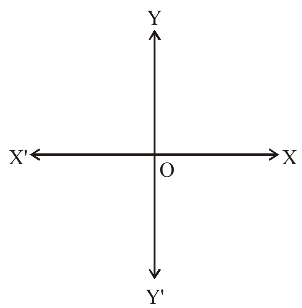
Chapter 7 Co-ordinate Geometry, Probability and Statistics

Co-ordinate Geometry

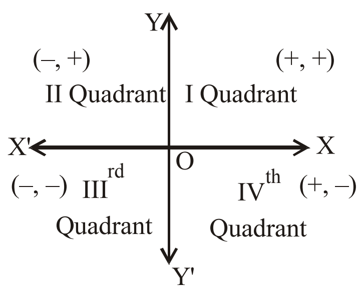
- **The Cartesian Co-ordinate System :**

  Let X'OX and YOY' be two perpendicular straight lines meeting at fixed point O then X'OX is called the x–axis and Y'OY is called the axis of y or y axis. Point 'O' is called the origin. x axis is known as **abscissa** and y–axis is known as **ordinate.**



Note : The *x*–axis and *y*–axis are mutually perpendicular to each other that is why, this system of coordinates is also called Rectangular cartesian coordinate system.

- **Quadrants :**

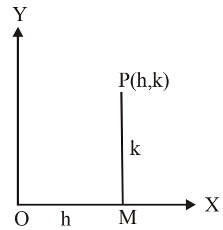


The coordinate axes X'OX and Y'OY divide the plane into four parts, called quadrants, numbered I, II, III and IV anti-clockwise from OX.

Note : The coordinates of a point on the *x*-axis are of the form $(x, 0)$, and of a point on the *y*– axis are of the form $(0, y)$.

- **Plotting of a point whose coordinates are known :**

  The point can be plotted by measuring its proper distance from the axes. Thus, any point (h, k) can be plotted as follows :



(i) Measure OM equal to h along the x-axis.

(ii) Now measure MP perpendicular to OM and equal k.

Note : If $x \neq y$, then the position of (x, y) in the Cartesian plane is different from the position of (y, x)

- **Distance Formula :**

  The distance between two points whose co–ordinates are P (x_1, y_1) and Q (x_2, y_2) given by the formula

  $$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

- **Distance from Origin :**

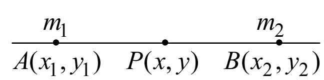
  $$\sqrt{(x-0)^2 + (y-0)^2} = \sqrt{x^2 + y^2}$$

Note : Since, distance is always non-negative (Positive), we take only the positive square root.

- **Section Formula :**

  The coordinates of the point P (x, y) which divides the line segment joining the points A (x_1, y_1) and B (x_2, y_2) internally in the ratio $m_1 : m_2$ are $x = \dfrac{m_1x_2 + m_2x_1}{m_1 + m_2}$ and

  $$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$



Note : If the ratio in which P (x, y) divides AB is k : 1, then the coordinates of the point P will be

$$\left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right)$$

- **Coordinates of Mid-Point :**

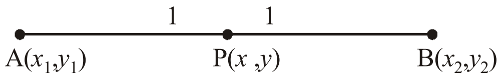
  (Special case of section formula)

  The mid-point of a line segment divides the line segment in the ratio 1 : 1

$\therefore$ The coordinates of the mid-point P of the join of the points A (x_1, y_1) and B (x_2, y_2) is

$$\left(\frac{1.x_1+1.x_2}{1+1}, \frac{1.y_1+1.y_2}{1+1}\right) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

(using section- formula $m_1 = 1, m_2 = 1$)



- **Area of a triangle :**

Area of ΔABC, formed by the points A(x_1, y_1), B(x_2, y_2), C(x_3, y_3) is given by the numerical value of the expression

$$\frac{1}{2}[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]$$

Note : (i) Area cannot be negative so, we shall ignore negative sign if it occurs in a problem.

(ii) To find the area of quadrilateral we shall divide it into two triangles by joining two opposite vertices, find their areas and add them.

(iii) If the area of triangle is zero sq. units then the vertices of triangle are collinear.

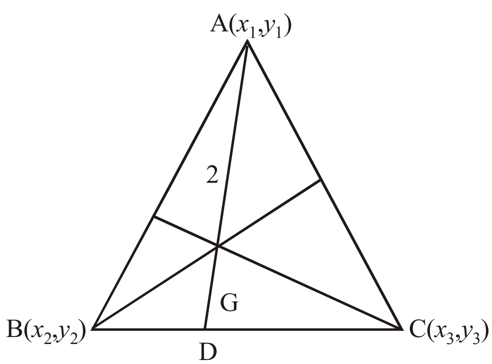
- **Centroid of a Triangle :**

The point where the medians of a triangle meet is called the centroid of the triangle.

"If AD is a mediam of the triangle ABC and G is its centroid, then $\dfrac{AG}{GD} = \dfrac{2}{1}$."

The coordinates of the point G are

$$\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$$



Some useful results

(I) Four points will form :

(a) a **parallelogram** if its opposite sides are equal, but diagonals are unequal.

(b) a **rectangle** if opposite sides are equal and two diagonals are also equal.

(c) a **rhombus** if all the four sides are equal, but diagonals unequal,

(d) a **square** if all sides are equal and diagonals are also equal.

(II) Three points will form:

(a) an equilateral triangle if all the three sides are equal.

(b) an isosceles triangle if any two sides are equal.

(c) a right angled triangle if sum of square of any two sides is equal to square of the third side.

(d) a triangle if sum of any two sides (distances) is greater than the third side (distance).

(III) Three points A, B and C are collinear or lie on a line if one of the following holds

(i) AB + BC = AC (ii) AC + CB = AB

(iii) CA + AB = CB.

Probability

- **Probability — an Experimental (empirical) approach :**

(i) A trial is an action which results in one or several outcomes.

(ii) An event for an experiment is the collection of some outcomes of the experiment.

(iii) Let n be the total number of trials. The *empirical probability* P(E) of an event E happening, is given by

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

Note : The empirical probability depends on the number of trials.

- **Probability as a Measure of Uncertainity :**

(i) **Experiment :** An operation which can produce some well defined outcomes, is known as an experiment.

(ii) **Trial :** Performing of an experiment is called Trial. *For example :* Tossing a coin, throwing a dice.

(iii) **Event :** The outcomes of an experiment are called events. *For example :* Getting a head or tail tossing a coin is an Event.

(iv) **Equally Likely Event :** Outcomes of trial are said to be equally likely if taking into consideration all the relevant evidences, there is no reason to expect one in preference to the others. *For example*,

(a) In throwing an unbiased die, all the six faces are equally likely to come.

(v) **Elementary event :** An event having only one outcome is called an elementary event.

(vi) **Remark :** The sum of the probabilities of all the elementary events of an experiment is 1.

(vii) **Sample Space :** The set of all possible outcomes in a trial is called sample space.

For example : (i) If a fair coin is tossed, there are two possible outcomes, namely head (H) & Tail (T).

$\therefore$ Sample space S = {H, T}

(ii) In unbaised die is thrown;
S = {1, 2, 3, 4, 5, 6}

(iii) When two coins are tossed ;
S = {HH, HT, TH, TT}

- **Favourable Cases :** If we toss a coin, the number of favourable cases for a head is 1 i.e., (H) and total number of equally likely cases = 2 i.e., (T, H)
- **Probability :** Mathematically, Probability of an event E, is defined as,

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{No.of outcomes of favourable cases to E}}{\text{Total no. of possible outcomes}}$$

The probability of an event E is a number between 0 and 1 inclusive i.e., $0 \le P(E) \le 1$

(i) If P(E) = 0, then the event cannot possibly occur. An event that cannot occur has 0 probability; Such an event is called impossible event.

(ii) If P(E) = 1, then the event is certain to occur. An event that is certain to occur has probability equal to one and is called a sure event.

- **Procedure for finding simple probability of an event :**

(i) Count the total number of outcomes in the sample space i.e., n(S);

(ii) Then count all possible outcomes of the event E = e = n(E).

(iii) Substitute these values in the below given formula for probability of event E.

$$P(E) = \frac{n(E)}{n(S)}$$

- **Complementary Event :**

Let $\overline{E}$ denote the event 'E does not occur'. Then

$$P(\overline{E}) = \frac{n(\overline{E})}{n(S)} = \frac{n(S) - n(E)}{n(S)} = 1 - \frac{n(E)}{n(S)}$$

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

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

Thus P (not E) = 1– P (E), this event is said to be a complementary event.

Statistics

- **Primary Data :**
If the data is collected by the investigator herself/himself with the specific purpose, then such data is called the primary data.
- **Secondary Data :**
If the data collected by someone else other than investigator are known as secondary data.
- **Frequency :**
It is a number which tells that how many times does a particular observation appear in a given data.
- **Frequency Distribution:**
A tabular arrangement of data sharing their corresponding frequencies is called a frequency distribution.
- **Class Interval :**
The group in which the raw data is condensed is called a Class interval.
- **Grouped Data :**
The data can be represented into classes or groups. Such a presentation is known as grouped data.

Class Limits : Here, marks obtained by all of the students are divided into seven classes namely, 25—35, 35—45 and so on. In class 25—35, 25 is called Lower class limit and 35 is called Upper class limit.

Class Size : The difference between upper and lower class limit is called Class size.

Here, class size is 35 – 25 = 45 – 35 = 10.

Class Mark : Class mark = $\frac{\text{Upper limit + lower limit}}{2}$

- **Descrete frequency distribution :**
When number of terms is large and variate are descrete, i.e., variate can accept some particular values only under finite limits and is repeated then it is called descrete frequency distribution.
- **Continuous frequency distribution :**
When number of terms is large and variate is continuous, i.e., variate can accept all values under finite limits and they are repeated then it is called continuous frequency distribution.
- **Graphical representation of data :**
The representation of data through diagrams helps us to visualize the whole meaning of a numerical distribution at a single glance. There are various methods of representing the data by means of graphs.

(A) Bar graphs

(B) Histograms of uniform width, and of varying widths

(C) Frequency polygons

- **Bar Graph :**
It is the simplest and most widely used graph in which the numerical data is represented by bars (rectangles) of equal width.

In a bar graph :

(i) The width of each bar can be any, but widths of all the bars should be the same.

(ii) The space between consecutive bars should also be same.

The height (or length) of a bar is proportional to the numerical data it represents.

- **Histogram :**
A histogram is a graphical representation of a frequency distribution in the form of rectangles one after the other.

The bases of these rectangles represent the magnitudes of the variables of the class-boundaries. So these are taken along the x-axis. The heights of these represent the frequencies of the corresponding magnitudes of the variable of the class-boundaries.

- **Frequency polygon :**
After drawing the histogram of a frequency distribution, when the mid-points of the respective tops of the rectangles are joined by the line segment, the figure so obtained is known as frequency polygon.

The mid-point of the top of the first rectangle is joined to the mid-point of the earlier interval (imagined) on the x-axis. Similarly the mid-point of the top of the last rectangle is joined to the mid-point of the next interval (imagined) on the x-axis.

- **Measures of Central Tendency (Averages) :**

There are three main averages :

(1) Mean (2) Median

(3) Mode

- **Mean:** The **mean** (or **average**) of a number of observations is the sum of the values of all the observations divided by the total number of observations.

It is denoted by the symbol $\bar{x}$, read as '***x*** bar'.

In general, for n observations, $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

- **Median :**

The **median** is that value of the given number of observations, which divides it into exactly two parts.

Median is the middle most or the central value of the variate in a set of observations,when the observations are arranged either in ascending or in descending order of their magnitudes.

- **Methods to find Median:**

When the data is arranged in ascending (or descending) order the median of ungrouped data is calculated as follows:

(i) When the number of observation (n) is odd, the median is the value of the $\frac{n+1}{2}$th observation.

(ii) When the number of observations (n) is even, the median is the mean of the $\frac{n}{2}$th and the $\frac{n}{2}+1$ th observations.

- **Mode :**

The **mode** is that value of the observation which occurs most frequently, i.e., an observation with the maximum frequency is called the mode.

Note : It is not effected by presence of extremely large or small items.

- **Short cut method (Assumed mean Method) :**

As per this method : $\bar{x} = A + \frac{1}{N}\sum_{i=1}^{n} f_i d_i$ where A is assumed mean and $d_i = x_i - A$, $N = \Sigma f_i$

Note : (i) This method is used when large calculation is involved in frequency data calculations and it is tedious to calculate mean value etc. by conventional method.

(ii) Generally the middle most value is considered as assumed mean.

- **Short cut method for calculating mean :**

Working rule for calculation of mean could be demonstrated in following steps.

Step 1 : Take any convienent value as assumed mean (A). This is generally taken as the one occupy by the middle (n), the interval having maximum frequency.

Step 2 : Calculate the deviation by differences of the value x from the assumed mean and denote deviations d_i. Thus, $d_i = x_i - A$.

Step 3 : Find $\mathbf{f_i d_i}$

Step 4 : The required mean can be calculated as

$$\bar{x} = A + \frac{\sum f_i d_i}{\sum f_i}$$

- **Step Deviation Method :**

If the deviation $\mathbf{d_i}$**'s** are divisible by any common number **C**, then $u_i = \frac{x_i - A}{C}$ and we use formula $\bar{x} = A + \left(\frac{\sum f_i u_i}{\sum f_i}\right)C$

where 'C' is differences between successive x_is. or we can say C = class size.

Note : (i) The step-deviation method will be convenient to apply if all the d_is have a common factor.

(ii) The mean obtained by all the three methods is the same.

- **Mode of Grouped Data :**

$$\text{Mode} = \ell + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad \text{where,}$$

ℓ = lower limit of the modal class*

h = size of the class interval

f_1 = frequency of the modal class

f_0 = frequency of the class preceeding the modal class

f_2 = frequency of the class succeeding the modal class.

Note : Modal class is the class having maximum frequency.

- **Median of Grouped Data :**

Step 1 : Make cumulative frequency table.

Step 2 : Choose the median class. Median class is the class whose cumulative frequency is greater than and nearest to $\frac{n}{2}$ where n is the sum of all frequencies.

Step 3 : Use this formula

$$\text{Median} = \ell + \left[\frac{\frac{n}{2} - c.f}{f}\right] \times h$$

where,

ℓ = lower limit of median class

n = sum of all frequencies

c.f = cumulative frequency of class preceding the median class

f = frequency of the median class

h = class size

Note : The relationship between three measures of central tendency.

3 Median = Mode + 2 Mean

- **Ogive :**

  Ogive is also called cumulative frequency curve. It is the graph plotted by marking on x-axis, the upper limits of the class intervals and their corresponding cumulative frequencies are marked on the vertical axis (y-axis), choosing a convenient scale.

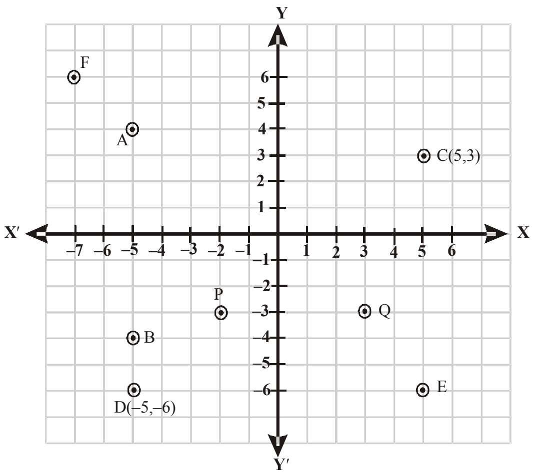
- **Graphical Representation of Cumulative Frequency Distribution**

  We can represent the cumulative frequency distribution as a cumulative frequency curve or an Ogive.

Exercise 1

DIRECTIONS : *This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.*

1. In the given figure, find Coordinate of A.



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

2. In the given figure, points identified by the coordinates (–2, –3) is,
(1) P (–2, –3) (2) Q (–2, –3)
(3) A (–2, –3) (4) C (–2, –3)

3. In the given figure, abscissa of C is,
(1) 4 (2) 5
(3) 6 (4) 7

4. In the given figure, Coordinate of the point E is
(1) (1, 2) (2) (5, –6)
(3) (5, 6) (4) (–5, –6)

5. If the segment joining the points (a, b) and (c, d) subtends a right angle at the origin, then
(1) $ac - bd = 0$ (2) $ac + bd = 0$
(3) $ab + cd = 0$ (4) $ab - cd = 0$

6. If $A = (a^2, 2a)$ and $B = \left(\frac{1}{a^2}, -\frac{2}{a}\right)$ and $S = (1, 0)$, then $\frac{1}{SA} + \frac{1}{SB} =$
(1) 2 (2) $\frac{1}{2}$
(3) 1 (4) $\frac{1}{3}$

7. The line $3x + 4y = 24$ cuts the x-axis at A and y- axis at B.Area of ΔAOB =
(1) 21 sq. units (2) 24 sq. units
(3) 27 sq. units (4) 48 sq. units

8. The points (k + 1, 1), (2k + 1, 3) and (2k + 2, 2k) are collinear if
(1) $k = -1, 2$ (2) $k = \frac{1}{2}, 2$
(3) $k = 2, 1$ (4) $k = -\frac{1}{2}, 2$

9. Line formed by joining (–1, 1) and (5, 7) is divided by a line x + y = 4 in the ratio of
(1) 1 : 2 (2) 1 : 3
(3) 3 : 4 (4) 1 : 4

10. Radius of circumcircle of a triangle ABC is $5\sqrt{10}$ units. If point P is equidistant from A (1, 3), B (– 3, 5) and C (5, –1) then AP =
(1) 5 (2) $5\sqrt{5}$
(3) 25 (4) $5\sqrt{10}$

11. A circle drawn with origin as the centre passes through $\left(\frac{13}{2}, 0\right)$. The point which does not lie in the interior of the circle is
(1) $\left(-\frac{3}{4}, 1\right)$ (2) $\left(2, \frac{7}{3}\right)$
(3) $\left(5, -\frac{1}{2}\right)$ (4) $\left(-6, \frac{5}{2}\right)$

12. If area of Δ formed by joining mid-points of the sides of ΔABC is 2 sq. units, then area of ΔABC =
(1) 8 (2) 4
(3) 2 (4) 1

13. The area of a triangle with vertices $(a, b + c)$, $(b, c + a)$ and $(c, a + b)$ is
(1) $(a + b + c)^2$ (2) 0
(3) $a + b + c$ (4) abc

14. The ratio in which the line $2x + y - 4 = 0$ divides the line segment joining the points A (2, –2) and B (3, 7) is
(1) 3 : 7 (2) 4 : 7
(3) 2 : 9 (4) 4 : 9

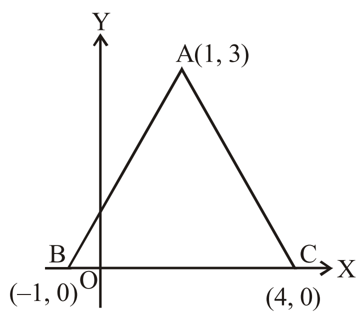
15. If the distance between the points (2, –2) and $(-1, x)$ is 5, one of the values of x is
(1) –2 (2) 2
(3) –1 (4) 1

16. The mid-point of the line segment joining the points A (–2, 8) and B (– 6, –4) is
(1) (– 4, – 6) (2) (2, 6)
(3) (– 4, 2) (4) (4, 2)

17. In the adjoining figure, the area of the triangle ABC is

(1) 15 sq. units (2) 10 sq. units

(3) 7.5 sq. units (4) 2.5 sq. units



18. What is the probability of choosing a vowel from the alphabet?

(1) $\frac{21}{26}$ (2) $\frac{5}{26}$

(3) $\frac{1}{21}$ (4) None of these

19. Which of the following is the sample space when 2 coins are tossed?

(1) {H, T, H, T} (2) {H, T}

(3) {HH, HT, TH, TT} (4) None of the above

20. A large basket of fruit contains 3 oranges, 2 apples and 5 bananas. If a piece of fruit is chosen at random, what is the probability of getting an orange or a banana?

(1) $\frac{4}{5}$ (2) $\frac{1}{2}$

(3) $\frac{7}{10}$ (4) None of these

21. A pair of dice is rolled. What is the probability of getting a sum of 2?

(1) $\frac{1}{6}$ (2) $\frac{1}{3}$

(3) $\frac{1}{36}$ (4) None of these

22. In a shipment of 100 televisions, 6 are defective. If a person buys two televisions from that shipment, what is the probability that both are defective?

(1) $\frac{3}{100}$ (2) $\frac{9}{2500}$

(3) $\frac{1}{330}$ (4) None of these

23. In the United States, 43% of people wear a seat belt while driving. If two people are chosen at random, what is the probability that both of them wear a seat belt?

(1) 86% (2) 18%

(3) 57% (4) None of these

24. The probability expressed as a percentage of a particular occurrence can never be

(1) less than 100

(2) less than 0

(3) greater than 1

(4) anything but a whole number

25. Someone is asked to take a number from 1 to 100. The probability that it is a prime is

(1) $\frac{1}{5}$ (2) $\frac{6}{25}$

(3) $\frac{1}{4}$ (4) $\frac{13}{50}$

26. If the probability of an event is p, the probability of its complementary event will be

(1) p – 1 (2) p

(3) 1 – p (4) $1-\frac{1}{p}$

27. If an event cannot occur, then its probability is

(1) 1 (2) $\frac{3}{4}$

(3) $\frac{1}{2}$ (4) 0

28. A fair dice is rolled. Probability of getting a number x such that $1 \le x \le 6$, is

(1) 0 (2) >1

(3) between 0 and 1 (4) 1

29. The probability of getting a number between 1 and 100 which is divisible by 1 and itself only is

(1) $\frac{29}{98}$ (2) $\frac{1}{2}$

(3) $\frac{25}{98}$ (4) $\frac{23}{98}$

30. A single letter is selected at random from the word 'PROBABILITY'. The probability that it is a vowel is

(1) $\frac{3}{11}$ (2) $\frac{4}{11}$

(3) $\frac{2}{11}$ (4) $\frac{5}{11}$

31. One ticket is selected at random from 100 tickets numbered 0.0, 01, 02, ... 99. Suppose x is sum of the digits and y is product of the digits. Then probability $x = 9$ and y = 0 is

(1) $\frac{2}{17}$ (2) $\frac{3}{23}$

(3) $\frac{1}{50}$ (4) $\frac{1}{25}$

32. The probability that a leap year should have exactly 52 tuesday is

(1) $\frac{2}{7}$ (2) $\frac{3}{7}$

(3) 1 (4) $\frac{5}{7}$

33. For an event E, P (E) + $P(\bar{E})$ = q, then

(1) $0 \le q < 1$ (2) $0 < q \le 1$

(3) $0 < q < 1$ (4) none of these

34. A child has a die whose six faces show the number as given below:

$\boxed{1}\ \boxed{2}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{6}$

The die is thrown once. What is the probability of getting 5 ?

(1) $\frac{1}{6}$ (2) $\frac{2}{5}$

(3) 0 (4) 1

35. A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought?

(1) 40 (2) 240

(3) 480 (4) 750

36. The abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its

(1) mean (2) median

(3) mode (4) all the three above

37. The mean of 11 numbers is 35. If the mean of first 6 numbers is 32 and that of last 6 numbers is 37, then the 6^{th} number is equal to

(1) 28 (2) 29

(3) 31 (4) None of these

38. Construction of a cumulative frequency table is useful in determining the

(1) mean (2) median

(3) mode (4) All three measures

39. In a frequency distribution, the mid value of a class is 10 and the width of the class is 6. The lower limit of the class is

(1) 6 (2) 7

(3) 8 (4) 12

40. If the mean of the observations x, $x + 3$, $x + 5$, $x + 7$ and $x + 10$ is 9, the mean of the last three observations is

(1) $10\frac{1}{3}$ (2) $10\frac{2}{3}$

(3) $11\frac{1}{3}$ (4) $11\frac{2}{3}$

Exercise 2

MCQ Based Questions

DIRECTIONS (Qs. 1 to 4) : *This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.*

1. The points A (9, 0), B (9, 6), C (– 9, 6) and D (– 9, 0) are the vertices of a

(1) square (2) rectangle

(3) rhombus (4) trapezium

2. The points (– 4, 0), (4, 0), (0, 3) are the vertices of a

(1) right triangle (2) isosceles triangle

(3) equilateral triangle (4) scalene triangle

3. The point which divides the line segment joining the points (7, –6) and (3, 4) in ratio 1 : 2 internally lies in the

(1) I quadrant (2) II quadrant

(3) III quadrant (4) IV quadrant

4. If we join any two points by a straight line, the figure formed will be

(1) frequency polygon (2) histogram

(3) ogive (4) none

Matching Based Questions

DIRECTIONS (Qs. 5 to 7) : *Match the Column-I with Column-II and select the correct answer given below the columns.*

5.

	Column I (Points)		**Column II (Quadrant)**
(A)	4, 4	(p)	I quadrant
(B)	–3, 7	(q)	II quadrant
(C)	2, –3	(r)	III quadrant
(D)	–1, –3	(s)	IV quadrant

(1) A → p; B → q; C → s; D → r (2) A → q; B → p; C → s; D → r

(3) A → p; B → q; C → r; D → s (4) A → q; B → p; C → r; D → s

6.

	Column I		**Column II**
(A)	If A (3, 2) and B (– 2, 1) are two vertices of a triangle ABC, whose centroid G has co-ordinates $\left(\frac{5}{3}, \frac{1}{3}\right)$, then the third vertex C is	(p)	(6, – 2)
(B)	Three vertices of a rectangle are (3, 4), (–1, 2) and (2, –4). Then the fourth vertex is	(q)	(6, 3)
(C)	If (1, 2), (4, y), (x, 6) and (3, 5) are the vertices of a | | gm taken in order, then (x, y) is	(r)	(1, 3)
(D)	The co-ordinates of the point which divides the joining of (–1, 7) and (4, –3) in the ratio 2 : 3 is	(s)	(4, –4)

(1) A → p; B → s; C → r; D → q (2) A → s; B → p; C → r; D → q

(3) A → s; B → p; C → q; D → r (4) A → p; B → s; C → q; D → r

7.

	Column I		**Column II**
(A)	If a random experiment is performed then each of its outcome is known as	(p)	deterministic experiment
(B)	The experiments which when repeated under identical conditions produce the same results are known as	(q)	Sample space
(C)	The set of all possible outcomes of a random experiment is called	(r)	Elementary event
(D)	If A and B are complementary events then	(s)	1
(E)	The sum of the probabilities of all the elementary events of a random experiment is equal to	(t)	P (B) = 1 – P (A)

(1) A → p; B → r; C → t; D → q; E → s (2) A → r; B → p; C → q; D → t; E → s

(3) A → p; B → r; C → q; D → s; E → t (4) A → r; B → p; C → t; D → q; E → s

Statement Based Questions

8. Consider the following statements :

I. The point (– 2, 0) lies on the y-axis.

II. The point (0, – 4) lies on the y-axis.

III. The point (– 1, 2) lies below the x-axis.

IV. The point (3, – 2) lies below the x-axis.

Which of the statements given above are not correct?

(1) Both 'I' and 'III' (2) Both 'II' and 'IV'
(3) Only 'I' (4) Only 'II'

9. Consider the following statements :

I. The point (a, b) lies on y-axis if b = 0

II. The origin is in the first quadrant.

III. The origin (0, 0) lies on x-axis.

IV. The y-axis is the vertical number line.

Which of the statements given above are correct?

(1) Both 'I' and 'II' (2) Both 'III' and 'IV'
(3) Both 'I' and 'III' (4) Both 'II' and 'IV'

10. Consider the following statements :

I. A point on the x– axis which is equidistant from A (5, 4) and B (–2 , 3) is (2, 0).

II. Distance between the points (a cos 35°, 0) and B (a, a cos 65°) is – a.

III. The distance between the points A (0, 6) and B (0, – 2) is 8.

IV. If the distance of P (x , y) from A (5 , 1) and B (– 1, 5) are equal, then $x = 2y$.

Which of the statements given above are correct?

(1) Both 'I' and 'II' (2) Both 'I" and 'III'
(3) Both 'I' and 'IV' (4) Both 'II' and 'IV'

11. Consider the following statements :

I. King, queen and jack are called face cards.

II. Any activity which is associated to certain outcome is called event.

III. Outcomes associated with experiment is called event.

IV. Probability of an event cannot be negative.

Which of the statement(s) given above is/are not correct?

(1) Only 'I' (2) Only 'II'
(3) Both 'I' and 'II' (4) Both 'III' and 'IV'

Passage Based Questions

DIRECTIONS (Qs. 12 to 20) : *Read the passage(s) given below and answer the questions that follow.*

PASSAGE - I

If $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$ are vertices of a ΔABC, then its centroid is $G\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$ and in a parallelogram, diagonals bisect each other.

12. The two vertices of a triangle are (6, 3) and (–1, 7) and its centroid is (1, 5). Then the third vertex is

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

13. The centroid of a triangle formed by (7, p), (q, –6), (9, 10) is (6, 3). The $p + q$

(1) 6 (2) 5
(3) 7 (4) 8

14. If(3, 2), (6, 3), (x, y) and (6, 5) are the vertices of a parallelogram, then $x + y$ =

(1) 13 (2) 14
(3) 16 (4) 15

PASSAGE - 2

A die has two faces each with number '1', three faces each with number '2' and one face with number '3'. Die is rolled once.

15. The probability of obtaining the number 2 is

(1) $\frac{1}{2}$ (2) $\frac{1}{6}$
(3) $\frac{1}{3}$ (4) None of these

16. The probability of getting the number 1 or 3 is

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$
(3) $\frac{1}{2}$ (4) None of these

17. The probability of not getting the number 3 is

(1) $\frac{1}{6}$ (2) $\frac{5}{6}$
(3) $\frac{1}{2}$ (4) None of these

PASSAGE - 3

The following table gives the weekly wages of workers in a factory:

Weekly wages	Mid-value (x_i)	No. of (f_i) workers	$f_i x_i$	Cumulative frequency
50 – 55	52.5	5	262.5	5
55 – 60	57.5	20	1150.0	25
60 – 65	62.5	10	625.0	35
65 – 70	67.5	10	675.0	45
70 – 75	72.5	9	652.0	54
75 – 80	77.5	6	465.0	60
80 – 85	82.5	12	990.0	72
85 – 90	87.5	8	700.0	80
		$\sum f_i = 80$	$\sum f_i x_i = 5520$	

18. The mean is

(1) 70 (2) 68
(3) 71 (4) 69

19. The modal class is

(1) 60-65 (2) 55-60
(3) 50-55 (4) none of these

20. The number of workers getting weekly wages, below ₹ 80 is

(1) 50 (2) 70
(3) 60 (4) 80

Assertion Reason Based Questions

DIRECTIONS (Qs. 21 to 30) : *Following questions consist of two statements, one labelled as the **'Assertion' (A)** and the other as **'Reason' (R)**. You are to examine these two statements carefully and select the answer to these items using the code given below.*

Code :

(1) Both A and R are individually true and R is the correct explanation of A:

(2) Both A and R are individually true but R is not the correct explanation of A.

(3) A is true but R is false

(4) A is false but R is true.

21. **Assertion :** The ratio in which the segment joining the points (–3, 10) and (0, –8) is divided by (–1, 6) is 2 : 7.

Reason: If A (x_1, y_1), $B(x_2, y_2)$, are two points. Then the point $C(x, y)$ such that C divides AB internally in the ratio K : 1 is given by $x = \frac{Kx_2 + x_1}{K+1}$, $y = \frac{Ky_2 + y_1}{K+1}$

22. **Assertion:** If the co-ordinates of the vertices of a triangle is (1, 1), (2, –3) and (3, 4), then its centroid is $\left(\frac{2}{3}, 2\right)$.

Reason: Centroid of a triangle with vertices (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by $\left(\frac{x_1 + x_2 + x_3}{2}, \frac{y_1 + y_2 + y_3}{2}\right)$

23. **Assertion:** If the co-ordinates of the vertices of a triangle is $A(-4, -2)$, $B(-3, -5)$ and C(3, –2), then its area is 10.5 sq. units.

Reason: Area of a triangle having its vertices as $P(x_1, y_1)$, $Q(x_2, y_2)$ and $R(x_3, y_3)$ is given by

Area (ΔPQR) = $\frac{1}{2}\left|\left[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right]\right|$

24. **Assertion:** If $P(A) = 0.25, P(B) = 0.50$ and $P(A \cap B) = 0.14$, then the probability that neither A nor B occurs is 0.39.

Reason : $\overline{A \cup B} = \overline{A} \cup \overline{B}$

25. **Assertion :** If a box contains 5 white, 2 red and 4 black marbles, then the probability of not drawing a white marble from the box is $\frac{5}{11}$.

Reason : $P\left(\overline{E}\right) = 1 - P(E)$, where E is any event.

26. **Assertion :** In rolling a dice, the probability of getting number 8 is zero.

Reason : Its an impossible event.

27. **Assertion :** The arithmetic mean of the following given frequency distribution table is 13.81.

x	4	7	10	13	16	19
f	7	10	15	20	25	30

Reason : $\overline{x} = \frac{\sum f_i x_i}{\sum f_i}$

28. **Assertion :** If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27 then median is 30.

Reason : Median $= \left(\frac{n+1}{2}\right)^{\text{th}}$ value, if n is odd.

29. **Assertion :** If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason : Median = $\frac{1}{2}$(mode + 2 mean)

30. **Assertion:** The difference between the maximum and minimum values of a variable is called its range.

Reason: The number of times a variate (observation) occurs in a given data is called range.

Feature Based Questions

31. On the basis of following features identify the correct event.

I. $P(\overline{E}) = 1 - P(E)$ II. P (not E) = 1 – P (E)

III. $P(\overline{E}) = \frac{n(\overline{E})}{n(S)}$

(1) Elementary event (2) Equally likely event
(3) Complementary event (4) Impossible event

32. On the basis of following features identify the correct central tendency.

I. It is denoted by $\overline{x}$.

II. It is equal to $\frac{\sum_{i=1}^{n} x_i}{n}$ for n observations.

(1) median (2) mean
(3) mode (4) variance

33. On the basis of following features identify the correct central tendency.

I. It is the middle most or the central value of the variate in a set of observations.

II. It is the mean of $\frac{n}{2}$th and $\left(\frac{n}{2}+1\right)$th observations, when the number of observation is even.

(1) Mean (2) Median
(3) Mode (4) Variance

34. On the basis of following features identify the correct graph.

I. It is called cumulative frequency curve.

II. It is represented with the help of cumulative frequency distribution.

III. It is a graph plotted by the upper limits of class intervals on x-axis and their corresponding cumulative frequencies on the y-axis.

(1) Bar graph (2) Histogram
(3) Ogive (4) Frequency polygon

Correct Definition Based Questions

35. Which of the following is an experiment ?
(1) Tossing a coin.
(2) Rolling a single 6-sided die.
(3) Choosing a marble from a jar.
(4) All of the above.

36. Which of the following is an outcome ?
(1) Rolling a pair of dice.
(2) Landing on red.
(3) Choosing 2 marbles from a jar.
(4) None of the above.

37. Which of the following is correct definition of sample space?
(1) The set of all possible outcomes in a trial is called sample space.
(2) The set of all possible events is called sample space.
(3) The set of all experiments is called sample space.
(4) The set of all favourable cases is called sample space.

38. Which of the following is correct relation between mean, median and mode ?

(1) Median = Mode + $\frac{2}{3}$ (Mean + Mode)

(2) Mean = Mode + $\frac{3}{2}$ (Median + Mode)

(3) Mean – Mode = 3 (Mean – Median)

(4) Mean + Mode = 3 (Mean + Median)

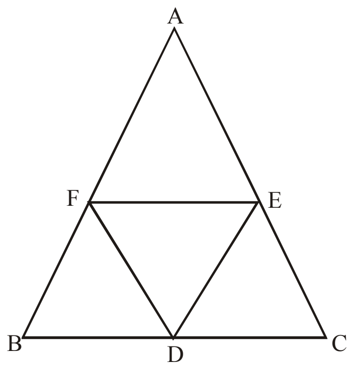
Hints SOLUTIONS

Exercise 1

1.	(1)	**2.**	(1)	**3.**	(2)	**4.**	(2)
5.	(2)	**6.**	(3)	**7.**	(2)	**8.**	(4)
9.	(1)	**10.**	(4)	**11.**	(4)		

12. (1) Area of ΔABC = 4 area of ΔDEF where D, E, F are the mid-points of BC, CA, AB, respectively.

Reqd. area = 4 (2) = 8 sq. units



13.	(2)	**14.**	(4)	**15.**	(2)	**16.**	(3)

17. (3) [Hint. From figure, base BC = 5 units and height of ΔABC = 3 units,

$\therefore$ area of $\Delta ABC = \frac{1}{2}$ base $\times$ height

$= \frac{1}{2} \times 5 \times 3$ sq. units.]

18.	(2)	**19.**	(3)	**20.**	(1)	**21.**	(3)
22.	(3)	**23.**	(2)	**24.**	(2)	**25.**	(3)
26.	(3)	**27.**	(4)	**28.**	(4)	**29.**	(3)
30.	(2)	**31.**	(3)	**32.**	(3)	**33.**	(4)
34.	(4)	**35.**	(3)	**36.**	(2)	**37.**	(2)
38.	(2)						

39. (2) Let x be the upper limit and y be the lower limit.

Since the mid value of the class is 10.

$\therefore \quad \frac{x+y}{2} = 10 \quad \Rightarrow \quad x + y = 20$ .....(1)

and $x - y = 6$ (width of the class = 6) .....(2)

By solving (1) and (2), we get $y = 7$.

Hence, lower limit of the class is 7.

40. (3) We know, mean = $\frac{\text{Sum of all the observations}}{\text{Total no. of observation}}$

$\Rightarrow$ Mean = $\frac{x - x + 3 - x + 5 - x + 7 + x - 10}{5}$

$9 = \frac{5x + 25}{5} \quad \Rightarrow \quad x = 4$

So, mean of last three observations is

$\frac{3x+22}{3} - \frac{12+22}{3} = \frac{34}{3} = 11\frac{1}{3}$

Exercise 2

1. (3)

2. (1)

3. (4)

4. (1) frequency polygon

5. (1) A $\to$ p; B $\to$ q; C $\to$ s; D $\to$ r

6. (3) A $\to$ s; B $\to$ p; C $\to$ q; D $\to$ r

7. (2) A $\to$ r; B $\to$ p; C $\to$ q; D $\to$ t; E $\to$ s

8. (1) Statements 'I' and 'III' are not correct.

9. (2) Statements 'III' and 'IV' are correct.

10. (2) Statements 'I' and 'III' are correct.

11. (2) Statement 'II' is false.

12. (2) Let the third vertex be (α, β)

$\therefore \quad \frac{\alpha + 6 - 1}{3} = 1, \frac{\beta + 3 + 7}{3} = 5, \Rightarrow \alpha = -2, \beta = 5$

$\therefore$ required point is (–2, 5)

13. (3) By the given condition $\frac{7+q+9}{3} = 6$ and

$\frac{p - 6 + 10}{3} = 3$

$\Rightarrow q = 2$ and $p = 5 \quad \therefore \quad p + q = 5 + 2 = 7$

14. (4) Since (3, 2), (6, 3), (x, y) and (6, 5) are the vertices of a parallelogram.

$\therefore \quad \frac{3+x}{2} = \frac{6+6}{2}$ and $\frac{2+y}{2} = \frac{3+5}{2}$

$\Rightarrow x = 9$ and $y = 6$

$\therefore \quad x + y = 15$

15. (1) As three faces are marked with number '2', so number of favourable cases = 3.

$\therefore$ Required probability, $P(2) = \frac{3}{6} = \frac{1}{2}$

16. (3) No. of favourable cases = No. of events of getting the number 1 + no. of events of getting the number 3 = 2 + 1 = 3

$\therefore$ Required probability, $P(1 \text{ or } 3) = \frac{3}{6} = \frac{1}{2}$

17. (2) Only 1 face is marked with 3, so there are 5 faces which are not marked with 3.

$\therefore$ Required probability, P (not 3) $= \frac{5}{6}$

18. (4) Mean $= \frac{\sum f_i x_i}{\sum f_i} = \frac{5520}{80} = ₹69$

19. (2) Modal class : We know that class of maximum frequency is called the modal class. i.e., 55-60 is the modal class.

20. (3) Number of workers getting weekly wages below ₹80 according to table = 60 workers.

21. (1) Reason (R) is true. (Standard Result)

For Assertion (A)

Let (–1, 6) divide the join of (–3, 10) and (6, –8) in the ratio $K:1$

$\therefore \quad -1 = \frac{6K-3}{K+1}$ and $6 = \frac{-8K+10}{K+1}$

$\Rightarrow \quad -K - 1 = 6K - 3$ and $6K + 6 = -8K + 10$

$\Rightarrow \quad 7K = 2$ and $14K = 4 \Rightarrow K = \frac{2}{7}$ and $K = \frac{4}{14} = \frac{2}{7}$

Hence required ratio is 2 : 7 $\therefore$ (A) is true. Since (R) gives (A)

22. (4)

23. (1)

24. (3) Here, Assertion is correct, but reason is not true.

25. (4) Assertion is not correct, but reason is correct.

$P(\text{white marble}) = \frac{5}{5+2+4} = \frac{5}{11}$

$P(\text{not white marble}) = 1 - \frac{5}{11} = \frac{11-5}{11} = \frac{6}{11}$

26. (1) Assertion and reason both are correct. Also reason is the correct explanation of the assertion.

27. (3) Mode = 3 Median – 2 Mean.

28. (1) Both assertion and reason are true, reason is the correct explanation of the assertion.

29. (4) Arranging the terms in ascending order,

0, 5, 11, 19, 21, 27, 30, 36, 42, 50, 52

median value $= \left(\frac{11+1}{2}\right)^{\text{th}} = 6^{\text{th}}$ value $= 27$

30. (3) Median $= \frac{1}{3}$(mode + 3 mean)

$= \frac{1}{3}(60 + 2 \times 66) = 64$

31. (3) Assertion is correct. But reason is false. The number of times a variate (observation) occurs in a given data is called frequency of that variate.

32. (3)

33. (2) Mean

34. (2) Median

35. (3) Ogive

36. (4)

37. (2)

38. (1)