HALF YEARLY EXAMINATION, 2024-25

MATHEMATICS

Time – 3:00 Hrs. **Class – XI** **M.M. : 80**

Date – 12.09.2024 (Thursday)

Name of the student _____Section _____

GENERAL INSTRUCTIONS:

1. This question paper contains **five sections A, B, C, D and E**. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has **18 MCQ's** questions and **02 Assertion – Reason based** questions of **one mark each**.
3. **Section B** has **5 Very Short Answer (VSA**) -type questions of **two marks each**.
4. **Section C** has **6 Short Answer (SA)** - type questions of **three marks each**.
5. **Section D** has **4 Long Answer (LA)** - type questions of **5 marks each**.
6. **Section E** has **3 source based/ passage based/integrated** units of assessment of **4 marks each** with sub – parts.

SECTION –A

(This section comprises of multiple choice questions of 1 mark each)

Q1 The roster form of the set $A = \{x: x \in Z, x^2 < 20\}$ is

a) $\{-4,-3,-2,-1,0,1,2,3,4\}$ b) $\{-4,-3,-2,-1,1,2,3,4\}$
c) $\{0,1,2,3,4\}$ d) none of these

Q2 The number of subsets of a set containing n elements is

a) n b) $2^n - 1$ c) n^2 d) 2^n

Q3 If $A = \{1,3,5,8\}\ and\ B = \{2,4\}$, then

a) $4 \in A$ b) $\{4\} \subset A$ c) $B \subset A$ d) none of these

Q4 The symmetric difference of $A = \{1,2,3\}\ and\ B = \{3,4,5\}$ is

a) $\{1,2\}$ b)$\{1,2,4,5\}$ c) $\{4,3\}$ d) $\{2,5,1,4,3\}$

Q5 If A and B are two sets such that $n(A) = 70, n(B) = 60, n(A \cup B) = 110$, then $n(A \cap B)$ is equal to

a) 240 b) 50 c) 40 d) 20

Q6 If R is a relation on set $A = \{1,2,3,4,5,6,7,8,9\}$ given by $xRy \Leftrightarrow y - 3x$, then R is

a) $\{(3,1), (6,2), (8,2), (9,3)\}$ b) $\{(3,1), (6,2), (9,3)\}$
c) $\{(3,1), (2,6), (3,9)\}$ d) none of these

Q7 If the set A has p elements, B has q elements, then the number of elements in AXB is

a) p + q b) p + q + 1 c) pq d) p^2

Q8 If R is a relation from A to a set B, then

a) $R = A \cup B$ b) $R = A \cap B$ c) $R \subseteq A \times B$ d) $R \subseteq B \times A$

Q9 If $f(x) = cos(logx)$, then $f(x^2)f(y^2) - \frac{1}{2}\left\{f\left(\frac{x^2}{y^2}\right) + f(x^2y^2)\right\}$ has the value

a) -2 b) -1 c) ½ d) none of these

Q10 Let$A = \{1,2,3\}, B = \{2,3,4\}$, then which of the following is a function from A to B?

a) $\{(1,2), (1,3), (2,3), (3,3)\}$ b) $\{(1,3), (2,4)\}$
c) $\{(1,3), (2,2), (3,3)\}$ d) $\{(1,2), (2,3), (3,2), (3,4)\}$

Q11 The domain of $f(x) = \sqrt{\frac{(x+1)(x-3)}{x-2}}$ is

a) $[-1,2) \cup [3,\infty)$ b) $(-1,2) \cup [3,\infty)$ c) $[-1,2] \cup [3,\infty)$ d)none of these

Q12 The radian measures of 520° is

a) $\left(\frac{26\pi}{9}\right)^c$ b) $\left(\frac{9\pi}{26}\right)^c$ c) $(520)^c$ d) none of these

Q13 The value of trigonometric ratio $cos(-480^\circ)$ is

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

Q14 If $tan\theta = -\frac{1}{\sqrt{5}}$ and θ lies in IV quadrant, then the value of $cos\theta$ is

a) $\frac{\sqrt{5}}{\sqrt{6}}$ b) $\frac{2}{\sqrt{6}}$ c) $\frac{1}{2}$ d) $\frac{1}{\sqrt{6}}$

Q15 The value of $(1+i)(1+i^2)(1+i^3)(1+i^4)$ is

a) 2 b) 0 c) 1 d) i

Q16 If $\frac{1-ix}{1+ix} = a + ib$, then $a^2 + b^2$ is

a) 1 b) -1 c) 0 d) none of these

Q17 If $Z = 1 - cos\theta + isin\theta$, then $|Z|$ is

a) $2sin\frac{\theta}{2}$ b) $2cos\frac{\theta}{2}$ c) $2cos\theta$ d) $2sin\theta$

Q18 If $-3x + 17 < -13$, then

a) $x \in (10,\infty)$ b) $x \in [10,\infty)$ c) $x \in (\infty,10]$ d) $x \in [-10,10)$

Assertion – Reason Based Questions

In the following questions, a statement of Assertion (A) is followed by a statement of Reason(R). Choose the correct answer out of the following choices.

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

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

(c) (A) is true and (R) is false

(d) (A) is false and (R) is true

Q19 Assertion (A): If $-3x + 12 < 0$, then $x \in (4,\infty)$

Reason(R): If $a < b$, then $ka > kb$, if $k > 0$

Q20 Assertion (A): If $2x - 7 > 5 - x\ and\ 11 - 5x \leq 1$, then $x \in (4,\infty)$

Reason(R): The solution set of system of linear inequations is the intersection of solution set of individual inequations.

SECTION – B

(This section comprises of very short answer type questions of 2 marks each)

Q21 Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. Find the values of m and n.

OR

Show that $n\{P[P(P(\emptyset))]\} = 4$

Q22 If A and B are two sets having 3 elements in common. If $n(A) = 5, n(B) = 4$, find $n(AXB)$ and $n(AXB) \cap (BXA)$

Q23 Define greater function and draw the graph of greater function in copy.

OR

Draw the graph of the function $f(x) = |2x - 3|$ in copy.

Q24 Find the angle between the minute hand and the hour hand of a clock when the time is 7:20 AM.

Q25 Express $(1 - 2i)^{-3}$ in standard form a+ib.

SECTION – C

(This section comprises of short answer type questions of 3 marks each)

Q26 Let R be a relation on Q defined by $R = \{(a, b): a, b \in Q \text{ and } a - b \in Z\}$

Show that a) $(a, a) \in R \text{ for all } a \in Q$ b) $(a, b) \in R \Longrightarrow (b, a) \in R$ c) $(a, b) \in R \text{ and } (b, c) \in R \Longrightarrow (a, c) \in R$

Q27 Find the range of the function $f(x) = \frac{x}{1+x^2}$

Q28 Prove that $\frac{cos(90^\circ+\theta)sec(-\theta)tan(180^\circ-\theta)}{sec(360^\circ-\theta)sin(180^\circ+\theta)cot(90^\circ-\theta)} = -1$

OR

Prove that $sin780^\circ sin120^\circ + cos240^\circ sin390^\circ = \frac{1}{2}$

Q29 Prove that $\frac{cos4x+cos3x+cos2x}{sin4x+sin3x+sin2x} = cot3x$

Q30 Find the value of $\frac{i^{592}+i^{590}+i^{588}+i^{586}+i^{584}}{i^{582}+i^{580}+i^{578}+i^{576}+i^{574}}$

OR

Find the value of $1 + i^2 + i^4 + i^6 + \cdots + i^{20}$

Q31 If $x = -5 + 2\sqrt{-4}$, find the value of $x^4 + 9x^3 + 35x^2 - x + 4$

SECTION – D

(This section comprises of long answer type questions of 5 marks each)

Q32 State and prove De – Morgan's Laws.

Q33 Solve for x: $2cos^2\theta + 3sin\theta = 0$

OR

If $cos\theta = \frac{cos\alpha\ cos\beta}{1-sin\alpha\ sin\beta}$, prove that one value of $tan\frac{\theta}{2} = \frac{tan\frac{\alpha}{2}-tan\frac{\beta}{2}}{1-tan\frac{\alpha}{2}tan\frac{\beta}{2}}$

Q34 Find the modulus and argument of $\frac{i-1}{cos\frac{\pi}{3}+isin\frac{\pi}{3}}$

Q35 Solve the following linear inequations graphically :

$$x - y \leq 1, x + 2y \leq 8, 2x + y \geq 2, x \geq 0, y \geq 0$$

OR

$$x + y \geq 1, 7x + 9y \leq 63, x \leq 6, y \leq 5, x \geq 0, y \geq 0$$

SECTION – E

This section comprises of **3 cases – study/passage bases** questions of **4 marks each** with sub – parts. The **first two case – study** questions have **three parts (a), (b) and (c) of 1,1 and 2** respectively. The **third case – study** question has **two sub – parts** of **two marks each**.

Q36 In a library 25 students read Physics, Chemistry and Mathematics books. It was found that 15 students read Mathematics, 12 students read Physics while 11 students read Chemistry. 5 students read both Mathematics and Chemistry, 9 students read Physics and Mathematics, 4 students read Physics and Chemistry and 3 students read all the three subject books.

a) Find the number of students who read none of the subjects
b) Find the number of students who read at least one of the subjects
c) Find the number of students who read only one of the subject

OR

Find the number of students who read only mathematics.

Q37 A child questioned his mathematics teacher that "If he has more than one linear inequation, than what will be the solution?"

Teacher replies, "The solution set of a system of linear inequations in one variable is the intersection of the solution sets of the linear inequations in the given system."

After that teacher gave some problems to solve.

Based on the given information, answer the following questions.

a) Find the solution *of the linear inequation* $2(2x + 3) - 10 < 6(x - 2)$
b) Find the solution *of the linear inequation* $\frac{2x-3}{4} + 6 < 2 + \frac{4x}{3}$
c) Find the combine solution of the system of linear inequations (a) and (b)

OR

Find the solution of the linear inequation $\frac{x}{2x+1} \geq \frac{1}{4}$

Q38 The water acidity in a pool is considered normal, when the average pH reading of three daily measurements is between 7.2 and 7.8. The first two pH reading are 7.48 and 7.85 and third is x.

On the basis of the above information, answer the following questions.

a) Find the average pH of the three days
b) Find the system of linear inequation from the above information

HALF YEARLY EXAMINATION, 2024-25

MATHEMATICS

Time – 3:00 Hrs. **Class – XI** **M.M. : 80**

Date – 18.09.2024 (Wednesday)

Name of the student _____Section _____

GENERAL INSTRUCTIONS:

1. This question paper contains **five sections A, B, C, D and E**. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has **18 MCQ's** questions and **02 Assertion – Reason based** questions of **one mark each**.
3. **Section B** has **5 Very Short Answer (VSA**) -type questions of **two marks each**.
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6. **Section E** has **3 source based/ passage based/integrated** units of assessment of **4 marks each** with sub – parts.

SECTION –A

(This section comprises of multiple choice questions of 1 mark each)

Q1 Two finite sets have m and n elements respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are.

(a) 7, 6 (b) 5, 1 (c) 6, 3 (d) 8, 7

Q2 Let A and B be two sets such that n(A)= 16, n(B)= 14, n(A∪B)=25 then n(A∩B) is equal to

(a) 30 (b) 50 (c) 5 (d) none of these

Q3 The set of circles passing through the origin (0,0)

(a) Finite set (b) infinite set (c) Null set (d) none of these

Q4 If A = {1, 2, 6} and R be the relation defined on A by R = {(a, b): a ∈ A, b ∈ A and a divides b}, then range of R is equal to

(a) {1, 2} (b) {2, 6} (c) {1, 2, 6} (d) None of these

Q5 Empty set is a _____.

(a) Infinite set (b) Finite set (c) Unknown set (d) Universal set

Q6 If A and B be sets A^c , B^c denote the complements of the sets A and B, then set

(A — B) ∪ (B — A) ∪ (A ∩ B) is equal to

(a) $A \cup B$ (b) $A^c \cup B^c$ (c) $A^c \cap B^c$ (d) $A \cap B$

Q7 Find the angle in radian through which a pendulum swings it its length is 75 cm and tip describes an arc of length 21 cm.

(a) 7/25 (b) 6/25 (c) 8/25 (d) 3/25

Q8 If x, y are real numbers such that ordered pairs (x + y, x -y) and (2x + 3y, 3x - 2y) are equal, then (x, y) is equal to

(a) (7, 6) (b) (5, 1) (c) (6, 3) (d) (0, 0)

Q9 Let f = {(1, 1), (2, 3), (0, -1), (-1, -3)} be a function from Z to Z defined by f(x) = mx + c. Determine c.

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

Q10 Given f(x) = 3x – 5, for what value of x does 2[f(x)] – 1 = f(3x – 6)

(a) 0 (b) 4 (c) 6 (d) 7

Q11 If 4x + 3 < 6x +7, then x belongs to the interval

(a) (2, ∞) (b) (-2, ∞) (c) (-∞, -2) (d) (-4, ∞)

Q12 Domain of the function $f(x) = \frac{x^2+3x+5}{x^2-5x+4}$

(a) R – {1, 3} (b) {1, 4} (c) R – {1, 4} (d) Set of all real numbers

Q13 If coty = 7 /24 and y lies in the third quadrant then value of cosy - siny is:

(a) 17 /25 (b) 16 /25 c. 14/ 25 d. 13/25

Q14 tan $(\frac{\pi}{4} + x)$ tan $(\frac{\pi}{4} - x)$ is:

(a) 0 (b) -1 (c) 1/2 (d)1

Q15 The modulus of the complex number $4 + 3i^7$ is equal to

(a) 5 (b) −5 (c) 2 (d) 3

Q16 If (2+5i) Z = (3-7 i), then Z =……

(a) 1+i (b) 1−i (c) −1+i (d) −1−i

Q17 Multiplicative inverse of complex number (1+i) is

(a) $\frac{1}{2}$(1+i) (b) $\frac{1}{2}$ (1−i) (c) $\frac{1}{2}$(−1+i) (d) $\frac{1}{2}$(−1−i)

Q18 The solution set of equation $|x + 2| \leq 5$ is

(a) (-7,5) (b) [-7.3] (c) [-5,5] (d) (-7,3)

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(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.

Q19 **Assertion (A):** Let A = {1, 2} and B = {3, 4}. Then, number of relations from A to B is 16.

Reason (R): If n(A) = p and n(B) = q, then number of relations is 2^{pq}.

Q20 **Assertion (A):** The value of sin(690°)cos(120°) + cos(690°)sin(120°) = 1

Reason (R): The values of sine is negative in third and fourth quadrant respectively.

SECTION – B

(This section comprises of very short answer type questions of 2 marks each)

Q21 Let f, g: R→R be defined by f(x) = x + 1 and g(x) = 2x – 3. Find (f – g)(1) and (f. g)(0).

OR

Let f be the subset of Z x Z, defined by f = {(ab, a + b): a, b ∈Z}. Is f a function from Z to Z? Justify.

Q22 Write the following intervals in set- builder form: (i) (-3, 0) (ii) (6, 12].

Q23 Write the relation R = {(x, x^3) : x is a prime number less than 10} in roster form, find the range.

Q24 For cyclic quadrilateral ABCD show that Cos A + Cos B + Cos C + Cos D = 0

Q25 if $\left(\frac{1+i}{1-i}\right)^{100}$ =a+ib,then find the value of a and b .

SECTION – C

(This section comprises of short answer type questions of 3 marks each)

Q26 If P = {x : x < 3, x∈N}, Q = {x : x≤ 2, x ∈ W}. Find (P∪Q) × (P∩Q)

OR

A = {1,2, 3, 4, 5} and B = {2, 4, 6}.

(i) Find n(A×B)

(ii) A correspondence of elements from A to B given as {(1, 2), (2, 2), (3, 4), (3, 6), (4, 4), (5, 6)}. Is it a function? Justify your answer.

(iii) If the function f : A⟶B such that (a, b) ∈ f and a < b, defined by f = {(1, 2), (x, 4), (2, 4), (4, y), (5, 6)}, then find x and y.

Q27 Determine the range of the function f which is defined as

$$f = \left\{\left(x, \frac{x^2}{1+x^2}\right) : x \in R\right\}$$

Q28 Show that $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4\sin^2\left(\frac{x-y}{2}\right)$

Q29 Show that $\cos 20^0 \cos 40^0 \cos 60^0 \cos 80^0 = 1/16$

Q30 If $(x+iy)^3 = u+iv$, then show that $\frac{u}{v} + \frac{v}{y} = 4(x^2 - y^2)$

OR

Solve :$|1+i|^x = 2^x$

Q31 Solve : -13 < 3 - 4x < 11

SECTION – D

(This section comprises of long answer type questions of 5 marks each)

Q32 For any two sets A and B, Prove that:

(i) $(A \cup B)' = A' \cap B'$ (ii) $(A \cap B)' = A' \cup B'$

Q33 Prove that : $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$

OR

Show that $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$

Q34 If α and β are different complex numbers with $|\beta|$ =1, then find $\left|\frac{\beta-\alpha}{1-\beta\,\bar{\alpha}}\right|$.

Q35 A solution of 9% acid is to be diluted by adding 3% acid solution to it. The resulting mixture is to be more than 5% but less than 7% acid. If there is 460 liters of 9% acid solution, how many liters of 3% solution will have to be added?

OR

A man wants to cut three lengths from a single piece of board of length 91cm. The second length is to be 3cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5cm longer than the second.

SECTION – E

Q36 In a city of 56,000 people, following is the number of fans of players Rohit (R), Virat (V) and Dhoni (D):

Players	Number of Fans
Rohit	23,000
Virat	25,000
Dhoni	18,000
Rohit and Virat	12,000
Rohit and Dhoni	10,000
Virat and Dhoni	8,000
Rohit, Virat and Dhoni	3,000

Based on the above information, answer the following: **(1+1+2)**

(a) How many people are fans of at least 2 players?

(b) How many people follow R or V but not D?

(c) How many people are fans of at least 1 player?

OR

(c) How many people are not fans of any players?

Q37 If $\tan x = \frac{5}{12}$ $and\ x\ lies\ in 3^{rd} quadrant,$ **(1+1+2)**

Based on the above information, answer the following:

(a) $\sin\frac{x}{2}$ (b) $\cos\frac{x}{2}$ (c) $\tan\frac{x}{2}$ **OR** (c) $sinx$

Q38 If the Celsius /Fahrenheit (F) conversion formula is given by F = $\frac{9}{5}$C + 32°? **(1+1+2)**

Based on the above information, answer the following:

(a) At What temperature Celsius and Fahrenheit are equal.
(b) When temperature is 212° F, find the temperature in Celsius.
(c) A solution is to be kept between 77°F and 86°F. What is the range in temperature in degree Celsius?

OR

(c) A solution is to be kept between 30° C and 40° C What is the range in temperature in degree Fahrenheit.

HALF YEARLY EXAMINATION, 2024-25

APPLIED MATHEMATICS

Time – 3:00 Hrs. **Class – XI** **M.M. : 80**

Date – 12.09.2024 (Thursday)

Name of the student _____Section _____

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 alternative in all such questions.

SECTION - A

(All Questions are compulsory. No internal choice is provided in this section)

Q1 In a G.P., 5th term is 27 and 8th term is 729. Find its 11th term.

a) 729 b) 2187 c) 6561 d) 19683

Q2 How many terms of G.P. 2,4,8,16, …… are required to give sum 254?

a) 4 b) 5 c) 6 d) 7

Q3) The positive integer n so that $\lim_{x\to 3} \frac{x^n - 3^n}{x - 3}$ = 108 is

(a) 3 (b) 4 (c) -2 (d) 1

Q4) If $y = \log\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx}$ is equal to –

(a) $\frac{4x^3}{1-x^4}$ (b) $\frac{-4x}{1-x^4}$ (c) $\frac{1}{4-x^4}$ (d) $\frac{-4x^3}{1-x^4}$

Q5. If ${}^nC_2 = {}^nC_3$ then find n.

a) 2 b) 3 c) 5 d) 6

Q6. Determine n if ${}^{2n}C_3 : {}^nC_3 = 9:1$.

a) 7 b) 14 c) 28 d) 32

Q7. How many words can be formed from the letters of the word DOGMATIC, if all the vowels remain together :

(A) 4140 (B) 4320 (C) 432 (D) 43

Q8. How many numbers of 6 digits can be formed from the digits of the number 112233?

a) 30 b) 60 c) 90 d) 120

Q9 In A.P. 171, 162, 153, ……. Find first negative term.

a) 0 b) -2 c) -6 d) -9

Q10 If 3rd term of an A.P. is 6 and 5th term of that A.P. is 12. Then find the 21st term of that A.P.

a) 40 b) 42 c) 60 d) 63

Q11 Let A and B be two sets in the same universal set. Then, A-B =

(a) $A' \cap B$ (b) $A \cap B$ (c) $A \cap B'$ (d) none of these

Q12 Total number of ways in which 8 students can be seated in a circle is

(i) 40302 (ii) 40320 (iii) 5040 (iv) 50040

Q13. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x = 1$ is

(a) 0 (b) 1 (c) 1/2 (d) $1/\sqrt{2}$

Q14. An urn contains 6 balls of which two are red and four are black. Two balls are drawn at random. What is the probability that they aress of different colours?

A) 2/5 B)1/15 C) 8/15 D) 4/15

Q15. If two dice are tossed in together, then the probability of getting the sum of digits on their upper faces as to be 8 will be

(a) 2/18 (b) 5/36 (c) 1/18 (d) 1/36

Q16) If f(x) = (x + 1)/x then df(x)/dx is

(i) 1/x (ii) -1/x (iii) $-1/x^2$ (iv) $1/x^2$

Q17) $\lim_{x\to\infty} \frac{2x^2+3x+4}{3x^2+4x+5}$ is equal to (a) 0 (b) 1 (c) 2/3 (d) None of these

Q18) $f(x) = \begin{cases} \frac{2^{x+2}-16}{4^x-16}, & if\ x \neq 2 \\ k, & if\ x = 2 \end{cases}$ at $x = 2$

If f(x) is continuous at x =2 then value of k is

(A) 1 (B) 2 (C) 1/2 (D) 0

ASSERTION REASON BASED QUESTIONS

In the following questions, a statement of Assertion(A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices

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

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

c. A is true but R is false.

d. A is false but R is true.

Q19 Assertion (A) :

For the function $f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + ... + \frac{x^2}{2} + 1.$ $f(1) = 100\, f'(0)$

Reason (R) : $\frac{d}{dx}(x^n) = nx^{n-1}$

Q.20 Assertion (A): Two dice are thrown simultaneously. There are 11 possible outcomes and each of them has a probability 1/11.

Reason (R) : Probability of an event (E) is defined as

P(E) =(Number of favourable outcomes) /(Total number of possible outcomes)

SECTION B

Q21 Let A = {1, 2, 3,...,14}. Define a relation R from A to A by

R = {(x, y) : $3x - y = 0$, where $x, y \in$ A}. Write R in roster form & write its domain, codomain and range.

Q-22 Find dy/dx if $y = \log \sqrt{x} + \sqrt{\log x}$

OR

If $e^x + e^y = e^{x+y}$, prove that $\frac{dy}{dx} = -e^{y-x}$

Q.23 An urn contains 10 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black ?

OR

Three cards are drawn successively, without replacement from a pack of 52 well shuffled cards. What is the probability that first two cards are kings and the third card drawn is an ace?

Q24 If $\lim_{x\to 1} \frac{x^4-1}{x-1} = \lim_{x\to k} \frac{x^3-k^3}{x^2-k^2}$, then find the value of k.

Q.25 Prove that

$${}^{47}c_4 + \sum_{r=1}^{5} {}^{52-r}c_3 = {}^{52}c_4$$

SECTION C

Q.26 Which of the following relations are functions? Give reasons. If it is a function, determine its domain and range.

(i) {(2,1), (5,1), (8,1), (11,1), (14,1), (17,1)}

(ii) {(1,3), (1,5), (2,5)}.

Q.27 Using first principle find the derivative of $f(x) = x^3$.

Q.28 Find values of a & b if f(x) is continuous at x= 2 and x=10

$$f(x) = \begin{cases} 5, & if\ x \le 2 \\ ax + b, & if\ 2 < x < 10 \\ 21, & if\ x \ge 10 \end{cases}$$

Q.29 How many 3-digit numbers can be formed from the digits 1, 2, 3, 4 and 5 assuming that

(i) repetition of the digits is allowed?

(ii) repetition of the digits is not allowed?

OR

(i) Find number of diagonals in a convex hexagon.

(ii) Find number of sides in a convex polygon if it has 9 diagonals.

Q.30 If 3 coins are tossed together then find the probability to get

i) Exactly one head ii) At least one head iii) At most one head

OR

If two dice are tossed together then find the probability to get the sum of digits on their upper faces as to be

i) Exactly 7 ii) Atleast 7 iii) At most 7

Q.31 Solve :

$$\lim_{x\to 2}\left[\frac{1}{x-2}-\frac{2(2x-3)}{x^3-3x^2+2x}\right]$$

SECTION - D

(This section comprises of long answer type questions (LA) of 5 mark each)

Q.32 In how many ways the letters of word " MANREGA" can be arranged in the two cases given below :

i) when all vowels are never together ?

ii) if no two vowels are together ?

OR

Permute the letters of word "AASTHA" and if all the words so formed are arranged alphabetically (in dictionary order) then find the Rank of "AASTHA"

Q.33 If *a, b, c* and *d* are in G.P. show that

$(a^2 + b^2 + c^2)(b^2 + c^2 + d^2) = (ab + bc + cd)^2$

Q.34 Prove that sum of n AMs between any two numbers a & b is equal to n times of the single arithmetic mean between them.

Q.35 What is the number of ways of choosing 4 cards from a pack of 52 playing cards? In how many of these

(i) four cards are of the same suit,

(ii) four cards belong to four different suits,

(iii) are face cards,

(iv) two are red cards and two are black cards,

(v) cards are of the same colour?

OR

If there given 12 points out of which 5 are collinear then find :

i) Total number of straight lines which can be drawn by joining these points.

ii) Total number of triangles which can be drawn by joining these points.

SECTION E

(This section comprises of 3 source based questions (Case Studies) of 4 mark each)

Q.36 **Case Study 1:** Read the following passage and answer the questions given below (Internal Choice is in option iii.) (Marks 1 + 1 + 2)

In a school a special campaign was organized to cultivate the reading habit among the students and for this they were motivated to subscribe some newspapers. After one month In a survey of 60 students in a class was done to know the output. It was found that 25 people read newspaper H, 26 people 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 three newspapers. Now using venn diagram find–

i) The number of students who read exactly one of the newspapers.

ii) The number of students who read exactly two newspapers.

iii) The number of students who read at least one of the newspapers.

OR

The number of students who read H & T but not I.

Q.37 **Case Study 2:** Read the following passage and answer the questions given below. (1+2+1)

In a school it was decided to prepare a 5 members team to take care of environment in school campus from a group of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has

i) no girl ?

ii) at least one boy and one girl ?

iii) In how many ways these 4 girls and 7 boys can be seated for the selection process if no two girls are seating together ?

OR

In how many ways they can be seated if all girls are never sitting together ?

Q.38 **Case Study 3 :** Read the following passage and answer the questions given below (Internal Choice is in option iii.) (Marks 1 + 1 + 2)

In a factory which manufactures bolts, operators A, B and C manufacture respectively 25%, 35% and 40% of the bolts. Of their outputs, 5, 4 and 2 percent are respectively defective bolts. What is the probability that-

i) Bolt is manufactured by the A and is defective ?

ii) Defective bolt is produced ?

iii) One bolt which is found defective while sampling is produced by C ?

OR

iii) One bolt which is found defective while sampling is not produced by B ?