Mathematics

TARGET : JEE 2013

SCORE

JEE (Advanced)

Home Assignment # 04

ALLEN CAREER INSTITUTE
KOTA (RAJASTHAN)
Path to Success

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HOME ASSIGNMENT # 04

STRAIGHT OBJECTIVE TYPE

1. Length of each edge of a regular tetrahedron is 1. The distance between the centroid of two faces is -

(A) 1 (B) $\frac{1}{4}$ (C) $\frac{1}{3}$ (D) 3

2. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}, \vec{f}$ are position vectors of 6 points A, B, C, D, E & F respectively such that $3\vec{a}+4\vec{b}=6\vec{c}+\vec{d}=4\vec{e}+3\vec{f}=\vec{x}$, then -

(A) $\overrightarrow{AB}$ is parallel to $\overrightarrow{CD}$

(B) line AB, CD and EF are concurrent

(C) $\overrightarrow{EB}$ is perpendicular to $\overrightarrow{AF}$

(D) $7\vec{x}$ is position vector of the point dividing CD in 1 : 6

3. z is a complex number satisfying $|z-3| \le 4$ and $|\omega z - 1 - \omega^2| = a$ (where ω is complex cube root of unity), then -

(A) $0 \le a \le 2$ (B) $0 \le a \le 8$ (C) $2 \le a \le 8$ (D) $2 \le a \le 4$

4. The coefficient of x^6 in the expansion of $\left(x^2+\frac{4}{x^2}+3\right)^5$ must be -

(A) 90 (B) 110 (C) 100 (D) 120

5. Read following statements :

(i) if two lines in space are perpendicular to a third line then they will be parallel

(ii) if two planes are perpendicular to a third plane then they will be parallel

(iii) if two lines are parallel to a plane then they will be parallel

(iv) $\vec{a}\times\vec{b}$ is a vector along the line of intersection of two nonparallel planes $3\vec{r}.\vec{a}+5=0$ and $5\vec{r}.\vec{b}-7=0$.

Identify the true and false statement (in order of statement) -

(A) TTTT (B) TFFT (C) FFTF (D) FFFT

6. Acute angle between the lines $L_1 : x + y = 0 = y + z$ and $L_2 : 2x + y + z = 0, x + 2y + z = 0$ is -

(A) $\cos^{-1}\frac{3}{11}$ (B) $\cos^{-1}\sqrt{\frac{3}{11}}$ (C) $\sin^{-1}\sqrt{\frac{2}{11}}$ (D) $\sin^{-1}\frac{2}{11}$

7. Equation of a line lying in xy plane is $3x + 5y = 15$ its vector equation is -

(A) $\vec{r}=3\hat{j}+\lambda(3\hat{i}+5\hat{j})$, where $\lambda \in R$

(B) $\vec{r}=5\hat{i}+\lambda(5\hat{i}-3\hat{j})$, where $\lambda \in R$

(C) $\vec{r}=\mu(5\hat{i}-3\hat{j})$, where $\mu \in R$

(D) $\vec{r}=(-\hat{i}+4\hat{j})+\lambda(5\hat{j}-3\hat{i})$, where $\lambda \in R$

8. A vector $\vec{a}=2\hat{i}+3\hat{j}+7\hat{k}$ is there in right handed rectangular coordinate system. The coordinate system is rotated about z-axis from positive x to positive y-axis through angle π/2, then new components of $\vec{a}$ will be -

(A) (2, 3, 7) (B) (–2, –3, 7) (C) (3, –2, –7) (D) (3, –2, 7)

FILL THE ANSWER HERE

1.	Ⓐ Ⓑ Ⓒ Ⓓ	2.	Ⓐ Ⓑ Ⓒ Ⓓ	3.	Ⓐ Ⓑ Ⓒ Ⓓ	4.	Ⓐ Ⓑ Ⓒ Ⓓ
5.	Ⓐ Ⓑ Ⓒ Ⓓ	6.	Ⓐ Ⓑ Ⓒ Ⓓ	7.	Ⓐ Ⓑ Ⓒ Ⓓ	8.	Ⓐ Ⓑ Ⓒ Ⓓ

9. A plane $2x + 3y + 5z = 1$ has point P which is at minimum distance from the line joining A(1, 0, –3) and B(1, –5, 7), then distance AP is equal to -

(A) $3\sqrt{5}$ (B) $2\sqrt{5}$ (C) $4\sqrt{5}$ (D) none of these

10. Sum of coefficients of terms which contains integral powers of x in the expansion $(2+\sqrt{x})^{30}$ is -

(A) $\frac{2^{30}+1}{2}$ (B) $\frac{2^{30}-1}{2}$ (C) $\frac{3^{30}-1}{2}$ (D) $\frac{3^{30}+1}{2}$

11. If $\text{Arg}\left(\frac{z-2}{z-2i}\right)=\frac{\pi}{4}$, then correct statement is -

(A) minimum value of |z| is 0 (B) minimum value of |z| is $2\sqrt{2}-2$

(C) maximum value of |z| is 4 (D) maximum value of |z| is $2\sqrt{2}+2$

12. log (a + c), log(a + b), log(b + c) are in A.P. and a, c, b are in H.P., where a, b, c > 0. If $a+b=\frac{kc}{4}$, then the value of k is -

(A) 2 (B) 4 (C) 6 (D) 8

13. $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors and every two are inclined to each other at an angle $\cos^{-1}(3/5)$ If $\vec{a}\times\vec{b}=p\vec{a}+q\vec{b}+r\vec{c}$, where p, q, r are scalars, then $55q^2$ is equal to -

(A) 1 (B) 5 (C) 6 (D) 9

14. If a_1, a_2, a_3 .... a_{2n} are in A.P. with common difference d & $(2n-1)d=\frac{\pi}{2}$, then $\sin^2 a_1 - \sin^2 a_2 + \sin^2 a_3 - \sin^2 a_4 + \ldots + \sin^2 a_{(2n-1)} - \sin^2 a_{2n}$ is equal to -

(A) $\frac{-\cos 2a_1}{2}$ (B) $\frac{-\sin 2a_1}{2}$ (C) $\frac{\sin\left(a_1-\frac{d}{2}\right)}{2}$ (D) $\frac{\sin\left(a_1+\frac{d}{2}\right)}{2}$

15. If 6^{th} term of a G.P. is 96 & n^{th} term is lying between 500 & 780, where first term is a & ([a] ≠ 0, where [.] denotes greatest integer function) & common ratio is positive integer (r ≠ 1), then number of terms in the series are -

(A) 8 (B) 9 (C) 10 (D) 11

16. In a G.P. consisting of positive numbers the product of the first four terms is 4 and the second term is the reciprocal of the fourth term. Then sum of the G.P. up to infinite term is -

(A) 8 (B) –8 (C) $4(\sqrt{2}+1)$ (D) $4(\sqrt{2}-1)$

17. The sum of the infinitely decreasing geometric progression is equal to the greatest value of the function $f(x) = 3x^3 - x - 76$ on the interval [0, 3] ; the first term of the progression is equal to the square of the common ratio. The common ratio of the G.P. is -

(A) $\sqrt{2}-1$ (B) $\sqrt{3}-1$ (C) $\sqrt{2}+1$ (D) $\frac{1}{\sqrt{3}+1}$

9.	Ⓐ Ⓑ Ⓒ Ⓓ	10.	Ⓐ Ⓑ Ⓒ Ⓓ	11.	Ⓐ Ⓑ Ⓒ Ⓓ	12.	Ⓐ Ⓑ Ⓒ Ⓓ
13.	Ⓐ Ⓑ Ⓒ Ⓓ	14.	Ⓐ Ⓑ Ⓒ Ⓓ	15.	Ⓐ Ⓑ Ⓒ Ⓓ	16.	Ⓐ Ⓑ Ⓒ Ⓓ
17.	Ⓐ Ⓑ Ⓒ Ⓓ						

18. If $\vec{a}$ and $\vec{b}$ are vectors such that $|\vec{a}|=2,\ |\vec{b}|=1,\ \vec{a}\wedge\vec{b}=\frac{\pi}{3}$ and $\vec{c}$ satisfies $2(\vec{a}+\vec{b})+\vec{c}=\vec{b}\times\vec{c}$, then the value of $|(\vec{a}\times\vec{c}).\vec{b}|$ is -

(A) 2 (B) 3 (C) 4 (D) 6

19. Two lines whose equations are $L_1:\frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{\lambda}$ and $L_2:\frac{x-2}{3}=\frac{y-3}{2}=\frac{z-2}{3}$ lie in the same plane. If L_1 intersects a plane x + y + z = 15 at P, then distance of P from (3, 4, 3) is -

(A) 6 (B) 4 (C) 2 (D) 3

20. If the shortest distance between the line $\vec{r}=(\hat{i}+2\hat{j}+3\hat{k})+\lambda_1(2\hat{i}+3\hat{j}+4\hat{k})$ and $\vec{r}=(2\hat{i}+4\hat{j}+5\hat{k})+\lambda_2(3\hat{i}+4\hat{j}+5\hat{k})$ is x, then $\cos^{-1}(\cos\sqrt{6}x)$ is equal to -

(A) $\frac{1}{2}$ (B) 0 (C) 1 (D) 2

21. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non-coplanar, then $\frac{[\vec{a}+2\vec{b}\ \ \vec{b}+2\vec{c}\ \ \vec{c}+2\vec{a}]}{[\vec{a}\ \vec{b}\ \vec{c}]}$ is equal to -

(A) 3 (B) 6 (C) 8 (D) 9

22. If 't' is the period of f (x) satisfying f(x + 5) + f (x) = 0, ∀ x ∈ R and 4th term in the expansion of $\left(3-\frac{2x}{5}\right)^t$ has the greatest numerical value, then |x| belongs to -

(A) $\left[\frac{45}{16},\frac{30}{7}\right]$ (B) $\left[\frac{30}{7},\frac{25}{4}\right]$ (C) $\left[\frac{25}{4},9\right]$ (D) $\left[\frac{5}{3},\frac{45}{16}\right]$

23. If $\left|\sqrt{2}z-3+2i\right|=|z|\left|\sin\left(\frac{\pi}{4}+\arg z_1\right)+\cos\left(\frac{3\pi}{4}-\arg z_1\right)\right|$, where $z_1 = 1+\frac{i}{\sqrt{3}}$, then locus of z is -

(A) a pair of straight lines (B) circle
(C) parabola (D) ellipse

24. Vectors $\vec{a}, \vec{b}$ and $\vec{c}$ with magnitude 2, 3 & 4 respectively are coplanar. A unit vector $\vec{d}$ is perpendicular to all of them. If $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d})=\frac{\hat{i}}{6}-\frac{\hat{j}}{3}+\frac{\hat{k}}{3}$ and the angle between $\vec{a}$ and $\vec{b}$ is 30°, then $\left|\vec{c}.\hat{i}\right|+\left|\vec{c}.\hat{j}\right|+\left|\vec{c}.\hat{k}\right|$ is equal to -

(A) $\frac{5}{3}$ (B) $\frac{5}{9}$ (C) $\frac{5}{12}$ (D) $\frac{5}{18}$

25. If the value of $\left[\vec{a}+2\vec{b}+3\vec{c}\ \ \vec{b}+2\vec{c}+3\vec{a}\ \ \vec{c}+2\vec{a}+3\vec{b}\right]=k\left[\vec{a}\ \vec{b}\ \vec{c}\right]$, then k equals -

(A) 6 (B) 9 (C) 12 (D) 18

18.	Ⓐ Ⓑ Ⓒ Ⓓ	**19.**	Ⓐ Ⓑ Ⓒ Ⓓ	**20.**	Ⓐ Ⓑ Ⓒ Ⓓ	**21.**	Ⓐ Ⓑ Ⓒ Ⓓ
22.	Ⓐ Ⓑ Ⓒ Ⓓ	**23.**	Ⓐ Ⓑ Ⓒ Ⓓ	**24.**	Ⓐ Ⓑ Ⓒ Ⓓ	**25.**	Ⓐ Ⓑ Ⓒ Ⓓ

26. If the coefficient of x in the expansion of $\left(x-\frac{1}{ax^2}\right)^{10}$ is – 15, then the value of 'a' is equal to -

(A) $\frac{1}{5}$ (B) $\frac{1}{2}$ (C) 2 (D) 3

27. A plane x + 2y – 3z = 12 has point P which is at minimum distance from line joining A(1, 0, –3) and B(2, 3, –1), then $(AP)^2$ is equal to -

(A) 0 (B) 14 (C) 28 (D) 56

28. The term independent of x in the product $(4+x+7x^2)\left(x-\frac{3}{x}\right)^{11}$ is -

(A) $7.{}^{11}C_6$ (B) $3^6.\ {}^{11}C_6$ (C) $3^5.\ {}^{11}C_5$ (D) $-12.\ 2^{11}$

29. Let $|\vec{a}|=1$ and $|\vec{b}|=3$. If $\vec{a}+\lambda\vec{b}$ and $\vec{a}-\lambda\vec{b}$ are mutually perpendicular vectors, then $|\lambda|$ is -

(A) $\frac{1}{\sqrt{3}}$ (B) $\frac{1}{9}$ (C) 3 (D) $\frac{1}{3}$

30. If angle between line $\vec{r}=\hat{i}+2\hat{k}+\lambda(4\hat{j}-3\hat{k})$ and xy-plane is α and angle between the planes x + 2y = 0 and 2x + y = 0 is β, then $\frac{\cos^2\alpha}{\sin^2\beta}$ is equal to -

(A) 1 (B) $\frac{9}{16}$ (C) $\frac{16}{9}$ (D) $\frac{9}{25}$

31. Number of rational terms in $\left(\sqrt[4]{5}+\sqrt[7]{2}\right)^{100}$ is -

(A) 2 (B) 3 (C) 4 (D) 5

32. If T_m & T_n denotes the m^{th} & n^{th} terms of an A.P. respectively, such that $T_m=\frac{1}{n}$, $T_n=\frac{1}{m}$, then which of the following is necessarily a root of the equation $(a-3b)x^2+(2b+5a)x+(b-6a)=0$ -

(A) T_{mn} (B) T_{m+n} (C) T_m+T_n (D) $T_m\,.\,T_n$

33. Centre of the tetrahedron OABC with O being origin and A(a, 1, 3), B(2, b, –6), C(–1, 4, c) is (1, 3, –1). The value of a^2-b+4c^2 is -

(A) 0 (B) 6 (C) 10 (D) 16

34. If the sum to n terms of a series is given by $\frac{n(n+1)(n+2)}{6}$, then the n^{th} term of the series is -

(A) $\sum n^2$ (B) $\left(\sum n\right)^2$ (C) $\sum n$ (D) $n+\sum n$

35. If $2\vec{a}+3\vec{b}+6\vec{c}=0$, then $(\vec{a}\times\vec{b})-(\vec{b}\times\vec{c})+(\vec{c}\times 2\vec{a})$ is equal to -

(A) $2(\vec{b}\times\vec{c})$ (B) $3(\vec{b}\times\vec{c})$ (C) $5(\vec{b}\times\vec{c})$ (D) $6(\vec{b}\times\vec{c})$

26. Ⓐ Ⓑ Ⓒ Ⓓ	27. Ⓐ Ⓑ Ⓒ Ⓓ	28. Ⓐ Ⓑ Ⓒ Ⓓ	29. Ⓐ Ⓑ Ⓒ Ⓓ
30. Ⓐ Ⓑ Ⓒ Ⓓ	31. Ⓐ Ⓑ Ⓒ Ⓓ	32. Ⓐ Ⓑ Ⓒ Ⓓ	33. Ⓐ Ⓑ Ⓒ Ⓓ
34. Ⓐ Ⓑ Ⓒ Ⓓ	35. Ⓐ Ⓑ Ⓒ Ⓓ		

36. The line L : $\frac{x-1}{3}=\frac{y+2}{k}=\frac{z-1}{3}$ makes an isosceles triangle with the planes x + y + z = 3 and x – y + z = 5, then the point of intersection of L with plane x – 2y + 3z + 4 = 0 is at a distance 'p' from the origin, where 'p' is equal to -

(A) $3\sqrt{2}$ (B) $2\sqrt{2}$ (C) $3\sqrt{3}$ (D) $2\sqrt{3}$

37. If a, b, c are three distinct numbers in A.P., then $e^a + e^b$, $2e^b$, $e^b + e^c$ are in -

(A) A.P. (B) G.P. (C) H.P. (D) none of these

38. The number of solution(s) of the form (x, y, z) satisfying $x^8 + y^8 + z^8 = 8xyz - 5$ is (are) -

(A) 1 (B) 2 (C) 4 (D) 8

39. If $\vec{a},\vec{b}$ and $\vec{c}$ are three unit vectors, no two of which are collinear, $\vec{a}+2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b}+3\vec{c}$ collinear with $\vec{a}$, then $|\vec{a}+2\vec{b}+8\vec{c}|$ is equal to -

(A) 0 (B) 1 (C) 2 (D) 3

40. The value of $\lim_{n\to\infty}\sum_{r=1}^{n}\left(\sum_{k=1}^{r-1}\frac{1}{5^n}\,{}^nC_r\,.\,{}^rC_k\,.3^k\right)$ is equal to -

(A) 1 (B) 2 (C) 3 (D) 4

41. $\hat{a}$ and $\hat{c}$ are unit vectors and $|\vec{b}| = 4$. If the angle between $\hat{a}$ and $\hat{c}$ is $\cos^{-1}(1/4)$, then $\vec{b} - 2\hat{c} = \lambda\hat{a}$, where λ can be equal to –

(A) 3 (B) 1/4 (C) 4 (D) –3

42. If a + b + c = 6 where a, b, c ∈ R^+ then the maximum value of a^3b^2c is -

(A) $3^2 . 2^3$ (B) $3^2 . 2^2$ (C) $3^3 . 2^2$ (D) 6

43. a, b, c are three distinct positive numbers and ab^2c^3 has the greatest value $\frac{1}{432}$, then -

(A) $a = 1,\ b = \frac{1}{4},\ c = \frac{1}{3}$ (B) $a = \frac{1}{6},\ b = \frac{1}{3},\ c = \frac{1}{2}$

(C) $a = \frac{1}{2},\ b = 1,\ c = \frac{1}{6}$ (D) $a = \frac{1}{2},\ b = \frac{1}{3},\ c = \frac{1}{6}$

44. If square root of, $a^{\frac{1}{a}}.(2a)^{\frac{1}{2a}}.(4a)^{\frac{1}{4a}}.(8a)^{\frac{1}{8a}}$........ ∞ is $\frac{8}{27}$, then the value of 'a' is -

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) $\frac{1}{5}$

45. If a, b, c are non-zero numbers in A.P., then $\frac{1}{a}-bc,\ \frac{1}{b}-ca,\ \frac{1}{c}-ab$ are in -

(A) A.P. (B) G.P. (C) H.P. (D) none of these

36.	Ⓐ Ⓑ Ⓒ Ⓓ	**37.**	Ⓐ Ⓑ Ⓒ Ⓓ	**38.**	Ⓐ Ⓑ Ⓒ Ⓓ	**39.**	Ⓐ Ⓑ Ⓒ Ⓓ
40.	Ⓐ Ⓑ Ⓒ Ⓓ	**41.**	Ⓐ Ⓑ Ⓒ Ⓓ	**42.**	Ⓐ Ⓑ Ⓒ Ⓓ	**43.**	Ⓐ Ⓑ Ⓒ Ⓓ
44.	Ⓐ Ⓑ Ⓒ Ⓓ	**45.**	Ⓐ Ⓑ Ⓒ Ⓓ				

46. The sum of three numbers in G.P. is 21 and the sum of their squares is 189. If the sum to infinite terms for the given G.P. is defined, then the common ratio is -

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) none of these

47. If a, b, c are in G.P., x and y be the arithmetic mean between a, b and b, c respectively, then $\left(\frac{a}{x}+\frac{c}{y}\right)\left(\frac{b}{x}+\frac{b}{y}\right)$ is equal to -

(A) 2 (B) –4 (C) 4 (D) 6

48. If a & b are real numbers such that 3a + 4b = 25, then minimum value of $a^2 + b^2$ is equal to -

(A) 1 (B) 5 (C) 25 (D) not defined

49. If $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ are roots of the equation $z^5 + z^4 + z^3 + z^2 + z + 1 = 0$, then $\prod_{i=1}^{5}(2-\alpha_i)$ is equal to -

(A) 63 (B) 31 (C) 32 (D) 64

50. If $\vec{b}$ and $\vec{c}$ are two non-collinear vectors such that $\vec{a}.(\vec{b}+\vec{c}) = 4$ and $\vec{a}\times(\vec{b}\times\vec{c}) = (x^2-2x+6)\,\vec{b}+(\sin y)\,\vec{c}$, then the point (x, y) always lies on -

(A) x = 1 (B) y = 1 (C) $y = \pi$ (D) x + y = 0

51. The equation of a plane is 2x – y –3z = 5 and A(1,1,1), B(2, 1, –3), C(1, –2, –2) and D(–3, 1, 2) are four points. The line segment which does not intersect the plane is -

(A) AC (B) AB (C) BC (D) BD

52. If principal argument of z satisfying inequalities $|z-3| \le \sqrt{2}$ and $|z-6-3i| \le 2\sqrt{2}$ is θ, then $\tan 2\theta$ is equal to -

(A) $\frac{1}{4}$ (B) $\frac{8}{15}$ (C) $\frac{3}{4}$ (D) $\frac{7}{15}$

53. If the imaginary part of the expression $\frac{e^{i\theta}}{z-2}+\frac{z-2}{e^{i\theta}}$ is zero, then the locus of z is (where θ is a constant such that $\theta \ne \arg(z-2)$) -

(A) a straight line parallel to x-axis (B) a parabola

(C) a circle of radius 1 and centre (2, 0) (D) a straight line parallel to y-axis

54. If z satisfies $iz^2 = \bar{z}^2 + z$, then arg z is equal to (z is non zero complex number) -

(A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $-\frac{3\pi}{4}$

55. Let z_1 and z_2 be the non real roots of the equation $z^2 + 6z + b = 0$. If the origin and the points represented by z_1 and z_2 in argand plane forms an equilateral triangle then value of b is -

(A) 12 (B) 18 (C) 9 (D) 8

46.	Ⓐ Ⓑ Ⓒ Ⓓ	47.	Ⓐ Ⓑ Ⓒ Ⓓ	48.	Ⓐ Ⓑ Ⓒ Ⓓ	49.	Ⓐ Ⓑ Ⓒ Ⓓ
50.	Ⓐ Ⓑ Ⓒ Ⓓ	51.	Ⓐ Ⓑ Ⓒ Ⓓ	52.	Ⓐ Ⓑ Ⓒ Ⓓ	53.	Ⓐ Ⓑ Ⓒ Ⓓ
54.	Ⓐ Ⓑ Ⓒ Ⓓ	55.	Ⓐ Ⓑ Ⓒ Ⓓ				

56. If $\frac{1}{a}+\frac{1}{a-2b}+\frac{1}{c}+\frac{1}{c-2b}=0$ and a, b, c are not in A.P., then -

(A) a, b, c are in G.P. (B) a, $\frac{b}{2}$, c are in A.P.

(C) a, $\frac{b}{2}$, c are in H.P. (D) a, 2b, c are in H.P.

57. The sum to n terms of the series $\frac{3}{1^2}+\frac{5}{1^2+2^2}+\frac{7}{1^2+2^2+3^2}+.........$ is

(A) $\frac{3n}{n+1}$ (B) $\frac{6n}{n+1}$ (C) $\frac{9n}{n+1}$ (D) $\frac{12n}{n+1}$

58. The maximum value of the sum of the A.P. 50, 48, 46, 44, ... is -

(A) 325 (B) 648 (C) 650 (D) 652

59. The number of common terms to the two sequences 17, 21, 25,.......417 and 16, 21, 26, ..., 466 is -

(A) 19 (B) 20 (C) 21 (D) 91

60. The value of $\sum_{\substack{r=0 \\ r\le s}}^{s}\sum_{s=1}^{n} {}^{n}C_s \, {}^{s}C_r$ is -

(A) $3^n - 1$ (B) $3^n + 1$ (C) 3^n (D) $3(3^n - 1)$

61. If the numerically greatest term in the expansion of $(3 - 5x)^{11}$, where $x = \frac{1}{5}$ is 1485λ, then λ is equal to -

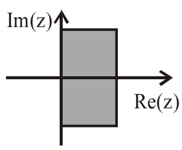
(A) 81 (B) 243 (C) 729 (D) none of these

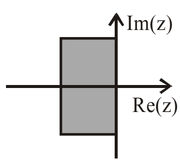
62. If A(1 + i), B(3 + 4i) and C(z) are the vertices of a ΔABC in which $\angle BAC = \frac{\pi}{3}$ and AC = 2AB. Then z is -

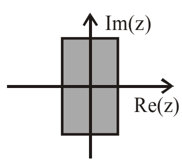
(A) $3+4i+i\sqrt{3}(2+3i)$ (B) $(3+4i)+\frac{1}{\sqrt{3}}i(2+3i)$

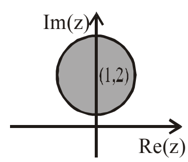
(C) $(2+3i)+i\sqrt{3}(3+4i)$ (D) $(2+3i)+\frac{i}{\sqrt{3}}(3+4i)$

63. If the shaded portion represents the set of complex numbers, then which of the following set of complex numbers satisfy the inequality $\tan^{-1}(\log_3|2z - 1|) > \tan^{-1}(\log_3|2z + 1|)$ -

(A) 

(B) 

(C) 

(D) 

64. If $\left|\frac{z_1-3z_2}{3-z_1\bar{z}_2}\right|=1$ and $|z_2| \ne 1$, then $|z_1|$ is -

(A) 3 (B) 1 (C) 2 (D) 4

56.	Ⓐ Ⓑ Ⓒ Ⓓ	**57.**	Ⓐ Ⓑ Ⓒ Ⓓ	**58.**	Ⓐ Ⓑ Ⓒ Ⓓ	**59.**	Ⓐ Ⓑ Ⓒ Ⓓ
60.	Ⓐ Ⓑ Ⓒ Ⓓ	**61.**	Ⓐ Ⓑ Ⓒ Ⓓ	**62.**	Ⓐ Ⓑ Ⓒ Ⓓ	**63.**	Ⓐ Ⓑ Ⓒ Ⓓ
64.	Ⓐ Ⓑ Ⓒ Ⓓ						

65. $\text{Arg}\left[i^{-53}+\{i^{n}+i^{n+1}+i^{n+2}+i^{n+3}+4\}i\right]$ is -

(A) 0 (B) π (C) $\frac{\pi}{2}$ (D) $-\frac{\pi}{2}$

66. If $(1 + x)^5 = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5$, then the value of $(a_0 - a_2 + a_4)^2 + (a_1 - a_3 + a_5)^2$ is equal to -

(A) 243 (B) 32 (C) 1 (D) 2^{10}

67. If $|z| = 2$, then the points representing the complex numbers $-2i + \frac{4-2\sqrt{5}i}{z}$ lies on the circle -

(A) whose centre is (0, 0) and radius = 2
(B) whose centre is (0, 2) and radius = 2
(C) whose centre is (–2, 0) and radius = 3
(D) whose centre is (0, –2) and radius = 3

MULTIPLE OBJECTIVE TYPE

68. If OABC is a tetrahedron (where O is origin and points A, B, C lies on x, y, z axes respectively). Let A' is point on $OA(\vec{a})$, B' is point on $OB(\vec{b})$ & C' is point on $OC(\vec{c})$ such that A'B'C' plane is parallel to ABC and volume of tetrahedron OA'B'C' is half the volume of tetrahedron OABC, then -

(A) equation of plane through three points A', B', C' is $\frac{x}{|\vec{a}|}+\frac{y}{|\vec{b}|}+\frac{z}{|\vec{c}|}=\frac{1}{2}$

(B) equation of plane through three points A', B', C' is $\frac{x}{|\vec{a}|}+\frac{y}{|\vec{b}|}+\frac{z}{|\vec{c}|}=\frac{1}{2^{1/3}}$

(C) $\frac{\text{area of }(\Delta ABC)}{\text{area of }(\Delta A'B'C')}=2^{1/3}$

(D) $\frac{\text{area of }(\Delta ABC)}{\text{area of }(\Delta A'B'C')}=2^{2/3}$

69. $z_1 = a + ib$ and $z_2 = c + id$ are two complex numbers (a, b, c, d $\in$ R) such that $|z_1| = |z_2| = 1$ and $\text{Im}(z_1\bar{z}_2)=0$. If $w_1 = a + ic$ and $w_2 = b + id$, then -

(A) $\text{Im}(w_1\bar{w}_2)=0$ (B) $\text{Im}(w_2\bar{w}_1)=0$ (C) $\text{Im}\left(\frac{w_1}{w_2}\right)=0$ (D) $\text{Re}\left(\frac{w_1}{\bar{w}_2}\right)=0$

70. Four positive numbers form a G.P. The product of the first number and the fourth one equals the greater root of the equation $x^{2+\log_{10}x}=(0.001)^{-2\frac{2}{3}}$ and the sum of the square of the second and square of the third number is equal to 250. Then -

(A) the four numbers in G.P. will be rational.
(B) the common ratio of the G.P. will be rational
(C) the first term of the G.P. will be rational
(D) the product of II^{nd} and III^{rd} term of G.P. will be rational

65.	Ⓐ Ⓑ Ⓒ Ⓓ	66.	Ⓐ Ⓑ Ⓒ Ⓓ	67.	Ⓐ Ⓑ Ⓒ Ⓓ	68.	Ⓐ Ⓑ Ⓒ Ⓓ
69.	Ⓐ Ⓑ Ⓒ Ⓓ	70.	Ⓐ Ⓑ Ⓒ Ⓓ				

71. The line x = 2y = 3z meets the plane x + y + z = 11 at the point P and the sphere centred at origin and radius equal to 14, at the points R and S, then -

(A) PR + PS = 28 (B) PR . PS = 147 (C) PR = PS (D) PR + PS = RS

72. A line passes through two points whose position vectors are $\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+\hat{k}$. The position vector of a point on it at a unit distance from the first point is -

(A) $\frac{1}{5}(5\hat{i}+\hat{j}-7\hat{k})$ (B) $\frac{1}{5}(4\hat{i}+9\hat{j}-13\hat{k})$ (C) $\frac{1}{5}(6\hat{i}+\hat{j}-7\hat{k})$ (D) $\frac{1}{5}(5\hat{i}+9\hat{j}-13\hat{k})$

73. If $(1 + x + x^2 + x^3)^{100} = a_0 + a_1x + a_2x^2 + ... + a_{300}x^{300}$, then -

(A) $a_0 + a_1 + a_2 + a_3 + ... + a_{300}$ is divisible by 1024

(B) $a_0 + a_2 + a_4 + ... + a_{300} = a_1 + a_3 + ... + a_{299}$

(C) coefficients equidistant from beginning and end are equal

(D) $a_1 = 100$

74. Let $P_1 \equiv x + y + z = 6$ & $P_2 \equiv x + y + z = 11$ be the two parallel planes. Let three points A, B & C are such that their x, y & z co-ordinates can take only positive integral values, then -

(A) if point A & origin lies on same side of plane P_1, then A can take 10 different locations in space.

(B) if point B & origin lies on same side of plane P_2, then B can take 10 different locations in space.

(C) if point B & origin lies on same side of plane P_2, then B can take120 different locations in space.

(D) if point C lies between planes P_1 & P_2, then it can take 100 different locations in space.

75. The correct statement(s) is/are -

(A) The line of intersection of planes $\vec{r}.\vec{n}_1 = q_1, \vec{r}.\vec{n}_2 = q_2$ and $\vec{r}.\vec{n}_3 = q_3, \vec{r}.\vec{n}_4 = q_4$ are perpendicular if $(\vec{n}_1.\vec{n}_3)(\vec{n}_2.\vec{n}_4) = (\vec{n}_1.\vec{n}_4)(\vec{n}_2.\vec{n}_3)$.

(B) If three distinct planes $\vec{r}.\vec{n}_1 = q_1, \vec{r}.\vec{n}_2 = q_2, \vec{r}.\vec{n}_3 = q_3$ intersect in a line which is contained by the plane $\vec{r}.\vec{n}_4 = q_4$, then $[\vec{n}_1\ \vec{n}_2\ \vec{n}_4]\vec{n}_3 = [\vec{n}_1\ \vec{n}_2\ \vec{n}_3]\vec{n}_4$.

(C) If four distinct planes $\vec{r}.\vec{n}_1 = q_1, \vec{r}.\vec{n}_2 = q_2, \vec{r}.\vec{n}_3 = q_3$ and $\vec{r}.\vec{n}_4 = q_4$ intersect in a line, then $[\vec{n}_1\ \vec{n}_2\ \vec{n}_4]\vec{n}_3 = [\vec{n}_1\ \vec{n}_2\ \vec{n}_3]\vec{n}_4$.

(D) If a plane contains line of intersection of planes $\vec{r}.\vec{n}_1 = q_1, \vec{r}.\vec{n}_2 = q_2$ and is parallel to line of intersection of planes $\vec{r}.\vec{n}_3 = q_3, \vec{r}.\vec{n}_4 = q_4$ then $[\vec{n}_1\ \vec{n}_2\ \vec{n}_4]\vec{n}_3 = [\vec{n}_1\ \vec{n}_2\ \vec{n}_3]\vec{n}_4$.

76. If a_1, a_2, a_3, a_4, a_5 are distinct positive terms in AP having common difference d, then -

(A) $5a_3^2 > 4d^2$ (B) sum of all terms = $5a_3$

(C) $a_1 + 5a_5, 3a_3, 2a_2 + 4a_4$ are in A.P. (D) $a_1a_5 < a_2a_4$

71.	Ⓐ Ⓑ Ⓒ Ⓓ	**72.**	Ⓐ Ⓑ Ⓒ Ⓓ	**73.**	Ⓐ Ⓑ Ⓒ Ⓓ	**74.**	Ⓐ Ⓑ Ⓒ Ⓓ
75.	Ⓐ Ⓑ Ⓒ Ⓓ	**76.**	Ⓐ Ⓑ Ⓒ Ⓓ				

77. The equation of plane passing through A(3, 2, 4) and parallel to vectors $\vec{n}_1 = \hat{i} - 2\hat{j} - 4\hat{k}$ and $\vec{n}_2 = 2\hat{i} + \hat{j} + \hat{k}$ are (where $\vec{a}$ denotes the position vector of A) -

(A) $\vec{r}.(2\hat{i} - 9\hat{j} + 5\hat{k}) = 2$

(B) $2x - 9y + 5z + 2 = 0$

(C) $\vec{r} = (3\hat{i} + 2\hat{j} + 4\hat{k}) + \lambda(\hat{i} - 2\hat{j} - 4\hat{k}) + \mu(2\hat{i} + \hat{j} + \hat{k})$

(D) $[\vec{r}\,\vec{n}_1\,\vec{n}_2] = [\vec{a}\,\vec{n}_1\,\vec{n}_2]$

78. Points that lie on the lines bisecting the angle between the lines $\frac{x-2}{2} = \frac{y-3}{3} = \frac{z-6}{6}$ and $\frac{x-2}{3} = \frac{y-3}{6} = \frac{z-6}{2}$ are -

(A) (7, 12, 14) (B) (0, –3, 14) (C) (1, 0, 10) (D) (–3, –6, –2)

79. The value r for which ${}^{30}C_r\,{}^{15}C_0 + {}^{30}C_{r-1}\,{}^{15}C_1 + ... + {}^{30}C_0\,{}^{15}C_r$ is maximum is/are -

(A) 21 (B) 22 (C) 23 (D) 24

80. If 1, ω, ω^2, ... ω^{n-1} are the n, n^{th} roots of unity, then $(2 - \omega)(2 - \omega^2)$ .... $(2 - \omega^{n-1})$ equal to -

(A) $2^n - 1$

(B) ${}^nC_0 + {}^nC_1 + {}^nC_2 + ... + {}^nC_{n-1}$

(C) $\sqrt{{}^{2n+1}C_0 + {}^{2n+1}C_1 + ...{}^{2n+1}C_n} - 1$

(D) $2^{n-1}(n + 2)$

81. In the expansion of $(x + y + z)^9$ -

(A) every term is of the form ${}^9C_r \cdot {}^rC_k \cdot x^{9-r} \cdot y^{r-k} \cdot z^k$

(B) coefficient of $x^4y^7z^3$ is 0

(C) the number of terms is 55

(D) coefficient of $x^2y^3z^4$ is 1260

82. Let $z = \exp\left(\exp i\frac{\pi}{3}\right)$, then -

(A) $\ell n(\text{Re}\, z) = \frac{1}{2} + \ell n\left(\cos\frac{\sqrt{3}}{2}\right)$

(B) $\ell n(\text{Re}\, z) = \frac{1}{2} + \ell n\left(\cos\frac{\sqrt{3}}{2}\right)$

(C) $\ell n(\text{Im}\, z) = \frac{1}{2} + \ell n\left(\sin\frac{\sqrt{3}}{2}\right)$

(D) $\ell n(\text{Im}\, z) = \frac{1}{2} - \ell n\left(\sin\frac{\sqrt{3}}{2}\right)$

83. If the complex numbers z_1, z_2, z_3 & z_4 taken in that order are the vertices of a rhombus, then -

(A) $z_1 + z_3 = z_2 + z_4$

(B) $|z_1 - z_2| = |z_2 - z_3|$

(C) $\frac{z_1 - z_3}{z_2 - z_4}$ is purely imaginary

(D) $|z_3 - z_1| = |z_4 - z_2|$

77. Ⓐ Ⓑ Ⓒ Ⓓ **78.** Ⓐ Ⓑ Ⓒ Ⓓ **79.** Ⓐ Ⓑ Ⓒ Ⓓ **80.** Ⓐ Ⓑ Ⓒ Ⓓ

81. Ⓐ Ⓑ Ⓒ Ⓓ **82.** Ⓐ Ⓑ Ⓒ Ⓓ **83.** Ⓐ Ⓑ Ⓒ Ⓓ

84. For the equation $(2 + 3i)z + (2 - 3i)\bar{z} - 6 = 0$, which of the following is true -

(A) The complex number with minimum modulus satisfying the given equation is $\frac{6}{13}-\frac{9}{13}i$.

(B) The argument of any complex number satisfying the given equation is $\tan^{-1}\frac{2}{3}$.

(C) Any z satisfying the given equation also satisfies $z = (3 + i) + \lambda(3 + 2i)$ for suitable $\lambda \in R$.

(D) If z_1 & z_2 are the two points satisfying given equation such that $Re(z_1) = 0$ & $Im(z_2) = 0$, then $\frac{1}{2}|z_1||z_2|=\frac{3}{4}$.

85. Let ω be a non-real cube root of unity & $z=\sum_{r=2}^{8}(r-1)(r-\omega)(r-\omega^2)$, then -

(A) $Arg(z) = 0$ (B) $|z| = 36^2 - 7$ (C) $|z|=36^2-8$ (D) $Arg(z)=\frac{\pi}{2}$

86. If z is the complex number satisfying $|z - 3 - 4i| \le 10$ and $\alpha = \sin^{-1}(\sin(|z|_{max}))$, $\beta=\cos^{-1}\left(\cos\left(-\frac{|z|_{max}+|z|_{min}}{3}\right)\right)$, then -

(A) $\alpha - 3\beta = \pi$ (B) $\alpha - 3\beta = -\pi$ (C) $\sin^2\alpha + \cos^2 3\beta = 1$ (D) $\sin^2\alpha + \cos^2 3\beta = -1$

87. The sides of a triangle ABC (right angled at B) are equimultiples of three consecutive natural numbers such that perimeter of the triangle is 24 units. If z_1, z_2 & z_3 represent affixes of vertices A, B & C respectively and $B(z_2)$ is given by $6 + i.0$ and AB coincide with real axis, then -

(A) inradius of the Δ is 2 (B) $|z_1|_{max} = 12$

(C) circumcircle of the Δ is $\left|z-\frac{z_1+z_3}{2}\right|=10$ (D) $|z_1|_{min} = 6$

88. Let $\vec{x}=\hat{i}+3\hat{j}-2\hat{k}$, $\vec{y}=2\hat{i}+4\hat{j}+\hat{k}$ and a vector $\vec{z}$ satisfying $\vec{x}\times\vec{z}=\vec{x}\times\vec{y}$ and $\vec{z}.\vec{x}=0$. Then $[|\vec{z}|]$ is greater than, (where [.] denotes greatest integer function)

(A) 1 (B) 2 (C) 3 (D) 4

89. If ω is the imaginary cube root of unity such that $\left|\left(\sum_{r=1}^{n}\left(r.\sum_{p=1}^{r}(\omega^{P-1})\right)\right)-155\omega\right|=\left(\sum_{r=1}^{n}\left(r.\sum_{p=1}^{r}\omega^{P-1}\right)\right)-155\omega$, then n is equal to -

(A) 29 (B) 30 (C) 31 (D) 32

90. If z_1, z_2, z_3 are the vertices of an equilateral triangle with centroid at origin & length of circum radius of triangle is 1 unit. Then which of the following may be the vertices of an equilateral triangle -

(A) $-z_1, -z_2, -z_3$ (B) $(z_1 + |z_2|), (z_2 + |z_3|), (z_3 + |z_1|)$

(C) $\frac{(z_1+z_2)}{2},\frac{(z_2+z_3)}{2},\frac{(z_3+z_1)}{2}$ (D) $\frac{z_1}{2|z_1|},\frac{z_2}{2|z_2|},\frac{z_3}{2|z_3|}$

84.	Ⓐ Ⓑ Ⓒ Ⓓ	85.	Ⓐ Ⓑ Ⓒ Ⓓ	86.	Ⓐ Ⓑ Ⓒ Ⓓ	87.	Ⓐ Ⓑ Ⓒ Ⓓ
88.	Ⓐ Ⓑ Ⓒ Ⓓ	89.	Ⓐ Ⓑ Ⓒ Ⓓ	90.	Ⓐ Ⓑ Ⓒ Ⓓ		

COMPREHENSION

Paragraph for Question 91 and 92

Let $(1 + x + x^2)^{20} = a_0 + a_1x + a_2x^2 + ... + a_{40}\, x^{40}$. Further $S = \sum_{r=0}^{40} a_r$. Two coefficients are chosen from the coefficients $a_0, a_1, ..., a_{40}$ and the probability that they are equal is p (considering no three coefficients are equal). Units digit of S is equal to b and $a = \frac{1-p}{10p}$.

On the basis of above information, answer the following :

91. If $\left(\sqrt{a-b}+b\right)^6 = I + F$, where $0 \le F < 1$ and $I \in N$, then the value of I is -

(A) 413 (B) 414 (C) 415 (D) 416

92. The coefficient a_3 is equal to -

(A) $\frac{3.20!}{18!}$ (B) $\frac{4.20!}{18!}$ (C) $\frac{20!}{17!\,3!}$ (D) $\frac{20!}{18!}$

Paragraph for Question 93 to 95

Consider a plane having equation $\vec{r}.\vec{n} = d$ (where $\vec{n}$ should not be unit vector) & two points A($\vec{a}$) & B($\vec{b}$) are lying on same side w.r.t. the plane.

On the basis of above information, answer the following :

93. If foot of perpendiculars from A & B to the plane are A' & B' respectively then distance A'B' is equal to

(A) $\frac{\left|(\vec{b}-\vec{a}).\vec{n}\right|}{\left|\vec{n}\right|}$ (B) $\left|(\vec{b}-\vec{a}).\vec{n}\right|$ (C) $\frac{\left|(\vec{b}-\vec{a})\times\vec{n}\right|}{\left|\vec{n}\right|}$ (D) $\left|(\vec{b}-\vec{a})\times\vec{n}\right|$

94. Reflection of the A($\vec{a}$) w.r.t. the plane has the position vector -

(A) $\vec{a}+\frac{2}{n^2}(d-\vec{a}.\vec{n})\vec{n}$ (B) $\vec{a}+\frac{(d-\vec{a}.\vec{n})}{n^2}\vec{n}$ (C) $\vec{a}+\frac{2}{n^2}(\vec{d}+\vec{a}.\vec{n})\vec{n}$ (D) none of these

95. If a plane is drawn from the point $\vec{a}$ parallel to $\vec{r}.\vec{n} = d$ & another plane is drawn from the point $\vec{b}$ parallel to $\vec{r}.\vec{n} = d$ & the distance between two planes is d_1 then $(A'B')^2 + d_1^2$ is equal to (A'B' is mentioned in Q.14)

(A) $\frac{(\vec{b}-\vec{a})^2}{n^2}$ (B) $\left|\vec{b}-\vec{a}\right|^2 n^2$ (C) $(\vec{b}-\vec{a})^2$ (D) n^2

91.	Ⓐ Ⓑ Ⓒ Ⓓ	**92.**	Ⓐ Ⓑ Ⓒ Ⓓ	**93.**	Ⓐ Ⓑ Ⓒ Ⓓ	**94.**	Ⓐ Ⓑ Ⓒ Ⓓ
95.	Ⓐ Ⓑ Ⓒ Ⓓ						

Paragraph for Question 96 to 98

Let $f(x) = ae^{2x} + be^{x} + cx$ satisfies the condition $f(0) = -1$, $f'(\ell n2) = 31$ and $\int_0^{\ell n4} (f(x) - cx)dx = \frac{39}{2}$.

Image of a line $\frac{x-1}{3} = \frac{y-3}{5} = \frac{z-4}{2}$ in the plane $(a-3)x + (b+a)y + z + c = 0$ be a line $L = 0$ whose direction ratios are 1, p, q respectively. Let $\vec{\ell} = a\hat{i} + b\hat{j} + c\hat{k}$ and $\vec{m} = (p-2)\hat{i} + 2\hat{j} + (q+3)\hat{k}$.

On the basis of above information, answer the following :

96. a + b + c is equal to -
(A) –2 (B) 2 (C) 1 (D) 0

97. $p^2 + 4q$ is equal to -
(A) 25 (B) 32 (C) 36 (D) 40

98. Component of vector $\vec{\ell}$ which is perpendicular to vector $\vec{m}$, is -
(A) $20\hat{i} - 12\hat{j} + 12\hat{k}$ (B) $5\hat{i} - 6\hat{j} + 3\hat{k}$ (C) $\frac{20\hat{i} + 10\hat{j} + 10\hat{k}}{9}$ (D) $\frac{25\hat{i} - 64\hat{j} + 7\hat{k}}{9}$

Paragraph for Question 99 to 101

The base of a pyramid is rectangular, three of its vertices of the base are A(2, 2, –1), B(3, 1, 2) and C(1, 1, 1) (may or may not be in order). Its vertex at the top is $P\left(4, -\frac{26}{3}, -\frac{10}{3}\right)$ and fourth vertex of the base is D.

On the basis of above information, answer the following :

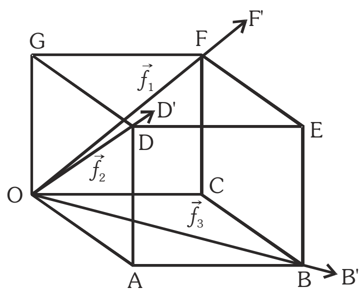
99. Co-ordinates of D are -
(A) (4, 0, 2) (B) (4, 2, 0) (C) (2, 0, 4) (D) (0, 2, 4)

100. Co-ordinates of foot of the normal drawn from P on the base of the pyramid are -
(A) $\left(2, \frac{4}{3}, \frac{2}{3}\right)$ (B) $\left(2, \frac{2}{3}, \frac{4}{3}\right)$ (C) $\left(\frac{4}{3}, 2, \frac{2}{3}\right)$ (D) $\left(\frac{2}{3}, \frac{4}{3}, 2\right)$

101. Volume of the pyramid is -
(A) 20 cubic units (B) 10 cubic units (C) 40 cubic units (D) 30 cubic units

Paragraph for Question 102 to 104

Three forces $\vec{f}_1, \vec{f}_2$ & $\vec{f}_3$ of magnitude 2, 4 and 6 units respectively act along three face diagonals of a cube as shown in figure. Let P_1 be a parallelopiped whose three co-terminus edges be three vectors $\vec{f}_1, \vec{f}_2$ & $\vec{f}_3$. Let the joning of mid-points of each pair of opposite edges of parallelopiped P_1 meet in point X.



On the basis of above information, answer the following questions :

102. The magnitude of the resultant of the three forces is -
(A) 5 (B) 10 (C) 15 (D) none of these

96.	Ⓐ Ⓑ Ⓒ Ⓓ	97.	Ⓐ Ⓑ Ⓒ Ⓓ	98.	Ⓐ Ⓑ Ⓒ Ⓓ	99.	Ⓐ Ⓑ Ⓒ Ⓓ
100.	Ⓐ Ⓑ Ⓒ Ⓓ	101.	Ⓐ Ⓑ Ⓒ Ⓓ	102.	Ⓐ Ⓑ Ⓒ Ⓓ		

103. The volume of the parallelopiped P_1 is -

(A) $48\sqrt{2}$ (B) $96\sqrt{2}$ (C) $24\sqrt{2}$ (D) $50\sqrt{2}$

104. $\ell(OX)$ is equal to -

(A) 5 (B) 1.5 (C) 2 (D) 2.5

Paragraph for Question 105 to 108

Roots of $z^n - 1 = 0$ are $1, \alpha, \alpha^2, \alpha^3, ... \alpha^{n-1}$

where $\alpha = \cos\frac{2\pi}{n} + i\sin\frac{2\pi}{n}$

so $z^n - 1 = (z-1)(z-\alpha) .... (z-\alpha^{n-1})$

On the basis of above information, answer the following questions :

105. If n = 20, then $1 + \alpha^{10} + \alpha^{20} + \alpha^{30} + ... \alpha^{190}$ is equal to -

(A) 20 (B) 190 (C) 0 (D) none of these

106. $\sum_{r=1}^{n-1} \ell n \sin\frac{r\pi}{n}$ is equal to $(n \in I^+)$

(A) $\ell n(n) - (n-1)\ell n2$ (B) $\ell n(n) + (n-1)\ell n2$ (C) $\ell n(n) - (n+1)\ell n2$ (D) $\ell n(n) + (n+1)\ell n2$

107. If n = 7, then the equation whose roots are $\alpha + \alpha^2 + \alpha^4$ and $\alpha^3 + \alpha^5 + \alpha^6$ is -

(A) $x^2 - x + 2 = 0$ (B) $x^2 + x - 2 = 0$ (C) $x^2 - x - 2 = 0$ (D) $x^2 + x + 2 = 0$

108. If n = 5, then $(1+\alpha)(1+\alpha^2)(1+\alpha^3)(1+\alpha^4)$ is equal to -

(A) zero (B) –1 (C) 1 (D) 2

Paragraph for Question 109 to 111

Consider a circle centred at origin O and passing through points $A(z_1)$, $B(z_2)$ and $C(z_3)$. The tangents to the circle at A, B and C intersect at D, E and F; D, E, F are opposite to A, B, C respectively. Also $\angle AOB = \angle BOC = \theta$, where $\theta \in \left(\frac{\pi}{2}, \pi\right)$ satisfying the equation

$$\sqrt{17\sec^2 x + 16\left(\frac{1}{2}\tan x \sec x - 1\right)} = -2\tan x(1 + 4\sin x)$$

On the basis of above information, answer the following :

109. Which of the following is not the equation of tangent to the circle at A (z represents any variable point on the tangent at A) -

(A) $z = z_1(1 + i\lambda),\ \lambda \in R_0$ (B) $\arg\left(\frac{z - z_1}{z_1}\right) = \pm\frac{\pi}{2}$

(C) $\frac{z - z_1}{z_1} + \frac{\bar{z} - \bar{z}_1}{\bar{z}_1} = 0$ (D) $\frac{z - z_1}{z_1} - \frac{\bar{z} - \bar{z}_1}{\bar{z}_1} = 0$

110. The complex representation of intersection point F is given by -

(A) $\frac{z_1 + z_2}{2}$ (B) $\sqrt{z_1 z_2}$ (C) $\frac{2z_1 z_2}{z_1 + z_2}$ (D) $\frac{z_1 + z_2}{\sqrt{z_1 z_2}}$

103.	Ⓐ Ⓑ Ⓒ Ⓓ	**104.**	Ⓐ Ⓑ Ⓒ Ⓓ	**105.**	Ⓐ Ⓑ Ⓒ Ⓓ	**106.**	Ⓐ Ⓑ Ⓒ Ⓓ
107.	Ⓐ Ⓑ Ⓒ Ⓓ	**108.**	Ⓐ Ⓑ Ⓒ Ⓓ	**109.**	Ⓐ Ⓑ Ⓒ Ⓓ	**110.**	Ⓐ Ⓑ Ⓒ Ⓓ

111. z_1, z_2, z_3 are in G.P. with common ratio r, then $[\, i\ell nr \,]$ is equal to (where [.] denotes greatest integer function) -

(A) –3 (B) –2 (C) –1 (D) 0

Paragraph for Question 112 to 114

Two vectors $\vec{a}$ and $\vec{b}$ having unit modulus and angle between them is θ. Now $\phi(\theta) = \int_{-(\vec{a}.\vec{b})^2}^{(\vec{a}\times\vec{b})^2} f^2(x)dx$ and f satisfies the condition $f(y) + f(x) = \frac{x+y}{xy}$ for all $x, y \in R - \{0\}$ and $h(\theta) = -\phi(\theta) + |\vec{a}\times\vec{b}_1|^2|\vec{a}.\vec{b}_1|^2$, where $|b_1| = 2|b|$.

On the basis of above information, answer the following questions :

112. Fundamental period of $\phi(\theta)$ is -

(A) $\frac{\pi}{2}$ (B) π (C) 2π (D) 6π

113. The volume of the parallelopiped formed by $\vec{a}$, $\vec{b}$ and $\vec{a}\times\vec{b}$, where angle between $\vec{a}$ & $\vec{b}$ is taken for which $h(\theta)$ is minimum is -

(A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{8}$

114. If $\vec{a}$ & $\vec{b}$ are non collinear vectors, then number of solution of the equation $4\phi(\theta) + \sqrt{3}\phi'(\theta) = 0$ in $[0, 2\pi]$, are -

(A) 2 (B) 4 (C) 6 (D) 8

Paragraph for Question 115 to 117

Let the origin O of the argand plane represents the home town of a person. Suppose the man travels $\sqrt{2}$ units in north-east direction to reach city A. Then he travels 1 unit in east direction to reach town B. From town B he starts to move along a circular path, in anticlockwise direction with centre O and radius OB, to reach to city C such that ∠ BOC is right angle. Finally he returns home by the shortest path from city C. Let z_1, z_2 and z_3 be the complex numbers corresponding to the points A, B and C respectively.

On the basis of above information answer the following :

115. The image of complex number z_2 under the locus $|z - z_1| = |z - z_3|$ -

(A) $\frac{16}{5}+\frac{16}{5}i$ (B) $\frac{2}{5}+\frac{2}{5}i$ (C) $\frac{16}{5}+\frac{2}{5}i$ (D) $-\frac{8}{5}+\frac{14}{5}i$

116. Let z_p & z_q be the two complex numbers satisfying the equations $|z - z_2| = 1$ & $|z - z_3| = 1$ respectively, then maximum value of $|z_p - z_q|$ is -

(A) $\sqrt{10}$ (B) $\sqrt{10} - 2$ (C) $2 + \sqrt{10}$ (D) none of these

111. Ⓐ Ⓑ Ⓒ Ⓓ	**112.** Ⓐ Ⓑ Ⓒ Ⓓ	**113.** Ⓐ Ⓑ Ⓒ Ⓓ	**114.** Ⓐ Ⓑ Ⓒ Ⓓ
115. Ⓐ Ⓑ Ⓒ Ⓓ	**116.** Ⓐ Ⓑ Ⓒ Ⓓ		

117. The area enclosed by the path traced by the person during his complete journey is -

(A) $\frac{5\pi}{4}-\frac{1}{2}$ (B) $\frac{5\pi}{4}$ (C) $\frac{5\pi}{4}-1$ (D) $\frac{5\pi-1}{4}$

Paragraph for Question 118 to 120

Consider an equation $z^{12} + z^6 + 1 = 0$, whose roots are $\alpha_1, \alpha_2, ...\alpha_{12}$ and $\theta_1, \theta_2, ...\theta_{12}$ are the arguments of the roots of the equation, where $0 < \theta_1 < \theta_2 < .... < \theta_{12}$.

On the basis of above information answer the following :

118. $\cos\left(\sum_{i=1}^{12}\theta_i\right)+i\sin\left(\sum_{i=1}^{12}\theta_i\right)$ is equal to -

(A) 0 (B) –1 (C) 1 (D) $\frac{1}{2}$

119. The value of $\sec(3\tan^{-1}(\tan(\arg(\alpha_1))) + 6\cos^{-1}(\cos(\arg(\alpha_{12})))$ is equal to -

(A) sec10° (B) –1 (C) 1 (D) $\frac{1}{2}$

120. Sum of real parts of all roots of the equation whose imaginary part is negative, is -

(A) cos10° (B) cot10° (C) $-\frac{\cos^2 10°}{\sin 10°}$ (D) 0

MATCH THE COLUMN

121. **Column-I** **Column-II**

	Column-I		Column-II
(A)	Let $\vec{a}=\hat{i}+\hat{j}$ & $\vec{b}=2\hat{i}-\hat{k}$. If the point of intersection of the lines $\vec{r}\times\vec{a}=\vec{b}\times\vec{a}$ & $\vec{r}\times\vec{b}=\vec{a}\times\vec{b}$ is 'P', then $\ell^2(OP)$ (where O is the origin) is	(P)	0
(B)	If $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{b}=2\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+2\hat{j}+\hat{k}$ and $\vec{a}\times(\vec{b}\times\vec{c})$ is equal to $x\vec{a}+y\vec{b}+z\vec{c}$, then x + y + z is equal to	(Q)	5
(C)	The number of values of x for which the angle between the vectors $\vec{a}=x^9\hat{i}+(x^3-1)\hat{j}+2\hat{k}$ & $\vec{b}=(x^3-1)\hat{i}+x\hat{j}+\frac{1}{2}\hat{k}$ is obtuse	(R)	7
(D)	Let $P_1 \equiv 2x - y + z = 7$ & $P_2 \equiv x + y + z = 2$. If P be a point that lies on P_1, P_2 and XOY plane, Q be the point that lies on P_1, P_2 and YOZ plane and R be the point that lies on P_1, P_2 & XOZ plane, then [Area of triangle PQR] (where [.] is greatest integer function)	(S)	11

117. (A) (B) (C) (D) **118.** (A) (B) (C) (D) **119.** (A) (B) (C) (D) **120.** (A) (B) (C) (D)

121.
(A) (P) (Q) (R) (S) (T)
(B) (P) (Q) (R) (S) (T)
(C) (P) (Q) (R) (S) (T)
(D) (P) (Q) (R) (S) (T)

122. Consider three planes

$P_1 \equiv 2x + y + z = 1$

$P_2 \equiv x - y + z = 2$

$P_3 \equiv \alpha x - y + 3z = 5$

The three planes intersects each other at point P on XOY plane and at point Q on YOZ plane. O is the origin.

	Column-I	**Column-II**
(A)	The value of α is	(P) 1
(B)	The length of projection of PQ on x-axis is	(Q) 2
(C)	If the co-ordinates of point R situated at a minimum distance from point 'O' on the line PQ are (a, b, c), then value of 7a + 14b + 14c is	(R) 4
		(S) 3
(D)	If the area of ΔPOQ is $\sqrt{\frac{a}{b}}$, then value of a – b is	

123.

	Column-I	**Column-II**
(A)	The direction cosines of a line satisfy the relations $\lambda(\ell + m) = n$ and $mn + n\ell + \ell m = 0$. The value of λ for which the two lines are perpendicular to each other, is	(P) 0
		(Q) 2
(B)	In the expansion of $(1 + x)^{36}$, 7th and 8th terms are equal and the value of $\left(\frac{7}{x}+6\right)^2$ is λ, then the value of $\lambda^{1/4}$ is	(R) 3
		(S) 6
(C)	The number of complex numbers satisfying $\lvert z + 2i\rvert + \lvert z - 2i\rvert = 8$ and $\lvert z - i\rvert + \lvert z + i\rvert = 2$ is	

124. If z = x + iy, then on the basis of information given in column-I match the answers in column-II

	Column-I	**Column-II**
(A)	$\lvert\lvert z + i\rvert - \lvert z - 5i\rvert\rvert = 2a$ represents a hyperbola then number of integral values of 'a' are	(P) 1
(B)	Area enclosed by the rays with equations $\arg(z + 1) = \pm\frac{\pi}{4}$ & $\arg(z - 1) = \pm\frac{3\pi}{4}$ is	(Q) 2
(C)	$f(z) = (2z - 3)i$ where $f(z)$ is always real & $-5 \le f(z) \le 5$, then number of common solution(s) of $f(z)$ & $\left\lvert z-\frac{5}{2}\right\rvert = 1$ is/are	(R) 3
(D)	If roots of $(z - 5)^6 = 64$ represents a regular hexagon and distance between its two parallel sides is λ; value of $\frac{\lambda^2}{2}$ is	(S) 6

122.
(A) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(B) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(C) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(D) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ

123.
(A) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(B) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(C) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(D) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ

124.
(A) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(B) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(C) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(D) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ

125. Let z_1, z_2, z_3 are vertices of a triangle

	Column-I		Column-II
(A)	If $2(z_3 - z_1) + (i\sqrt{3}+1)(z_1 - z_2) = 0$, then triangle is	(P)	right angled
(B)	$\text{Re}\left(\dfrac{z_3 - z_1}{z_3 - z_2}\right) = 0$, then triangle is	(Q)	obtuse angled
(C)	$\text{Re}\left(\dfrac{z_3 - z_1}{z_3 - z_2}\right) < 0$, then triangle is	(R)	isosceles
(D)	$\dfrac{z_3 - z_1}{z_3 - z_2} = i$, then triangle is	(S)	equilateral

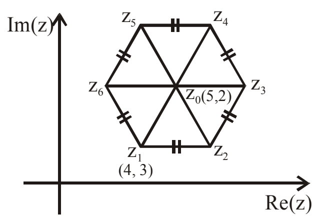
126. **Column-I** **Column-II**

(A) Let $z_1 = 2 + i$, $z_2 = 4 + 2i$ and z_3 be a complex number such that $\ell n\text{Re}(z_3)$ & $\ell n\text{Im}(z_3)$ are defined for which $\dfrac{z_2 - z_3}{z_3 - z_1}$ is purely real, then $\tan(\arg z_3)$ is — (P) 0

(Q) $\dfrac{1}{2}$

(B) For a complex number z the minimum value of $|z| + \left|z - \dfrac{\sqrt{3}}{2} - \dfrac{i}{2}\right|$ is

(C) In the following figure, the value of $\text{Re}(z_3) - \text{Im}(z_3)$ is equal to — (R) 1



(D) If z_1 & z_2 are two complex numbers such that $\arg(z_1 + z_2) = 0$ & $\text{Im}(z_1 z_2) = 0$, then $|z_1 - \bar{z}_2|$ is — (S) 4

125.		126.	
(A)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ	(A)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(B)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ	(B)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(C)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ	(C)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(D)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ	(D)	Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ

127. **Column-I** | **Column-II**

(A) If the angle between the plane $x - 3y + 2z = 1$ and the line $\frac{x-1}{2} = \frac{y-1}{1} = \frac{z-1}{-3}$ is θ, then the value of $|\text{cosec}\,\theta|$ is — (P) 2

(B) If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar and $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = \frac{4}{7}$, then $[2\vec{a}-\vec{b}\ \ 2\vec{b}-\vec{c}\ \ 2\vec{c}-\vec{a}]$ is — (Q) 3

(C) Let $\vec{r} = (\vec{a}\times\vec{b})\sin x + (\vec{b}\times\vec{c})\cos y + 2(\vec{c}\times\vec{a})$, where $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors. If $\vec{r}$ is perpendicular to $(\vec{a}+\vec{b}+\vec{c})$ and the minimum value of $(x^2 + y^2)$ is $\frac{k\pi^2}{4}$, then 'k' is — (R) 4

(D) Locus of complex number 'z' satisfying $\arg\left(\frac{z-5+4i}{z+3-2i}\right) = \frac{\pi}{3}$ is the arc of a circle whose radius is equal to $\frac{10}{3}\sqrt{p}$ $(p \in N)$, then 'p' is — (S) 5

(T) an odd integer

INTEGER TYPE / SUBJECTIVE TYPE

128. For any sequence of real number $A = \{a_1, a_2, a_3.....\}$, a sequence ΔA is defined such that $\Delta A = \{a_2 - a_1, a_3 - a_2, a_4 - a_3, ...\}$. Suppose that all of the terms of the sequence $\Delta(\Delta A)$ are 1 and that $a_{19} = a_{92} = 0$. Find a_3.

129. Let $2[x]$, $6\{x\}$ and $3x$ be first three terms of a G.P. where $x \in R^+$ and [.] and {.} represent greatest integer and fractional part functions respectively. If there is another G.P. whose terms are square of reciprocal of the terms of given G.P. and the sum of infinite terms of this G.P. is S then find the value of 100S.

130. Let $(1 + ix)^{81} = f(x) + ig(x)$ where $x \in R$ and $i = \sqrt{-1}$. If S be sum of all coefficient of $f(x)$, then the value of $\log_{32}(S)$ is

127. (A) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(B) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(C) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ
(D) Ⓟ Ⓠ Ⓡ Ⓢ Ⓣ

128. ☐ **129.** ☐ **130.** ☐

131. A square ABCD of side length $\sqrt{50}$ is folded along diagonal AC so that planes ACB' and ACD are perpendicular to one another where B' is the new position of B. If the shortest distance between AB' and CD is $\frac{10}{\sqrt{n}}$, then n is

132. Let $L_1 : \frac{x-6}{3} = \frac{y-7}{-1} = \frac{z-4}{1}$ and $L_2 : \frac{x}{-3} = \frac{y+9}{2} = \frac{z-2}{4}$. If L_1 & L_2 are skew lines such that P & Q are two points nearest to each other lying on lines L_1 & L_2 respectively. If image of P with respect to plane 3x + 3y – z = 11 is R(a,b,c), then (a + b + c) equals

133. The volume of the tetrahedron whose vertices are the points with position vectors $\hat{i}+\hat{j}+\hat{k},\ -\hat{i}-3\hat{j}+7\hat{k},\ \hat{i}+2\hat{j}-7\hat{k}$ and $3\hat{i}-4\hat{j}+\lambda\hat{k}$ is 22, then the digit at unit place of λ is

134. Given $f(a,b,c) \le \frac{\pi}{2}$, where $f(a,b,c) = \left|\frac{a}{b} - \frac{1}{2}\right| + (3b-2c)^2 + \sin^{-1}(1+((a-1)^2+(b-2)^2))$. Also Π denotes the plane through the line $\frac{y}{b}+\frac{z}{c}=1$, x = 0 and parallel to the line $\frac{x}{a}-\frac{z}{c}=1$, y = 0. If the plane Π cuts the co-ordinate axes at A, B, C, then volume of tetrahedron OABC, O being the origin, is

135. Let $\vec{a} = \begin{bmatrix} -3 \\ 1 \\ 1 \end{bmatrix}, \vec{b} = \begin{bmatrix} 4 \\ 2 \\ 4 \end{bmatrix}$ & $\vec{c} = \begin{bmatrix} 2 \\ 2 \\ 0 \end{bmatrix}$. If V_1 is the volume of parallelopiped whose three coterminous edges are the vectors $\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}$ & V_2 is the volume of tetrahedron whose coterminous edges are the vectors $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}$, then the value of $(V_1 + V_2)$ is

136 Given a regular tetrahdedron OABC with side length 1 unit. Let D & E are mid points of AB & OC respectively. If $\overrightarrow{DE}.\overrightarrow{AC} = \frac{m}{n}$ (where m & n are coprime), then (m + n) is

137. If P, Q, R are three points such that $\left|\overrightarrow{PQ}\right| = 3$ & $\left|\overrightarrow{QR}\right| = 4$, then the value of $\overrightarrow{PR}.(\overrightarrow{QR}+\overrightarrow{QP})$ is

131.	132.	133.	134.
135.	136.	137.	

138. The projection of the line $\frac{x}{2}=\frac{y-1}{2}=\frac{z-1}{1}$ on a plane P is $\frac{x}{1}=\frac{y-1}{1}=\frac{z-1}{-1}$. If plane P passes through (a, –2, 0), then a is equal to

139. Let $\hat{a}\times\hat{b}+\hat{c}=\hat{b}+\hat{a}\times\hat{c}$, then $|2\hat{a}+\hat{b}-\hat{c}|^2$ is equal to (where $\hat{a}$, $\hat{b}$ and $\hat{c}$ are unit vectors)

140. Two variable complex numbers z_1 & z_2 with their arguments in $(-\pi, \pi]$ are such that $|z_1-(6+2i)|\le 2\sqrt{2}$ and $|z_2-(4\sqrt{2}+i12\sqrt{2})|\le k$, where maximum value of $\arg(z_1)$ = minimum value of $\arg(z_2)$, then k is equal to

138.		139.		140.	

ANSWER KEY

1. C **2.** B **3.** B **4.** B **5.** D **6.** B **7.** B **8.** D **9.** B **10.** D

11. D **12.** D **13.** D **14.** A **15.** B **16.** A **17.** B **18.** B **19.** D **20.** C

21. D **22.** A **23.** B **24.** D **25.** D **26.** C **27.** D **28.** B **29.** D **30.** C

31. C **32.** A **33.** B **34.** C **35.** C **36.** D **37.** C **38.** C **39.** C **40.** A

41. A **42.** C **43.** B **44.** B **45.** C **46.** A **47.** C **48.** C **49.** A **50.** A

51. C **52.** B **53.** C **54.** B **55.** A **56.** D **57.** B **58.** C **59.** B **60.** A

61. C **62.** A **63.** B **64.** A **65.** C **66.** B **67.** D **68.** B,C

69. A,B,C,D **70.** B,D **71.** A,B,D **72.** A,D **73.** A,B,C,D

74. A,C,D **75.** A,B,C,D **76.** A,B,D **77.** B,C,D **78.** A,B,C,D

79. B,C **80.** A,B,C **81.** A,B,C,D **82.** A,C **83.** A,B,C

84. A,C,D **85.** A,C **86.** B,C **87.** A,B **88.** A,B

89. A,B,C **90.** A,B,C,D **91.** C **92.** B **93.** C **94.** A **95.** C **96.** B

97. D **98.** D **99.** B **100.** A **101.** A **102.** B **103.** C **104.** A **105.** C **106.** A

107. D **108.** C **109.** D **110.** C **111.** A **112.** A **113.** B **114.** B **115.** D **116.** C

117. A **118.** C **119.** B **120.** D **121.** (A)→(S), (B)→(R), (C)→(P), (D)→(P)

122. (A)→(R); (B)→(P); (C)→(Q); (D)→(S) **123.** (A)→(Q), (B)→(S), (C)→(P)

124. (A)→(Q), (B)→(Q), (C)→(P), (D)→(S) **125.** (A)→(S), (B)→(P), (C)→(Q), (D)→(P,R)

126. (A)→(Q); (B)→(R); (C)→(S); (D)→(P) **127.** (A)→(P); (B)→(R); (C)→(S,T); (D)→(Q,T)

128. 712 **129.** 45 **130.** 8 **131.** 3 **132.** 4 **133.** 3 **134.** 1 **135.** 288 **136** 3 **137.** 7

138. 5 **139.** 4 **140.** 8

Important Notes