Class XI Session 2025-26
Subject - Applied Maths
Sample Question Paper - 3

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. A bag contains 5 brown and 4 black socks. A man pulls out two socks. The probability that these are of the same colour is: **[1]**

a) $\frac{48}{108}$ b) $\frac{5}{108}$

c) $\frac{18}{108}$ d) $\frac{30}{108}$

2. Third Quartile is **[1]**

a. a measure used to describe the distribution data
b. also called upper quartile
c. also called lower quartile
d. the sum of numbers in a set of data divided by the number of pieces of data.

a) Statement (a) is correct b) Statement (d) is correct

c) Statement (b) is correct d) Statement (c) is correct

3. What sum will amount to ₹ 17640 in 2 years at 5% per annum compounded yearly? **[1]**

a) ₹ 16500 b) ₹ 16000

c) ₹ 15000 d) ₹ 15500

4. $2^4 = 16$ in logarithmic form is **[1]**

a) $\log_4 16 = 2$ b) $\log_2 16 = 4$

c) $\log_4 2 = 16$

d) $4 \log 2 = \log 16$

5. Let A = {3, 5} and B = {7, 11} and R be the relation from A to B defined as R = {(a, b) : a ∈ A, b ∈ B, a -b is odd}, then **[1]**

a) $R = \phi$

b) $R \subset A \times B$

c) $R \subset B \times A$

d) $R = A \times B$

6. The value of $2 + \log_{10}(0.01)$ is **[1]**

a) 4

b) 3

c) 0

d) 1

7. If A and B are events such that P(A) = 0.4, P(B) = 0.3 and P(A ∪ B) = 0.5, then $P(B' \cap A)$ is equal to: **[1]**

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

b) $\frac{3}{10}$

c) $\frac{1}{2}$

d) $\frac{2}{3}$

8. The quation of parabola with focus at (-3, 0) and directrix x - 3 = 0 is: **[1]**

a) $y^2 = 12x$

b) $x^2 = 12y$

c) $y^2 = -12x$

d) $x^2 = -12y$

9. How many odd days are there in 300 years? **[1]**

a) 1

b) 2

c) 3

d) 0

10. If the mean of the numbers 5, a, 11, 9, 6 and b is 8 and the variance is $\frac{14}{3}$, then which one of the following gives possible values of a and b? **[1]**

a) a = 15, b = 2

b) a = 4, b = 13

c) a = 10, b = 7

d) a = 12, b = 5

11. If $\log_{\frac{1}{3}} 27\sqrt{3} = x$, then value of x is **[1]**

a) $\frac{7}{2}$

b) 7

c) -7

d) $-\frac{7}{2}$

12. The difference between simple interest and compound interest on ₹ 15000 for one yea 8% per annum calculated half-yearly is: **[1]**

a) ₹ 26

b) ₹ 20

c) ₹ 22

d) ₹ 24

13. 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) 45

b) 25

c) 35

d) 10

14. Bag A contains 3 red and 5 black balls and bag B contains 2 red and 4 black balls. A ball is drawn from one of the bags. The probability that ball drawn is red is **[1]**

a) $\frac{3}{8}$

b) $\frac{17}{24}$

c) $\frac{1}{3}$ d) $\frac{17}{48}$

15. A and B play a game where each is asked to select a number from 1 to 25. If the two numbers match, both of them win a prize. The probability that they will not win a prize in a single trial is: **[1]**

a) $\frac{2}{25}$ b) $\frac{24}{25}$

c) $\frac{1}{25}$ d) $\frac{3}{25}$

16. The amount of money today which is equal to a series of payments in the future is: **[1]**

i. nominal value of annuity
ii. sinking value of annuity
iii. present value of annuity
iv. future value of annuity

a) ii and iii b) iv and i

c) only iii d) i and ii

17. In an examination, there are four multiple-choice questions and each question has 4 choices. The number of ways in which a student can fail to get all answer correct is **[1]**

a) 256 b) 255

c) 254 d) 63

18. If A = {1, 2, 3}, B = {1, 4, 5, 9} and R is a relation from A to B defined by x is greater than y. Then, Range of R **[1]**

a) {4, 6, 9} b) {4}

c) {1} d) {1, 2, 6, 9}

19. **Assertion (A):** If each of the observations $x_1, x_2, ..., x_n$ is increased by a, where a is a negative or positive number, then the variance remains unchanged. **[1]**

Reason (R): Adding or subtracting a positive or negative number to (or from) each observation of a group does not affect the variance.

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):** If 7th, 10th and 13th term of a G.P. are a, b and c respectively, then b_2 = ac. **[1]**

Reason (R): In a G.P., $a_n = \sqrt{a_{n-k} \times a_{n+k}}, n, k \in N.$

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 score of a class of boys and girls in an examination is x. The ratio of boys and girls in the class is 3:1. If the average score of boys is x + 1, find the average score of girls. **[2]**

22. If A = {x : x is a natural number and 1 < x $\leq$ 6} and B = {x : x is a natural number and 6 < x < 10}, find **[2]**

i. A ∪ B
ii. A ∩ B

iii. A - B

iv. B - A

OR

If X = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}, write

i. A subset of X that contains all odd numbers.

ii. A subset of X that contains all even numbers.

iii. A subset of X that contains all prime numbers.

iv. A subset of X that contains all multiples of 3

v. A subset of X that contains a number less than 6.

vi. A subset of X that contains a number greater than 15.

23. Two trains are running in the same direction at 90 km/h and 126 km/h respectively. The length of the first train is 130 m and the time to cross each other is 25 seconds from the time they meet. Find the length of the second train. **[2]**

24. Find the derivative of $\frac{3x+4}{5x^2-7x+9}$ with respect of x. **[2]**

OR

Find $\frac{dy}{dx}$: $(x + y)^2 = 2axy$

25. Convert the decimal number to the binary number: 639 **[2]**

Section C

26. The sum of the first six terms of an arithmetic progression is 42. The ratio of the 10th term to the 30th term is $\frac{1}{3}$. Calculate the first and the thirteenth term. **[3]**

OR

Find n so that $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ maybe the A.M. between a and b.

27. Without using distance formula, show that points (-2, -1), (4, 0), (3, 3) and (-3, 2) are the vertices of a parallelogram. **[3]**

28. Find domain and range of the real function $f(x) = \frac{1}{1-x^2}$. **[3]**

29. Divide ₹ 21866 into two parts such that the amount of one in 3 years is same as the amount of the second in 5 years, the rate of compound interest being 5% per annum. **[3]**

30. Evaluate $\frac{2^{-3} \cdot \sqrt{6} \cdot 3^2}{6^3 \cdot 2^5}$ **[3]**

31. In a survey of 450 people, it was found that 110 play cricket, 160 play tennis and 70 play both cricket as well tennis. How many play neither cricket nor tennis? **[3]**

Section D

32. A ball is drawn from a bag containing 5 white and 7 black balls. **[5]**

i. What is the probability of drawing a white ball?

ii. What are the odds of drawing a white ball?

iii. If two balls are drawn simultaneously, what is the probability that both balls are white?

iv. What are the odds in favour of drawing two black balls?

v. What is the probability of drawing one white and one black ball?

OR

An urn contains m white and n black balls. A ball is drawn at random and is put back into the urn along with k additional balls of the same colour as that of the ball drawn. A ball is again drawn at random. Show that the probability of drawing a white ball does not depend on k.

33. Evaluate the following limits: $\lim\limits_{x \to 2} \frac{\sqrt{3-x}-1}{2-x}$. **[5]**

34. Find the mean deviation about the mean for the data **[5]**

Income per day in ₹	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800
Number of persons	4	8	9	10	7	5	4	3

OR

The lengths (in cm) of 10 rods in a shop are: 40.0, 52.3, 55.2, 72.9, 52.8, 79.0, 32.5, 15.2, 27.9, 30.2

Find mean deviation from the mean.

35. If a parabolic reflector is 40 cm is diameter and 10 cm deep. Find the focus of reflector. **[5]**

Section E

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

During sports day of a school different patterns are made for students to perform. One such pattern is made by putting flags at B(3, 2) and C(4, -1), other flags and lines are to be put based on some calculations. Let us try the different positions.

(a) Find the Equation of BC.

(b) Find the Equation of AC.

(c) Find the Equation of AB.

OR

Coordinates of a point which divides medians of a triangle ABC in the ratio 2 : 1

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

A panel of two judges P and Q graded seven dramatic performances by independently awarding marks as follows:

Performance	1	2	3	4	5	6	7
Marks by P	46	42	44	40	43	41	45
Marks by Q	40	38	36	35	39	37	41

(a) Find the mean of the marks given by judge P.

(b) Find the mean of the marks given by judge Q.

(c) Find the standard deviation of the marks given by judge P.

OR

Find the standard deviation of the marks given by judge Q.

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

Five friends Mohit, Sachin, Rohit, Mohan and kapil were playing in a ground, where they sit in a row in a straight line.

(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?

OR

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

Five friends Mohit, Sachin, Rohit, Mohan and kapil were playing in a ground, where they sit in a row in a straight line.

(a) In how many ways these five students can sit in a row?

(b) Total number of sitting arrangements if Mohit and Sachin sit together:

(c) What are the possible arrangements if Rohit and Mohan sits at the extrement positions?

(d) What are the possible orders if Kapil is sitting in the middle?

Solution

Section A

1. **(a)** $\frac{48}{108}$

Explanation:

P(same coloured socks) = P(both brown) + P(both white)

= $\frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{3}{8}$

= $\frac{20}{72} + \frac{12}{72}$

= $\frac{32}{72}$

= $\frac{4}{9} = \frac{48}{108}$

2.

(c) Statement (b) is correct

Explanation:

Third Quartile, Q_3 is upper quartile where first quartile, Q_1 is lower quartile.

3.

(b) ₹ 16000

Explanation:

Let the sum of P

$\therefore P\left(1 + \frac{5}{100}\right)^2$ = 17640

$\Rightarrow$ p $\times$ $\frac{21}{20} \times \frac{21}{20} = 17640 \Rightarrow P = \frac{17640 \times 20 \times 20}{21 \times 21}$

$\Rightarrow$ P = ₹ 16000

4.

(b) $\log_2 16 = 4$

Explanation:

$2^4 = 16$ in logarithmic form.

As we know that

if $a^y = x$

then $\log_a x = y$

$\therefore \log_2 16 = 4$

5. **(a)** R = ϕ

Explanation:

Here, A = {3, 5}, B = {7, 11} and R = {(a, b) : a $\in$ A, b $\in$ B, a - b is odd}.

As both a and b take odd values, hence their difference can never be odd.

$\therefore$ R = ϕ

6.

(c) 0

Explanation:

2 + $\log_{10}$ (0.01) = 2 + $\log_{10} \frac{1}{100}$ = 2 + $\log_{10} 10^{-2}$

= 2 - 2 $\log_{10}$ 10 = 2 - 2 = 0

7. **(a)** $\frac{1}{5}$

Explanation:

We have, P(A) = 0.4, P(B) = 0.3 and P(A ∩ B) = 0.5

Now P(A ∪ B) = P(A) + P(B) - P(A ∩ B)

$\Rightarrow$ P(A ∩ B) = 0.4 + 0.3 - 0.5 = 0.2

$\therefore$ P(B'∩ A) = P(A) - P(A ∩ B) = 0.4 - 0.2 = 0.2 = $\frac{1}{5}$

8.

(c) $y^2 = -12x$

Explanation:

Let p (x, y) be any point on the parabola. Then,

$\sqrt{(x-3)^2+(y+0)^2} = \left|\frac{x+3}{\sqrt{1+0}}\right|$ [Using SP= PM]

$\Rightarrow (x - 3)^2 + y^2 = (x + 3)^2 \Rightarrow y^2 = -12x$

9. **(a)** 1

Explanation:

In 300 years, we have 72 leap years and 228 non-leap years.

So, odd days = 72 $\times$ 2 + 228 $\times$ 1 = 144 + 228 = 372

= 7 $\times$ 53 + 1 = 1 odd day

10.

(c) a = 10, b = 7

Explanation:

Mean = 8

$\Rightarrow \frac{5+a+11+9+6+b}{6} = 8$

$\Rightarrow$ a + b = 17 ...(i)

Variance = $\frac{14}{3}$

$\Rightarrow \frac{1}{6}(25 + a^2 + 121 + 81 + 36 + b^2) - 8^2 = \frac{14}{3}$

$\Rightarrow a^2 + b^2 = 149$

$\Rightarrow a^2 + (17 - a)^2 = 149$ ...[From (i)]

$\Rightarrow a^2 - 17a + 70 = 0$

$\Rightarrow$ a = 10 or 7

$\Rightarrow$ b = 7 or 10

11.

(d) $-\frac{7}{2}$

Explanation:

$\log_{\frac{1}{3}} 27\sqrt{3} = x$

$\log_{\frac{1}{3}} 3^3 \times \sqrt{3} = x$

$\log_{\frac{1}{2}} 3^{\frac{7}{2}} = x$

$\log_{\frac{1}{3}} \left(\frac{1}{3}\right)^{-\frac{7}{2}} = x \left[\because a^x = \left(\frac{1}{a}\right)^{-x}\right]$

$\therefore x = -\frac{7}{2}$

12.

(d) ₹ 24

Explanation:

For C.I.:

C.I. = $15000\left(1+\frac{4}{100}\right)^2 - 15000$

$= 15000\left[\frac{26}{25} \times \frac{26}{25} - 1\right] = \frac{15000 \times 51}{25 \times 25}$ = ₹ 1224.

S.I. = $\frac{15000 \times 51}{25 \times 25}$ = ₹ 1200

∴ Difference between C.I. and S.I. = ₹ 1224 - ₹ 1200 = ₹24

13.

(b) 25

Explanation:

We may have:

i. 1 Woman and 2 men
ii. 2 Women and 1 man

∴ required number of ways

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

= $(2 \times \frac{5 \times 4}{2 \times 1}) + (1 + 5)$

= (20 + 5) = 25

14.

(d) $\frac{17}{48}$

Explanation:

As P(red) = $P(A) \cdot P(\frac{R}{A}) + P(B) \cdot P(\frac{R}{B})$

= $\frac{1}{2} \cdot \frac{3}{8} + \frac{1}{2} \cdot \frac{2}{6} = \frac{3}{16} + \frac{1}{6} = \frac{17}{48}$

15.

(b) $\frac{24}{25}$

Explanation:

They win a prize if the number chosen by A matches with that of B.

Thus, probability of winning a prize = $\frac{1}{25} \times 1 = \frac{1}{25}$

Thus, probability of not winning = $1 - \frac{1}{25} = \frac{24}{25}$

16.

(c) only iii

Explanation:

present value of annuity

17.

(b) 255

Explanation:

There are 4 choices for each question

So, there are 4 ways to answer questions.

Number of ways to answer 4 questions

= $4 \times 4 \times 4 \times 4$

= 256

Out of 256 ways, there is only one way that has all the answers Correct.

So, the number of ways in which a student can fail to get all answers correct = 256 - 1 = 255

18.

(c) {1}

Explanation:

Here

⇒ R = {(2, 1), (3, 1)} Hence Range(R) = {1}

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

Explanation:

Assertion: Let $\bar{x}$ be the mean of x_1, x_2 ..., x_n. Then, variance is given by

$\sigma_1^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$

If a is added to each observation, the new observations will be

$y_i = x_i + a$

Let the mean of the new observations be $\bar{y}$.

Then,

$\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i = \frac{1}{n}\sum_{i=1}^{n}(x_i + a)$

$= \frac{1}{n}\left[\sum_{i=1}^{n} x_i + \sum_{i=1}^{n} a\right]$

$= \frac{1}{n}\sum_{i=1}^{n} x_i + \frac{na}{n} = \bar{x} + a$

i.e. $\bar{y} = \bar{x} + a$ ...(ii)

Thus, the variance of the new observations is $\sigma_2^2 = \frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i + a - \bar{x} - a)^2$ [using Eqs. (i) and (ii)]

$= \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2 = \sigma_1^2$

Thus, the variance of the new observations is same as that of the original observations.

Reason: We may note that adding (or subtracting) a positive number to (or from) each observation of a group does not affect the variance.

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

Explanation:

We know that in a G.P., terms taken at regular intervals also form a G.P.

So, a_{n-k}, a_n, a_{n+k} are in G.P.

$\Rightarrow a_n^2 = a_{n-k} \cdot a_{n+k} \Rightarrow a_n = \sqrt{a_{n-k} \cdot a_{n+k}}$

$\therefore$ R is true.

Given $a_7 = a$, $a_{10} = b$ and $a_{13} = c$

So, $a_{10} = \sqrt{a_{10-3} \times a_{10+3}} = \sqrt{a_7 \cdot a_{13}}$

$\Rightarrow b = \sqrt{ac} \Rightarrow b^2 = ac$

$\therefore$ A is true and R is the correct explanation of A.

Section B

21. Let the number of boys be 3x and the number of girls be x.

Then, total number of students = 4x

Average score of the class = A

$\therefore$ Total score of all the students = 4 Ax

Average score of all the boys = A + 1

$\therefore$ Total score of all the boys = 3x(A + 1) = 3 Ax + 3x

$\Rightarrow$ Total score of all the girls = 4 Ax - 3 Ax - 3x = Ax - 3x = (A - 3)x

$\Rightarrow$ Average score of the girls = $\frac{(A-3)x}{x}$ = (A - 3)

22. Here, A = {2, 3, 4, 5, 6} and B = {7, 8, 9}

i. $A \cup B$ = {2, 3, 4, 5, 6, 7, 8, 9,}

ii. $A \cap B = \phi$

iii. A - B = {2, 3, 4, 5, 6} = A

iv. B - A = {7, 8, 9} = B

OR

i. {1, 3, 5, 7, 9, 11, 13, 15}

ii. {2, 4, 6, 8, 10, 12, 14}

iii. {2, 3, 5, 7, 11, 13}

iv. {3, 6, 9, 12, 15}

v. {1, 2, 3, 4, 5}
vi. ϕ

23. Let the length of the second train be x m.
Distance covered to cross each other = (130 + x) m
Since trains are running in the same direction, so
relative speed = (126 - 90) km/h = 36 km/h
= $\left(36 \times \frac{5}{18}\right)$ m/s = 10 m/s
Given that time taken to cross each other = 25 sec
$\therefore \quad 25 = \frac{130 + x}{10} \Rightarrow$ 130 + x = 250 $\Rightarrow$ x = 120
Hence, the length of the second train = 120 m

24. Let y = $\frac{3x+4}{5x^2-7x+9}$
$(5x^2 - 7x + 9) \frac{dy}{dx}(3x + 4) - \frac{dy}{dx} = \frac{(3x+4)\frac{d}{dx}(5x^2-7x+9)}{(5x^2-7x+9)^2}$
$= \frac{(5x^2-7x+9)3-(3x+4)(10x-7)}{(5x^2-7x+9)^2}$
$= \frac{15x^2-21x+27-30x^2-40x+21x+28}{(5x^2-7x+9)^2}$
$= \frac{-15x^2-40x+55}{(5x^2-7x+9)^2}$

OR

Given $(x + y)^2 = 2axy$
Differentiating the equation on both sides with respect to x,
$\Rightarrow \frac{d}{dx}(x + y)^2 = \frac{d}{dx}(2axy)$
$\Rightarrow 2(x + y)\frac{d}{dx}(x + y) = 2a[x\frac{dy}{dx} + y\frac{d}{dx}(x)]$
$\Rightarrow 2(x + y)[1 + \frac{dy}{dx}] = 2a[x\frac{dy}{dx} + y(1)]$
$\Rightarrow 2(x + y)+2(x + y)\frac{dy}{dx} = 2ax\frac{dy}{dx} + 2ay$
$\Rightarrow \frac{dy}{dx}[2(x + y) - 2ax] = 2ay - 2(x + y)$
$\Rightarrow \frac{dy}{dx} = \frac{2[ay-x-y]}{2[x+y-ax]}$
$\Rightarrow \frac{dy}{dx} = \left(\frac{ay-x-y}{x+y-ax}\right)$

25. Given decimal number is 639

2	639	
2	319	1
2	159	1
2	79	1
2	39	1
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
2	0	1

Required binary number is 1001111111

Section C

26. Let 'a' be the first term and 'd' be a common difference.

$S_6 = 42$

$\frac{6}{2}|(2a + 5d) = 14$

$2a = 14 - 5d$ ...(i)

$\frac{a_{10}}{a_{30}} = \frac{1}{3}$

$\frac{a+9d}{a+29d} = \frac{1}{3}$

$\frac{2a+18d}{2a+58d} = \frac{1}{3}$

$\frac{14-5d+18d}{14-5d+58d} = \frac{1}{3}$ From (i)

$\frac{14+13d}{14+53d} = \frac{1}{3}$

$42 + 39d = 14 + 53d$

$28 = 14d$

$\Rightarrow d = 2$

From (i)

$2a + 5d = 14$

$\Rightarrow a = 2$

Now, $a_{13} = 2 + 12 \times 2 = 26$

OR

The arithmetic mean between a and b is $\frac{a+b}{2}$

According to given, $\frac{a^n+b^n}{a^{n-1}+b^{n-1}} = \frac{a+b}{2}$

$\Rightarrow 2a^n + 2b^n = a^n + ab^{n-1} + a^{n-1}b + b^n$

$\Rightarrow a^n + b^n - ab^{n-1} - a^{n-1}b = 0$

$\Rightarrow (a^n - a^{n-1}b) + (b^n - ab^{n-1}) = 0$

$\Rightarrow a^{n-1}(a - b) + b^{n-1})(b - a) = 0$

$\Rightarrow (a - b)(a^{n-1} - b^{n-1}) = 0$

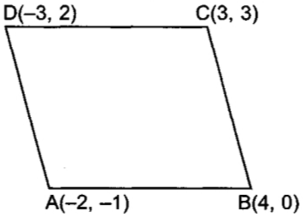
$\Rightarrow a^{n-1} - b^{n-1} = 0$ ($\because a \neq b$)

$\Rightarrow a^{n-1} = b^{n-1} \Rightarrow \frac{a^{n-1}}{b^{n-1}} = 1$

$\Rightarrow \left(\frac{a}{b}\right)^{n-1} = 1 = \left(\frac{a}{b}\right)^0$

$\Rightarrow n - 1 = 0 \Rightarrow n = 1$

27.



Let A(-2, -1), B(4, 0), C(3, 3) and D(-3, 2) be the vertices of the given quadrilateral ABCD, then

Slope of AB = $\frac{0+1}{4+2} = \frac{1}{6}$

Slope of BC = $\frac{3-0}{3-4}$ = -3

Slope of CD = $\frac{2-3}{-3-3} = \frac{1}{6}$

Slope of DA = $\frac{-1-2}{-2+3}$ = -3

As slope of AB = slope of CD, So AB || DC.

slope of BC = slope of AD. So BC || AD.

Hence, ABCD is a parallelogram.

28. For domain: $1 - x^2 \neq 0$ $x \neq \pm 1$

$\therefore$ Domain = R - {-1, 1}

For range: $y = \frac{1}{1-x^2} \Rightarrow y - yx^2 = 1 \Rightarrow yx^2 = y - 1$

$x = \pm\sqrt{\frac{y-1}{y}}$

$\frac{y-1}{y} > 0$, $y \neq 0 \Rightarrow y^2 - y > 0$

$\Rightarrow \left(y - \frac{1}{2}\right)^2 > \left(\frac{1}{2}\right)^2 \Rightarrow y - \frac{1}{2} > \frac{1}{2}$ or $y - \frac{1}{2} < -\frac{1}{2}$

$\Rightarrow y > 1$ or $y < 0$

Range = $(-\infty, 0) \cup (1, \infty)$.

29. Divide ₹ 21866 into two parts such that the amount of one in 3 years is same as the amount of the second in 5 years, the rate of compound interest being 5% per annum.

Divide Rs. 21866 into two parts such that the amount of one part in 3 years is the same as the amount of the second part in 5 years.

Let, First part (That put for 3 years) = x

So, Second part (That put for 5 years) = 21866 - x

We know the formula for compound interest:

$A = P\left(1 + \frac{R}{100}\right)^n$

So from the given condition, we get,

$x\left(1 + \frac{5}{100}\right)^3 = (21866 - x)\left(1 + \frac{5}{100}\right)^5$

$x = (21866 - x)\left(1 + \frac{5}{100}\right)^{5-3}$

$x = (21866 - x)\left(\frac{105}{100}\right)^2$

$x = (21866 - x)\left(\frac{21}{20}\right)\left(\frac{21}{20}\right)$

$\frac{400x}{441} + x = 21866$

$\frac{400x+441x}{441} = 21866$

$\frac{841x}{441} = 21866$

$x = \frac{21866 \times 441}{841}$

x = 11466

Therefore,

The first part (That put for 3 years) = ₹11466

So, the second part (That put for 5 years) = 21866 - 11466 = ₹10400

30. $\frac{2^{-3} \cdot \sqrt{6} \cdot 3^2}{6^3 \cdot 2^5} = \frac{2^{-3} \cdot \sqrt{2 \times 3} \cdot 3^2}{(2 \times 3)^3 \cdot 2^5} = \frac{2^{-3} \cdot 2^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} \cdot 3^2}{2^3 \cdot 3^3 \cdot 2^5}$

$= 2^{-3+\frac{1}{2}-3-5} \cdot 3^{\frac{1}{2}+2-3}$

$= 2^{-\frac{21}{2}} \cdot 3^{-\frac{1}{2}} = \frac{1}{2^{10}\sqrt{6}}$

31. Let C and T denotes the students who play cricket and tennis, respectively.

Given, n(C) = 110, n(T) = 160, n(C ∩ T) = 70, n(U) = 450.

Using identity,

n(C ∪ T) = n(C) + n(T) - n(C ∩ T)

= 110 + 160 - 70

= 200

∴ No. of students play neither cricket nor tennis

= n(U) - n(C ∩ T)

= 450 - 200

= 250

Section D

32. i. Since there are 5 white out of a total of 12 balls, the probability of drawing a white ball is $\frac{5}{12}$

ii. The odds against drawing a white ball are (1 - p) :p i.e.

$\left(1 - \frac{5}{12}\right) : \frac{5}{12} = \frac{7}{12} : \frac{5}{12}$ = 7 : 5

iii. Now if two balls are to be drawn simultaneously, the total number of ways of doing so is $^{12}C_2$, and number of ways of choosing two white balls is $^5C_2$; so the probability of drawing two white balls

$= \frac{5C_2}{12C_2} = \frac{5 \times 4}{1 \times 2} \times \frac{1 \times 2}{12 \times 11} = \frac{5}{33}$

iv. The probability of drawing two black balls = $\frac{{}^7C_2}{{}^{12}C_2} = \frac{7\times6}{1\times2} \times \frac{1\times2}{12\times11} = \frac{7}{22}$

So the odds in favour of drawing two black balls are

p: (1 - p) = $\frac{7}{22} : \left(1 - \frac{7}{22}\right) = \frac{7}{22} : \frac{15}{22}$ = 7 : 15

v. The number of ways of choosing one white ball and one black ball is ${}^5C_1 \times {}^7C_1 = 5 \times 7 = 35$

So the probability of drawing one white and one black ball = $\frac{35}{12C_2} = \frac{35 \times 1 \times 2}{12 \times 11} = \frac{35}{66}$

OR

Case I: When white ball is drawn.

P(white ball from urn) = $\frac{m}{m+n}$

White ball is put back into urn along with k white balls.

Total number of balls in bag: m + n + k

Total white balls = m + k

∴ Probability of drawing white ball = $\frac{m+k}{m+n+k}$

∴ Probability in this case = $\left(\frac{m}{m+n}\right)\left(\frac{m+k}{m+n+k}\right)$ ...(i)

Case II: When black ball is drawn.

P(black ball from urn) = $\frac{n}{m+n}$

Black ball is put back into urn along with k black balls.

∴ Number of balls in bag = m + n + k

Number of white balls = m

∴ Probability of drawing a white ball = $\frac{m}{m+n+k}$

∴ Probability in this case = $\left(\frac{n}{m+n}\right)\left(\frac{m}{m+n+k}\right)$ ...(ii)

Hence, by theorem of total probability, probability of drawing a white ball, when one ball is drawn and put back in bag along with k balls of same colour

= $\left(\frac{m}{m+n}\right)\left(\frac{m+k}{m+n+k}\right) + \left(\frac{n}{m+n}\right)\left(\frac{m}{m+n+k}\right)$

= $\left(\frac{m}{m+n}\right)\left[\frac{m+k}{m+n+k} + \frac{n}{m+n+k}\right]$

= $\frac{m}{m+n}\left(\frac{m+n+k}{m+n+k}\right) = \frac{m}{m+n}$

Hence, probability of drawing a white ball is independent of k.

33. Given: $\lim\limits_{x\to2} \frac{\sqrt{3-x}-1}{2-x}$

Rationalizing the given equation, we have,

$\lim\limits_{x\to2} \frac{\sqrt{3-x}-1}{2-x} = \lim\limits_{x\to2} \frac{(\sqrt{3-x}-1)}{(2-x)} \frac{(\sqrt{3-x}+1)}{(\sqrt{3-x}+1)}$

$= \lim\limits_{x\to2} \frac{(3-x-1)}{(2-x)(\sqrt{3-x}+1)}$

$= \lim\limits_{x\to2} \frac{(2-x)}{(2-x)(\sqrt{3-x}+1)}$

$\Rightarrow \lim\limits_{x\to2} \frac{\sqrt{3-x}-1}{2-x} = \lim\limits_{x\to2} \frac{1}{(\sqrt{3-x}+1)}$

Now, we can see that the indeterminant form is removed, so substituting x as 2

We get, $\lim\limits_{x\to2} \frac{\sqrt{3-x}-1}{2-x} = \frac{1}{1+1} = \frac{1}{2}$

34.

Income per day	Mid values x_i	f_i	f_ix_i	$\lvert x_i - 358\rvert$	$f_i\lvert x_i - 358\rvert$
0 - 100	50	4	200	308	1232
100 - 200	150	8	1200	208	1664
200 - 300	250	9	2250	108	972
300 - 400	350	10	3500	8	80
400 - 500	450	7	3150	92	644
500 - 600	550	5	2750	192	960
600 - 700	650	4	2600	292	1168

700 - 800	750	3	2250	392	1176
		50	17900		7896

Mean $\bar{x} = \frac{1}{N} \sum f_i x_i = \frac{1}{50} \times 17900 = 358$

Mean deviation about mean $= \frac{1}{N} \sum_{i=1}^{n} f_i \left| x_i - \bar{x} \right|$

$= \frac{1}{50} \times 7896 = 157.92$

OR

Let $\bar{x}$ be the mean of the given data set.Then we have.

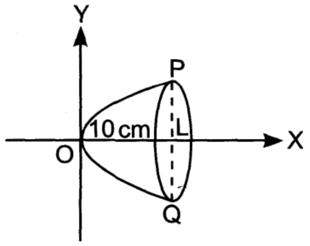
$\bar{x} = \frac{40+52.3+55.2+72.9+52.8+79+32.5+15.2+27.9+30.2}{10}$= 45.98

x_i	$\|d_i\| = \|x_i - 45.98\|$
40	5.98
52.3	6.32
55.2	9.22
72.9	26.92
52.8	6.82
79	33.02
32.5	13.48
15.2	30.78
27.9	18.08
32	13.98
Total	164.6

MD = $\frac{1}{10} \times$ 164.6 = 16.46

Therefore Mean deviation from the mean is 16.4 cm

35. PQ = 10 cm, PL = 20 cm, OL = 10 cm



$\therefore$ Coordinates of P are (10, 20)

Let equation of parabolic reflection is

$y^2 = 4ax$

$(20)^2 = 4 \times 10 \times a \Rightarrow 400 = 40a \Rightarrow a = 10$

$\therefore$ focus is (10, 0).

Section E

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

During sports day of a school different patterns are made for students to perform. One such pattern is made by putting flags at B(3, 2) and C(4, -1), other flags and lines are to be put based on some calculations. Let us try the different positions.

(i) Slope of BC = $\frac{-1-2}{4-3}$ = -3

Equation of BC is y - 2 = -3(x - 3)

$\Rightarrow$ y - 2 = -3x + 9

$\Rightarrow$ 3x + y - 11 = 0

(ii) A(1, 2), C(4, -1)

Slope of AC = $\frac{-1-2}{4-1}$ = -1

Equation of AC is y - 2 = -1(x - 1)

$\Rightarrow$ y - 2 = -x + 1

$\Rightarrow$ x + y -3 = 0

(iii)A(1, 2), B(3, 2)

Slope of AB = $\frac{2-2}{3-1}$ = 0

Equation of AB is y - 2 = 0(x - 1) $\Rightarrow$ y = 2

OR

Centroid of triangle = $\left(\frac{1+3+4}{3}, \frac{2+2-1}{3}\right)$ = $\left(\frac{8}{3}, 1\right)$

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

A panel of two judges P and Q graded seven dramatic performances by independently awarding marks as follows:

Performance	1	2	3	4	5	6	7
Marks by P	46	42	44	40	43	41	45
Marks by Q	40	38	36	35	39	37	41

(i) Mean marks given by Judge $P = \frac{46+42+44+40+43+41+45}{7}$

$= \frac{301}{7}$

= 43

(ii) Mean marks given by Judge $Q = \frac{40+38+36+35+39+37+41}{7}$

$= \frac{266}{7}$

= 38

(iii)

Marks by 'P'	**$d_i = x_i$ - A**	$d_i{}^2$
46	6	36
42	2	4
44	4	16
40	0	0
43	3	9
41	1	1
45	5	25
	$\Sigma d_i = 21$	$\Sigma d_i{}^2 = 91$

Standard Deviation $(\sigma) = \sqrt{\frac{\Sigma d_i{}^2}{N} - \left(\frac{\sum d_i}{N}\right)^2}$

$\sqrt{\frac{91}{7} - \left(\frac{21}{7}\right)^2}$

$= \sqrt{13 - 9}$

= 2

OR

Marks by 'Q'	**$d_i = x_i$ - A**	$d_i{}^2$
40	5	25
38	3	9
36	1	1
35	0	0
394	4	16
37	2	4
41	6	36
	$\Sigma d_i = 21$	$\Sigma d_i{}^2 = 91$

Standard Deviation $(\sigma) = \sqrt{\frac{\Sigma {d_i}^2}{N} - \left(\frac{\sum d_i}{N}\right)^2}$

$= \sqrt{\frac{91}{7} - \frac{21}{7}}$

$\sqrt{4} = 2$

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

Five friends Mohit, Sachin, Rohit, Mohan and kapil were playing in a ground, where they sit in a row in a straight line.

(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

OR

Read the text carefully and answer the questions:

Five friends Mohit, Sachin, Rohit, Mohan and kapil were playing in a ground, where they sit in a row in a straight line.

(i) Total number of ways = 5! = 120

(ii) Two position are fixed for Mohit and Sachin therefore considering it as one unit, total students left = 3 + 1 = 4

Total possible arrangement = $4! \times 2! = 48$

(iii) Total possible arrangements = $3! \times 2! = 12$

(iv) Total possible arrangements = 4! = 24