PT4/ANNUAL EXAMINATION, 2022-23

MATHEMATICS (041)

Time – 3 hrs. **Class – XI** **M.M. – 80**

Name of the student _____ Section ____ Date - 13.02.2023 (Monday)

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 and 02 Assertion – Reason based questions 1 mark each.
3. Section B has 5 Very Short Answer (VSA) type questions of 2 marks each.
4. Section C has 6 Short Answer (SA) type questions of 3 marks each.
5. Section D has 4 Long Answer (LA) type questions of 5 marks each.
6. Section E has 3 source bases/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

SECTION – A

(Multiple Choice Questions) Each question carries 1 mark.

Q1 Let $A = \{x: x = 6n, n \in N\}$ *and* $B = \{x: x = 9n, n \in N\}$, *then* $A \cap$B is

a) $\{x: x = 6n, n \in N\}$ b) $\{x: x = 9n, n \in N\}$

c) $\{x: x = 54n, n \in N\}$ d) $\{x: x = 18n, n \in N\}$

Q2 Let $f: R \to R: f(x) = x^2 + 1$, then $f^{-1}(10)$ is

a) $\{-3,3\}$ *b*) $\{101\}$ c) $\{-2,2\}$ d) $\{-5,5\}$

Q3 The degree measure of $(-2)^c$ is (where c stands for radians)

a) $-110^\circ 32' 44''$ b) $110^\circ 32' 44''$ c) $114^\circ 32' 44''$ d) $-114^\circ 32' 44''$

Q4 The value of $cosec(-1110^\circ)$ is

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

Q5 The value of $\left\{i^{18} + \left(\frac{1}{i}\right)^{25}\right\}^3$ is

a) $1 - i$ b) $2(1 - i)$ c) $1 + i$ d) $2(1 + i)$

Q6 The conjugate of $(2 - 5i)^2$ is

a) $-21 + 20i$ b) $21 + 20i$ c) $-21 - 20i$ d) $21 - 20i$

Q7 The solution set of $\frac{x+4}{x-2} > 0$is

a) $(-\infty, -4)$ b) $(2, \infty)$ c) $(-\infty, -4) \cup (2, \infty)$ d) Not possible to solve

Q8 If $(n + 1)! = 90(n - 1)!$,then the value of n is

a) 10 b) 9 c) 90 d) Not possible to solve

Q9 If $C_{r+4}^{20} = C_{r+2}^{20}$, then the value of r is

a) 20 b) 7 c) 2 d) Any natural number

Q10 How many terms are there in the expansion of $\{(a + b)^6 + (a - b)^6\}$

a) 5 b) 4 c) 8 d) 0

Q11 If the GP is $\frac{1}{4}, \frac{-1}{2}, 1, -2, +4, \ldots$, then the 10^{th} term is

a) -128 b) 128 c) 125 d) -2

Q12 If the slope of the line joining the points $A(x, 2)\ and\ B(6, -8)\ is\ \frac{-5}{4}$, then the value of x is

a) -2 b) 2 c) -5 d) 5

Q13 If the focus and the directrix of the parabola is F(4,0) and x = -4 , then the equation of parabola is

a) $y^2 = 16x$ b) $x^2 = 16y$ c) $y^2 = -16x$ d) $x^2 = -16y$

Q14 The distance between two points whose coordinates are (-2, 1, -3) and (4, 3, -6) is

a) 14 b) 49 c) 7 d) 31

Q15 In which octant does (3, -2, -5) lie?

a) Octant II b) Octant III c) Octant VII d) Octant VIII

Q16 The value of $\lim_{x \to 0} \frac{\tan 3x}{\tan 5x}$ is

a) $\frac{3}{5}$ b) $\frac{5}{3}$ c) $\frac{-5}{3}$ d) $\frac{-3}{5}$

Q17 The value of $\lim_{x \to 0} \frac{\cos 3x - \cos 5x}{x^2}$ is

a) 3 b) 5 c) 8 d) 4

Q18 If $y = \sqrt{\frac{1-cos2x}{1+cos2x}}$, then $\frac{dy}{dx}$ is

a) $sec^2 x$ b) 0 c) tanx d) Not possible to solve

ASSERTION – REASON BASED QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason (R). Pick the correct option:

(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: Derivative of sinx with respect to x is cosx

Reason: Derivative of a function f(x) with respect to x is given by $f'(x) = \lim_{h \to 0} \frac{f(x+h) + f(x)}{h}$

Q20 Assertion: A bag has 3 red balls and 5 green balls. If we take two balls from the bag, then probability of getting red balls is 3/28.

Reason: Probability of getting two red balls = Number of red balls / total number of balls

SECTION – B

(This section comprises of very short answer type – questions (VSA) of 2 mark each.)

Q21 If a, b, c are in GP and $a^{1/x} = b^{1/y} = c^{1/z}$, prove that x, y, z are in AP.

OR

If x, 2y, 3z are in AP, where the distinct number x, y, z are in GP then find the common ratio of the GP.

Q22 Find the equation of a circle with centre (h, k) and touching the x – axis.

Q23 Find the equation of the hyperbola with centre at the origin, length of the transverse axis 6 and one focus at (0, 4).

OR

Find the equation of hyperbola whose vertices are (±7, 0) and the eccentricity is 4/3.

Q24 Evaluate $\lim_{x \to 0} \frac{\sqrt{1+3x}-\sqrt{1-3x}}{x}$

Q25 The odds in favour of occurrence of the event are 5:12. Find the probability of the occurrence of this event.

SECTION – C

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

Q26 In a survey of 425 students in a school, it was found that 115 drink apple juice, 160 drink orange juice and 80 drink both apple as well as orange juice. How many drink neither apple juice nor orange juice?

Q27 Find the domain and range of the real function, $f(x) = \frac{x-3}{x-5}$

OR

$$f(x) = \frac{1}{\sqrt{x-[x]}}$$

Q28 In how many of the distinct permutations of the letters in MISSISSIPPI do the 4 I's not come together?

OR

If the words 'AGAIN' are written as in a dictionary, what will be the 50th word?

Q29 Find the coordinates of the focus and the vertex, the equations of the directrix and the axis, and length of the latus rectum of the parabola $3x^2 = -16y$.

OR

Find the equation of the parabola with vertex at the origin, the axis along the x-axis and passing through the point (2, 3).

Q30 Find the lengths of the major and minor axes, coordinates of the vertices and the foci, the eccentricity of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$

Q31 If $y = cos^2 x^2$, find $\frac{dy}{dx}$

SECTION – D

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

Q32 Let $A = \{1,2\}, B = \{3,4\}$ and $C = \{4,5\}$. Verify that $(A \times B) \times C = A \times (B \times C)$ And hence find $A \times B \times C$

Q33 Prove that $\frac{sin\,8x cos x - sin\,6x cos\,3x}{cos\,2x cos x - sin\,4x sin\,3x} = tan 2x$

OR

Prove that cosx cos 2x cos 4x cos 8x = $\frac{\sin 16x}{16 \sin x}$

Q34 Prove that $C_{2n}^{4n} : C_n^{2n} = \{1 \times 3 \times 5 \times \ldots \times (4n-1)\} : \{1 \times 3 \times 5 \times \ldots \times (2n-1)\}^2$

OR

If ${}^{n+1}C_{r+1} : {}^{n}C_r = 11 : 6$ and ${}^{n}C_r : {}^{n-1}C_{r-1} = 6 : 3$, find n & r.

Q35 Arithmetic mean of two numbers is 3 times their geometric mean. Show that the numbers are in the ratio $(3 + 2\sqrt{2}) : (3 - 2\sqrt{2})$.

SECTION – E

(This section comprises of 3 case study/ passage – based questions of 4 marks each with two sub parts. First two case study questions have three sub – parts (i), (ii), (iii) of 1,1,2 respectively. The third case study question has sub – parts of 2 marks each.)

Q36 In drilling world's deepest hole, the Kola Superdeep Borehole, the deepest manmade hole on Earth and deepest artificial point on Earth, as a result of a scientific drilling project, it was found that the temperature T in degree Celsius, x km below the surface of Earth, was given by:

T = 30 + 25 (x – 3), 3 < x < 15. If the required temperature lies between 200^o C and 300^o C, then

i) Find at what depth, x will lie between.

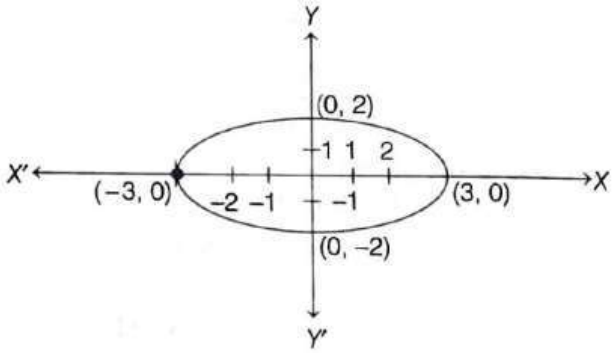
ii) Draw the graph of the following inequality on the number line if |x| < 5

iii) Solve for x, $-9x + 2 > 18$

OR

$13x + 15 \leq -4$

Q37 Due to heavy storm an electric wire got bent as shown in the figure. It followed a mathematical shape.



Answer the following questions given below

i) Name the shape and find the equation of the shape

ii) Foci of the shape is

iii) Eccentricity of the shape is

OR

iii) Latus reactum of the shape is

Q38 Mohan is doing one of his projects. For this he asked mathematics marks of 58 students which are as follows:

x_i	3	5	9	11	13
f_i	6	15	25	8	4

i) What would be the mean deviation about mean for the data?

ii) What would be the mean deviation about median for the data?

PT4/ANNUAL EXAMINATION, 2022-23

APPL. MATHEMATICS (241)

Time – 3 hrs. **Class – XI** **M.M. – 80**

Name of the student _____ Section ____ Date - 13.02.2023 (Monday)

GENERAL INSTRUCTIONS -

- This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
- Section A has 20 MCQs of 1 mark each.
- Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
- Section C has 6 Short Answer (SA)-type questions of 3 marks each.
- Section D has 4 Long Answer (LA)-type questions of 5 marks each.
- Section E has 3case based questions (4 marks each) with sub parts.

SECTION - A

(Multiple Choice Questions) Each question carries 1 mark

Q1 The value of $\left(\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}\right)$ is

A) 0 B) 1 C) 60 D) none of these

Q2. If in a certain language, METAL is coded as LFSBK, how is MUMBAI coded in that code ?

A) LVLCZJ B) LVLCAJ C) LVLBZJ D) LVLDZJ

Q3. If 3rd term of a GP is 4 then the product of first 5 terms is-

A) 512 B) 1024 C) 128 D) 4096

Q4. The length of the attitude (in cm) of a rhombus if lengths of its two diagonals are 12 cm and 16 cm respectively

A) 19.2 B) 9.6 C) 4 D) none of these

Q5. The value of P(n, n – 1) is

A) n B) 2n C) n ! D) 2n!

Q6. Convert the binary equivalent 10101 to its decimal equivalent.

A) 21 B) 12 C) 22 D) 31

Q7. $8^{x+1} = 64$, what is the value of 3^{2x+1} ?

A) 1 B) 3 C) 9 D) 27

Q8. The average of 25 observations is 36. If the average of the first 13 observations is 32 and that of the last 13 observations is 39, find the 13th observation.

A) 21 B) 22 C) 23 D) 24

Q9. A clock gains 5 seconds for every 3 minutes. If the clock started working at 7 a.m. in the morning, then what will be the correct time if the wrong clock shows 4.15 p.m. on the same day?

A) 4.30 PM B) 4.00 PM C) 4.05 PM D) 4.10 PM

Q10. On January 1, 2006, it was Sunday. What will be the day of the week on January 1, 2010?

A) Saturday B) Friday C) Monday D) Sunday

Q11. If A and B together can build a house in 10 days; B and C can build it together in 12 days and C and A can build it in 15 days. In how many days A, B & C together can build the house ?

A) 6 days B) 4 days C) 8 days D) 12 days

Q12. A, P, R, X, S and Z are sitting in a row. S and Z are in the centre. A and P are at the ends. R is sitting to the left of A. Who is to the right of P ?

A) A B) X C) S D) Z

Q13. Odd one out among 693, 462, 572, 427, 671, 264 is :

A) 693 B) 572 C) 427 D) 264

Q14. Karl Pearson's coefficient of skewness is given by

A) (Mean-Mode)/(S.D.) B)(Mean-Median)/(S.D.) C) Both A & B D) None of these

Q15. If $\beta_2 = \mu_4 / (\mu_2)^2$ and $\beta_2 > 3$ then the frequency curve is called

A) Mesokurtic B) Platykurtic C) Leptokurtic D) None of these

Q16. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x = 1$ is

A) 1 B) 1/2 C) $1/\sqrt{2}$ D) 0

Q17. Evaluate $\lim_{x \to 0} \frac{\sqrt{2+x} - \sqrt{2}}{x}$

A) $\frac{1}{2\sqrt{2}}$ B) $\frac{1}{2}$ C) $\frac{1}{\sqrt{2}}$ D) 0

Q18. Probability of getting 53 Sundays or 53 Mondays in a leap year is

(A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{3}{7}$ (D) $\frac{4}{7}$

Q19. Equation of a line passing through (2,3) and perpendicular to 4x+5y =6 is

A) 5x-4y +2 = 0 B) 4x+5y = 23 C) 5x-4y = 23 D) 4x+5y+2 =0

Q20 Center and radius of circle $x^2 + y^2$-4x-6y-3 = 0 are

A) (2,-3) & 2 units B) (-2,3) & 3 units C) (2,3) & 4 units D) (-2,-3) &5 units

SECTION - B

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

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 ∈ A}. Write down its domain, codomain and range.

OR

A = {1, 2, 3, 5} and B = {4, 6, 9}. Define a relation R from A to B by R = {(x, y): the difference between x and y is odd; x ∈ A, y ∈ B}. Write R in roster form

Q22. Ravi is son of Aman's father's sister. Sahil is the son of Divya who is the mother of Gaurav and grandmother of Aman. Ashok is the father of Tanya and grandfather of Ravi. Divya is the wife of Ashok. Explain

(i) How is Ravi related to Divya?
(ii) How is Gaurav's wife related to Tanya?

Q23. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that the student has opted neither NCC nor NSS.

OR

4 cards are drawn from a well shuffled deck of 52 cards. What is the probability of obtaining 3 diamonds and one spade?

Q24. Statements: Some actors are singers. All the singers are dancers.

Conclusions:

1. Some actors are dancers.

2. No singer is actor.

Explain with appropriate diagrams which conclusion is correct and which one is the wrong conclusion.

Q25. Find domain and range of the function f(x) = $\sqrt{9-x^2}$

SECTION - C

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

Q26. Insert 3 GMs between 4 & 2500.

OR

If *a, b, c* and *d* are in G.P. show that $(a^2 + b^2 + c^2)$,$(ab + bc + cd)$, $(b^2 + c^2 + d^2)$ are also in GP.

Q27. Derive standard equation for parabola $y^2 = 4ax$

OR

Find the coordinates of the focus, axis of the parabola, the equation of the directrix and the length of the latus rectum of parabola $y^2=12x$

Q28. Find value of k if f(x) is continuous

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

OR

If $\lim\limits_{x\to 1}\dfrac{x^4-1}{x-1}=\lim\limits_{x\to k}\dfrac{x^3-k^3}{x^2-k^2}$, then find the value of *k*.

Q29. Using first principle find the derivative of function $f(x)= x^4$

OR

Find dy/dx if $y= \log\sqrt{x} + \sqrt{logx}$

Q30. If

X	5	4	3	2	1
Y	4	2	10	8	6

then find the Karl Pearson's coefficient of correlation between X & Y

Q31. The scores of nine students in Maths and Economics are given as :

Maths : 35, 23, 47, 17, 10, 43, 9 , 6, 28

Economics: 30, 33, 45, 23, 8, 49, 12, 4, 31

Find the coefficient of Spearman's rank correlation.

SECTION - D

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

Q32. Mr Pandey lives in Lucknow .The reading of electric meter of his house is found to be 5678 units. If the previous month's reading was 4803 units and connection load is 4 kW, calculate his electricity bill for that month. Tariff plan is given below. Energy charges Fixed charge Rs 110 per kW/month Energy tax is 5 % of tariff rates. Surcharge is Rs 0.26 per unit.

No of units	0-150	151-300	301-500	>500
Price per unit (in Rs)	5.5	6	6.5	7

Q33. A borrows Rs 8 Lakhs from B at 10% pa interest compounded annually and lends the same to C at same rate compounded half yearly. Find overall gain or loss of A in this transaction over a period of one and half year.

OR

Find the amount of regular annuity of Rs 5000 payable at the end of each year for 3 years at 10% p.a. compounded annually.

Q34. In financial year 2019-20 Varun's (age 38 years) gross salary was Rs 7,28,000. He deposited Rs 8000 per month in NPS and paid Rs 21825 as premium of LIC. He deposited Rs 5000 in his PPF account and paid Rs 40000 as the tuition fee of his children. Calculate the income tax paid by him at the end of the financial year.

OR

A shopkeeper buys an article whose printed price is Rs 4000 from a wholesaler at a discount of 20% and sells it to a consumer at the printed price. If the sales are intra-state and rate of GST is 12 % then find-

i) the price of article inclusive of GST at which shopkeeper bought it.

ii) the amount of GST paid by shopkeeper to the state government.

iii) the amount of GST received by the central government.

iv) the amount which the consumer pays for the article.

Q35. A manufacturer has three machine operators A, B and C. The first operator A produces 1% defective items, whereas the other two operators B and C produce 5% and 7% defective items respectively. A is on the job for 50% of the time, B is on the job for 30% of the time and C is on the job for 20% of the time. A defective item is produced, what is the probability that it was produced by A?

SECTION - E

(This section comprises of 3 case-study/passage-based questions of 4 marks each)

Q36. **Case-Study 1:**Read the following passage and answer the questions given below.

In a school students were motivated to subscribe some good and popular newspapers to enhance their reading skills as well as to make them updated with the current affairs and happenings in the country as well as outside the country. After the drive a survey was also done to know the output.

During the survey of 60 students of a class, it was found that 25 students 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 three newspapers. Based on the above information, find the following. (Show by appropriate venn diagram)

i) The number of students who read newspaper T only

ii) The number of students who read exactly one newspaper

iii) The number of students who read exactly two newspapers

iv) The number of students who still don't read any newspaper

Q37. **Case-Study 2 :** Read the following passage and answer the questions given below.

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) at least 3 girls ?

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

Q38. **Case-Study 3:** Read the following passage and answer the questions given below.

In an economy class students were being taught about shares and the comparison of stability of their price values with an example of the prices of shares of two companies by providing the following data (the prices of shares X and Y of past 10 weeks).

X	35	54	52	53	56	58	52	50	51	49
Y	108	107	105	105	106	107	104	103	104	101

Based on the above information, answer the following questions. (Show complete calculation)

(i) What is the variance of prices of share X ?

(ii) What is the standard deviation of prices of share Y ?