

PT-2/HALF YEARLY EXAMINATION, 2022-23
APPLIED MATHEMATICS

Time – 3 hrs.

Class – XI

M.M. : 80

Date – 16.09.2022 (Friday)

Name of the student _____ Section _____

General Instructions:

- This question paper contains **six sections**. Each section is compulsory.
- **Section A**-7 Multiple Choice Questions (each of 1 mark)
- **Section B**-6 Multiple Choice Questions (each of 2 marks)
- **Section C**- 8 Subjective Type Questions (each of 2 marks)
- **Section D**- 4 Subjective Type Questions (each of 4 marks)
- **Section E**- 4 Subjective Type Questions (each of 6 marks)
- **Section F**- 1 Case Study based Question (5 marks)

SECTION-A (Multiple Choice Questions -1 mark each)

- Q1. 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
- Q2. The sets A & B have 5 & 9 elements respectively, such that A is proper subset of B, then the total number of elements $A \cup B$ are-
- A) 5 B) 9 C) 14 D) 4
- Q3. Let $A = \{a, b, c\}$ and $B = \{1, 2\}$ then the number of relations from A into B are
- A) 6 B) 5 C) 32 D) 64
- Q4. If 3rd term of a GP is 4 then the product of first 5 terms is-
- A) 512 B) 1024 C) 128 D) 4096
- Q5. In a certain code, TOGETHER is written as RQEGRJCT. In the same code, PAROLE will be written as
- A) RYPQJG B) RCPQJG C) NCPQJG D) NCPQJC
- Q6. Find the Odd One which does not belong to the group : 343, 1728, 8, 4913
- A) 343 B) 1728 C) 8 D) 4913
- Q7. How many words beginning with T and ending with E can be made (with no letter repeated) out of the letters of the word 'TRIANGLE' ?
- A) 1440 B) $P(8,6)$ C) 720 D) 72

SECTION-B (Multiple Choice Questions - 2 marks each)

- Q8. The set $A = \{x : x \in \mathbb{N}, \text{ and } x^2 - 9x + 20 = 0\}$ is
- A) Null set B) Finite set C) Infinite set D) None of these

- Q9. $(256)^{0.16} \times (256)^{0.09} = ?$
 A) 4 B) 16 C) 64 D) 256.25
- Q10. If $\log 27 = 1.431$, then the value of $\log 9$ is:
 A) 0.934 B) 0.945 C) 0.954 D) 0.958
- Q11. If the 5th term of an AP is $\frac{1}{7}$ and the 7th term of the same AP is $\frac{1}{5}$ then its 35th term is equal to
 A) 0 B) 1 C) 5 D) 7
- Q12. If the sum of the first $2n$ terms of an A.P. 2,5,8,..... is equal to the sum of the first n terms of the A.P. 57, 59,61..... then the value of n is
 A) 10 B) 11 C) 12 D) 13
- Q13. The value of $P(n, n - 1)$ is
 A) n B) $2n$ C) $n!$ D) $2n!$

SECTION - C (Subjective Type Questions - each of 2 marks)

- Q14. Find value of $(110101)_2 \times (10110)_2$. Verify your answers by converting these binary numbers into their equivalent decimal numbers also.
- Q15. If $A = \{1,2,3,4\}$ and $B = \{3,4,5,6\}$ and $U = \{1,2,3,4,5,6,7,8\}$ then verify De Morgan's law.

OR

In a school there are 20 teachers who teach mathematics or physics. Of these, 12 teach mathematics and 4 teach both physics and mathematics. Find -

- a) how many teach mathematics only.
- b) how many teach Physics.

- Q16. Let $A = \{1, 2, 3, \dots, 14\}$. Define a relation R from A to A by $R = \{(x, y) : 3x - y = 0, \text{ where } x, y \in A\}$. Write R in roster form & write its domain, codomain and range.
- Q17. The sum of first three terms of a G.P. is 16 and the sum of the next three terms is 128. then find the common ratio of the G.P.

OR

Find a G.P. for which sum of the first two terms is -4 and the fifth term is 4 times the third term.

- Q18. Insert 3 GMs between 2 & 162.
- Q19. **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.

- Q20. The data given below represents a coded language for different colours, analyse it and answer the questions following it:

“black orange yellow purple blue” is written as “set jet let get bet”

“grey green red purple” is written as “get pet wet vet”

“purple blue red silver” is written as “vet set get tet”

“grey orange pink” is written as “ bet ret pet”

a) What is the code for the colour “Grey”?

b) Which colour has been coded as “set”?

OR

‘Balloons are blue’ is coded as ‘834’

‘Rainbow in sky’ is coded as ‘723’

‘Carpet is beautiful’ is coded as ‘629’

‘Box is heavy’ is coded as ‘325’

a) What will be the code for ‘India is a beautiful country’

b) What will be the code for ‘OPJS is the Best’

Q21. 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

If letters of word “ NIKUNJ” are permuted and the words so farmed are arranged in dictionary order (or alphabetical order) then find the rank of “NIKUNJ”.

SECTION – D (Subjective Type Questions - 4 marks each)

Q22. The mean of 25 observations is 36. If the mean of the first 13 observations is 32 and that of the last 13 observations is 39, find the 13th observation.

Q23. 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 ?

OR

Two trains 200 m and 150 m long are running on parallel rails at the rate of 40 km/hr and 45 km/hr respectively. In how much time will they cross each other, if they are running in the same direction?

Q24. Prove that sum of n AMs between any two numbers a & b is equal to n times of the single arithmetic mean between them.

OR

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

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

Q25. 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?

SECTION – E (Subjective Type Questions - 6 marks each)

Q26. Prove that:

$$1/(1 + x^{b-a} + x^{c-a}) + 1/(1 + x^{a-b} + x^{c-b}) + 1/(1 + x^{b-c} + x^{a-c}) = 1$$

OR

If $5^x = 7^y = 35^{-z}$ then prove that $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0$

Q27. If $\log 3712 = 3.5696$, $\log 23.4 = 1.3692$ and $\text{antilog } 2.7542 = 567.9$ then using the properties of logarithms find the value of $0.003712 \times (0.0234)^{1/2}$.

Q28. A rectangular sheet of length 176 cm and width 88 cm is rolled along its length and thus formed a cylinder. Find its volume. Now it is rolled along its width and turned into a cylinder again. Find the difference of volumes (in cu cm) of cylinders so formed in both cases.

OR

Find the area of a trapezium if lengths of its parallel sides are 5 cm & 10 cm and that of the non-parallel sides are 3 cm & 4 cm respectively.

Q29. 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 should sit together ?

(v) In how many ways can a team of 5 members be selected if one specific girl has to be included compulsorily?

SECTION – F (Case Study based Question - 5 marks)

Q30. 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, answer the following questions.

i) The number of students who read newspaper T only :

A) 8 B) 10 C) 12 D) None of these

ii) The number of students who read exactly one newspaper :

A) 19 B) 30 C) 52 D) None of these

iii) The number of students who read exactly two newspapers :

A) 19 B) 30 C) 52 D) 25

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

A) 8 B) 6 C) 5 D) 3

v) The number of students who read H & I both but not the T newspaper :

A) 8 B) 6 C) 5 D) 9

PT-2/HALF YEARLY EXAMINATION, 2022-23
MATHEMATICS (041)

Time – 3 hrs.

Class – XI

M.M. : 80

Date – 16.09.2022 (Friday)

Name of the student _____ Section _____

General Instructions:

- This question paper contains two parts A and B.

Part – A:

- It consists of three sections- I, II and III.
- Section I comprises of 7 MCQs type questions of 1 Mark each.
- Section II comprises of 6 MCQs type questions of 2 Marks each.
- Section III case study comprises of case-based questions of 1 Mark each.

Part – B:

- It consists of three sections- IV, V and VI.
- Section IV comprises of 8 questions of 2 marks each.
- Section V comprises of 4 questions of 4 marks each.
- Section VI comprises of 4 questions of 6 marks each.

Part-A

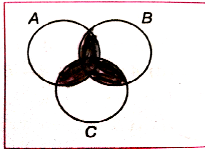
Section I :Comprises of 7 MCQs type questions of 1 Mark each

- Q1 If $A = \{1,2,3,4,5\}$, $B = \{2,4,6\}$ and $C = \{3,4,6\}$ then $C \cap (A \cup B)$ is equal to: 1
a) $\{3,4,6\}$ b) $\{1,2,3\}$ c) $\{3,4,5\}$ d) ϕ
- Q2 If $\tan\theta = -4/3$, θ lies in 2nd quadrant, then $\sin\theta$ is 1
a) $3/5$ b) $3/4$ c) $4/5$ d) $5/3$
- Q3 If A has n number of elements, then the number of relations define on A is 1
a) n^2 b) n^n c) $2n$ d) $2^{n \times n}$
- Q4 Two finite sets of have m and n elements respectively the total number of subsets of first set is 112 more than the total number of subsets of the second set find the value of m and n respectively. 1
a) 4,7 b) 7,4 c) 3,6 d) 6,3
- Q5 $A = \{x: x \text{ is a positive integer less than 7 and } 2^x - 1 \text{ is an odd number}\}$ 1
a) $\{1, 2, 3, 5\}$ b) $\{1, 3, 5\}$ c) $\{1, 2, 3, 4, 5, 6\}$ d) $\{1, 2, 3, 4, 5\}$
- Q6 Doman of $f(x) = \sqrt{4x - x^2}$ is: 1
a) $R - [0, 4]$ b) $R - (0, 4)$ c) $(0, 4)$ d) $[0, 4]$
- Q7 The radian measure of $40^\circ 20'$ is equal to 1
a) $\frac{120\pi}{504}$ b) $\frac{121\pi}{540}$ c) $\frac{120\pi}{540}$ d) $\frac{121\pi}{504}$

Section II : Comprises of 6 MCQs type questions of 2 Marks each.

- Q8 If $aN = \{ax : x \in N\}$, then the set $6N \cap 8N$ is equal to 2
a) $8N$ b) $12N$ c) $24N$ d) $48N$

Q9



2

If A, B and C are three events. What does the Venn diagram represent?

- a) Exactly two events b) at most two events c) at least two events d) none of these

Q10 A horse is tied to a post by a rope. If the horse moves along a circular path always keeping the rope tight and describes 88m when it has traced out 54° at the centre. Find the length of the rope. 2

- a) $\frac{880}{3}m$ b) $\frac{880}{30}m$ c) $\frac{88}{3\pi}m$ d) $\frac{880}{3\pi}m$

Q11 $\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x$ is equal to 2

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

Q12 If $3 \tan(\theta - 15^\circ) = \tan(\theta + 15^\circ)$, where $0^\circ < \theta < 90^\circ$, then θ is 2

- a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

Q13 If $f(x) = x^2 - 3x + 1$, find $x \in \mathbb{R}$ such that $f(2x) = f(x)$ 2

- a) -1,0 b) -1,2 c) 0,1 d) 0,2

Section III: Case study comprises of case-based Questions of 1 Mark each

Q14 In a survey of 60 people, it was found that 25 people read newspaper H, 26 read newspaper T, 26 read newspaper I, 9 read both H and I, 11 read both T and H, 9 read both T and I, 3 read all three newspapers. 5

On the basis of above information's answer the followings:

- The number of people who read at least one of the newspapers.
- The number of people who read exactly one newspaper.
- The number of people who do not read any newspaper.
- The number of people who read only newspaper H.
- The number of people who read newspaper H and T but not I.

Part-B

Section IV: Comprises of 8 questions of 2 marks each.

Q15 Show that in cyclic quadrilateral ABCD: $\tan A + \tan B + \tan C + \tan D = 0$. 2

OR

Prove that: $\cos^2 \frac{\pi}{8} + \cos^2 \frac{3\pi}{8} + \cos^2 \frac{5\pi}{8} + \cos^2 \frac{7\pi}{8} = 2$

Q16 Find the angle between the minute hand of a clock and the hour hand when the time is 7.20. 2

Q17 Express $\tan 4\theta$ in terms of $\tan \theta$. 2

Q18 Find a linear function $f(x)$ if $f(0) = 2$ and $f(1) = -1$. 2

Q19 Let $A = \{-2, 1, 0, 1, 2\}$ and $f: A \rightarrow Z$ given by $f(x) = x^2 - 2x - 3$. Find (a) the range of f , (b) pre-images of 6. 2

OR

Let f be a subset of $Z \times Z$ defined by $f = \{(ab, a + b) : a, b \in Z\}$. Is f a function from Z into Z ? Justify your answer.

- Q20 Let R be the relation on the set N of natural numbers defined by 2
 $R = \{(x, y) : x + 3y = 12, x \in N, y \in N\}$. Find: (i) Domain of R (ii) Range of R.
- Q21 If $A = \{x : x^2 = 4, x \in I\}$, $B = \{y : y^2 = 9, y \in I\}$, then find $A \cup B$ and $A \cap B$. 2
- Q22 Verify $(A \cap B)' = A' \cup B'$ where $A = \{2, 3, 4, 5, 6\}$ and $B = \{3, 6, 7, 8\}$ are subsets of the 2
set $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$.

Section V: Comprises of 4 questions of 4 marks each.

- Q23 Let A, B and C be the non-empty sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$. 4
Show that $B = C$.

OR

Let A and B be sets, if $A \cap X = B \cap X = \emptyset$ and $A \cup X = B \cup X$ for some set X, prove that $A = B$.

- Q24 Let $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4\}$ and $R = \{(x, y) : (x, y) \in A \times B, y = x + 1\}$ 4
(i) find $A \times B$ (ii) write R in roster form
(iii) write domain & range of R (iv) represent R by an arrow diagram
- Q25 Let f be a function defined by $f : x \rightarrow 5x^2 + 2, x \in R$ 4
(i) find the image of 3 under f (ii) find $f(3) + f(2)$
(iii) find x such that $f(x) = 22$ (iv) find the pre-image of 7 under f
- Q26 If $\tan x = \frac{3}{4}, \pi < x < \frac{3\pi}{2}$, find the value of $\sin \frac{x}{2}$ and $\tan \frac{x}{2}$. 4

OR

$$\frac{\sin A + \sin 2A + \sin 4A + \sin 5A}{\cos A + \cos 2A + \cos 4A + \cos 5A} = \tan 3A$$

Section VI: Comprises of 4 questions of 6 marks each

- Q27 Prove that $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$ 6
- Q28 Prove that $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$ 6

OR

Prove that $\cos \alpha + \cos \beta + \cos \gamma + \cos (\alpha + \beta + \gamma) = 4 \cos \left(\frac{\alpha + \beta}{2}\right) \cos \left(\frac{\gamma + \beta}{2}\right) \cos \left(\frac{\alpha + \gamma}{2}\right)$

- Q29 Find the domain and the range of $f(x) = \frac{x^2}{1 + x^2}$ 6

OR

Find the domain and the range of $f(x) = \frac{1}{1 - x^2}$

- Q30 Let R be a relation from Q into Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a - b \in Z\}$. Show 6
that
 $(a, a) \in R$, for all $a \in Q$
 $(a, b) \in R$ implies $(b, a) \in R$
 $(a, b) \in R, (b, c) \in R$ implies $(a, c) \in R$

