Class XI Session 2024-25
Subject - Applied Mathematics
Sample Question Paper - 10

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. Which of the formula is related to Bayes' theorem? **[1]**

a) $P\left(\frac{A}{B}\right)=\frac{P\left(\frac{B}{A}\right)}{P(B)}$

b) $P\left(\frac{A}{B}\right)=\frac{1}{P(B)}$

c) $P\left(\frac{A}{B}\right)=\frac{P\left(\frac{B}{A}\right)\cdot P(A)}{P(B)}$

d) $P\left(\frac{A}{B}\right)=\frac{P(A)}{P(B)}$

2. The mean of 100 observations is 50 and their standard deviation is 5. The sum of all squares of all the observations is **[1]**

a) 252500

b) 50,000

c) 250,000

d) 255000

3. The compound interest on ₹ 50000 at 5% per annum is ₹ 5125. The time period is: **[1]**

a) 2 years

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

c) 3 years

d) $1\frac{1}{2}$ years

4. $(64)^{\frac{2}{3}}$ is equal to **[1]**

a) 12

b) 4

c) 16

d) 8

5. Let R be the relation in the set N given by R = {(a, b) : a = b – 2, b > 6}. **[1]**

a) (6, 8) ∈ R

b) (8, 7) ∈ R

c) $(2, 4) \in R$ d) $(3, 8) \in R$

6. The value of $3^{\frac{4}{\log_4 9}} + 27^{\frac{1}{\log_{36} 9}} + 81^{\frac{1}{\log_5 3}}$, is: **[1]**

a) 847 b) 860

c) 890 d) 857

7. If $P(A \cup B) = 0.8$ and $P(A \cap B) = 0.3$, then $P(A') + P(B')$ is equal to: **[1]**

a) 0.9 b) 1.1

c) 0.7 d) 0.5

8. If (x, 3) and (3, 5) are the extremities of a diameter of a circle with centre at (2, y), then the values of x and y are **[1]**

a) None of these b) (3, 1)

c) x = 4, y = 1 d) x = 8, y = 2

9. A and B together can do a piece of work in 10 days. C can do the same work alone in 15 days. If A, B and C work together, then number of days to finish the work is: **[1]**

a) 4 days b) 8 days

c) 6 days d) 5 days

10. Following are the marks obtained by 9 students in a mathematics test: 50, 69, 20, 33, 53, 39, 40, 65, 59 **[1]**
The mean deviation from the median is:

a) 12.67 b) 14.76

c) 9 d) 10.5

11. If log (3x + 1) = 2, then the value of x is **[1]**

a) $\frac{19}{3}$ b) 99

c) $\frac{1}{3}$ d) 33

12. The simple interest on a certain sum of money for 2 years at 10% per annum is half the compound interest on ₹ 5000 for 2 years at 10% per annum. The sum is: **[1]**

a) ₹ 2500 b) ₹ 2925

c) ₹ 2850 d) ₹ 2625

13. In how many ways can a cricket team be chosen out of a batch of 15 players, if a particular player is always chosen? **[1]**

a) 965 b) 1364

c) 1001 d) 364

14. A man is known to speak truth in 3 out of 4 times. He throws a dice and reports that it is a six. Then the probability that it is actually a six is **[1]**

a) $\frac{4}{9}$ b) $\frac{2}{7}$

c) $\frac{1}{6}$ d) $\frac{3}{8}$

15. A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the probability of getting exactly one red ball is **[1]**

a) $\frac{45}{196}$

b) $\frac{15}{56}$

c) $\frac{15}{29}$

d) $\frac{135}{392}$

16. The amount at the compound interest which is calculated yearly on a certain sum of money is ₹ 1250 is one year and ₹ 1375 in two years. The rate of interest per annum is: **[1]**

a) 9%

b) 10%

c) 8%

d) 11%

17. Out of 5 men and 2 women, a committee of 3 persons is to be formed so as to include at least one woman. The number of ways in which it can be done is **[1]**

a) 25

b) 35

c) 45

d) 10

18. Let n (A) = m, and n (B) = n. Then the total number of possible relations that can be defined from A to B is **[1]**

a) 2^{mn}

b) $m^n - 1$

c) $n^m - 1$

d) m^n

19. Consider the following data **[1]**

x_i	4	8	11	17	20	24	32
f_i	3	5	9	5	4	3	1

Assertion (A): The variance of the data is 45.8.

Reason (R): The standard deviation of the data is 6.77.

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):** In an AP., the sum of 4th term from the beginning and sum of 4th term from the end is equal to sum of 7th term from the beginning and 7th term from the end. **[1]**

Reason (R): Sum of first n terms of a AP., $S_n \frac{n}{2}(a+l)$, where a = first term, l = last term.

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. The average marks of 15 students are 45. If average marks of the first 8 students are 48 and that of the last 8 students is 42, find the marks obtained by 8th student. **[2]**

22. Are the following pair of sets equal? Give reason. A= {2, 3}; B = {x|x is a solution of $x^2 - 5x + 6 = 0$} **[2]**

OR

There are 210 members in a club. 100 of them drink tea and 65 drink tea but not coffee, each member drinks tea or coffee. Find how many drink coffee? How many drink coffee but not tea?

23. I travelled a certain distance at a speed of 40 km/h and the remaining distance at 60 km/h. The total distance of 240 km was covered in 5 hours. Find the distance covered at the speed of 40 km/h. **[2]**

24. Differentiate the function with respect to x: $\frac{1}{\sqrt{a^2-x^2}}$ **[2]**

OR

If y = $\sqrt{x} + \frac{1}{\sqrt{x}}$, prove that 2x$\frac{dy}{dx}$ + y = $2\sqrt{x}$

25. Convert the decimal number 394 to the binary number. **[2]**

Section C

26. The sum of the first four terms of an A.P. is 56. The sum of the last four terms is 112. If the first term is 11, then find the number of terms. **[3]**

OR

In an A.P., if the pth term is $\frac{1}{q}$ and qth term is $\frac{1}{p}$. Prove that the sum of first pq term is $\frac{1}{2}$ (pq + 1).

27. A line passes through P(1, 2) such that its intercept between the axes is bisected at P. Find the equation of line. **[3]**

28. Find the domain and range of f(x) = |2x - 3| - 3. **[3]**

29. Divide ₹15,500 into two parts such that if one part be lent out at 15 % per annum and the other at 24 % per annum, the total annual income is ₹3,000. **[3]**

30. In a factory the production of scooters rose to 46,305 from 40,000 in 3 years. Find the annual rate of growth of the product of scooters. **[3]**

31. If A = {1, 2, 3, 4, 5}, B = {2, 3, 4} and C = {2, 4, 5}; state whether the following statements are true or false. **[3]**

i. A $\subset$ B
ii. A $\subset$ C
iii. B $\subset$ A
iv. B $\subset$ C
v. C $\subset$ A
vi. C $\subset$ B
vii. B = C
viii. $\phi \subset$ B
ix. A $\leftrightarrow$ B
x. B $\leftrightarrow$ C
xi. A $\leftrightarrow$ C

Section D

32. The probability of a student A passing an examination is $\frac{3}{5}$ and of student B is $\frac{4}{5}$. Assuming that the two events **A passes**, **B passes** as independent. Find the probability of **[5]**

i. both the students passing the examination
ii. only A passing the examination
iii. only one of them passing the examination
iv. none of them passing the examination

OR

In a bolt factory, three machines, A, B, C, manufacture 25%, 35% and 40% of the total production respectively. Of their respective outputs, 5%, 4% and 2% are defective. A bolt is drawn at random from the total product and it is found to be defective. Find the probability that it was manufactured by the machine C.

33. For what value of λ is the function defined by $f(x) = \begin{cases} \lambda\left(x^2 - 2x\right), & \text{if } x \leq 0 \\ 4x + 1, & \text{if } x > 0 \end{cases}$ continuous at x = 0? **[5]**

34. While calculating the mean and variance of 10 readings, a student wrongly uses the reading 52 for the correct reading 25. He obtained the mean and variance as 45 and 16 respectively. Find the correct mean and variance. **[5]**

OR

The following table gives the number of finished articles turned out per day by different number of workers in a factory. Find the standard deviation of the daily output of finished articles.

Number of articles:	18	19	20	21	22	23	24	25	26	27
No. of workers:	3	7	11	14	18	17	13	8	5	4

35. Find the coordinates of the focus, axis of the parabola, the equation of the directrix and the length of the latus rectum: $x^2 = 6y$ **[5]**

Section E

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

A triangular park has two of its vertices as B(-4, 1) and C(2, 11). The third vertex A is a point dividing the line joining the points (3, 1) and (6, 4) in the ratio 2: 1.

(a) Find the coordinates of third vertex A.

(b) Find the equation of line passing through A and parallel to BC.

(c) Find the equation of the line passing through A and perpendicular to BC.

OR

Find the area of triangular field ABC.

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

In this age of competitions rank plays an important role. Let us try to answer some questions related to percentile rank with respect to the given data of marks of 10 students 13, 52, 42, 22, 44, 105, 45, 88, 90, 76.

(a) If score is 90, then find the percentile rank?

(b) If score is 52 then find the percentile rank?

(c) If score is 105 then find the percentile rank?

OR

If percentile rank is 60 then find the score?

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

The purpose of the student council is to give students an opportunity to develop leadership by organizing and carrying out school activities and service projects. Create an environment where every student can voice out their concern or need. Raju, Ravi Joseph, Sangeeta, Priya, Meena and Aman are members of student’s council. There is a photo session in a school these 7 students are to be seated in a row for photo session.

(a) Find the total number of arrangements so that Raju and Ravi are at extreme positions?

(b) Find the number of arrangements so that Joseph is sitting in the middle.

(c) Find the number of arrangements so that three girls are together.

(d) Find the number of arrangements so that Aman and Ravi are not together?

OR

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

Two friends Pankaj and Pooja were playing cards. There were 52 cards in a deck.

(a) In how many ways Sunil can select all four cards from same suit?

(b) In how many ways Anita can select four cards from different suit?

(c) In how many ways Sunil can select all face cards?

(d) In how many ways Anita can select two cards of same colour?

Solution

Section A

1.
   (c) $P\left(\frac{A}{B}\right)=\frac{P\left(\frac{B}{A}\right)\cdot P(A)}{P(B)}$
   Explanation: Since, $P\left(\frac{B}{A}\right)=\frac{P(B\cap A)}{P(A)}$
   $\therefore \frac{P\left(\frac{B}{A}\right)\cdot P(A)}{P(B)}=\frac{P(B\cap A)}{P(A)}\times\frac{P(A)}{P(B)}$
   $=\frac{P(B\cap A)}{P(B)}$
   $=\frac{P(A\cap B)}{P(B)}$
   $=P\left(\frac{A}{B}\right)$
2. **(a)** 252500
   Explanation: Given, $\bar{\mathbf{x}}$ = 50, n = 100 and σ = 5
   $\sigma=\frac{\sum x_i}{N}$
   $\sum x_i$ = 50 × 100
   $\sum x_i$ = 5000
   Now, $\sigma^2=\frac{\sum x_i^2}{N}-(\bar{x})^2$
   25 = $\frac{\sum x_i^2}{100}$ - $(50)^2$
   $\sum x_i^2$ = 252500
3. **(a)** 2 years
   Explanation: Let the time period be n.
   $\therefore 50000\left(1+\frac{5}{100}\right)^n$ - 50000 = 5125
   $\Rightarrow 50000\times\left(\frac{21}{20}\right)^n$ = 55125
   $\Rightarrow \left(\frac{21}{20}\right)^n=\frac{55125}{50000}=\frac{11025}{10000}=\frac{441}{400}=\left(\frac{21}{20}\right)^2$
   ⇒ n = 2.
4.
   (c) 16
   Explanation: as $(64)^{\frac{2}{3}}=4^{\frac{2}{3}\times 3}=4^2=16$
5. **(a)** (6, 8) ∈ R
   Explanation: (6, 8) ∈ R
   as b - 2 = 8 - 2 = 6 and b>6 .
6.
   (d) 857
   Explanation: 857
7. **(a)** 0.9
   Explanation: $P(A\cup B)=P(A)+P(B)-P(A\cap B)$
   $\Rightarrow P(A)+P(B)=P(A\cup B)+P(A\cap B)$
   ⇒ P(A) + P(B) = 0.8 + 0.3
   ⇒ P(A) + P(B) = 1.1
   ⇒ 1 - P$(\bar{A})$ + 1 - P(B) = 1.1
   ⇒ P($\bar{A}$) + P($\bar{B}$) = 2 - 1.1
   ⇒ P($\bar{A}$) + P($\bar{B}$) = 0.9

8. **(a)** None of these

Explanation: The endpoints of the diameter of a circle are (x, 3) and (3, 5).

According to the question, we have:

centre is midpoint of the endpoints of diameters.

$\frac{x+3}{2}$ = 2, y = $\frac{5+3}{2}$

$\Rightarrow$ x = 1, y = 4

9.

(c) 6 days

Explanation: 6 days

10. **(a)** 12.67

Explanation: Arranging given data in increasing order.

So, we have 20, 33, 39, 40, 50, 53, 59, 65, 69

Median = $\left(\frac{9+1}{2}\right)$th term = 5th term

$\therefore$ Median = 50

Mean deviation from median = $\frac{|20-50|+|33-50|+|39-50|+|40-50|+|50-50|+|53-50|+|59-50|+|65-50|+|69-50|}{9}$

$= \frac{30+17+11+10+0+3+9+15+19}{9} = \frac{114}{9}$ = 12.67

11.

(d) 33

Explanation: log (3x + 1) = 2 $\Rightarrow$ 10^2 = 3x + 1

$\Rightarrow$ 3x = 99 $\Rightarrow$ x = 33

12.

(d) ₹ 2625

Explanation: Let the sum be P, then

$\frac{P\times10\times2}{100} = \frac{1}{2}\left[5000\left(1+\frac{10}{100}\right)^2 - 5000\right]$

$\Rightarrow \frac{P}{5} = \frac{5000}{2}\left[\frac{11}{10}\times\frac{11}{10} - 1\right]$

$\Rightarrow$ P = $\frac{12500\times21}{100}$ = ₹ 2625.

13.

(c) 1001

Explanation: When a particular player is always chosen, then we have to select 10 players out of 14.

$\therefore$ Required number of ways = $^{14}C_{10}$ = $^{14}C_4 = \frac{14\times13\times12\times11}{4\times3\times2\times1}$ = 1001.

14.

(d) $\frac{3}{8}$

Explanation: As Probability = $\frac{\frac{3}{4}\cdot\frac{1}{6}}{\frac{3}{4}\cdot\frac{1}{6}+\frac{1}{4}\cdot\frac{5}{6}}$ = $\frac{3}{8}$

15.

(b) $\frac{15}{56}$

Explanation: Probability of getting exactly one red (R) ball $= P_R\cdot P_B\cdot P_B + P_B\cdot P_R\cdot P_R + P_B\cdot P_B\cdot P_R$

$= \frac{5}{8}\cdot\frac{3}{7}\cdot\frac{2}{6} + \frac{3}{8}\cdot\frac{5}{7}\cdot\frac{2}{6} + \frac{3}{8}\cdot\frac{2}{7}\cdot\frac{5}{6}$

$= \frac{15}{4\cdot7\cdot6} + \frac{15}{4\cdot7\cdot6} + \frac{15}{4\cdot7\cdot6}$

$= \frac{5}{56} + \frac{5}{56} + \frac{5}{56} = \frac{15}{56}$.

Which is the required solution

16.

(b) 10%

Explanation: ₹ 1250 is the interest of first year and ₹ 1375 is the interest in second year. Here, the difference is of ₹ 125 which is the interest obtained ₹ 1250.

Let rate be r %

$\therefore \frac{1250\times r\times1}{100} = 125$

$\Rightarrow r = \frac{125\times100}{1250} = 10$.

17. **(a)** 25

Explanation: We may have:

i. 1 Woman and 2 men

ii. 2 Women and 1 man

$\therefore$ required number of ways

= $({}^2C_1 \times {}^5C_2) + ({}^2C_2 \times {}^5C_1)$

= $(2 \times \frac{5\times4}{2\times1}) + (1 + 5)$

= (20 + 5) = 25

18. **(a)** 2^{mn}

Explanation: Given, n (A) = m, and n(B) = n

$\therefore$ n(A $\times$ B) = n(A). n(B) = mn

So, the total number of non-empty relations from A to B: 2^{mn}.

19.

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

Explanation: Assertion: Presenting the data in tabular form, we get

x_i	f_i	f_ix_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$	$f_i(x_i - \bar{x})^2$
4	3	12	-10	100	300
8	5	40	-6	36	180
11	9	99	-3	9	81
17	5	85	3	9	45
20	4	80	6	36	144
24	3	72	10	100	300
32	1	32	18	324	324
	30	**420**			**1374**

N = 30, $\sum_{i=1}^{7} f_ix_i$ = 420, $\sum_{i=1}^{7} f_i(x_i - \bar{x})^2$ = 1374

Therefore, $\bar{x} = \frac{\sum_{i=1}^{7} f_ix_i}{N} = \frac{1}{30} \times 420$ = 14

$\therefore$ Variance $\left(\sigma^2\right) = \frac{1}{N}\sum_{i=1}^{7} f_i(x_i - \bar{x})^2$

$\frac{1}{30} \times 1374$ = 458

Reason: Standard deviation $(\sigma) = \sqrt{45.8}$ = 6.77

20.

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

Explanation: We know that in an A.P., the sum of terms equidistant from beginning and end is constant.

$\therefore$ Assertion is true.

Also, Reason is true but Assertion is not the correct explanation of Assertion.

Section B

21. Given, average of marks of 15 students is 45

So sum of marks obtained by 15 students = 15 $\times$ 45 = 675

Also, average of first 8 students is 48

$\Rightarrow$ sum of marks obtained by first 8 students = 8 $\times$ 48 = 384

and average of last 8 students is 42

$\Rightarrow$ sum of marks obtained by last 8 students = 8 $\times$ 42 = 336

The marks obtained by 8th student = (384 + 336) - 675 = 720 - 675 = 45

Hence, the marks obtained by 8th student are 45

22. Given set A = {2, 3} ...(i)

and set B = {x : x is a solution of $x^2 - 5x + 6 = 0$}

For solution of $x^2 - 5x + 6 = 0$

$(x - 2)(x - 3) = 0 \Rightarrow x - 2 = 0$ or $x - 3 = 0 \Rightarrow x = 2, 3$

$\therefore$ set B = {2, 3} ...(ii)

From (i) and (ii), we notice sets A and B are equal.

OR

n (T) = 100

n (T - C) = 65

n (T ∪ C) = 210

n (T - C) = n (T) - n (T ∩ C)

65 = 100 - n (T ∩ C)

n (T ∩ C) = 35

n (T ∪ C) = n (T) + n (C) - n (T ∩ C)

210 = 100 + n (C) - 35

n (C) = 145.

Now,

n(C - T) = n(C) - n(C ∩ T)

n(C - T) = 145 - 35

n(C - T) = 110

23. Let distance covered at the speed of 40 km/h be x km

$\therefore$ Time taken = $\frac{x}{40}$ hrs

Distance covered at the speed of 60 km/h = (240 - x) km

$\therefore$ Time taken = $\frac{240-x}{60}$ hrs

$\therefore \frac{x}{40} + \frac{240-x}{60} = 5 \Rightarrow 3x + 480 - 2x = 600 \Rightarrow x = 120$

$\therefore$ Distance covered = 120 km

24. Let $y = \frac{1}{\sqrt{a^2-x^2}}$. Putting u = a - x , we get

$y = \frac{1}{\sqrt{u}} = u^{-1/2}$ and $u = a^2 - x^2$

$\therefore \frac{dy}{du} = -\frac{1}{2} u^{-3/2}$ and $\frac{du}{dx} = -2x$

Now, $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$\Rightarrow \frac{dy}{dx} = -\frac{1}{2} u^{-3/2} \times (-2x) = -\frac{1}{2u^{3/2}} \times (-2x) = \frac{x}{(a^2-x^2)^{3/2}}$ $[\because u = a^2 - x^2]$

OR

Given $y = \sqrt{x} + \frac{1}{\sqrt{x}} = x^{1/2} + x^{-1/2}$, diff. w.r.t. x, we get

$\frac{dy}{dx} = \frac{1}{2} x^{-1/2} + \left(-\frac{1}{2}\right) x^{-3/2} = \frac{1}{2\sqrt{x}} - \frac{1}{2x^{3/2}}$

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

$\Rightarrow 2x\frac{dy}{dx} + y = 2\sqrt{x}$

25. The given decimal number is 394

2	394	
2	197	0
2	98	1
2	49	0
2	24	1
2	12	0
2	6	0
2	3	0
2	1	1
2	0	1

This required binary number is 110001010

Section C

26. Given a = 11 and the sum of first four terms is 56.

Let d be the common difference, then 56 = $\frac{4}{2}$(2 × 11 + (4 - 1) × d)

⇒ 28 = 22 + 3d ⇒ d = 2

Let n be the number of terms and l be the last term.

Then the last four terms are l - 6, l - 4, l - 2, and l

According to given, (l - 6) + (l - 4) + (l - 2) + l = 112

⇒ 4l - 12 = 112

⇒ l = 31

⇒ 11 + (n - 1) × 2 = 31 [l = a + (n - 1)d]

⇒ n - 1 = 10

⇒ n = 11

OR

∵ T_n = a + (n - 1)d

Therefore, T_p = a + (p - 1)d = $\frac{1}{q}$ (given) ...(i)

and a + (q - 1) = $\frac{1}{p}$ (given) ...(ii)

Subtracting Eq. (i) from Eq.(ii),

d(p - 1 - q + 1) = $\frac{1}{q}$ - $\frac{1}{p}$

$\Rightarrow d(p-q)=\frac{p-q}{pq} \Rightarrow d=\frac{1}{pq}$

Putting the value of d in Eq. (i) we get

$a+\frac{(p-1)}{pq}=\frac{1}{q}$

$\Rightarrow a=\frac{1}{q}-\frac{p-1}{pq}$

$\Rightarrow a=\frac{p-p+1}{pq}=\frac{1}{pq}$

Now,

$\Rightarrow S_{pq}=\frac{pq}{2}[2a+(pq-1)d]$

$\left(\because S_n=\frac{n}{2}[2a+(n-1)d]\right)$

= $\frac{pq}{2}\left[2\times\frac{1}{pq}+(pq-1)\frac{1}{pq}\right]$

= $\frac{pq}{2}\times\frac{1}{pq}$(2 + pq - 1)

= $\frac{1}{2}$ (pq + 1)

27. Equation of a line in intercept from is

$\frac{x}{a}+\frac{y}{b}$ = 1

Given, $\frac{a+0}{2}$ = 1 and $\frac{0+b}{2}$ = 2

$\Rightarrow$ a = 2 $\Rightarrow$ b = 4

$\Rightarrow \frac{x}{2} + \frac{y}{4}$ = 1

$\Rightarrow$ 2x + y - 4 = 0, is the required equation of the line.

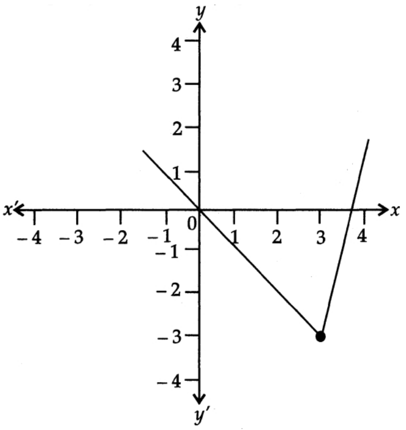
28. Given, f(x) = |2x - 3| - 3

The domain of the expression is all real number except where the expression is undefined. In this case, there is not real number that makes the expression undefined.

$\therefore$ Domain of f = (-∞, ∞) = R

The absolute value of expression has a 'V' shape. The range of a positive absolute value expression starts at its vertex and extends to infinity.

Range of f = $[-3, \infty)$ or $\{y : y \geq -3\}$



29. Let one of the parts be ₹ x. Then the other part is ₹(15,500 - x).

For the first part, we have

P = x, r = $\frac{15}{100}$ and t = 1

$\therefore$ I_1 = Simple Interest = Prt = x $\times \frac{15}{100} \times$ 1 = $\frac{3x}{20}$

For the second part, we have

P = (15,500 - x), r = $\frac{24}{100} = \frac{6}{25}$ and t = 1

$\therefore$ I_2 = Simple interest = Prt = (15,500 - x) $\times \frac{6}{25} \times$ 1 = $\frac{1}{25}$(93000 - 6x)

It is given that total annual interest is ₹ 3000.

$\therefore$ I_1 + I_2 = 3000

$\Rightarrow \frac{3x}{20} + \frac{1}{25}$ (93,000 - 6x) = 3000

$\Rightarrow$ 15x + 372,000 - 24x = 300,000 $\Rightarrow$ 9x = 72,000 $\Rightarrow$ x = 8,000

Hence, two parts are ₹ 8,000 and ₹(15,500 - 8,000) = ₹ 7,500

30. Let the annual rate of growth be R.

$\therefore$ Production of scooters after three years = P$\left(1 + \frac{R}{100}\right)^n$

46,305 = 4,000$\left(1 + \frac{R}{100}\right)^3$

$(1 + 0.01 R)^3 = \frac{46,305}{40,000}$

$(1 + 0.01 R)^3$ = 1.157625

$(1 + 0.01 R)^3 = (1.05)^3$

1 + 0.01 R = 1.05

0.01 R = 0.05

R = 5

Thus, the annual rate of growth is 5%

31. Given: A = {1, 2, 3, 4, 5}

and B = {2, 3, 4}

C = {2, 4, 5}

i. A $\subset$ B

Since 1 $\in A$ but 1 $\notin B \Rightarrow A \not\subset C$

So, Flase

ii. A ⊂ C

Since 1 ∈ A but $1 \notin C \Rightarrow A \not\subset C$

So, False

iii. B ⊂ A

Since, every element of B is also element of A, So B ⊂ A.

it is true statement

iv. B ⊂ C

Since 3 ∈ B but $3 \notin C \Rightarrow B \not\subset C$

So, False

v. C ⊂ A

Since every element of set C is also element of set A, So C ⊂ A.

Therefore, It is true statement.

vi. C ⊂ B

Since 5 ∈ C but $5 \notin B \Rightarrow C \not\subset B$

So, False

vii. B = C

Since 3 ∈ B but $3 \not\subset C \Rightarrow B \neq C$

So, False

viii. ϕ ⊂ B

We know that empty set is always subset of every set.

$\therefore \phi$ ⊂ B

Therefore, it is true statement

ix. False

x. False

xi. False

Section D

32. i. P(both the students passing the examination)

$= \frac{3}{5} \times \frac{4}{5} = \frac{12}{25}$

ii. P(only student A passing the examination)

$= \frac{3}{5} \times \frac{1}{5} = \frac{3}{25}$

iii. P(only one of them passing the examination)

= P(A passes and B does not pass) or (A does not pass and B passes)

$= \frac{3}{5} \times \frac{1}{5} + \frac{2}{5} \times \frac{4}{5} = \frac{3+8}{25} = \frac{11}{25}$

iv. P(none of them passing the examination)

= P(A does not pass and B does not pass)

$= \frac{2}{5} \times \frac{1}{5} = \frac{2}{25}$

OR

Let E_1, E_2 and E_3 be the events of drawing a bolt produced by machine A, B and C respectively. Therefore,we have,

$P(E_1) = \frac{25}{100} = \frac{1}{4}$, $P(E_2) = \frac{35}{100} = \frac{7}{20}$, and $P(E_3) = \frac{40}{100} = \frac{2}{5}$

Let E be the event of drawing a defective bolt. Therefore,

$P(\frac{E}{E_1})$ = probability of drawing a defective bolt, given that it is produced by the machine A $= \frac{5}{100} = \frac{1}{20}$

$P(\frac{E}{E_2})$ = probability of drawing a defective bolt, given that it is produced by the machine B $= \frac{4}{100} = \frac{1}{25}$

$P(\frac{E}{E_3})$ = probability of drawing a defective bolt, given that it is produced by the machine C $= \frac{2}{100} = \frac{1}{50}$

Therefore, we have,

Probability that the bolt drawn is manufactured by C, given that it is defective

$= P(\frac{E_3}{E})$

$= \frac{P\left(\frac{E}{E_3}\right) \cdot P(E_3)}{P\left(\frac{E}{E_1}\right) \cdot P(E_1) + P\left(\frac{E}{E_2}\right) \cdot P(E_2) + P\left(\frac{E}{E_3}\right) \cdot P(E_3)}$ [by Bayes's theorem]

$$\frac{\left(\frac{1}{50}\times\frac{2}{5}\right)}{\left(\frac{1}{20}\times\frac{1}{4}\right)+\left(\frac{1}{25}\times\frac{7}{20}\right)+\left(\frac{1}{50}\times\frac{2}{5}\right)} = \left(\frac{1}{125}\times\frac{2000}{69}\right)=\frac{16}{69}$$

Hence, the required probability is $\frac{16}{69}$.

33. $\underset{x=0}{LHL}=\lim_{h\to 0} f(0-h)$

$=\lim_{h\to 0}\lambda\left(h^2+2h\right)=0$

$\underset{x=0}{RHL}=\lim_{h\to 0} f(0+h)=\lim_{h\to 0}(4h+1)=1$

As for no value of $\lambda, \underset{x=0}{\text{LHL}}=\underset{x=0}{\text{RHL}}$,

$\therefore$ function is not continuous at x = 0, for any value of λ.

34. Number of observations, n = 10

Mean,

$\bar{x}$ = 45 Variance,

σ^2 = 16

Now,

Incorrect mean,

$\bar{x}$ = 45

$\Rightarrow \frac{\text{Incorrect }\sum x_i}{10}$ = 45

$\Rightarrow$ Incorrect $\sum x_i$ = 450

$\therefore$ Correct $\sum x_i$ = 450 - 52 + 25 = 423

$\Rightarrow$ Correct mean = $\frac{\text{Correct }\sum x_i}{10}=\frac{423}{10}$ = 42.3

Incorrect variance,

σ^2 = 16

$\Rightarrow$ 16 = $\frac{\text{Incorrect }\sum x_i^2}{10}$ - $(45)^2$

$\Rightarrow$ Incorrect $\sum x_i^2$ = 10 (16 + 2025) = 20410

$\therefore$ Correct $\sum x_i^2$ = 20410 - $(52)^2$ + $(25)^2$ = 20410 - 2704 + 625 = 18331

Now,

Correct variance = $\frac{18331}{10}$ - $(42.3)^2$ = 1833.1 - 1789.29 = 43.81

OR

For Calculation of Standard Deviation we prepare the following table.

x	f	$d_i = x_i - 23$	d_1^2	$f_i d_i$	$f_i d_i^2$
18	3	-5	25	-15	75
19	7	-4	16	-28	112
20	11	-3	9	-33	99
21	14	-2	4	-28	56
22	18	-1	1	-18	18
23	17	0	0	0	0
24	13	1	1	13	13
25	8	2	4	16	32
26	5	3	9	15	45
27	4	4	16	16	64
	N = $\sum f_i$ = 100			$\sum f_i d_i$ = - 62	$\sum f_i d_i^2$ = 514

Clearly, N = 100, $\sum f_i d_i$ = - 62 and $\sum f_i d_i^2$ = 514

$\therefore \sigma^2=\frac{1}{N}\left(\Sigma f_i d_i^2\right)-\left(\frac{1}{N}\Sigma f_i d_i\right)^2=\frac{514}{100}-\left(-\frac{62}{100}\right)^2=\frac{47556}{10000}$

Hence, $\sigma=\sqrt{\frac{47556}{10000}}=\frac{218.07}{100}$ = 2.1807

35. The given equation of parabola is $x^2 = 6y$ which is of the form $x^2 = 4ay$

$\therefore 4a = 6 \Rightarrow a = \frac{6}{4} \Rightarrow a = \frac{3}{2}$

$\therefore$ Coordinates of focus are $\left(0, \frac{3}{2}\right)$

Axis of parabola is x = 0

Equation of the directrix is $y = \frac{-3}{2} \Rightarrow 2y + 3 = 0$

Length of latus rectum $= \frac{4\times3}{2} = 6$

Section E

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

A triangular park has two of its vertices as B(-4, 1) and C(2, 11). The third vertex A is a point dividing the line joining the points (3, 1) and (6, 4) in the ratio 2: 1.

(i) 

Coordinates of A $= \left(\frac{2\times6+1\times3}{2+1}, \frac{2\times4+1\times1}{2+1}\right)$ i.e. (5, 3)

(ii) Slope of line BC $= \frac{11-1}{2+4} = \frac{5}{3}$

$\therefore$ Slope of line parallel to BC $= \frac{5}{3}$

Equation of line through A(5, 3) and parallel to BC is

$y - 3 = \frac{5}{3}(x - 5) \Rightarrow 3y - 9 = 5x - 25$

$\Rightarrow 5x - 3y - 16 = 0$

(iii) Slope of line perpendicular to BC $= -\frac{3}{5}$

Equation of line through A(5, 3) and perpendicular to BC is

$y - 3 = -\frac{3}{5}(x - 5) \Rightarrow 5y - 15 = -3x + 15$

$\Rightarrow 3x + 5y - 30 = 0$

OR

A(5, 3), B(-4, 1), C(2, 11)

Area of $\Delta ABC = \frac{1}{2}|5(1-11) + (-4)(11-3) + 2(3-1)|$ sq.units

$= \frac{1}{2}|-50 - 32 + 4|$ sq. units

$= \frac{1}{2} \times 78 sq.$ units = 39 sq.units

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

In this age of competitions rank plays an important role. Let us try to answer some questions related to percentile rank with respect to the given data of marks of 10 students 13, 52, 42, 22, 44, 105, 45, 88, 90, 76.

(i) Percentile rank $= \frac{8}{10} \times 100 = 80$

(ii) Percentile rank $= \frac{5}{10} \times 100 = 50$

(iii) Percentile rank $= \frac{9}{10} \times 100 = 90$

OR

$60 = \frac{\text{marks less than } a}{10} \times 100 \Rightarrow$ marks less than a = 6

a = 76

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

The purpose of the student council is to give students an opportunity to develop leadership by organizing and carrying out school activities and service projects. Create an environment where every student can voice out their concern or need. Raju, Ravi Joseph, Sangeeta, Priya, Meena and Aman are members of student's council. There is a photo session in a school these 7 students are to be seated in a row for photo session.

(i) Given Raju and Ravi are at the extreme positions

Case 1 Raju _______ _______ _______ _______ _______ Ravi

Case 2 Ravi _______ _______ _______ _______ _______ Raju

So remaining 5 places are filled in 5! Ways in both cases

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

Hence total number of arrangements $= 120 \times 2 = 240$ ways

(ii) ______ ______ ______ **Joseph** ______ ______ ______

So here middle place is occupied by Joseph remaining 6 places are filled by remaining 6 students in 6! Ways

$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$ ways

(iii) When all girls are together let's consider them as a single unit. So four 4 boys with single group of girls can be arranged in 4 + 1 = 5! Ways

______ ______ ______ ______ | Sangeeta Priya Meena |

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

But all the tree girls can be arranged in themselves in 3! Ways $= 3 \times 2 \times 1 = 6$

Hence total number of ways $= 5! \times 3! = 120 \times 6 = 720$

(iv) When Aman and Ravi are together let's consider them as a single unit. So remaining 5 students with single group of Aman and Ravi can be arranged in 5 + 1 = 6! Ways

______ ______ ______ ______ | Aman Ravi |

$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

But Aman and Ravi can be arranged in themselves in 2! Ways $= 2 \times 1 = 2$

Hence total number of ways $= 6! \times 2! = 720 \times 2 = 1440$ ways ...(i)

Total number of sitting arrangements of all 7 students without restriction

______ ______ ______ ______ ______ ______ ______

All seven students can fill seven seats in 7! Ways

$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040$ ways ...(ii)

But here we need the number of arrangements so that Aman and Ravi are not together = Total number of sitting arrangements of all 7 students without restriction - Number of arrangements so that Aman and Ravi are together.

From (i) and (ii) we have

The number of arrangements so that Aman and Ravi are not together = 5040 - 1440 = 3600

OR

Read the text carefully and answer the questions:

Two friends Pankaj and Pooja were playing cards. There were 52 cards in a deck.

(i) Sunil can choose four cards from same suit in $4 \times {}^{13}C_4$ ways

$= 4 \times \frac{13!}{9! \times 4!}$

= 4715 = 2860

(ii) Here one card to be selected from each suit therefore, he can select in ${}^{13}C_1 \times {}^{13}C_1 \times {}^{13}C_1 \times {}^{13}C_1$ ways

$= ({}^{13}C_1)^4 = 28561$

(iii) There are 12 face cards and 4 are to be selected out of these 12 cards. This can be done in ${}^{12}C_4$ ways

$= \frac{12!}{8!4!} 495$

(iv) Anita can select two cards of same colour in ${}^{26}C_2 + {}^{26}C_2$ ways = 325 + 325 = 650