MATHEMATICS
CLASS XI

Time: 3 hours **MM: 100**

General Instructions:

1. *All questions are compulsory.*
2. *The question paper consists of **26** questions divided into three sections **A**, **B** and **C**. Section **A** comprises **6** questions of **one mark** each, Section **B** comprises **13** questions of **four marks** each and Section **C** comprises 7 questions of **six marks** each.*
3. *All questions in Section **A** are to be answered in one word, one sentence or as per the exact requirement of the questions.*
4. *There is no overall choice. However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.*
5. *Use of calculator is not permitted. You may ask for logarithmic tables, if required.*

SECTION - A

Q1 Determine whether an inclusive "OR" or exclusive "OR" is used in a statement, also give reasons for your answer. ' Two lines intersect at a point or are parallel'. 1

Q2 Find the multiplicative inverse of the following complex number $\left(2+\sqrt{3}i\right)^2$. 1

Q3 write the component statements of the statement. Also, check whether the statement are or not. If X and Y are integers, then xy is a rational number. 1

Q4 Find x and y , if (X + 3, 5) = (6, 2x + y). 1

Q5 Write the negation of the given statement P: For every real number x, $x^2 > x$. 1

Q6 If $\frac{1}{8!}+\frac{1}{9!}=\frac{x}{10!}$, *find* x. 1

Section – B

Q7 Find the equation of the circle passing through the points (4,1) and (6,5) and whose centre is on the line 4x + y = 16. 4

OR

A rod of length 12cm moves with its ends always touching the coordinate axes. Determine the equation of locus of a point P on the rod, which is 3cm from the end in contact with the X – axis.

Q8 If $\tan x+\tan\left(x+\frac{\pi}{3}\right)+\tan\left(x+\frac{2\pi}{3}\right)=3$, then prove that $\frac{3\tan x-\tan^3 x}{1-3\tan^2 x}=1$. 4

Q9 Prove by using the principle of mathematical induction $\forall n\in N$ 4
2 + 5 + 8 + 11 + ……….. + (3n – 1) = ½ n(3n + 1)

Q10 Three positive numbers form an increasing GP. If the middle term in this GP is doubled, then new numbers are in AP find the common ratio of the GP. 4

Q11 A committee of 12 is to be formed from 9 women and 8 men. In how many ways this can be done if atleast five women have to be included in a committee? 4

Q12 If $\alpha \, and \, \beta$ are complex numbers with $|\beta|$ = 1 , then find $\left|\frac{\beta-\alpha}{1-\bar{\alpha}\beta}\right|$. 4

OR

Find the square root of – 15 – 8i.

Q13 A college awarded 38 medals in football, 15 in basket ball and 20 in cricket. If these medals 4 went to a total of 58 men and only three men got medals in all the three sports. How many received medals in exactly two of the three sports.

Q14 If f is a function satisfying f (x + y) = f(x) f(y) for all x, y $\in N$ such that f (1) = 3 and $\sum_{x=1}^{n} f(x) = 120$, find the value of n. 4

Q15 If f(x) = $x + \frac{1}{x}$, prove that $[f(x)]^3 = f(x^3) + 3f\left(\frac{1}{x}\right)$ 4

Q16 Road along 3x - 2y + 7 = 0 and 2x + 3y = 30 intersect at C. show that the two roads are at right angle at C.A river is flowing along Y- axis. A beautiful triangular park is tko be developed between the roads and the river. 4

(i) What is the area of the park, if all the distances are measured in km.

(ii) Write the importance of green fields and parks in city life?

Q17 Find the general solution of the following equation. 4

4sinx cosx + 2sinx + 2 cos x + 1 = 0

Q18 Find the value of X, if the ratio of 10th term to 11th term of the expansion (2 – 3x^3)^{20} is 45: 22. 4

OR

Find the value of a , so that the term independent of x in $\left(\sqrt{x} + \frac{a}{x^2}\right)^{10}$ is 405.

Q19 Find the equation of the hyperbola, the length of whose latusrectum is 8 and eccentricity is $3/\sqrt{5}$. 4

OR

Find the equation of the ellipse whose axes are along the coordinate axes, vertices are $(\pm 5, 0)$ and foci at $(\pm 4, 0)$.

SECTION - C

Q20 One card is drawn from a pack of 52 cards, each of the 52 cards being equally likely to be drawn. Find the probability that the card drawn B 6

(i) an ace. (ii) red. (iii) either red or king.

or

A coin is tossed if head comes up, a die is thrown but if tail comes up, the coin is tossed again, Find the probability of obtaining

(i) two tails. (ii) head and number 6 . (iii) head and an even number.

Q21 The mean and standard deviation of 20 observations are found to be 10 and 2 respectively. On rechecking it was found that an observation 8 was incorrect. Calculate the correct mean and standard deviation in each of the following cases 6

(i) if wrong item is omitted (ii) if it is replaced by 12

Q22 Find the derivative of $\frac{2x+3}{3x+2}$ from first principle. 6

Q23 Prove that tan x + 2 tan 2x + 4 tan 4x + 8 cot 8x = cotx 6

Q24 Solve the following inequalities graphically: 6

2x + y $\geq 4, x + y \leq 3 and 2x - 3y \leq 6$

Q25 Find the sum to n terms of the series 6

$1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2) + \ldots\ldots$

Q26 Prove that : $\sqrt{3}\operatorname{cosec} 20^0 - \sec 20^0 = 4$ 6

or

If cos $(\alpha + \beta) = \frac{4}{5}, \sin(\alpha - \beta) = \frac{5}{13}$ and α, β lie between 0 and $\pi/4$, find tan 2α .

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Answers

1 "OR" is exclusive 2 $\frac{1}{49}-\frac{4\sqrt{3}i}{49}$ 3 compound statement is true

4 x = 3 and 5 = 6 + y $\Rightarrow$ x = 3 and y = -1 5 $x^2 < x$.

6 x = 100 7 $x^2 + y^2 - 6x - 8y + 25 = 0$ or $x^2 + 9y^2 = 81$.

8 $\frac{9\tan x-3\tan^3 x}{1-3\tan^2 x}=3\Rightarrow\frac{3\tan x-\tan^3 x}{1-3\tan^2 x}=1$

9 P(n) is true $\forall n\in N$ 10 Hence , common ratio of GP is $2+\sqrt{3}$.

11 6062 12 1 or $\pm(1-4i)$ 13 9 men received medals in exactly two of the three sports.

14 n = 4 16 $\frac{39}{4}sqkm$ 17 From Eqs.(i) and (ii) , we have $n\pi+(-1)^n\frac{7\pi}{6}\,and\,2n\pi\pm\frac{2\pi}{3}$

18 $x=\frac{-2}{3}$ or $a=\pm3$ 19 $\frac{x^2}{25}-\frac{y^2}{20}=1$ or $\frac{x^2}{25}-\frac{y^2}{9}=1$

20 (i) 1/13 (ii) ½ (iii) 7/13 or (i) 1/8 (ii) 1/8 (iii) 3/8

21 (i) 1.997 (ii) 1.9899 22 $f'(x)=\frac{-5}{(3x+2)^2}$

25 $\frac{n(n+1)^2(n+2)}{12}$ 26 $\tan 2\alpha=\frac{56}{33}$