Jagrit Rajoriya

(3)

GOODLEY PUBLIC SCHOOL
HALF -YEARLY EXAMINATION (2023-24)
CLASS XI
SUBJECT: MATHEMATICS (041)

TIME: 3 Hours **MAX. MARKS 80**

General Instructions:

1. ***This Question Paper has 5 Sections A ,B ,C, D and E.***
2. ***Section A has 20 MCQs carrying 1 mark each.***
3. ***Section B has 5 questions carrying 02 marks each.***
4. ***Section C has 6 questions carrying 03 marks each.***
5. ***Section D has 4 questions carrying 05 marks each.***
6. ***Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 2 and 1 marks each respectively.***
7. ***All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Qs of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E***

SECTION A

Section A consists of 20 questions of 1 mark each.

1. If A∪{a,b}= {a,b,c,d,e}, then the smallest set A will be
   (a) {c,d,e} (b) {a,b,c,d,e} (c) {a,b} (d) ∅

2. If n(A)=5, n(B)=7 then maximum number of elements in A∪B is
   (a) 7 (b) 5 (c) 12 (d) None of these

3. If U is a Universal set and A is a non-empty set, then which of the following is true
   (a) A∪ U= A (b) A∪ U= U (c) A ∩ U=U (d) A∩A'=U

4. The function f:A→**R**, f(x)= (x^2-1) , where A ={-4 ,0,1,4}as a set of ordered pairs is:
   (a) {(-4,15),(0,-1),(1,0),(4,15)} (b) {(-4,-15),(0,-1),(1,0),(4,15)}
   (c) {(4,1),(0,-1),(1,0),(4,15)} (d) {(-4,15),(0,-1),(1,0)}

5. If set A and B have 3 and 4 elements respectively, then the number of subsets of set A× B is
   (a) 2^3 (b) 2^4 (c) 2^{12} (d) 2^7

6. Domain of $\sqrt{a^2 - x^2}$ (a>0) is
   (a) (-a,a) (b) [-a,a] (c) [0,a] (d)(-a,0]

7. If sinθ+cosecθ=2, then $\sin^2\theta$+$\text{cosec}^2\theta$ is
   (a) 1 (b) 2 (c) 3 (d) 4

8. The value of $\frac{\cos(\pi+x)\cos(-x)}{\sin(\pi-x)\cos(\frac{\pi}{2}+x)}$ is

(a) $\sin^2 x$ (b) $\cos^2 x$ (c) $\tan^2 x$ (d) $\cot^2 x$

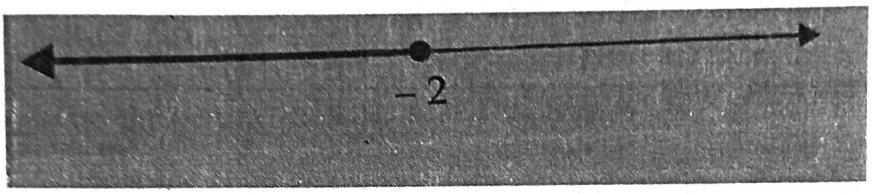
9. If $(\frac{1+i}{1-i})^x = 1$ and $n \in N$ then

(a) x=2n+1 (b) x=2n (c) x=4n (d) x=4n+1

10. The value of $\sqrt{-25} \times \sqrt{-9}$ is

(a) 15 (b) -15 (c) 15i (d) -15i

11. Solution of linear inequality in variable x is represented on given number line is



(a) $x \in (-\infty, -2)$ (b) $x \in (-\infty, -2]$ (c) $x \in (-2, \infty]$ (d) $x \in [-2, \infty)$

12. If x<5, then

(a) -x< -5 (b) -x≤ -5 (c) – x> -5 (d) -x≥ -5

13. The value of $\frac{6!}{3!}$ is

(a) 2! (b) 2 (c) 120 (d) 3!

14. The number of different 4- digit numbers that can be formed with the digits 2,3,4,7 and using each digit only once is

(a) 120 (b) 96 (c) 24 (d) 100

15. There are 10 persons in a party and if each two of them shake hands with each other, how many hand shake happen in the party?

(a) 20 (b) 25 (c) 45 (d) 30

16. If (2a+2b)+i(b-a)= - 4i, then the real values of a and b are respectively:

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

17. The total number of terms in the expansion of $(x + a)^{100}$ is

(a) 50 (b)100 (c)200 (d)101

18. The sum of exponents of x and y in the expansion of $(x + y)^{10}$ is

(a) 11 (b)10 (c)20 (d) none of these

DIRECTION: In the question number 19 and 20 , a statement of Assertion(A) is followed by a statement of Reason(R) . Choose the correct option

19. Statement A (Assertion): If $3x+8>2$, then $x \in \{-1, 0, 1, 2 \ldots\}$ where x is an integer

Statement R (Reason): The solution set of the inequality $4x+3<5x+7$ for all $x \in \mathbf{R}$ is $[4,\infty)$

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

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

(c) Assertion (A) is true but reasons (R) is false.

(d) **Assertion (A) is false but reasons (R) is true.**

20. Statement A (Assertion): The number of ways in which 5 students of a class out of 40 students can be taken for an excursion party is 40_{C_5}

Statement R (Reason): The number of combinations of n distinct objects taken r at a time is given by n_{C_r}.

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

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

(c) Assertion (A) is true but reasons (R) is false.

(d) Assertion (A) is false but reasons (R) is true.

SECTION- B

Section B consists of 5 questions of 2 marks each.

21. If f(x) = ax +b, where a and b are integers, f(-1) = -5 and f(3) =3. Find a and b.

22. If $\tan A = \frac{a}{a+1}$, $\tan B = \frac{1}{2a+1}$ then find the value of A + B

23. If $\sin x = \frac{3}{5}$, $\cos y = \frac{-12}{13}$, where x and y both lie in second quadrant, find the value of $\sin(x+y)$

OR

Find the value of $\tan 75^0 - \cot 75^0$

24. Find the conjugate of $\frac{1+7i}{(2-i)^2}$

OR

Express in the form of a+ib: $(\frac{1}{3} + 3i)^3$

25. Calculate $(96)^3$ using Binomial theorem.

SECTION- C

Section C consists of 6 questions of 3 marks each.

26. For any two sets A and B , prove the following using properties of sets:

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

27.Prove that: $\frac{tan5\theta+tan3\theta}{tan5\theta-tan3\theta} = 4\cos2\theta\cos4\theta$

OR

Prove that $\sqrt{2+\sqrt{2+2cos4x}} = 2\cos x$, where $0<x<\frac{\pi}{4}$.

28. Find the value of $\left|(1+i)\frac{(2+i)}{(3+i)}\right|$

29.In how many ways can the word CHRISTMAS be arranged so that letters C and M never occur together?

OR

Find r if : ${}^{5}P_{r} = {}^{6}P_{r-1}$

30. Which is greater : $(1.2)^{4000}$ or 800?

31. Expand the expression: $(x+1)^6 + (x-1)^6$.

OR

Show that 3^{2n+2}-8n- 9 is divisible by 64, whenever n is a positive integer.

SECTION- D

Section D consists of 4 questions of 5 marks each.

32. Let U = {1,2,3,4,5,6}, A = {2,3} and B = {3,4,5}. Find A', B', A'∩B', A∪B and hence show that $(A \cup B)' = A' \cap B'$.Draw venn- diagram in each case.

33. If P = {9,4,25}and Q ={1,2,3,5,-2,-3,-5}.A relation R is defined from P and Q as

R= $\{(x,y) : x = y^2, x \in P, y \in Q\}$.

(i) Write this relation in Roster form.
(ii) Draw arrow diagram for the above relation.
(iii)What is its domain , range and codomain?

OR

Let f= $\{(x, \frac{x^2}{1+x^2}) : x \in R\}$be a function from **R** into **R.** Determine the domain and range of f.

34. How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?

35.A group consists 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) atleast one boy and one girl? (iii) atleast 3 girls?

OR

If ${}^{n}P_{r} = 336$, ${}^{n}C_{r} = 56$. Find n and r and hence find ${}^{n-1}C_{r-1}$.

SECTION- E

Section E consists of 3questions of 4 marks each.

CASE STUDY- 1

36. Read the following text and answer the following questions based on the same:

Consider the following real -valued functions : f(x) , g(x) and h(x) defined as

$f(x) = |x|$

$g(x) = [x]$

$h(x) = x^2$

(i) Write the domain and range of the function f(x).

(ii) Draw the graph of f(x)

OR

Draw the graph of g(x)

(iii) Find the domain and range of h(x)

CASE STUDY -2

37. Trigonometry is the combination of two words –'Trigon' means triangle and metron means measure. It is a branch of geometry that studies relationship between lengths and angles of a triangle.Degree and radian units of measurement of angles are used ,also called Indian system of measurement of triangles . In this system πradian = 180^0; 1^0= 60 minute;

1 minute = 60 seconds. Length of arc l is given by $l=\theta r$.

On the basis of above information answer the following questions:

(i) Convert $\frac{11}{36}$ radians into degree, minutes and seconds.

(ii) a. Find the length of an arc made by minute's hand of a clock in 40 minutes having radius 1.5cm.

OR

If the arcs of the same length in two circles subtend angles 65^0 and 80^0 at the centre, then find the ratio of their radii.

(ii) Convert $\frac{7\pi}{18}$ into degrees.

CASE-STUDY -3

38. Four friends decide to play a game of cards .They picked a normal deck of cards with 52 playing cards.

The deck has 4 suits(Hearts, Diamonds, Spade and Clubs). Hearts and Diamonds are red in colour while Spades and Clubs are black in colour. Each suit has 13 cards each with one Ace(A), 9 numbered cards(2 to 10) and 3 face cards (Jack J , King K and Queen Q).

Based on the above information answer the following questions:

(i) What is the number of ways of choosing 4 cards of the same suit?

(ii) What is the number of ways of choosing 4 cards of same colour?

OR

Find the number of ways of choosing two red cards and two black cards.

(iii) Find the number of ways of choosing 4 face cards.