QUESTION 2009

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten the following:

i) The co-ordinates of the centroid of the triangle whose vertices are (2, 0), (1, –3), (–3, 3) is

a) (2, 1) ✓b) (0, 0) c) (–1, 3) d) (2, 4)

ii) If $ax^2+bx+c=0(a\neq 0)$ then the sum of its roots will be

✓a) $-\frac{b}{a}$ b) $\frac{c}{a}$ c) $\frac{a}{b}$ d) $\frac{b}{a}$

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iii) The value of ${}^{10}C_3$ is

a) 100 b) 110 ✓c) 120 d) 90

iv) The sum of the binomial coefficients $C_0+C_1+C_2+\ldots\ldots+C_n$ is

a) 2 ✓b) 2^n c) 2^{n-1} d) none of these

v) Let the function $f: R \to R$ defined by

$$f(x) = 2x-1 \text{ for } x>2$$
$$= x^2-1 \text{ for } -2 \le x \le 2$$
$$= 3x+1 \text{ for } x<-2.$$

then the value of $f(-3)$ is

a) 3 ✓b) –8 c) 5 d) none of these

vi) The value of x for which the equation $2^x = 3^{-x}$ is satisfied is

a) 1 ✓b) 0 c) –1 d) none of these

vii) The sequence $\{1, 3, 5, 7, \ldots\ldots\}$ forms an A.P. which of the following is true?

✓a) Common difference = 2 b) Common difference = 3
c) Common difference = 1 d) Common difference = 4

viii) The value of $\log_2 2$

✓a) 1 b) 0 c) 2 d) 2^2

ix) If α and β are the roots of the equation $x^2-2x+1=0$, then the value of $\frac{1}{\alpha}, \frac{1}{\beta}$ is

a) –2 b) 0 c) 1 ✓d) 2

x) If the roots of the equation $ax^2+bx+c=0, (a \neq 0)$ are real and equal, then its discriminant satisfies

a) $D>0$ and $D=a$ perfect square ✓b) $D=0$
c) $D>0$ and $D \neq a$ d) $D<0$.

xi) The sum of the first n terms of an A.P. series $\{1, 2, 3, 4, 5, \ldots\ldots\}$ is

a) $\frac{n}{2}$ b) $\frac{n+1}{2}$ ✓c) $\frac{n(n+1)}{2}$ d) $\frac{n(n-1)}{2}$

xii) If $f(x+1)=2x+3$, then $f(-3)$ is

a) 5 b) 3 c) 7 ✓d) –5

xiii) The co-ordinates of the middle point of the line joining the points (2, 3) and (3, 2) is
a) (2, 2) ✓b) (2.5, 2.5) c) (3, 3) d) none of these

Group – B
(Short Answer Type Questions)

2. In how many ways can 12 examination papers be arranged so that the best and the worst papers may never come together?
See Topic: PERMUTATIONS AND COMBINATIONS, Short Answer Type Question No. 4.

3. Find the term independent of x in the expansion of $\left(x^2+\frac{1}{x}\right)^{12}$
See Topic: MATHEMATICAL INDUCTION & BINOMIAL THEOREM, Short Answer Type Question No. 3.

4. The arithmetic mean of two numbers is 34 and their geometric mean is 16. Find the numbers.
See Topic: SEQUENCES & SERIES, Short Answer Type Question No. 3.

5. Show that the points (3, 0), (6, 4) and (–1, 3) are the vertices of a right-angled isosceles triangle.
See Topic: TWO DIMENSIONAL COORDINATE GEOMETRY, Short Answer Type Question No. 7.

6. The straight line $\frac{x}{a}+\frac{y}{b}=1$ is such that $a+b=10$. Find the locus of the middle point of that part of the line which is intercepted between the axes.
See Topic: TWO DIMENSIONAL COORDINATE GEOMETRY, Short Answer Type Question No. 8.

Group – C
(Long Answer Type Questions)

7. a) Find the angle between the straight lines $x-2y+1=0$ and $x+3y=2$.
See Topic: TWO DIMENSIONAL COORDINATE GEOMETRY, Long Answer Type Question No. 8.

b) Find the equation of the circle concentric to $x^2+y^2-4x+6y-13=0$ and passing through the point (–4, 5).
See Topic: TWO DIMENSIONAL COORDINATE GEOMETRY, Long Answer Type Question No. 9.

c) Show that the circle $x^2+y^2-6x-8y+23=0$ does not touch the straight line $4x-7y+28=0$.
See Topic: TWO DIMENSIONAL COORDINATE GEOMETRY, Long Answer Type Question No. 10.

8. a) In how many ways can the letters of the word VOWEL be arranged?
i. How many of these begin with V?
ii. How many begin with V and do not end with L?
See Topic: PERMUTATIONS AND COMBINATIONS, Long Answer Type Question No. 1.

b) Show that $1/(\log_a abc)+1/(\log_b abc)+1/(\log_c abc)=1$

See Topic: BASIC ALGEBRA, Long Answer Type Question No. 11.

c) A locomotive engine without a train can run 35 km/hour and its speed is diminished by a quantity which varies as the square root of the number of wagons attached. If with 16 wagons its speed is 15 km/hour, what is the least number of wagons that the engine will fail to move? Find also the greatest number of wagons that the engine can move.

See Topic: RATIO, PROPORTION AND VARIATION, Long Answer Type Question No. 3.

9. a) Prove that $C_0^2 + C_1^2 + C_2^2 + \ldots\ldots + C_n^2 = \frac{(2n)!}{(n!)^2}$

See Topic: MATHEMATICAL INDUCTION & BINOMIAL THEOREM, Long Answer Type Question No. 2.

b) If α, β be the roots of $ax^2 + bx + c = 0$, then form an equation whose roots are α/β and β/α.

See Topic: THEORY OF QUADRATIC EQUATION, Long Answer Type Question No. 8.

c) If α, β be the rots of the equation $2x^2 - 3x + 4 = 0$, then find the value of $\alpha^4 + \beta^4$.

See Topic: THEORY OF QUADRATIC EQUATION, Long Answer Type Question No. 9.

10. a) If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P. and $(a+b+c) \neq 0$, then show that $\frac{b+c}{a}, \frac{c+a}{b}, \frac{a+b}{c}$ are also in A.P.

See Topic: SEQUENCES & SERIES, Long Answer Type Question No. 7.

b) If x is real, find the maximum value of $\frac{x+2}{2x^2+3x+6}$.

See Topic: MATHEMATICAL INDUCTION & BINOMIAL THEOREM, Long Answer Type Question No. 3.

c) Solve for $x: 4^x - 3.2^{x+2} + 2^5 = 0$.

See Topic: BASIC ALGEBRA, Long Answer Type Question No. 12.

11. a) Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be the universal set, $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{5, 6, 7\}$. Then verify that $(A \cup B)^c = A^c \cap B^c$ and $A - B = A \cap B^c$.

See Topic: SETS, Long Answer Type Question No. 8.

b) If $a/3 = b/4 = c/7$, then prove that $a + b = c$.

See Topic: BASIC ALGEBRA, Long Answer Type Question No. 13.

c) The sum of n terms of an A.P. is n^2. Find the series. What is the common difference? Which term is 59?

See Topic: SEQUENCES & SERIES, Long Answer Type Question No. 8.

12. a) Find the square root of $7+\sqrt{15}+\sqrt{18}+\sqrt{30}$.

See Topic: BASIC ALGEBRA, Long Answer Type Question No. 14.

b) If $y=\dfrac{\sqrt{x+a}-\sqrt{x-a}}{\sqrt{x+a}+\sqrt{x-a}}$, show that $y+\dfrac{1}{y}=\dfrac{2x}{a}$.

See Topic: BASIC ALGEBRA, Long Answer Type Question No. 15.