1. Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. The values of m and n are

1) $m=7, n=6$ **2)** $m=6, n=3$ **3)** $m=5, n=1$ **4)** $m=8, n=7$

2. If $\{x\}$ and $[x]$ represent fractional and integral part of x, then find the value of $[x]+\sum_{r=1}^{2011}\frac{\{x+r\}}{2011}$.

1) 2000 **2)** x **3)** $\{x\}$ **4)** $2x$

3. With the usual notation in a ΔABC $\begin{vmatrix} 1 & 1 & 1 \\ \sin A & \sin B & \sin C \\ \sin^2 A & \sin^2 B & \sin^2 C \end{vmatrix} =$

1) $\frac{1}{8R^3}(a-b)(b-c)(c-a)$ 2) $8R^3$ 3) $(a-b)(b-c)(c-a)$ 4) $\frac{1}{8R}(a-b)(b-c)(c-a)$

4. If $\bar{r} = 3\bar{p} + 4\bar{q}$ and $2\bar{r} = \bar{p} - 3\bar{q}$ then

1) $\bar{r}, \bar{q}$ have same direction and $|\bar{r}| < 2|\bar{q}|$ **2)** $\bar{r}, \bar{q}$ have opposite direction and $|\bar{r}| > 2|\bar{q}|$ **3)** $\bar{r}, \bar{q}$ have opposite direction and $|\bar{r}| < 2|\bar{q}|$ **4)** $\bar{r}, \bar{q}$ have same direction and $|\bar{r}| > 2|\bar{q}|$

5. The number of functions f from $\{1,2,3,......,20\}$ onto $\{1,2,3,......,20\}$ such that $f(k)$ is a multiple of 3, whenever k is a multiple of 4, is

1) $5^6 \times 15$ 2) $5! \times 6!$ 3) $(15)! \times 6!$ 4) $6^5 \times (15)!$

6. Let $A=\{2,3,4,5,\ldots.,30\}$ and '$\simeq$' be an equivalence relation on $A \times A$, defined by $(a,b) \simeq (c,d)$, if and only if $ad=bc$. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair $(4,3)$ is equal to :

1) 8 **2)** 5 **3)** 6 **4)** 7

7. If the sum of the first 15 terms of the series $\left(\frac{3}{4}\right)^3+\left(1\frac{1}{2}\right)^3+\left(2\frac{1}{4}\right)^3+3^3+\left(3\frac{3}{4}\right)^3+\ldots.$ is equal to $225k$, then k is equal to

1) 54 **2)** 108 **3)** 27 **4)** 9

8. If the system of linear equations

$x+y+z=5$

$x+2y+2z=6$

$x+3y+\lambda z=\mu,(\lambda,\mu\in R)$, has infinitely many solutions, then the value of $\lambda+\mu$ is

1) 7 **2)** 9 **3)** 10 **4)** 12

9. Let $\alpha \in R$ and the three vectors $\vec{a} = \alpha\hat{i} + \hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \alpha\hat{k}$ and $\vec{c} = \alpha\hat{i} - 2\hat{j} + 3\hat{k}$. Then the set $S = \{\alpha : \vec{a}, \vec{b}$ and $\vec{c}$ are coplanar$\}$

1) contains exactly two positive numbers **2)** is empty **3)** contains exactly two numbers only one of which is positive **4)** is singleton

10. In a parallelogram $ABCD$, $|\overrightarrow{AB}| = a; |\overrightarrow{AD}| = b$ and $|\overrightarrow{AC}| = c$ then $\overrightarrow{DB}.\overrightarrow{AB}$ has the value

1) $\frac{3a^2+b^2-c^2}{2}$ 2) $\frac{a^2+3b^2-c^2}{2}$ 3) $\frac{a^2-b^2+3c^2}{2}$ 4) $\frac{a^2+3b^2+c^2}{2}$

11. variable straight lines $L_1 : y = 2x + c_1$ and $L_2 : y = 2x + c_2$ meet the x-axis in A_1 and A_2 respectively and y-axis in B_1 and B_2 respectively locus of intersection point of A_1B_2 and A_2B_1 is

1) $y + x = 0$ **2)** $y = x$ **3)** $y + 2x = 0$ **4)** $y = 2x$

12. When the origin is shifted to a suitable point, the equation $2x^2 + y^2 - 4x + 4y = 0$ transformed as $2x^2 + y^2 - 8x + 8y + 18 = 0.$ The point to which origin was shifted is

1) (1, 2) **2)** (1, -2) **3)** (-1, 2) **4)** (-1, -2)

13. A straight line through the origin 'O' meets the parallel lines $4x+2y=9$ and $2x+y+6=0$ at points P and Q respectively. then point O divides the segment PQ in the ratio

1) 1 : 2 **2)** 3 : 4 **3)** 2 : 1 **4)** 4 : 3

14. The vertex A of ΔABC is (3,-1). The equations of median BE and angle bisector CF are $x-4y+10=0$ and $6x+10y-59=0$, respectively. Equation of AC is

1) $5x+18y=37$ 2) $15x+8y=37$ 3) $15x-8y=37$ 4) $15x+8y+37=0$

15. Let a, b, c be in arithmetic progression. Let the centroid of the triangle with vertices $(a, c), (2, b)$ and (a, b) be $\left(\frac{10}{3}, \frac{7}{3}\right)$. If α, β are the roots of the equation $ax^2 + bx + 1 = 0$, then the value of $\alpha^2 + \beta^2 - \alpha\beta$ is

1) $\frac{71}{256}$ **2)** $-\frac{69}{256}$ **3)** $-\frac{71}{256}$ **4)** $\frac{69}{256}$

16. The circumcentre of triangle formed by lines $2x^2 - 3xy - 2y^2 = 0$ and $3x + 4y - 20 = 0$ is

1) (2,3) **2)** (3,2) **3)** (3,3) **4)** (0,5)

17. If the equation $x^3+ax^2y+bxy^2+y^3=0$ represents three lines two of which are perpendicular then equation of third line is

1) $y=ax$ 2) $y=bx$ 3) $y=x$ 4) $y=-x$

18. A tetrahedron has vertices at $O(0,0,0)$. $A(1,2,1), B(2,1,3)$ and $C(-1,1,2)$. Then the angle between the faces OAB and ABC will be

1) $\pi/2$ 2) $\cos^{-1}\left(\frac{19}{35}\right)$ 3) $\cos^{-1}\left(\frac{17}{31}\right)$ 4) $\pi/6$

19. Equation of the bisector of the angle between the planes $x+2y+2z-9=0, 4x-3y+12z+13=0$ containing the origin is

1) $25x+17y+62z-78=0$ 2) $x+35y-10z-156=0$ 3) $25x+17y+62z-156=0$ 4) $x+35y-10z-78=0$

20. On which of the lines lies the point of intersection of $\frac{x-4}{2}=\frac{y-5}{2}=\frac{z-3}{1}$ and $x+y+z=2$

1) $\frac{x-2}{2}=\frac{y-3}{2}=\frac{z+3}{3}$ 2) $\frac{x-4}{3}=\frac{y-5}{1}=\frac{z-5}{-1}$ 3) $\frac{x-1}{1}=\frac{y-3}{2}=\frac{z+4}{-5}$ 4) $\frac{x+3}{3}=\frac{4-y}{3}=\frac{z+1}{-2}$

21. Let $\vec{r} = (a \times b)\sin x + (b \times c)\cos y + 2(\bar{c} \times \bar{a})$ where $\bar{a}, \bar{b}, \bar{c}$ are non zero non coplanar vectors. If $\vec{r}$ is orthogonal to $\bar{a} + \bar{b} + \bar{c}$ then find minimum value of $\frac{20}{\pi^2}(x^2 + y^2)$

22. If $\log_{12} 18 = \alpha$ and $\log_{24} 54 = \beta$ then find the value of $\left(\frac{1-\alpha\beta}{\alpha-\beta}\right)$

23. If $2f(xy)=(f(x))^y+(f(y))^x\ \forall\ x,y$ and $f(1)=2$ then $\left[\sum_{n=1}^{9}\frac{f(n)}{2^{10}}\right]$ where [.] is the greatest value function

24. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+1 & n^2+n \\ 2k-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 56$ then find value of n.

25. If $\bar{a}, \bar{b}$ are two unit vectors then value of $(1-\bar{a}.\bar{b})^2+\left|\bar{a}+\bar{b}+(\bar{a}\times\bar{b})\right|^2$ is equal to

26. The distance between the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and the plane $x+y-z+10=0$ is____

27. The number of integral value of λ such that the plane through $A(-\lambda^2,1,1)B(1,-\lambda^2,1)$ and $C(1,1,-\lambda^2)$ also passes through $P(-1,-1,1)$ is ______

28. If $Q(0,-1,-3)$ is image of P in the plane $3x-y+4z=2$ and $R(3,-1,-2)$. Area triangle PQR is K then $(4K^2-91)$ is_____

29. Centriod and one vertex of an equilateral triangle are $G(1,1)$ and $A(1,2)$ other two vertices are $B(x_1,y_1),C(x_2,y_2)$ then $|x_1+x_2-2(y_1+y_2)|=$ ____

30. Two sides of a rectangle are $3x+4y+5=0, 4x-3y+15=0$ and one of its vertices is (0, 0). Then area of rectangle is ______.