is selected from the remaining cards, find the probability of getting a king.

(a) $\frac{3}{49}$
(b) 1
(c) $\frac{7}{17}$
(d) none of these

Ans: Since, from the deck of 52 cards, one king, queen, and jack are removed, so the total cards remain is $52-3=49$.

In 49 cards, there is total 3 king cards.

Thus, the probability of getting a king $=\frac{3}{49}$.

Hence, option (a) is the correct answer.

16. What is the probability of getting a number less than 7 in a single throw of a die?

(a) $\frac{1}{2}$
(b) 0
(c) 1
(d) none of these

Ans: The number of total possible outcomes is 6.

All the numbers less than 7 are $1,2,3,4,5,6$.

Thus, the probability of getting a number less than 7 in a single throw $=\frac{6}{6}=1$.

Hence, option (c) is the correct answer.

17. One card is drawn from a well shuffled deck of 52 cards. Find the probability of drawing '10' of a black suit.

(a) $\frac{1}{26}$
(b) 1
(c) $\frac{1}{2}$
(d) 0

Ans: The number of possible outcomes is 52.

The number of cards with 10 of black suit is 2.

Thus, the probability of drawing '10' of a black suit $=\frac{2}{52}=\frac{1}{26}$

Hence, option (a) is the correct answer.

18. Cards each marked with one of the numbers $4,5,6,\ldots,20$ are placed in a box and mixed thoroughly. One card is drawn at random from the box, what is the probability of getting an even prime number?

(a) 0
(b) 1
(c) 2
(d) 3

Ans: The number of possible outcomes is 17.

Now, the only number which is even and prime is 2, but it does not belong to the list $4,5,6,...,20$.

So, the probability of getting an even prime $=\frac{0}{17}=0$.

Thus, option (a) is the correct answer.

19. A bag contains 5 red and 4 black balls. A ball is drawn at random from the bag. What is the probability of getting a black ball?

(a) $\frac{1}{3}$

(b) $\frac{2}{9}$

(c) $\frac{4}{9}$

(d) None of these

Ans: There is total $5+4=9$ bags and from them, 4 are black.

Therefore, the probability of getting a black ball $=\frac{4}{9}$.

Thus, option (c) is the correct answer.

20. A dice is thrown once, what is the probability of getting a prime number?

(a) 1

(b) $\frac{1}{2}$

(c) $\frac{3}{2}$

(d) 0

Ans: The number of possible outcomes while throwing one dice, is 6.

Now, the list of 3 prime numbers is $2,3,5$.

Therefore, the probability of getting a prime number is $=\frac{3}{6}=\frac{1}{2}$.

Thus, option (b) is the correct answer.

21. What is the probability that a number selected from the numbers $1,2,3,\ldots,15$ is a multiple of 4?

(a) $\frac{1}{5}$

(b) $\frac{1}{2}$

(c) $\frac{2}{3}$

(d) 1

Ans: The number of possible outcomes is 15.

Now, the list of the 3 numbers between 1 and 15, which are multiple of 4 are $4,8,12$.

Therefore, the required probability $=\frac{3}{15}=\frac{1}{5}$.

Thus, option (a) is the correct answer.

22. If E be any event, then value of $P(E)$ lie in between

(a) $0<P(E)<1$

(b) $0\le P(E)<1$

(c) $0\le P(E)\le 1$

(d) $0\le P(E)\le 2$

Ans: By the definition of probability, the maximum and minimum value of probability are 1 and 0 respectively.

So, $0 \le P(E) \le 1$.

Thus, option (c) is the correct answer.

23. Maximum and minimum value of probability is

(a) $(1,1)$
(b) $(1,0)$
(c) $(0,1)$
(d) none of these

Ans: By the definition of probability, the maximum and minimum value of probability are 1 and 0 respectively.

Thus, the option (b) is the correct answer.

24. An unbiased die is thrown. What is the probability of getting an even number or a multiple of 3?

(a) $\frac{2}{3}$
(b) $\frac{3}{2}$
(c) 1
(d) none of these

Ans: The number of possible outcomes while throwing an unbiased die is 6 and the number of evens is 3 [which are $2,4,6$].

Also, the numbers, which are multiple of 3 are $3,6$.

Thus, the 4 numbers which are even or multiple of 3 are $2,3,4,6$.

Hence, the probability of getting an even number or a multiple of 3 is $= \frac{4}{6} = \frac{2}{3}$.

So, option (a) is the correct answer.

25. Let E be any event, then the value of $P(E)+P(\text{not } E)$ equals to

(a) 1
(b) 0
(c) 3
(d) $\frac{1}{2}$

Ans: By the definition of probability,

if E is an event, then the value of $P(E)+P(\bar{E})=1$, that is,

$P(E)+P(\text{not } E)=1$

So, option (a) is the correct answer.

26. Degree of polynomial $y^3 - 2y^2 - \sqrt{3y} + \frac{1}{2}$ is

(a) $\frac{1}{2}$
(b) 2
(c) 3
(d) $\frac{3}{2}$

Ans: It is known that, the degree of a polynomial is the highest power of the variable contains in that polynomial.

Therefore, the degree of the polynomial $y^3-2y^2-\sqrt{3y}+\frac{1}{2}$ is 3.

Thus, option (c) is the correct answer.

27. Zeros of $P(x) = 2x^2 + 9x - 35$ are

(a) 7 and $\frac{5}{2}$
(b) –7 and $\frac{5}{2}$
(c) 7 and 5
(d) 7 and 2

Ans: The zeros of the polynomial $P(x) = 2x^2 + 9x - 35$ are -7 and $\frac{5}{2}$, because

$P(-7) = 2(-7)^2 + 9(-7) - 35 = 0$ and

$P\left(\frac{5}{2}\right) = 2\left(\frac{5}{2}\right)^2 + 9\left(\frac{5}{2}\right) - 35 = 0.$

Thus, option (b) is the correct answer.

28. The quadratic polynomial whose zeros are 3 and –5 is

(a) $x^2 + 2x - 15$
(b) $x^2 + 3x - 8$
(c) $x^2 - 5x - 15$
(d) None of these

Ans: The polynomial with the zeroes 3 and -5 is given by

$x^2 - (3-5)x + 3(-5)$

$= x^2 + 2x - 15.$

So, option (a) is the correct answer.

29. If α and β are the zeros of the quadratic polynomial $P(x) = x^2 - px + q$, then the value of $\alpha^2 + \beta^2$ is equal to

(a) $p^2 - 2q$

(b) $\frac{p}{q}$

(c) $q^2 - 2p$

(d) none of these

Ans: Since, α and β are the roots of the polynomial $P(x) = x^2 - px + q$, so $\alpha + \beta = p$ ..... (i)

and $\alpha\beta = q$.

Therefore,

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$
$$= p^2 - 2q$$

So, option (a) is the correct answer.

Short Answer Questions **2 Marks**

1. Which of the following experiments have equally likely outcomes? Explain.

(i) A driver attempts to start a car. The car starts or does not start.

Ans: "A driver tries to start a car" in the experiment. We cannot presume that each event is equally likely to occur since the car starts or does not start. As a result, there are no equally likely outcomes in the experiment.

(ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

Ans: "A player tries to shoot a basketball," says the experiment. We cannot

assume that each result is equally likely to occur, whether she shoots or misses the shot. As a result, no equally likely outcomes are possible in the experiment.

(iii) A trial is made to answer a true-false question. The answer is right or wrong.

Ans: During the test, "A true-false question is asked in a trial. The response is correct or incorrect." We know with certainty that the outcome will be one of two likely outcomes: right or wrong. We can reasonably expect each event, correct or wrong, to occur in the same way.

As a result, the likelihood of doing it right or wrong are equal.

(iv) A baby is born. It is a boy or a girl.

Ans: "A baby is born, it is a boy or a girl," says the experiment. We know with certainty that the outcome will be one of two likely outcomes: a boy or a girl. We have reason to believe that each event, boy or girl, is equally likely to occur. As a result, both boy and female outcomes are equally likely.

2. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Ans: Because we know that a coin toss can only land in one of two ways – head up or tail up – the tossing of a coin is regarded a fair manner of selecting which team should have the ball at the start of a football game. It is reasonable to infer that either event, whether head or tail, has the same probability of occurring as the other, i.e., the outcomes head and tail are equally likely to occur. So, the outcome of a coin toss is absolutely unexpected.

3. A bag contains lemon flavoured candles only. Malini takes out one candy without looking into the bag. What is the probability that she takes out:

(i) an orange flavoured candy?

Ans: Consider the occurrence with the experiment of removing an orange-flavoured candy from a bag of lemon-flavored candies.

Note that, there is not any outcomes that represents an orange flavoured candy.

Hence, the event is impossible and so its probability is 0.

(ii) a lemon flavoured candy?

Ans: Consider the event of taking a lemon flavoured candy from a bag that contains only lemon flavoured candies.

This event represents a certain event. So, its probability is 1.

4. A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is:

(i) red?

Ans: The number of total balls in the bag is $3+5=8$. Therefore, there is total 8 possible outcomes.

Since the bag contains 3 red balls, so the number of favourable outcomes $=3$.

Thus, the probability of getting a red ball $=\frac{3}{8}$.

(ii) not red?

Ans: There are 5 balls, which are not red.

So, the number of favourable outcomes is 5.

Thus, the probability of obtaining a ball, that is not red $=\frac{5}{8}$.

5. A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be:

(i) red?

Ans: The number of total marbles in the box $=5+8+4=17$.

So, the number of possible outcomes is 17.

The number of red marbles in the box is 5.

Therefore, the number of favourable outcomes is 5.

Hence, the probability of getting a red marble $=\frac{5}{17}$.

(ii) white?

Ans: The number of white marbles in the box is 8.

So, the number of favourable outcomes $=8$.

Thus, the probability of getting a white marble $=\frac{8}{17}$.

(iii) not green?

Ans: The number of marbles which are not green is $5+8=13$.

So, the number of favourable outcomes is 13.

Thus, the probability of not obtaining a green marble $=\frac{13}{17}$.

6. A piggy bank contains hundred 50 p coins, fifty Re. 1 coins, twenty Rs. 2 coins and ten Rs. 5 coins. If it is equally likely that of the coins will fall out when the bank is turned upside down, what is the probability that the coin:

(i) will be a 50 p coin?

Ans: The number of total coins in a piggy bank $=100+50+20+10=180$.

That is, the number of total possible outcomes is 180.

Now, since, in the piggy bank, the number of 50 coins are 100, so there are 100 favourable outcomes.

Thus, the probability of falling out of a 50 p coin $=\frac{100}{180}=\frac{5}{9}$.

(ii) will not be a Rs. 5 coin?

Ans: Except the Rs. 5 coin, there are $100+50+20=170$ coins.

So, the number of favourable outcomes is 170.

Thus, the probability of falling out of a coin other than Rs. 5 coin $=\frac{170}{180}=\frac{17}{18}$.

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

Ans: The total number of fish (male and female) in the tank $=5+8=13$.

So, the total number of possible events is 13.

Now, since, the number of male fishes in the tank is 5, so the number of favourable outcomes is 5.

Thus, the probability of taking out a male fish $=\frac{5}{13}$.

8. Five cards – then 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?

Ans: The number of total possible outcomes is 5.

Since, the number of Queen is 1, so

the number of favourable outcomes $=1$.

Thus, the probability of getting a Queen card $=\frac{1}{5}$.

(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?

Ans: Since, one card is put aside, so now, number of total possible outcomes is $5-1=4$.

(a) an ace?

Ans: Since, there is only one ace card, so the number of favourable outcomes is 1.

Thus, the probability of getting an ace card $=\frac{1}{4}$.

(b) a queen?

Ans: Since, there is no queen card left after the first pick up, so the number of favourable outcomes is 0.

Thus, the probability of getting a Queen card $=\frac{0}{4}=0$.

9.

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

Ans: The number of total possible outcomes is 20.

The number of defective bulbs is 4.

Therefore, the favourable outcomes are 4.

Thus, the probability of getting a defective bulb $= \frac{4}{20} = \frac{1}{5}$.

(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?

Ans: Since, one defective bulb is replaced, so the number of favourable outcomes $= 20 - 1 = 19$.

Now, there is total $19 - 4 = 15$ non-defective bulbs.

That is, the number of favourable outcomes is 15.

Thus, the probability of getting a non-defective bulb is $= \frac{15}{19}$.

10. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

(i) a two-digit number

Ans: Since, there is total 90 discs, so the number of possible outcomes is 90. Now, the number of two-digit numbers from 1 to 90 is $90 - 9 = 81$.

So, the number of favourable outcomes is 81.

Thus, the probability of getting a disc with a two-digit number $= \frac{81}{90} = \frac{9}{10}$.

(ii) a perfect square numbers.

Ans: From 1 to 90, the perfect squares are 1, 4, 9, 16, 25, 36, 49, 64 and 81.

Favourable outcomes = 9

Hence P (getting a perfect square) =

(iii) a number divisible by 5.

Ans: The numbers divisible by 5 from 1 to 90 are 18.

Favourable outcomes = 18

Hence P (getting a number divisible by 5) =

11. A child has a die whose six faces show the letters as given below:

A, B, C, D, E, A.

The die is thrown once. What is the probability of getting:

(i) A?

Ans: The number of total possible outcomes $= 6$.

Since, there are 2 $A's$, so the number of possible outcomes $= 2$.

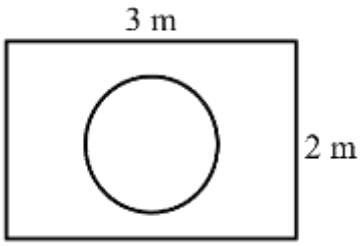
Thus, the probability of getting a letter $A = \frac{2}{6} = \frac{1}{3}$.

(ii) D?

Ans: Since, there is only one D, so the number of favourable outcomes is 1.

Therefore, the probability of getting a letter $D = \frac{1}{6}$

12. Suppose you drop a die at random on the rectangular region shown in the figure given on the next page. What is the probability that it will land inside the circle with diameter 1 m?



Ans: The area of rectangle (in the given figure) $=3\times 2=6\ \text{m}^2$

Also, the area of the circle inside the rectangle,

$=\pi r^2$

$=\pi\left(\frac{1}{2}^2\right)$

$=\frac{\pi}{4}\ \text{m}^2$

Thus, the probability that the die will land inside the circle $=\frac{\frac{\pi}{4}}{6}=\frac{\pi}{24}$.

13. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is 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

Ans: The number of total ball pens is 144.

There are 20 defective pens.

So, the number of good pens $=144-20=124$.

That is, there are 124 favourable outcomes.

Hence, the probability that she will buy $=\frac{124}{144}=\frac{31}{36}$.

(ii) she will not buy it?

Ans: There are 20 favourable outcomes.

Thus, the probability that she will not buy $= \frac{20}{144} = \frac{5}{36}$.

14. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball, determine the number of blue balls in the bag.

Ans: Suppose that, the number of blue balls in the bag is x.

Therefore, the number of total balls contained in the bag $= x + 5$.

Then, the probability that a blue ball is drawn, $P_1 = \frac{x}{x+5}$.

Also, the probability that a red ball is drawn, $P_2 = \frac{5}{x+5}$.

Now, by the given condition,

$P_1 = 2P_2$

$\Rightarrow \frac{x}{x+5} = 2 \cdot \frac{5}{x+5}$

$\Rightarrow \frac{x}{\cancel{x+5}} = 2 \cdot \frac{5}{\cancel{x+5}}$

$\Rightarrow x = 10$

Thus, the number of blue balls in the bag is 10.

15. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball?

If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x.

Ans: It is given that the box contains 12 balls.

So, there is total 12 possible outcomes.

Now, let there are x favourable outcomes while drawing a black ball.

Then, the probability of getting a black ball, $P_1 = \frac{x}{12}$.

Now, if 6 more balls put in the box, then the number of possible outcomes becomes $= 12 + 6 = 18$.

Then, there are $x + 6$ favourable outcomes.

Therefore, now, the probability of getting a black ball, $P_2 = \frac{x+6}{18}$.

So, the given condition,

$$P_2 = 2P_1$$
$$\Rightarrow \frac{x+6}{18} = 2 \cdot \frac{x}{12}$$
$$\Rightarrow \frac{x+6}{18} = \frac{x}{6}$$
$$\Rightarrow 6x + 36 = 18x$$
$$\Rightarrow 12x = 36$$
$$\Rightarrow x = 3$$

Thus, the value of x is 3.

16. A jar contains 24 marbles, some are green and others are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number if blue marbles in the jar.

Ans: Since, the jar contains 24 marbles, so the number of favourable outcomes $= 24$.

Suppose that, there are x green marbles.

Therefore, the number of favourable outcomes is x.

So, the probability of getting a green marble is $\frac{x}{24}$.

It is given that, the probability that the marble drawn is green $=\frac{2}{3}$.

That is, $\frac{x}{24}=\frac{2}{3}$

$\Rightarrow x=16$

So, the number of green marbles is 16.

Hence, the number of blue marbles $=24-16=8$.

17. Why is tossing a coin considered is the way of deciding which team should get the ball at the beginning of a football match?

Ans: When a coin is tossed, the probability of getting head $=\frac{1}{2}$ and

probability of getting a tail $=\frac{1}{2}$.

So, both probabilities are the same.

That's why, tossing a coin is considered to be a fair way of deciding which team should get the ball.

18. An unbiased die is thrown, what is the probability of getting an even prime number?

Ans: When an unbiased die is thrown, the list of 6 outcomes is given by $1,2,3,4,5,6$.

Also, the number of favourable outcomes is 1 [Since, 2 is the only number which is even and prime.]

Thus, the probability of getting an even prime number is $\frac{1}{6}$.

19. Two unbiased coins are tossed simultaneously, find the probability of getting two heads.

Ans: The list of 4 outcomes is given by HH, HT, TH, TT.

The only favourable outcome is HH [Two heads]

Thus, the probability of getting two heads while tossing two unbiased coins simultaneously $=\frac{1}{4}$.

20. One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting a jack of hearts.

Ans: The number of total outcomes is 52.

The only favourable case is 1. [since, there exists only one jack of hearts]

Hence, the probability of getting a jack of hearts $=\frac{1}{52}$.

21. A game consists of tossing a one-rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result i.e., three heads or three fails and loses otherwise. Calculate the probability that Hanif will lose the game.

Ans: It is given that a coin is tossed thrice.

So, the list of possible outcomes is given by

$\{HHH,HHT,HTH,THH,HTT,THT,TTH,TTT\}$.

Therefore, the number of possible outcomes is 8.

The outcomes with 3 heads and 3 tails are HHH, TTT.

So, the number of favourable outcomes is 2.

Thus, the probability that Hanif will win the game $\frac{2}{8}=\frac{1}{4}$

The probability that Hanif will lose the game $=1-\frac{1}{4}=\frac{3}{4}$.

22. Gopy 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?

Ans: The number of total fishes $=5+8=13$.

There are 5 male fishes.

Thus, the probability that the fish taken out is a male $=\frac{5}{13}$.

23. A lot consists of 144 ball pens of which 20 are defective and the others are food. Arti will buy a pen if it is 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

Ans: The number of total ball pens is 144.

There are 20 defective pens.

So, the number of good pens $=144-20=124$.

The probability that she will buy $=\frac{124}{144}=\frac{31}{36}$.

(ii) she will not buy it?

Ans: The probability that she will not buy $= \frac{20}{144} = \frac{5}{36}$.

24. Harpreet tosses two different coins simultaneously (say one is of Rs 1 and other is Rs 2), what is the probability that she gets "at least one head"?

Ans: The list of 4 possible outcomes is given by $\{HH, TT, TH, HT\}$.

The list of 3 outcomes when at least one head is obtained is given by $\{TH, HT, HH\}$.

Thus, the probability of getting at least one head $= \frac{3}{4}$.

25. Why is tossing a coin considered is the way of deciding which team should get the ball at the beginning of a football match?

Ans: When a coin is tossed, the probability of getting head $= \frac{1}{2}$ and

probability of getting a tail $= \frac{1}{2}$.

That is, both the probabilities are the same.

That's why, tossing a coin is considered to be a fair way of deciding which team should get the ball.

26. Two unbiased coins are tossed simultaneously, find the probability of getting two heads.

Ans: The list of 4 outcomes while tossing two unbiased coins is given by HH, HT, TH, TT.

Therefore, the only favourable outcome is HH.

Hence, the probability of getting two heads while tossing two unbiased coins $=\frac{1}{4}$

27. One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting a jack of hearts.

Ans: The number of total outcomes is 52.

The number of favourable cases is 1. [since, in a deck of playing cards, there is only one jack of hearts]

Hence, the probability of getting a jack of hearts is $=\frac{1}{52}$.

28. If two dice are thrown once, find the probability of getting 9.

Ans: The number of total possible outcomes while throwing two dice is $6\times 6=36$.

The possible outcomes for getting 9 are $(3+6),(4+5),(5+4),(6+3)$.

That is, the favourable outcomes are 4.

Hence, the probability of getting 9 while throwing two dice $=\frac{4}{36}=\frac{1}{9}$.

29. A card is drawn from a well shuffled deck of playing cards. Find the probability of getting a face card.

Ans: It is known that, the deck of playing cards contains 52 cards. So, the number of total possible outcomes is 52.

The number of favourable outcomes is $=4+4+4=12$, where 4 cards are jack, 4 cards are queen and 4 cards are king.

Thus, the probability of getting a face card while drawing a random card from the well shuffled deck is $=\frac{12}{52}=\frac{3}{13}$.

30. What is the probability of having 53 Mondays in a leap year?

Ans: It is known that, there is 366 days in a leap year containing 52 weeks and 2 days.

These two days can be $(\mathrm{MT}),(\mathrm{TW}),(\mathrm{W\ Th}),(\mathrm{Th\ F}),(\mathrm{FS}),(\mathrm{SS}),(\mathrm{SM})$. Now, since, 52 weeks contain 52 Mondays, so the remaining Monday can be obtained if the two days are (MT) or (SM), that is, 2 out of 7 cases. Thus, the probability of having 53 Mondays in a leap year $=\frac{2}{7}$.

31. Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out from the bag at random, what is the probability that the number on the card taken out is an even number?

Ans: The number of total outcomes is $=20-3=17$.

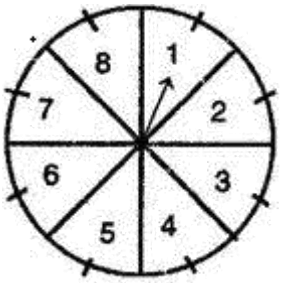
The list of 9 even numbers marked on the cards is given by $4,6,8,10,12,14,16,18,20$.

So, there is total 9 favourable outcomes.

Thus, the probability of getting card marked with an even number is $=\frac{9}{17}$.

Short Answer Questions **3 Marks**

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



(i) 8?

Ans: An arrow can point to any of the 8 numbers in eight different ways.

Therefore, there are 8 possible outcomes.

So, the number 8 can be appear only one way.

Thus, the probability that the arrow points at 8 is $=\frac{1}{8}$.

(ii) an odd number?

Ans: In the circle, there is only 4 odd numbers, viz., $1,3,5,7$.

So, there are 4 favourable outcomes.

Thus, the probability that the arrow points at an odd number is $=\frac{4}{8}=\frac{1}{2}$.

(iii) a number greater than 2?

Ans: In the circle, the numbers greater than 2 are $3,4,5,6,7,8$.

So, there is total 6 favourable outcomes.

Thus, the probability that the arrow points at a number greater than 2 is $=\frac{6}{8}=\frac{3}{4}$

(iv) a number less than 9?

Ans: In the circle, the numbers that are less than 9 are $1,2,3,4,5,6,7,8$.

So, there is 8 possible outcomes.

Thus, the probability that the arrow points at a number less than 9, is $=\frac{8}{8}=1$.

2. A dice is thrown once. Find the probability of getting:

(i) a prime number.

Ans: The total number of favourable outcomes from a dice roll is 6.

The prime numbers that can be appear in the dice are $2, 3$ and 5.

Thus, the number of possible outcomes is 3.

So, the probability of getting a prime number is $=\frac{3}{6}=\frac{1}{2}$

(ii) a number lying between 2 and 6.

Ans: On a dice, the numbers which lie between 2 and 6 are $3, 4, 5$.

So, there is total 3 favourable outcomes.

Thus, the probability of getting a number lying between 2 and 6 is $=\frac{3}{6}=\frac{1}{2}$.

(iii) an odd number.

Ans: The odd numbers on a dice are $1, 3$ and 5.

So, there is total 3 favourable outcomes.

Thus, the probability of obtaining an odd number is $=\frac{3}{6}=\frac{1}{2}$.

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

Ans: When, a coin is tossed three times, then the outcomes are: $HHH, HHT, HTH, THH, TTH, HTT, THT, TTT$.

So, there is total 8 possible outcomes.

The outcomes when he loses the game are: $HHT, HTH, THH, TTH, HTT, THT$

Therefore, there is total 6 favourable outcomes.

Thus, the probability of losing the game by him is $=\frac{6}{8}=\frac{3}{4}$.

4. A die is numbered in such a way that its faces show the numbers $1,2,2,3,3,6$. It is thrown two times and the total score in two throws is noted. Complete the following table which gives a few values of the total score on the two throws:

Number in second throw \ Number in first throw						
+	1	2	2	3	3	6
1	2	3	3	4	4	7
2	3	4	4	5	5	8
2					5	
3						
3			5			9
6	7	8	8	9	9	12

What is the probability that the total score is:

(i) even

Ans: The following describes the complete table:

Number in second throw	Number in first throw					
+	1	2	2	3	3	6
1	2	3	3	4	4	7
2	3	4	4	5	5	8
2	3	4	4	5	5	8
3	4	5	5	6	6	9
3	4	5	5	6	6	9
6	7	8	8	9	9	12

There is total 6 rows and 6 columns in the table, so $6\times 6=36$ possible outcomes can be obtained.

Now, the number of favourable outcomes of obtaining total score even is 18.

Thus, the probability of obtaining total score even is $=\frac{18}{36}=\frac{1}{2}$.

(ii) 6

Ans: The favourable outcomes of obtaining total score 6 are 4.

Thus, the probability of obtaining total score 6 is $=\frac{4}{36}=\frac{1}{9}$.

(iii) at least 6?

Ans: The favourable outcomes of obtaining total score at least 6 are 15. Thus, the probability of obtaining the total score at least 6 is $=\frac{15}{36}=\frac{5}{12}$.

5. 18 cards numbered $1,2,3,\ldots,18$ are put in a box and mixed thoroughly. A card is drawn at random from the box. Find the probabilities that the card bears

(i) an even number.

Ans: From 1 to 18, there are 18 cards.

So, the number of possible outcomes is 18.

Now, the list of the 9 even numbers marked on the cards is given by $2,4,6,8,10,12,14,16,18$.

Thus, the probability of drawing a card marked with even number $=\frac{9}{18}=\frac{1}{2}$.

(ii) a number divisible by 2 or 3.

Ans: The list of 12 numbers that are divisible by 2 or 3 are

$2,3,4,6,8,9,10,12,14,15,16,18$.

So, the number of favourable outcomes is 12.

Thus, the probability of drawing a card marked with a number divisible by 2 or 3 is $=\frac{12}{18}=\frac{2}{3}$.

6. A bag contains 5 red balls, 4 green balls and 7 white balls. A ball is drawn at random from the box. Find the probability that the ball drown is

(a) white

Ans: The bag contains total $5+4+7=16$ balls.

So, there is total 16 possible outcomes.

Now, the number of white balls in the bag is 7, that is, the number of favourable outcomes is 7.

Thus, the probability of drawing a white ball is $=\frac{7}{16}$.

(b) neither red nor white

Ans: The number of balls that are neither red nor white $=$ the number of green balls $=4$.

So, the number of possible outcomes is 4.

Hence, the probability of drawing a ball that is neither red nor white $=\frac{4}{16}=\frac{1}{4}$.

7. A box contains 20 balls bearing numbers $1,2,3,4,\ldots,20$. A ball is drawn at random from the box, what is the probability that the number on the ball is

(i) an odd number

Ans: From, 1 to 20, there is total 20 balls, that is, the number of total outcomes is 20.

Now, the list of 10 odd numbers from 1 to 20 is given by $1,3,5,7,9,11,13,15,17,19$.

Thus, the probability of drawing a ball bearing an odd number is $=\frac{10}{20}=\frac{1}{2}$.

(ii) divisible by 2 or 3

Ans: The list of 10 numbers that are divisible by 2 is given by

$2,4,6,8,10,12,14,16,18,20$.

The list of 6 numbers that are divisible by 3 is given by

$3,6,9,12,15,18$.

Now, the 3 numbers that are divisible by both 2 and 3 are $6,12,18$.

So, the numbers divisible by 2 or 3 are $=10+6-3=13$.

Thus, there is total 13 possible favourable outcomes.

Hence, the probability of drawing a ball bearing a number that is divisible by 2 or 3 is $=\frac{13}{20}$.

(iii) prime number

Ans: The list of 8 prime numbers between 1 and 20 is given by $2,3,5,7,11,13,17,19$.

So, the number of favourable outcomes is 8.

Thus, the probability of drawing a ball bearing a prime number is $=\frac{8}{20}=\frac{2}{5}$.

8. A bag contains 5 red and some blue balls,

(i) if probability of drawing a blue ball from the bag is twice that of a red ball, find the number of blue balls in the bag.

Ans: Suppose that, there are x blue balls in the bag.

So, there is total $x+5$ balls in the bag.

Therefore, the probability of drawing a blue ball $=\frac{x}{x+5}$ and

the probability of drawing a red ball $=\frac{5}{x+5}$.

Now, by the given condition,

$$\frac{x}{\cancel{x+5}}=2\cdot\frac{5}{\cancel{5+x}}$$

$$\Rightarrow x=10$$

Thus, there is total 10 blue balls in the bag.

(ii) if probability of drawing a blue ball from the bag is four times that of a red ball, find the number of blue balls in the bag.

Ans: According to the given condition,

$$\frac{x}{5+x} = 4 \cdot \frac{5}{5+x}$$

$$\Rightarrow \frac{x}{\cancel{5+x}} = 4 \cdot \frac{5}{\cancel{5+x}}$$

$$\Rightarrow x = 20$$

Thus, there is total 20 blue balls in the bag.

9. A box contains 3 blue marbles, 2 white marbles. If a marble is taken out at random from the box, what is the probability that it will be a white one? Blue one? Red one?

Ans: The number of total possible outcomes is $3 = 2 + 4 = 9$.

There is total 2 white marbles.

So, the probability of taking a white marble $= \frac{2}{9}$.

There is total 3 blue marbles.

Therefore, the probability of taking a blue marble $= \frac{3}{9} = \frac{1}{3}$.

Also, there is total 4 red marbles.

Thus, the probability of getting a red marble $= \frac{4}{9}$.

10. The integers from 1 to 30 inclusive are written on cards (one number on one card). These card one put in a box and well mixed. Joseph picked up one card. What is the probability that his card has

(i) number 7

Ans: From 1 to 30, there are total 30 integers.

So, there is total 30 possible outcomes.

Thus, the probability of getting the number 7 is $=\frac{1}{30}$

(ii) an even number

Ans: The list of 15 even numbers from 1 to 30 is given by

2,4,6,8,10,12,14,16,18,20,22,24,26,28,30.

So, there is total 15 favourable outcomes.

Hence, the probability of picking up an even number $=\frac{15}{30}=\frac{1}{2}$.

(iii) a prime number

Ans: The list of 10 prime numbers from 1 to 30 is given by

2,3,5,7,11,13,17,19,23,29.

So, there is total 10 favourable outcomes.

Hence, the probability of picking up a prime number $=\frac{10}{30}=\frac{1}{3}$.

11. A bag contains lemon flavoured candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out

(i) an orange flavoured candy?

Ans: It is given that, the bag has only the lemon flavoured candies.

So, probability of getting an orange flavoured candy $=\frac{0}{1}=0$.

(ii) a lemon flavoured candy?

Ans: It is provided that, the bag contains only the lemon flavoured candies.

So, the probability of getting an orange flavoured candy $=\frac{1}{1}=1$.

12. A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball from the bag is twice that of a red, find the number of blue balls in the bag.

Ans: Let there are x blue balls in the bag.

So, the bag contains total $x+6$ balls.

Therefore, the probability of drawing a blue ball $=\frac{x}{x+6}$ and

the probability of drawing a red ball $=\frac{6}{x+6}$.

Now, by the given condition,

$$\frac{x}{x+6}=2\cdot\frac{6}{6+x}$$

$\Rightarrow x=12$

Thus, there is total 12 blue balls in the bag.

13. A bag contains 5 red, 4 black and 3 green balls. A ball is taken out of the bag at random, find the probability that the selected ball is

(i) of red colour.

Ans: The bag contains total $5+4+3=12$ balls, that is, there is total 12 outcomes.

Also, the number of red balls contained in the bag is 5.

Hence, the probability of selecting a red ball is $=\frac{5}{12}$.

(ii) not of green colour.

Ans: The number of balls except the green ones $=12–3=9$.

So, the number of favourable outcomes is 9.

Thus, the probability of selecting a ball that is not green is $=\frac{9}{12}=\frac{3}{4}$.

14. From a well shuffled pack of 52 cards, black aces and black queens are removed. From the remaining cards a card is drawn at random, find the probability of drawing a king or a queen.

Ans: A pack of cards contains 52 cards. From them, there is only 2 black aces cards and 2 black queen cards.

Therefore, the number of cards left $=52-2-2=48$.

So, there are 48 equally likely cases available.

Also, in 48 cards, there is total $4+2=6$ queens and kings left. Thus, the number of favourable cases is 6.

Hence, the probability of drawing a king or a queen is $=\frac{6}{48}=\frac{1}{6}$.

15. Which of the following experiments have equally likely outcomes? Explain.

(i) A driver attempts to start a car. The car starts or does not start.

Ans: When a driver tries to start a car, the likelihood of the car starting or not starting are not equal.

(ii) A player attempts to shoot a basketball, she/he shoots or misses the shot.

Ans: When a player tries to shoot a basketball, the likelihood of hitting the target or missing the shot are not equal.

(iii) A baby is born. It is a boy or a girl.

Ans: A baby is born; whether it is a boy or a girl, is an equally likely event.

16. Find the probability that a number selected at random from the numbers $1,2,3,\ldots,35$ is a

(i) prime number

Ans: The list of 11 prime numbers between 1 and 35 is given by $2,3,5,7,11,13,17,19,23,29,31$.

Between 1 and 35, there are total 35 numbers, so the number of total outcomes is 35.

Thus, the probability that the chosen number is a prime $=\frac{11}{35}$.

(ii) multiple of 7

Ans: The list of 5 numbers between 1 and 35 that are multiple of 7 is given by $7,14,21,28,35$.

So, the number of favourable outcomes is 5.

Thus, the probability of choosing a number that is multiple of 7 $=\frac{5}{35}=\frac{1}{7}$

(iii) multiple of 3 or 5.

Ans: The list of 11 numbers between 1 and 35 which are multiple of 3 is given by $3,6,9,12,\underline{15},18,21,24,27,\underline{30},33$.

Also, the list of 7 numbers between 1 and 35 which are multiple of 5 is given by $5,10,\underline{15},20,25,\underline{30},35$.

Thus, the numbers that is multiple of both 3 and 5 are $15,30$.

So, the numbers which are multiple of 3 or 5 is given by

$=11+7-2$

$=16$

Thus, the probability of getting a number that is multiple of 3 or 5 is

$=\frac{16}{35}$.

Long Answer Questions **4 Marks**

1. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting:

(i) a king of red colour.

Ans: Total number of outcomes $=52$.

There are two suits of red cards, that is, diamond and heart.

Each of the suits has one king.

So, there is only one favourable outcome.

Thus, the probability of getting a king of red colour $=\frac{2}{52}=\frac{1}{26}$.

(ii) a face card

Ans: The number of face cards in a pack is 12.

So, the number of favourable outcomes is 12.

Thus, the probability of getting a face card $= \frac{12}{52} = \frac{3}{13}$.

(iii) a red face card

Ans: It is known that, there are 2 suits of red cards, that is, diamond and heart and each of the suits contain 3 face cards.

Therefore, there is total 6 favourable outcomes.

Thus, the probability of getting a red face card $= \frac{6}{52} = \frac{3}{26}$.

(iv) the jack of hearts

Ans: Recall that, in a deck of 52 cards, there is only one jack of heart.

So, the number of favourable outcomes is 1.

Thus, the probability of getting the jack of hearts $= \frac{1}{52}$.

(v) a spade

Ans: It is known that, there is 13 cards of spade.

So, the number of favourable outcomes is 13.

Thus, the probability of getting a spade $= \frac{13}{52} = \frac{1}{4}$.

(vi) the queen of diamonds.

Ans: Note that, there is only one queen of diamonds.

So, the number of favourable outcomes is 1.

Thus, the probability of getting the queen of diamonds $= \frac{1}{52}$.

2. A die is thrown twice. What is the probability that:

(i) 5 will not come up either time?

Ans: The following are the outcomes of the experiment where a dice is thrown twice:

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

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

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

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

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

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

So, there is total 36 outcomes.

Now let A denotes the event that first throw shows 5 and

let B denotes the event that the second throw shows 5.

Thus, there is total 6 favourable outcomes in each of the cases.

Therefore, $P(A)=\frac{6}{36}$ and $P(B)=\frac{6}{36}$

$\Rightarrow P(\overline{A})=1-\frac{6}{36}=\frac{30}{36}=\frac{5}{6}$ and $P(\overline{B})=\frac{5}{6}$.

Hence, the probability that 5 will not come in either time

$=\frac{5}{6}\times\frac{5}{6}$

$=\frac{25}{36}$

(ii) 5 will come up at least once?

Ans: Suppose that, S is the sample space related with the random experiment of throwing a die two times. So, $n(S)=36$.

Therefore, $A \cap B =$ first and second throw shoe 5, that is, obtaining 5 in each throw.

Then, $A=\{(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)\}$

and $B=\{(1,5),(2,5),(3,5),(4,5),(5,5),(6,5)\}$.

$P(A)=\frac{6}{36}, P(B)=\frac{6}{36}$ and $P(A \cap B)=\frac{1}{36}$.

Thus, the probability that 5 will come at least once in throwing a dice twice, $P(A \cap B)=P(A)+P(B)-P(A \cup B)$

$=\frac{6}{36}+\frac{6}{36}-\frac{1}{36}$

$=\frac{11}{36}$

3. Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on the following days?

(i) the same day?

Ans: The list of favourable outcomes related with two consumers visiting a specific shop in the same week (Tuesday to Saturday) is:

(T,T) (T,W) (T,TH) (T,F) (T,S)

(W,T) (W,W) (W,TH) (W,F) (W,S)

(TH, T) (TH, W) (TH, TH) (TH, F) (TH, S)

(F, T) (F, W) (F, TH) (F, F) (F, S)

(S,T) (S, W) (S, TH) (S, F) $(S< S)$

Therefore, there are total 25 favourable outcomes.

Now, the outcomes of visiting on the same day can be listed as

$(T,T),(W,W),(TH,TH),(F,F)$ and (S,S).

Thus, the probability that both Shyam and Ekta will visit the shop on the same day is $=\frac{5}{25}=\frac{1}{5}$.

(ii) consecutive days?

Ans: The list of favourable outcomes of visiting the shop on consecutive days are $(T, W),(W, T),(W, TH),(TH, W),(TH, F),(F, TH),(S, F)$ and (F, S).

So, there are total 8 favourable outcomes.

Thus, the probability that both Shyam and Ekta will visit the shop on consecutive days $=\frac{8}{25}$.

(iii) different days?

Ans: There are total $25-5=20$ favourable outcomes of visiting on different days.

So, there are total 20 favourable outcomes.

Thus, probability that both Shyam and Ekta will visit the shop on different days $=\frac{20}{25}=\frac{4}{5}$.

4. A card is drawn at random from a well shuffled deck of playing cards. Find the probability that the card drawn is

(i) a card of spades of an ace

Ans: The number of cards in a deck $=52$.

There is total 13 spades and 4 aces in a deck of playing cards.

There is one card which is common [i.e., ace of spade]

So, the number of favourable outcomes $=13+4-1=16$.

Thus, the probability of getting a card of spades of an ace $=\frac{16}{52}=\frac{4}{13}$.

(ii) a red king

Ans: The number of red kings $=2$.

Thus, the probability of getting a red king is $=\frac{2}{52}=\frac{1}{26}$.

(iii) neither a king nor a queen.

Ans: The total number of king and queen $=4+4=8$.

The number of cards that are neither king nor a queen $=52-8=44$.

Thus, the probability of getting neither a king nor a queen $=\frac{44}{52}=\frac{11}{13}$.

(iv) either a king or a queen

Ans: The total number of king and queen $=4+4=8$.

Thus, the probability of getting either a king or a queen $=\frac{8}{52}=\frac{2}{13}$.

(v) a face card.

Ans: The number of face cards $=4+4+4=12$ [Jack, queen and king are the face

cards]

Therefore, the probability of getting a face card $= \frac{12}{52} = \frac{3}{13}$.

(vi) cards which is neither king nor a red card.

Ans: The number of cards that are neither red card nor king $= 52 - (26 + 4 - 2)$

$= 52 - 28$

$= 24$

Thus, the probability of getting a card that is neither a king nor a red card $= \frac{24}{52}$

$= \frac{6}{13}$

5. Cards marked with numbers $1, 2, 3, \ldots, 25$ are placed in a box and mixed thoroughly and one card is drawn at random from the box, what is the probability that the number on the card is

(i) a prime number?

Ans: Total number of outcomes that are possible $= 25$

There are 9 favourable cases, which can be listed as $2, 3, 5, 7, 11, 13, 17, 19, 23$.

Thus, the probability of getting a prime number $= \frac{9}{25}$.

(ii) a multiple of 3 or 5?

Ans: The numbers that are multiple of 3 or 5 can be listed as $3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 24, 25$.

So, there are total 12 favourable cases.

Therefore, the probability of getting a multiple of 3 and 5 is $=\frac{12}{25}$.

(iii) an odd number?

Ans: The odd numbers can be listed as $1,3,5,7,9,11,13,15,17,19,21,23,25$.

Therefore, there are total 13 favourable cases.

Thus, the probability of getting an odd number $=\frac{13}{25}$.

(iv) neither divisible by 5 nor by 10?

Ans: The numbers that are neither divisible by 5 nor by 10 can be listed as $1,2,3,4,6,7,8,9,11,12,13,14,16,17,18,19,21,22,23,24$.

So, there are total 20 favourable cases.

Thus, the probability of getting a number that is neither divisible by 5 nor by 10 is $=\frac{20}{25}=\frac{4}{5}$.

(v) perfect square?

Ans: The perfect square numbers can be listed as $1,4,9,16,25$.

Therefore, there are total 5 favourable cases.

Thus, the probability of getting a perfect square number $=\frac{5}{25}=\frac{1}{5}$.

(vi) a two-digit number?

Ans: All two-digit numbers can be listed as

$10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25$.

So, there are total 16 favourable cases.

Thus, the probability of getting a two-digit number $=\frac{16}{25}$.

6. From a pack of 52 playing cards, jacks, queens, kings and aces of red colour are removed. From the remaining a card is drawn at random. Find the probability that the card drawn is

(i) a black queen

Ans: Total number of cards $=52$.

Number of cards that are removed $=2+2+2+2=8$ [2 jack, 2 queen, 2 king and 2 aces of red colour]

The number of cards remains $=52-8=44$

Therefore, the total number of outcomes $=44$

The number of favourable outcomes $=2$ [Since, the number of black queens is 2]

Thus, the probability of getting a black queen $=\frac{2}{44}=\frac{1}{22}$

(ii) a red card

Ans: The number of favourable outcomes = the number of remaining red cards $=26-8=18$.

Thus, the probability of getting a red card $=\frac{18}{44}=\frac{9}{22}$.

(iii) a black jack

Ans: The number of favourable outcomes = The number of black jacks $=2$

Therefore, the probability of getting a black jack $=\frac{2}{44}=\frac{1}{22}$.

(iv) a picture cards

Ans: The number of picture cards remains $=2+2+2=6$ [King, queen, jack are picture cards]

Therefore, the probability of getting a picture card $=\frac{6}{44}=\frac{3}{22}$.

(v) a honourable card

Ans: The number of Honourable cards remains $=2+2+2+2=8$ [ace, jack, queen and king are honourable cards]

Thus, the probability of getting a honourable card $=\frac{8}{44}=\frac{2}{11}$.