

Class XI Session 2025-26

Subject - Applied Maths

Sample Question Paper - 2

Time Allowed: 3 hours

Maximum Marks: 80

General Instructions:

1. This Question paper contains - **five sections** A, B, C, D and E. Each section is compulsory. However, there is some internal choice in some questions.
2. Section A has 18 MCQ's and 02 Assertion Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer(VSA) questions of 2 marks each.
4. Section C has 6 Short Answer(SA) questions of 3 marks each.
5. Section D has 4 Long Answer(LA) questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (04 marks each) with sub parts.
7. Internal Choice is provided in 2 questions in Section-B, 2 questions in Section-C, 2 Questions in Section-D. You have to attempt only one alternatives in all such questions.

Section A

1. $\log_2 8$ is equal to [1]
a) 2 b) 4
c) 3 d) 8
2. For a frequency distribution mean deviation from mean is computed by [1]
a) $M.D. = \frac{\sum d}{\sum f}$ b) $M.D. = \frac{\sum f}{\sum f|d|}$
c) $M.D. = \frac{\sum f|d|}{\sum f}$ d) $M.D. = \frac{\sum fd}{\sum f}$
3. In what time will a sum of ₹ 1562.50 produce ₹ 195.10 at 4% per annum compound interest? [1]
a) $1\frac{1}{2}$ years b) 2 years
c) $2\frac{1}{2}$ years d) 3 years
4. Which of the following binary numbers is equivalent to decimal number 24? [1]
a) 111111 b) 11001
c) 11000 d) 1101111
5. Characteristic of $\log 0.0003798$ is [1]
a) $\bar{4}$ b) 4
c) $\bar{3}$ d) 3



6. The value of $\left(5\frac{1}{16}\right)^{-\frac{3}{4}}$ is [1]
 a) $\frac{27}{8}$ b) $\frac{4}{9}$
 c) $\frac{8}{27}$ d) $\frac{9}{4}$
7. The mean of five numbers is 30. If one number is excluded, their mean becomes 28. The excluded number is: [1]
 a) 35 b) 38
 c) 30 d) 28
8. In a city 20 percent of the population travels by car, 50 percent travels by bus and 10 percent travels by both car and bus. Then persons travelling by a car or bus is [1]
 a) 80 percent b) 40 percent
 c) 60 percent d) 70 percent
9. Number of relations that can be defined on the set $A = \{a, b, c, d\}$ is [1]
 a) 24 b) 4^4
 c) 2^{16} d) 16
10. Let $A = \{1, 2, 3\}$, $B = \{1, 3, 5\}$. If relation R from A to B is given by $R = \{(1, 3), (2, 5), (3, 3)\}$. Then, R^{-1} is [1]
 a) $\{(3, 3), (3, 1), (5, 2)\}$ b) $\{(1, 3), (2, 5), (3, 3)\}$
 c) $\{(1, 3), (5, 2)\}$ d) $\{(5, 2)\}$
11. The number of digits in the binary system are [1]
 a) 2 b) 4
 c) 6 d) 10
12. Integrated Goods and Services Tax is applicable when: [1]
 a) Sold within a state b) Sold in Union territory
 c) Sold from one GST dealer to another GST dealer d) There is interstate supply
13. Deduction of the principal of the home loan is allowed under section _____. [1]
 a) 24 b) 80C
 c) 80E d) 80D
14. In a certain code language, FOUL is written as HNVO, in the same code language HURT is written as [1]
 a) ITSV b) JT SW
 c) ITSW d) JTWS
15. If Karl Pearson's coefficient of skewness of a distribution is 2.5, standard deviation is 8 and mean is 30, then mode of the distribution is: [1]
 a) 20 b) 25
 c) 10 d) 5
16. Suppose A and B are two events. Event B has occurred and it is known that $P(B) < 1$. What is $P(A/B')$ equal to? [1]



$$a) \frac{P(A)+P(AB')}{1-P(B)}$$

$$b) \frac{P(A)-P(AB)}{1-P(B)}$$

$$c) \frac{P(A)-P(B)}{1-P(B)}$$

$$d) \frac{P(A)+P(B')}{1-P(B)}$$

17. The inclination of straight line with the x-axis, whose slope is $-\frac{1}{\sqrt{3}}$ is [1]

a) 150°

b) 30°

c) 60°

d) 180°

18. A man borrows ₹ 21000 at 10% per annum compound interest. How much he has to pay to the end of each year to clear his debt in two years? [1]

a) ₹ 10500

b) ₹ 12100

c) ₹ 11000

d) ₹ 12000

19. **Assertion(A):** If A, B and C are three mutually exclusive and exhaustive events such that $P(C) = \frac{1}{4}P(B)$ and $p(A) = \frac{1}{2}p(B)$, then $p(B) = \frac{3}{7}$ [1]

Reason(R): For three mutually exclusive and exhaustive events A, B and C

$$P(A) + P(B) + P(C) = 1.$$

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** The Total no. words with letters of the word civilization (all taken at a time) is 19958393. [1]

Reason (R): The number of permutation of n distincts objects (r taken at a time) is ${}^n P_r$.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, prove that $2x \frac{dy}{dx} = \sqrt{x} - \frac{1}{\sqrt{x}}$ [2]

OR

Differentiate the following functions with respect to x: $5^{3-x^2} + (3-x^2)^5$

22. Arrange the following words in a logical and meaningful order. [2]

1. Country 2. Furniture 3. Forest 4. Wood 5. Trees

OR

In a certain language if **CORONA** is coded as 6 and **MALARIA** is coded as 5 then how **CANCER** coded?

23. A takes 2 hours more than B to walk d km, but if A doubles his speed, then he can make it in 1 hour less than B. How much time does B require for walking d km? [2]

24. If A and B are two events associated with a random experiment such that $P(A) = 0.25$, $P(B) = 0.4$ and $P(A \text{ or } B) = 0.5$, find the values of [2]

i. $P(A \text{ and } B)$

ii. $P(A \text{ and } \bar{B})$

25. If the second day of April month is a Friday, then find the last day of the next month. [2]

Section C

26. Let f be the function defined as [3]

$$f(x) = \begin{cases} \frac{2x}{\sqrt{a+x}-\sqrt{a-x}}, & \text{if } x \neq 0 \\ 3k, & \text{if } x = 0 \end{cases}, a > 0. \text{ For what value of } k, \text{ function is continuous at } x = 0?$$

27. A polygon has 35 diagonals. Find the number of its sides. [3]

OR

Five boys and 5 girls are to be seated on a bench with the boys and girls alternately. Find the number of ways of their seating.

28. A man borrowed ₹5000 for 4 years under the following terms: 4% simple interest for the first $2\frac{1}{2}$ years, 4% compound interest for the rest of the period on the amount due after $2\frac{1}{2}$ years, the interest being compounded semi-annually. How much should he pay to settle the account? [3]

29. In a survey of 60 people, it was found that 25 people read Newspaper H, 26 read Newspaper T, 26 read Newspaper I, 9 read both H and I, 11 read both H and T, 8 read both T and I, 3 read all the three Newspapers. Find [3]

- the number of people who read at least one of the three Newspapers.
- the number of people who read exactly one Newspaper.

30. Find the values of the letter and give a reason for the steps involved. [3]

$$\begin{array}{r} B\ 3\ 4\ 5 \\ + C\ 9\ B\ A \\ \hline 8\ B\ A\ 2 \end{array}$$

31. For an industrial connection monthly consumption of water is 40 Kl, calculate the Water bill. Tariff rates can be considered as the table given below: [3]

| Monthly Consumption (in Kilolitre) | Service Charge (in ₹) | Volumetric Charge (Per Kl in ₹) |
|--|-----------------------|---------------------------------|
| Upto 20 | 146.41 | 5.27 |
| 20-30 | 219.62 | *26.36 |
| > 30 | 292.82 | 43.93 |
| Plus Sewer Maintenance Charges: 60% of water volumetric charge | | |

Section D

32. Find the mean, variance and standard deviation for the following frequency distribution: [5]

| Classes | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
|-----------|------|-------|-------|-------|-------|
| Frequency | 5 | 8 | 15 | 16 | 6 |

OR

The weights of sons and fathers (in kilograms) are given below:

| Weight of father | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 72 |
|------------------|----|----|----|----|----|----|----|----|
| Weight of son | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 |

Find the coefficient of correlation.

33. Consider the real function $f: \mathbb{R} \rightarrow \mathbb{R}: f(x) = x + 5$ for all $x \in \mathbb{R}$. Find its domain and range. Draw the graph of this function. [5]
34. Find four numbers forming a geometric progression in which the third term is greater than the first term by 9, and the second term is greater than the 4th by 18. [5]



OR

Divide 32 into four parts which are in AP such that the product of extremes is to the product of means as 7 : 15.

35. An air conditioner manufacturer allows a discount of 10% on marked price to dealer and the dealer sells the air conditioner to a consumer at a discount of 4% on marked price. If the marked price is ₹ 50,000 and the sales are intra-state sales with GST at 18%. Find: [5]
- the total amount paid by the consumer to the dealer.
 - the GST paid by the consumer to the dealer.
 - the GST paid by the dealer to the central and state governments.
 - the GST paid by the manufacturer to the central and state governments.

Section E

36. Read the text carefully and answer the questions: [4]

The marks scored by five students in a test for 25 marks are: 8, 13, 12, 15, 22.



- What is the Mean of the data?
- What is the variance of the given data?
- What is the Standard Deviation of the data?

OR

What is the Mean of first 20 natural numbers?

37. Read the text carefully and answer the questions: [4]

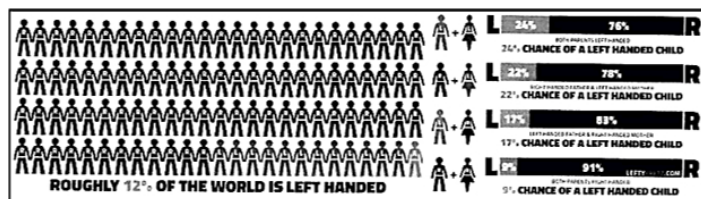
In a game a girl rolls a die, if she gets an even number she will toss a coin if she gets head in coin, she will win ₹ 10 if she gets tail in coin she will win ₹ 5. If she gets odd number in die she has to pay ₹ 20 to organiser.

- Find the total number of sample points in sample space?
- Find the probability that girl will win ₹ 10?
- Find the probability that girl will win ₹ 5?

OR

- Read the text carefully and answer the questions: [4]

Recent studies suggest that roughly 12% of the world population is left handed.



Depending upon the parents, the chances of having a left handed child are as follows:

A. When both father and mother are left handed:

Chances of left handed child is 24%.



B. When father is right handed and mother is left handed:

Chances of left handed child is 22%.

C. When father is left handed and mother is right handed:

Chances of left handed child is 17%.

D. When both father and mother are right handed:

Chances of left handed child is 9%.

Assuming that $P(A) = P(B) = P(C) = P(D) = \frac{1}{4}$ and L denotes the event that child is left handed.

(a) Find $P\left(\frac{L}{C}\right)$

(b) Find $P\left(\frac{\bar{L}}{A}\right)$

(c) Find $P\left(\frac{A}{L}\right)$

38. **Read the text carefully and answer the questions:**

[4]

During function lots of charts and displays are made with different colours, one such display is of concentric circles.

A circle is drawn whose equation is $x^2 + y^2 - 4x - 6y - 12 = 0$ and based on this other consecutive circles are drawn.

(a) Find the centre of given circle?

(b) Find the radius of given circle?

(c) Find the point which lies in the interior of circle?

OR

Find the Equation of a circle concentric with given circle, whose radius is double the radius of given circle?



Solution

Section A

1.

(c) 3

Explanation:

$$\log_2 8 = \log_2 (2^3) = 3 \log_2 2 = 3$$

[Applying rules $\log_a m^n = n \log_a m$ and $\log_a a = 1$]

2.

(c) $M.D. = \frac{\sum f|d|}{\sum f}$

Explanation:

The general formula of Mean is $\bar{x} = \frac{\sum x_1 f_1}{\sum f_1}$

For mean deviation, $d = (x - \text{mean})$

$$M.D. = \frac{\sum f|d|}{\sum f}$$

3.

(d) 3 years

Explanation:

Let the time required be n , then

$$1562.50 \left(1 + \frac{4}{100}\right)^n - 1562.50 = 195.10$$

$$\Rightarrow \left(\frac{26}{25}\right)^n = \frac{1562.50 + 195.10}{1562.50} = \frac{1757.60}{1562.50} = \left(\frac{26}{25}\right)^3$$

$$\Rightarrow n = 3.$$

4.

(c) 11000

Explanation:

$$1101111 = 1 \times 2^6 + 1 \times 2^5 + 0 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 111$$

$$11000 = 1 \times 2^4 + 1 \times 2^3 + 0 + 0 + 0 = 16 + 8 = 24$$

$$111111 = 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 63$$

$$11001 = 1 \times 2^4 + 1 \times 2^3 + 0 + 0 + 1 \times 2^0 = 16 + 4 + 1 = 21$$

5.

(a) $\bar{4}$

Explanation:

$$0.0003798 = 3.798 \times 10^{-4}$$

\therefore Characteristic of $\log 0.0003798 = -4$ i.e. $\bar{4}$

6.

(c) $\frac{8}{27}$

Explanation:

$$\begin{aligned} \left(5\frac{1}{16}\right)^{-\frac{3}{4}} &= \left(\frac{81}{16}\right)^{-\frac{3}{4}} = \left(\frac{16}{81}\right)^{\frac{3}{4}} = \left(\frac{2^4}{3^4}\right)^{\frac{3}{4}} \\ &= \left(\frac{2}{3}\right)^3 = \frac{8}{27} \end{aligned}$$



7.

(b) 38

Explanation:

Let the numbers are x_1, x_2, x_3, x_4 and x_5 . Then,

we have, $\frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} = 30$

$$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 = 150 \dots (i)$$

Now, suppose x_1 is excluded, then $\frac{x_2 + x_3 + x_4 + x_5}{4} = 28$ [given]

$$\Rightarrow x_2 + x_3 + x_4 + x_5 = 112 \dots (ii)$$

From Eqs. (i) and (ii), we get $x_1 = 150 - 112 = 38$

8.

(c) 60 percent

Explanation:

Let A denote the set of persons traveling by car, B denotes the set of persons traveling by bus, then

$$n(A) = 20, n(B) = 50, n(A \cap B) = 10$$

$$\therefore n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$= 20 + 50 - 10 = 60$$

9.

(c) 2^{16}

Explanation:

No. of elements in the set $A = 4$. Therefore, the no. of elements in $A \times A = 4 \times 4 = 16$. As, the no. of relations in $A \times A =$ no. of subsets of $A \times A = 2^{16}$.

10. (a) $\{(3, 3), (3, 1), (5, 2)\}$

Explanation:

Inverse of a relation is given by interchanging the element's position in each pair.

Ex: Inverse of relation $P = \{(x, y)\}$ is given by $P^{-1} = \{(y, x)\}$.

Therefore, $R^{-1} = \{(3, 1), (5, 2), (3, 3)\}$.

11. (a) 2

Explanation:

2

In a binary number system, we use only two digits, such as 0 and 1.

12.

(d) There is interstate supply

Explanation:

Integrated Goods and Services Tax is applicable when there is interstate supply.

13.

(b) 80C

Explanation:

The Principal portion of the EMI paid for the year is allowed as a deduction under Section 80C. The maximum amount that can be claimed is up to Rs 1.5 lakh. But to claim this deduction, the house property should not be sold within 5 years of possession.

14.

(b) JTSW

Explanation:

we have

$$\begin{array}{cccc} \text{F} & \text{O} & \text{U} & \text{L} \\ +2\downarrow & -1\downarrow & +1\downarrow & +3\downarrow \\ \text{H} & \text{N} & \text{V} & \text{O} \end{array}$$

Therefore

$$\begin{array}{cccc} \text{H} & \text{U} & \text{R} & \text{T} \\ +2\downarrow & -1\downarrow & +1\downarrow & +3\downarrow \\ \text{J} & \text{T} & \text{S} & \text{W} \end{array}$$

15.

(c) 10

Explanation:

10

16.

(b) $\frac{P(A) - P(AB)}{1 - P(B)}$

Explanation:

$$\begin{aligned} P(A/B') &= \frac{P(A \cap B')}{P(B')} \\ &= \frac{P(A) - P(A \cap B)}{1 - P(B)} = \frac{P(A) - P(AB)}{1 - P(B)} \end{aligned}$$

17. (a) 150°

Explanation:

let α be the inclination of line with the x-axis then

slope = $\tan \alpha$

so $\tan \alpha = -\frac{1}{\sqrt{3}}$

$= -\tan 30^\circ$

$= \tan (180^\circ - 30^\circ)$

$\tan \alpha = \tan 150^\circ$

$\Rightarrow \alpha = 150^\circ$

18.

(b) ₹ 12100

Explanation:

Let him pay ₹ R at the end of each year.

$$\therefore 21000 = R \left[\frac{100}{100+10} + \left(\frac{100}{100+10} \right)^2 \right]$$

$$\Rightarrow 21000 = R \left[\frac{100}{110} + \left(\frac{100}{110} \right)^2 \right] = R \left[\frac{10}{11} + \frac{100}{121} \right] = R \left[\frac{210}{121} \right]$$

$$\therefore R = \frac{21000 \times 121}{210} = ₹12100.$$

19.

(d) A is false but R is true.

Explanation:

We know that for three mutually exclusive and exhaustive events A, B and C

$$P(A) + P(B) + P(C) = 1$$

\therefore R is true.

$$\text{So, } \frac{1}{2}P(B) + P(B) + \frac{1}{4}P(B) = 1 \left(\because P(A) = \frac{1}{2}P(B) \text{ and } P(C) = \frac{1}{4}P(B) \right)$$

$$\Rightarrow \frac{7}{4}P(B) = 1 \Rightarrow P(B) = \frac{4}{7}$$

∴ A is false.

20.

(d) A is false but R is true.

Explanation:

Civilization: Letter $\Rightarrow 12$

i repeats 4 times

$$\text{Total no. of rearrangement} = \frac{12!}{4!}$$

$$= 19958400$$

Section B

21. We have, $y = \sqrt{x} + \frac{1}{\sqrt{x}}$

Differentiate with respect to x,

$$\Rightarrow \frac{dy}{dx} = \frac{d}{dx} \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)$$

$$\Rightarrow \frac{dy}{dx} = \frac{d}{dx}(\sqrt{x}) + \frac{d}{dx} \left(\frac{1}{\sqrt{x}} \right)$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2\sqrt{x}} + \left(\frac{-\frac{1}{2\sqrt{x}}}{x} \right)$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2\sqrt{x}} - \frac{1}{2x\sqrt{x}}$$

$$\Rightarrow \frac{dy}{dx} = \frac{x-1}{2x\sqrt{x}}$$

$$\Rightarrow 2x \frac{dy}{dx} = \frac{x-1}{\sqrt{x}}$$

$$\Rightarrow 2x \frac{dy}{dx} = \frac{x}{\sqrt{x}} - \frac{1}{\sqrt{x}}$$

$$\Rightarrow 2x \frac{dy}{dx} = \sqrt{x} - \frac{1}{\sqrt{x}}$$

OR

$$\text{Let } y = 5^{3-x^2} + (3-x^2)^5$$

Differentiating with respect to x, we get

$$\frac{dy}{dx} = \frac{d}{dx} \left(5^{3-x^2} \right) + \frac{d}{dx} \left\{ (3-x^2)^5 \right\}$$

$$\Rightarrow \frac{dy}{dx} = 5^{3-x^2} \log_e 5 \times \frac{d}{dx} (3-x^2) + 5(3-x^2)^{5-1} \times \frac{d}{dx} (3-x^2)$$

$$\Rightarrow \frac{dy}{dx} = 5^{3-x^2} \log_e 5 \times (0-2x) + 5(3-x^2)^4 \times (0-2x)$$

$$\Rightarrow \frac{dy}{dx} = -2x \{ 5^{3-x^2} \log_e 5 + 5(3-x^2)^4 \}$$

22. From the forest, given words, we can say that country contains forest, for has trees, trees have wood that is used to make furniture, Hence, the correct order of the given words is 1, 3, 5, 4, 2.

OR

$$C = 3, O = 15, R = 18, N = 14, A = 1$$

$$\text{CORONA} = 3 + 15 + 18 + 15 + 14 + 1$$

$$= \frac{66}{11} = 6$$

$$M = 13, A = 1, L = 12, R = 18, I = 9$$

$$\text{MALARIA} = 13 + 1 + 12 + 1 + 18 + 9 + 1$$

$$= \frac{55}{11} = 5$$

$$\text{CORONA} \rightarrow 6$$

$$\text{MALARIA} \rightarrow 5$$

$$\text{CANCER}$$

$$= 3 + 1 + 14 + 3 + 5 + 18$$

$$= \frac{44}{11} = 4$$

Thus CANCER is coded as '4'

23. Suppose B takes x hours to walk d km. Then A takes (x + 2) hours to walk d km.

$$\text{A's speed} = \left(\frac{d}{x+2} \right) \text{ km/hr, B's speed} = \left(\frac{d}{x} \right) \text{ km/hr}$$



$$A's \text{ new speed} = \left(\frac{2d}{x+2} \right) \text{ km/hr}$$

It is given that

$$\frac{\frac{d}{x}}{\left(\frac{2d}{x+2} \right)} = 1$$

$$\Rightarrow x - \left(\frac{x+2}{2} \right) = 1 \Rightarrow 2x - x - 2 = 2 \Rightarrow x = 4$$

Hence, B requires 4 hours to walk d km

24. i. It is given that

$$: P(A) = 0.25, P(A \text{ or } B) = 0.5 \text{ and } P(B) = 0.4$$

To find : $P(A \text{ and } B)$

$$\text{Formula used : } P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Substituting the value in the above formula we get,

$$0.5 = 0.25 + 0.4 - P(A \text{ and } B)$$

$$0.5 = 0.65 - P(A \text{ and } B)$$

$$P(A \text{ and } B) = 0.65 - 0.5$$

$$P(A \text{ and } B) = 0.15$$

ii. Given : $P(A) = 0.25, P(A \text{ and } B) = 0.15$ (from part (i))

To find : $P(A \text{ and } \bar{B})$

$$\text{Formula used : } P(A \text{ and } \bar{B}) = P(A) - P(A \text{ and } B)$$

Substituting the value in the above formula we get,

$$P(A \text{ and } \bar{B}) = 0.25 - 0.15$$

$$P(A \text{ and } \bar{B}) = 0.10$$

$$P(A \text{ and } \bar{B}) = 0.10$$

25. Given 2nd April is Friday.

From 3rd April to last day of the next month.

$$\text{Number of days} = 28 \text{ April} + 31 \text{ May} = 59$$

So, the number of odd days = $7 \times 8 + 3$ i.e. 3 days

Since 2nd April is Friday and there are 3 odd days up to last day of next month i.e. Saturday, Sunday, Monday.

\therefore The last day of the next month is Monday.

Section C

$$26. f(x) = \begin{cases} \frac{2x}{\sqrt{a+x} - \sqrt{a-x}} & , \text{ if } x \neq 0 \\ 3k & \text{ if } x = 0 \end{cases}$$

\therefore function is continuous

$$\therefore \lim_{x \rightarrow 0} f(x) = f(0).$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{2x}{\sqrt{a+x} - \sqrt{a-x}} = 3k$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{2x(\sqrt{a+x} + \sqrt{a-x})}{(\sqrt{a+x} - \sqrt{a-x})(\sqrt{a+x} + \sqrt{a-x})} = 3k$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{2x(\sqrt{a+x} + \sqrt{a-x})}{a+x - (a-x)} = 3k$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{2x(\sqrt{a+x} + \sqrt{a-x})}{a+x - a+x} = 3k$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{2x\sqrt{a+x} + \sqrt{a-x}}{2x} = 3k$$

$$\Rightarrow \sqrt{a} + \sqrt{a} = 3k$$

$$\Rightarrow 2\sqrt{a} = 3k$$

$$\Rightarrow k = \frac{2\sqrt{a}}{3}$$

27. Let n be the number of sides of a polygon and D be the number of diagonals of that polygon.

$$\text{We know that, } D = {}^nC_2 - n = \frac{n(n-3)}{2}$$

$$35 = \frac{n^2 - 3n}{2}$$

$$\Rightarrow n^2 - 3n - 70 = 0$$

$$\Rightarrow (n - 10)(n + 7) = 0$$

$$\Rightarrow n = 10, -7$$

Since, sides cannot be negative, therefore $n = 10$.

Hence, polygon is a decagon.

OR

Mark the seat numbers on the bench as 1, 2, 3, ..., 10 as shown:

$\times \quad \times \quad \times \quad \times \quad \times \quad \times \quad \times \quad \times \quad \times \quad \times$
 1 2 3 4 5 6 7 8 9 10

The boys and girls will sit alternately if the boys sit at seat numbers 1, 3, 5, 7 and 9 or sit on the seat numbers 2, 4, 6, 8 and 10. The girls will sit on the remaining seats.

Now 5 boys can be arranged among themselves in $|5|$ ways and 5 girls can be arranged among themselves in $|5|$ ways.

\therefore Required number of ways = $|5| \times |5| \times 2 = 120 \times 120 \times 2 = 28800$

28. For first $2\frac{1}{2}$ year.

$P = ₹5000$, $R = 4\%$, $T = 2\frac{1}{2}$ year = $\frac{5}{2}$ year

$$I = ₹ \frac{5000 \times 4 \times 10}{2 \times 100}$$

$$= 250 \times 4$$

$$= 1000$$

$$A = 5000 + 1000 = 6000$$

For remaining $1\frac{1}{2}$ year: $P = 6000$, $T = \frac{3}{2}$ year, $R = 4\%$ p.a.

$$A = P \left(1 + \frac{R}{200} \right)^{2n}$$

$$= 6000 \left(1 + \frac{4}{200} \right)^{\frac{3}{2} \times 2}$$

$$= 6000 \left(\frac{51}{50} \right)$$

$$= 6000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}$$

$$= \frac{795906}{125} = ₹6367.248$$

Total amount to be paid = ₹6367.248

29. Here

$$n(U) = a + b + c + d + e + f + g + h = 60 \dots (i)$$

$$n(H) = a + b + c + d = 25 \dots (ii)$$

$$n(T) = b + c + f + g = 26 \dots (iii)$$

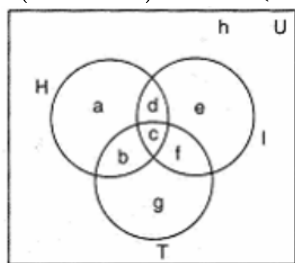
$$n(I) = c + d + e + f = 26 \dots (iv)$$

$$n(H \cap I) = c + d = 9 \dots (v)$$

$$n(H \cap T) = b + c = 11 \dots (vi)$$

$$n(T \cap I) = c + f = 8 \dots (vii)$$

$$n(H \cap T \cap I) = c = 3 \dots (viii)$$



Putting value of c in (vii),

$$3 + f = 8 \Rightarrow f = 5$$

Putting value of c in (vi),

$$3 + b = 11 \Rightarrow b = 8$$

Putting values of c in (v),

$$3 + d = 9 \Rightarrow d = 6$$

Putting value of c, d, f in (iv),

$$3 + 6 + e + 5 = 26 \Rightarrow e = 26 - 14 = 12$$

Putting value of b, c, f in (iii),

$$8 + 3 + 5 + g = 26 \Rightarrow g = 26 - 16 = 10$$

Putting value of b, c, d in (ii),

$$a + 8 + 3 + 6 = 25 \Rightarrow a = 25 - 17 = 8$$

i. Number of people who read at least one of the three newspapers

$$= a + b + c + d + e + f + g$$

$$= 8 + 8 + 3 + 6 + 12 + 5 + 10 = 52$$

ii. Number of people who read exactly one newspapers

$$= a + e + g$$

$$= 8 + 12 + 10 = 30$$

$$B \ 3 \ 4 \ 5$$

$$30. \quad \begin{array}{r} +C \ 9 \ B \ A \\ \hline \end{array}$$

$$\begin{array}{r} 8 \ B \ A \ 2 \\ \hline \end{array}$$

We have to find the value of A, B, and C.

For this, $5 + A$ we get 2, a number whose unit digit is 2

$$\text{Clearly } 5 + 7 = 12$$

So, $A = 7$, and Question becomes,

$$1$$

$$B \ 3 \ 4 \ 5$$

$$\begin{array}{r} +C \ 9 \ B \ 7 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \ B \ 7 \ 2 \\ \hline \end{array}$$

Now, we have $1 + 4 + B = 7$, A number whose unit digit is 7

So, the number should be 2, as $1 + 4 + 2 = 7$

$$\therefore B = 2$$

Now, the question reduced to,

$$1 \ 1$$

$$2 \ 3 \ 4 \ 5$$

$$\begin{array}{r} +C \ 9 \ 2 \ 7 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \ 2 \ 7 \ 2 \\ \hline \end{array}$$

Again we have $1 + 2 + C = 8$

So, the number should be 5, as $1 + 2 + 5 = 8$

$$\therefore C = 5$$

So, the question reduced to,

$$1 \ 1$$

$$2 \ 3 \ 4 \ 5$$

$$\begin{array}{r} +5 \ 9 \ 2 \ 7 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \ 2 \ 7 \ 2 \\ \hline \end{array}$$

Hence, $A = 7$; $B = 2$; $C = 5$

$$31. \text{ Volumetric Charge for consumption upto } 20\text{kl} = ₹ 20 \times 5.27 = ₹ 105.4$$

$$\text{Volumetric Charge for consumption between } 20\text{-}30 \text{ kl} = ₹ 10 \times 26.36 = ₹ 263.6$$

$$\text{Volumetric Charge for consumption between } 30\text{-}40 \text{ kl} = ₹ 10 \times 43.93 = ₹ 439.3$$

$$\text{Total volumetric Charge for consumption of } 40 \text{ kl} = ₹(105.4 + 263.6 + 439.3) = ₹ 808.3$$

$$\text{Service Charge} = ₹ 292.82$$

$$\text{Sewage Charges} = 60\% \text{ of Volumetric Charges}$$

$$= 808.3 \times 60\% = ₹ 484.98$$

$$\text{Amount of water bill for the given month} = ₹(808.3 + 292.82 + 484.98) = ₹ 1586.1$$

Thus, amount of domestic water bill is ₹ 1586.

Section D

| 32. | Class | Frequency f_i | Mid-point x_i | $\frac{y_i(x_i - 25)}{10}$ | y_i^2 | $f_i y_i$ | $f_i y_i^2$ |
|-----|-------|-----------------|-----------------|----------------------------|---------|-----------|-------------|
| | 0-10 | 5 | 5 | -2 | 4 | -10 | 20 |
| | 10-20 | 8 | 15 | -1 | 1 | -8 | 8 |
| | 20-30 | 15 | 25 | 0 | 0 | 0 | 0 |
| | | | | | | | |



| | | | | | | |
|-------|----|----|---|---|----|----|
| 30-40 | 16 | 35 | 1 | 1 | 16 | 16 |
| 40-50 | 6 | 45 | 2 | 4 | 12 | 24 |
| | 50 | | | | 10 | 68 |

$$\text{Mean, } \bar{x} = A + \frac{\sum_{i=1}^5 f_i y_i}{N} \times h = 25 + \frac{10}{50} \times 10 = 25 + 2 = 27$$

$$\text{Variance } (\sigma^2) = \frac{h^2}{N^2} \left[N \sum_{i=1}^5 f_i y_i^2 - \left(\sum_{i=1}^5 f_i y_i \right)^2 \right]$$

$$= \frac{(10)^2}{(50)^2} [50 \times 68 - (10)^2]$$

$$= \frac{1}{25} [3400 - 100] = \frac{3300}{25}$$

$$= 132$$

OR

Assumed mean for weight of father be A = 67 and for weight of son be B = 68. We construct the following table:

| x | u = x - A | u ² | y | v = y - B | v ² | uv |
|----|-----------|----------------|----|-----------|----------------|----|
| 65 | -2 | 4 | 67 | -1 | 1 | 2 |
| 66 | -1 | 1 | 68 | 0 | 0 | 0 |
| 67 | 0 | 0 | 65 | -3 | 9 | 0 |
| 67 | 0 | 0 | 68 | 0 | 0 | 0 |
| 68 | 1 | 1 | 72 | 4 | 16 | 4 |
| 69 | 2 | 4 | 72 | 4 | 16 | 4 |
| 70 | 3 | 9 | 69 | 1 | 1 | 3 |
| 72 | 5 | 25 | 71 | 3 | 9 | 15 |
| | 8 | 44 | | 8 | 52 | 32 |

Here, N = 8

$$\therefore r = \frac{\sum uv - \frac{1}{N} \sum u \sum v}{\sqrt{\sum u^2 - \frac{(\sum u)^2}{N}} \sqrt{\sum v^2 - \frac{(\sum v)^2}{N}}} = \frac{32 - \frac{1}{8} \times 8 \times 8}{\sqrt{44 - \frac{8^2}{8}} \sqrt{52 - \frac{8^2}{8}}}$$

$$= \frac{24}{\sqrt{36} \sqrt{44}} = 0.603$$

33. Here we have, $f(x) = x + 5 \forall x \in \mathbb{R}$

We need to find the Domain and Range of $f(x)$.

The domain of the given function is all real numbers except where the expression is undefined. In this case, there is no real number which makes the expression undefined.

As $f(x)$ is a polynomial function, we can have any value of x

Therefore,

$$\text{Domain } (f) = (-\infty, \infty) \{x | x \in \mathbb{R}\}$$

Now,

$$\text{Let } y = f(x)$$

$$y = x + 5$$

$$x = y - 5$$

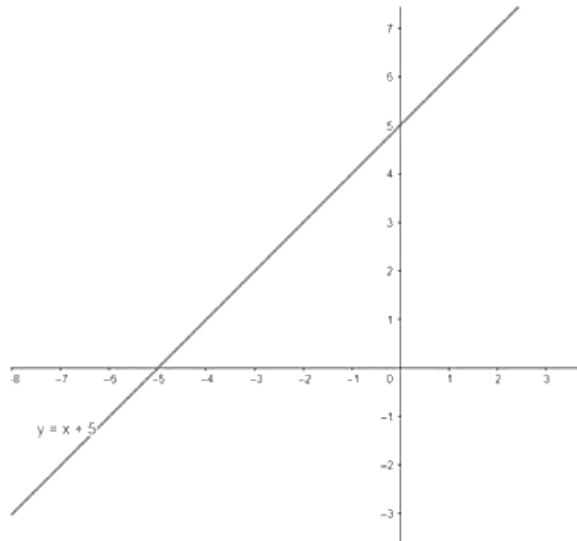
The range is set of all valid values of y .

Therefore,

$$\text{Range}(f) = (-\infty, \infty) \{y | y \in \mathbb{R}\}$$



Graph:



34. Let the four numbers in G.P. be a , ar , ar^2 , ar^3

$$\therefore ar^2 = a + 9 \text{ and } ar = ar^3 + 18$$

$$\text{Now, } ar^2 - a = 9$$

$$\Rightarrow a(r^2 - 1) = 9 \dots(i)$$

$$\text{And } ar - ar^3 = 18$$

$$\Rightarrow ar(1 - r^2) = 18$$

$$\Rightarrow -ar(r^2 - 1) = 18 \dots(ii)$$

Dividing eq. (ii) by eq. (i), we have

$$\frac{-ar(r^2 - 1)}{a(r^2 - 1)} = \frac{18}{9}$$

$$\Rightarrow r = -2$$

Putting value of r in eq. (i), we get

$$a(4 - 1) = 9$$

$$\Rightarrow a = 3$$

$$\therefore ar = 3 \times (-2) = -6$$

$$ar^2 = 3 \times (-2)^2 = 12$$

$$ar^3 = 3 \times (-2)^3 = -24$$

Therefore, the required numbers are 3, -6, 12, -24

OR

Let four parts be $(a - 3d)$, $(a - d)$, $(a + d)$ and $(a + 3d)$.

Then, Sum of four parts = 32

$$\Rightarrow (a - 3d) + (a - d) + (a + d) + (a + 3d) = 32$$

$$\Rightarrow 4a = 32$$

$$\Rightarrow a = 8$$

$$\text{and } \frac{(a - 3d)(a + 3d)}{(a - d)(a + d)} = \frac{7}{15}$$

$$\Rightarrow \frac{a^2 - 9d^2}{a^2 - d^2} = \frac{7}{15}$$

$$\Rightarrow \frac{64 - 9d^2}{64 - d^2} = \frac{7}{15} \text{ [put } a = 8]$$

$$\Rightarrow 960 - 135d^2 = 448 - 7d^2$$

$$\Rightarrow 128d^2 = 512$$

$$\Rightarrow d^2 = 4$$

$$\therefore d = \pm 2$$

Hence, the required parts are $8 - 3 \times 2$, $8 - 2$, $8 + 2$, $8 + 3 \times 2$ or $8 - 3(-2)$, $8 - (-2)$, $8 - 2$, $8 + 3(-2)$ i.e., 2, 6, 10, 14

35. The sales are intra-state sales with GST at 18 %. So, there are two components of GST (i) SGST at 9 % and (ii) CGST at 9 %

i. The manufacturer sells the air conditioner to the dealer at discount of 10 % on the marked price of ₹ 50,000.

$$\therefore \text{Discount} = 10 \% \text{ of } ₹ 50,000 = ₹ \left(\frac{10}{100} \times 50,000 \right) = ₹ 5000$$

Selling price of the air conditioner (S.P.) = ₹ 50,000 - ₹ 5000 = ₹ 45000.

CGST paid by the dealer to the manufacturer = 9 % of ₹ 45000.

$$= ₹ \left(\frac{9}{100} \times 45000 \right) = ₹ 4050$$

SGST paid by the dealer to the manufacturer = 9 % of ₹ 45000

$$= ₹ \left(\frac{9}{100} \times 45000 \right) = ₹ 4050$$

Total GST paid by the dealer to the manufacturer = ₹ 4050 + ₹ 4050

= ₹ 8100.

i.e. Input GST of the dealer = ₹ 8100.

The dealer sells the air conditioner at a discount of 4 % on marked price.

$$\therefore \text{Discount given by the dealer} = 4 \% \text{ of } ₹ 50,000 = ₹ \left(\frac{4}{100} \times 50,000 \right) = ₹ 2000$$

Selling price of the dealer = ₹ 50,000 - ₹ 2000 = ₹ 48000

$$\therefore \text{CGST paid by the consumer} = 9 \% \text{ of } ₹ 48000 = ₹ \left(\frac{9}{100} \times 48000 \right) = ₹ 4320$$

$$\text{SGST paid by the consumer} = 9 \% \text{ of } ₹ 48000 = ₹ \left(\frac{9}{100} \times 48000 \right) = ₹ 4320$$

Total GST paid by the consumer (output GST of dealer) = CGST + SGST

$$= ₹ 4320 + ₹ 4320 = ₹ 8640$$

Total amount paid by the consumer to the dealer = ₹ 48000 + ₹ 8640 = ₹ 56640

ii. GST paid by the consumer to the dealer = ₹ 8640.

iii. GST paid by the dealer to the central and state governments

= Output GST of dealer - Input GST of dealer

$$= ₹ 8640 - ₹ 8100 = ₹ 540$$

iv. GST paid by the manufacturer to the central and state governments

= Output GST of the manufacturer - Input of the manufacturer

$$= ₹ 8100 - ₹ 0 = ₹ 8100$$

Section E

36. Read the text carefully and answer the questions:

The marks scored by five students in a test for 25 marks are: 8, 13, 12, 15, 22.



$$(i) \text{ Mean} = \frac{12+8+13+15+22}{5} \\ = 14$$

$$(ii) \text{ Since, mean } (\bar{x}) = 14$$

| x_i | $x_i - \bar{X}$ | $(x_i - \bar{X})^2$ |
|-------|-----------------|---------------------|
| 8 | -6 | 36 |
| 12 | -2 | 4 |
| 13 | -1 | 1 |
| 15 | 1 | 1 |
| 22 | 8 | 64 |

$$\begin{aligned}\text{Var}(X) &= \frac{1}{n} \sum (x_i - \bar{X})^2 \\ &= \frac{106}{5} = 21.2\end{aligned}$$

$$\begin{aligned}\text{(iii) Standard Deviation} &= \sqrt{\text{Var.}} \\ &= \sqrt{21.2} = 4.604\end{aligned}$$

OR

$$\begin{aligned}\text{Sum of first 20 natural numbers} &= S_{20} \\ &= \frac{20}{2} [2 \times 1 + (19)1] \\ S_{20} &= 210 \\ \text{Mean} &= \frac{210}{20} \\ &= 10.5\end{aligned}$$

37. Read the text carefully and answer the questions:

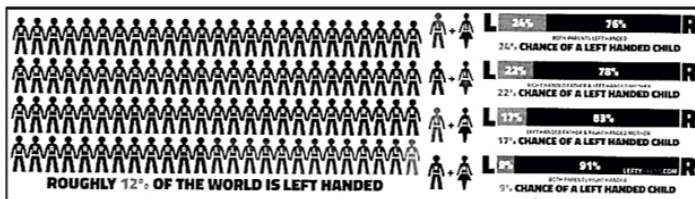
In a game a girl rolls a die, if she gets an even number she will toss a coin. If she gets head in coin, she will win ₹ 10 if she gets tail in coin she will win ₹ 5. If she gets odd number in die she has to pay ₹ 20 to organiser.

- (i) Total sample points = 9
- (ii) Girl will win ₹ 10 if she get head
 $E = \{(2H), (4H), (6H)\}$
 $P(E) = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} = \frac{3 \times 1}{12} = \frac{1}{4}$
- (iii) Girl will win ₹ 5 if she get tail
 $F = \{(2T), (4T), (6T)\}$
 $P(F) = \frac{3 \times 1}{12} = \frac{1}{4}$

OR

Read the text carefully and answer the questions:

Recent studies suggest that roughly 12% of the world population is left handed.



Depending upon the parents, the chances of having a left handed child are as follows:

- A. When both father and mother are left handed:
 Chances of left handed child is 24%.
- B. When father is right handed and mother is left handed:
 Chances of left handed child is 22%.
- C. When father is left handed and mother is right handed:
 Chances of left handed child is 17%.
- D. When both father and mother are right handed:
 Chances of left handed child is 9%.

Assuming that $P(A) = P(B) = P(C) = P(D) = \frac{1}{4}$ and L denotes the event that child is left handed.

- (i) $P\left(\frac{L}{C}\right) = \frac{17}{100}$
- (ii) $P\left(\frac{L}{A}\right) = 1 - P\left(\frac{L}{A}\right) = 1 - \frac{24}{100} = \frac{76}{100}$ or $\frac{19}{25}$
- (iii) $P\left(\frac{A}{L}\right) = \frac{\frac{1}{4} \times \frac{24}{100}}{\frac{1}{4} \times \frac{24}{100} + \frac{1}{4} \times \frac{22}{100} + \frac{1}{4} \times \frac{17}{100} + \frac{1}{4} \times \frac{9}{100}} = \frac{24}{72} = \frac{1}{3}$

38. Read the text carefully and answer the questions:

During function lots of charts and displays are made with different colours, one such display is of concentric circles.

A circle is drawn whose equation is $x^2 + y^2 - 4x - 6y - 12 = 0$ and based on this other consecutive circles are drawn.

- (i) $x^2 + y^2 - 4x - 6y - 12 = 0$
 Here, $2g = -4$, $2f = -6$, $c = -12$
 $g = -2$, $f = -3$, $c = -12$
 Centre $(-g, -f) = (2, 3)$
- (ii) $r = \sqrt{4 + 9 + 12} = \sqrt{25} = 5$ units

(iii) as $\sqrt{(2-0)^2 + (3-3)^2} < 5$

hence, (0,3) lies inside the circle.

OR

Radius of given circle = 5

Radius of required circle = 10

\therefore Circle is $(x-2)^2 + (y-3)^2 = (10)^2$

$\Rightarrow x^2 + y^2 - 4x - 6y - 87 = 0$