MATHEMATICS

1. The number of roots of $z^3 + \bar{z} = 0$ is

A. 2 B. 3
C. 4 D. 5

2. If z_1 and $z_2 (\neq 0)$ are the complex numbers such that $\left|\frac{z_1 - z_2}{z_1 + z_2}\right| = 1$, then

A. $z_2 = kz_1, k \in R$ B. $z_2 = ikz_1, k \in R$
C. $z_1 = z_2$ D. None of these.

3. If z is a point in the argand plane satisfying $|z-a| - |z-b| = c < |a-b|$, where a, b, c are fixed real numbers, then the locus of z is a

A. parabola B. ellipse
C. hyperbola D. line- segment .

4. If z_1 and z_2 are two non – zero complex numbers such that $|z_1 + z_2| = |z_1| + |z_2|$, then $\arg(z_1) - \arg(z_2)$ is equal to

A. $-\pi$ B. $-\frac{\pi}{2}$
C. $\frac{\pi}{2}$ D. 0

5. If $1, \omega, \omega^2, ..., \omega^{n-1}$ are the n^{th} roots of unity, then $(2-\omega)(2-\omega^2)...(2-\omega^{n-1})$ equals

A. $2^n - 1$ B. $2^n + 1$
C. $2^{n+1} - 1$ D. ${}^nC_1 + {}^nC_2 + ... + {}^nC_{n-1} + 1$

6. Suppose three real numbers a, b, c are in geometric progression. Let $z = \frac{a+ib}{c-ib}$ then

A. $z = i\frac{b}{c}$ B. $z = i\frac{a}{c}$
C. $z = 0$ D. None of these.

7. Let α, β, γ are three real numbers such that $\alpha^2+\beta^2+\gamma^2-\gamma=0$ and $z=\frac{\alpha+i\beta}{1-\gamma}$. Then $|z|^2$ equals

A. γ
B. $1-\gamma$
C. $\frac{\gamma}{1-\gamma}$
D. $\frac{1-\gamma}{\gamma}$

8. The centre of the circle $\left|\frac{z-1}{z+1}\right|=2$ is

A. $\frac{5}{3}+0i$
B. $1-i$
C. $1+2i$
D. $-4-i$

9. If ω is an imaginary cube root of unity, $x=a+b, y=a\omega+b\omega^2$ and $z=a\omega^2+b\omega$, then xyz equals

A. abc
B. a^2+b^2
C. a^4+b^4
D. a^3+b^3

10. The polar form of the complex number $1-i$ is

A. $\sqrt{2}e^{\frac{i\pi}{4}}$
B. $e^{\frac{i\pi}{4}}$
C. $\sqrt{2}e^{-\frac{i\pi}{4}}$
D. $e^{-\frac{i\pi}{4}}$

11. If a, b, c are distinct rational numbers, then the roots of the equation $(b-c)x^2+(c-a)x+(a-b)=0$ are

A. irrational
B. rational
C. equal
D. imaginary.

12. The number of real roots of $|x|^2+5|x|-6=0$ is

A. 0
B. 1
C. 2
D. 4

13. Out of the letters of the word CALCUTTA, different words are formed. They are

A. 8 !
B. 5040
C. 72
D. None of these.

14. If the equations $ax^2 + bx + c = 0$ and $x^2 + 2x + 2 = 0$ has a common root, then $a : b : c =$

A. 2:1:1 B. 1:2:2
C. 2:1:2 D. 1:1:1

15. The number of real roots of the equation $\left(\sqrt{2}+1\right)^x + \left(\sqrt{2-1}\right)^x = 1$ is

A. 1 B. 2
C. 0 D. 3

16. The range of the function $f(x) = |x-1| + |x-2| + |x-3|$ is

A. $[3,\infty)$ B. $[2,\infty]$
C. $[2,\infty)$ D. $[1,\infty)$

17. If $x^{11} + x + 1$ is divided by $x^2 + x + 1$ the remainder is

A. 1 B. $x+1$
C. $11x+1$ D. 0

18. If the point (3, 4) is rotated in the coordinate plane about origin through an angle $\frac{\pi}{2}$, the coordinates of the new point is

A. $(-4, 3)$ B. $(4, 3)$
C. $(4, -3)$ D. $(-3, -4)$

19. The real values of x satisfying $x^2 + 6|x| - 16 < 0$ is given by

A. $-8 < x < 2$ B. $-8 < x < 8$
C. $-2 < x < 8$ D. $-2 < x < 2$

20. If a^2, b^2, c^2 are in A.P., then $b+c, c+a, a+b$ are in

A. H.P. B. G.P.
C. A.P. D. None of these.

21. A vector $\vec{c}$, directed along the internal bisector of the angle between the vectors $\vec{a} + 7\hat{i} - 4\hat{j} - 4\hat{k}, \vec{b} = -2\hat{i} - \hat{j} + 2\hat{k}$ with $|\vec{c}| = 5\sqrt{6}$, is

A. $\frac{5}{3}\left(\hat{i} - 7\hat{j} + 2\hat{k}\right)$ B. $\frac{5}{3}\left(5\hat{i} - 5\hat{j} + 2\hat{k}\right)$
C. $\frac{5}{3}\left(\hat{i} - 7\hat{j} + 2\hat{k}\right)$ D. $\frac{5}{3}\left(-5\hat{i} + 5\hat{j} + 2\hat{k}\right)$

22. The vector $\hat{i}\times(\vec{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j})+\hat{k}\times(\vec{a}\times\hat{k})$ is equal to

A. $\vec{0}$
B. $\vec{a}$
C. $2\vec{a}$
D. None of these.

23. $\vec{a}\times(\vec{b}\times\vec{c})+\vec{b}\times(\vec{c}\times\vec{a})+\vec{c}\times(\vec{a}\times\vec{b})=$

A. 1
B. $2(\vec{a}\times\vec{b}\cdot\vec{c})$
C. $\vec{a}+\vec{b}+\vec{c}$
D. $\vec{0}$

24. If $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$, then

A. $\vec{a}$ is parallel to $\vec{b}$
B. $\vec{a}$ is perpendicular to $\vec{b}$
C. $|\vec{a}|=\vec{0}$
D. None of these.

25. A unit vector perpendicular to the plane of the vectors $-\hat{i}+\hat{j}+\hat{k}$, and $\hat{i}-\hat{j}+\hat{k}$ is

A. $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
B. $\hat{k}$
C. $\frac{\hat{k}+\hat{j}}{\sqrt{2}}$
D. $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$

26. The vectors $\vec{a}=\hat{i}+\hat{j}+m\hat{k}$, $\vec{b}=\hat{i}+\hat{j}+(m+1)\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}+m\hat{k}$ are coplanar if m is equal to

A. 1
B. 4
C. 3
D. None of these.

27. The vectors $\vec{a}=x\hat{i}-2\hat{j}+5\hat{k}$ and $\vec{b}=\hat{i}+y\hat{j}-z\hat{k}$ are collinear if (x,y,z) is

A. $(1,-2,-5)$
B. $\left(\frac{1}{2},-4,-10\right)$
C. $\left(-\frac{1}{2},4,10\right)$
D. None of these.

28. The volume of the parallelopiped whose sides are given by $\overrightarrow{OA}=2\hat{i}-3\hat{j}$, $\overrightarrow{OB}=\hat{i}+\hat{j}-\hat{k}$, $\overrightarrow{OC}=3\hat{i}-\hat{k}$ is

A. $\frac{4}{13}$
B. 4
C. $\frac{2}{7}$
D. None of these.

29. A vector orthogonal to the vectors $(1,-1,1)$ and $(2, 3, 5)$ in R^3 is

A. $(8,-3, 5)$
B. $(-8, 3, 5)$
C. $(8, 3, -5)$
D. $(-8, -3, 5)$

30. The domain of the function $f(x)=\sqrt{2x-1}+\sqrt{3-2x}$

A. $\left[\frac{1}{2},\infty\right)$
B. $\left(-\infty,\frac{3}{2}\right)$
C. $\left(\frac{1}{2},\frac{3}{2}\right]$
D. $\left[\frac{1}{2},\frac{3}{2}\right]$

31. Let $f(x)=\frac{x-[x]}{1+x-[x]}$, $x\in R$, then the range of f is

A. $[0, 1]$
B. $\left[0,\frac{1}{2}\right]$
C. $\left[0,\frac{1}{2}\right)$
D. $(0, 1)$

32. If $f(x)=\sin^{-1}(\sin x)$, then f is periodic with period

A. π
B. $\frac{\pi}{2}$
C. $\frac{\pi}{4}$
D. 2π

33. The range of the function $f(x)=2\sin^{-1}x+3\cos^{-1}x$ is

A. $[\pi, 2\pi]$
B. $\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$
C. $\left(\pi,\frac{3\pi}{2}\right)$
D. None of these.

34. Which of the following is a function ?

A. $\{(x, y): y^2=4ax,\ x, y\in R\}$
B. $\{(x, y): y=|x|,\ x, y\in R\}$
C. $\{(x, y): x^2+y^2=1,\ x, y\in R\}$
D. $\{(x, y): x^2-y^2=1,\ x, y\in R\}$

35. Which of the following function is not invertible

A. $f: R \rightarrow R,\ f(x) = 4x + 5$
B. $f: R \rightarrow R^{+} \cup \{0\},\ f(x) = 2x^2$
C. $f: R^{+} \rightarrow R^{+},\ f(x) = \frac{1}{x^2}$
D. None of these.

36. If $f: [0, \infty) \rightarrow [0, \infty)$, and $f(x) = \frac{x}{1+x}$ then the function f is

A. One-one and onto
B. One-one but not onto
C. Onto but not one-one
D. Neither one-one nor onto.

37. $\lim_{x \to 0} \frac{x-2}{|x-2|}$ equals

A. 2
B. 0
C. -2
D. None of these.

38. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2}$ is equal to

A. $\frac{3}{2}$
B. $\frac{1}{2}$
C. $\frac{2}{3}$
D. None of these.

39. Let $f(x) = \begin{cases} x+1 & \text{if } x \leq 1 \\ 3 - ax^2 & \text{if } x < 1 \end{cases}$. The value of a for which $f(x)$ is continuous is

A. 1
B. 2
C. -1
D. -2

40. The number of points at which the function $f(x) = \frac{1}{\log|x|}$ is discontinuous is

A. 1
B. 2
C. 3
D. 4

41. For $x \in R$, $\lim_{x \to \infty} \left(\frac{x-3}{x+2} \right)^x$ is equal to

A. e
B. e^{-1}
C. e^{-5}
D. e^{5}

42. The function $f(x)=[\cos x]=$ integral part of $\cos x$ is continuous at

A. At $x=\frac{\pi}{2}$

B. $x=0$

C. $x=\frac{3\pi}{2}$

D. None of these.

43. $\lim_{x\to\infty} x\sin\frac{1}{x}$ equals to

A. 1

B. 0

C. -1

D. $-\infty$

44. The set of all points where the function $f(x)=|x|$ is differentiable is

A. $(-\infty,\infty)$

B. $(-\infty,0)\cup(0,\infty)$

C. $(0,\infty)$

D. $[0,\infty)$

45. If $f(2)=4$ and $f'(2)=1$, then $\lim_{x\to 2}\frac{xf(2)-2f(x)}{x-2}=$

A. 2

B. -2

C. 1

D. 3

46. If $g(x)=-\sqrt{25-x^2}$ then $\lim_{x\to 1}\frac{g(x)-g(1)}{x-1}$ has the value

A. $\frac{1}{24}$

B. $\frac{1}{5}$

C. $-\sqrt{24}$

D. None of these.

47. Let $f(x+y)=f(x)f(y)$, for all x and y. If $f(5)=2$ and $f'(0)=3$, $f'(5)$ is equal to

A. 5

B. 6

C. 0

D. None of these.

48. The tangent to the curve $y=x^3$ parallel to the chord joining the points (0, 0) and (1, 1) has the point of contact

A. (1, 1)

B. $\left(\frac{1}{2},\frac{1}{2}\right)$

C. $\left(\frac{1}{\sqrt{3}},\frac{1}{3\sqrt{3}}\right)$

D. None of these.

49. $f(x) = xe^{x(1-x)}$, then $f(x)$ is

A. increasing on $\left[-\frac{1}{2}, 1\right]$

B. decreasing on R

C. increasing on R

D. decreasing $\left[-\frac{1}{2}, 1\right]$

50. If $f(x) = \int e^x (x-1)(x-4)\, dx$, then f decreases in the interval

A. $(-\infty, -4)$

B. $(-4, -1)$

C. $(1, 4)$

D. $(4, +\infty)$

51. The function $f(x) = x^2 e^{-2x}, x > 0$. Then the maximum value of $f(x)$ is

A. $\frac{1}{e}$

B. $\frac{1}{2e}$

C. $\frac{1}{e^2}$

D. None of these.

52. If the line $ax + by + c = 0$ is a normal to the curve $xy = 2$, then

A. $a < 0, b > 0$

B. $a > 0, b > 0$

C. $a < 0, b < 0$

D. None of these.

53. If $x^y y^x = 72$, then $\frac{dy}{dx}$ at (2, 3) is given by

A. $-\frac{9 + \log 729}{4 + \log 64}$

B. $\frac{9 + \log 729}{4 + \log 64}$

C. $-\frac{3 + \log 9}{2 + \log 8}$

D. $\frac{3 + \log 9}{2 + \log 8}$

54. If $f(x) = \log_e(\log_e x)$, then $f'(e)$ is equal to

A. e^{-1}

B. e

C. 1

D. 0

55. If the function f defined by $f(x)=\begin{cases} 2x+1 & \text{if } x\le 1 \\ ax^2+bx & \text{if } x>1 \end{cases}$ is derivable at every x, then

A. $a=0, b=2$
B. $a=3, b=0$
C. $a=4, b=-1$
D. $a=-1, b=4$

56. $\int \frac{dx}{x^3-x}=$

A. $\log_e \frac{\sqrt{x^2-1}}{|x|}$
B. $\log_e \frac{\sqrt{x^2-x}}{|x|}$
C. $\log_e \frac{x^2-1}{|x|}$
D. None of these.

57. $\int e^x(\cos x+\sin x)dx=$

A. $e^x(\sin x-\cos x)$
B. $e^x\cos x$
C. $e^x\sin x$
D. None of these.

58. $\int_0^{\pi} \frac{e^{\cos x}dx}{e^{\cos x}+e^{-\cos x}}=$

A. π
B. $\frac{\pi}{2}$
C. $\frac{\pi}{4}$
D. 0

59. If $f(x)=\begin{cases} e^{\cos x}\sin x & \text{for } |x|\le 2 \\ 2 & \text{otherwise} \end{cases}$ then $\int_{-2}^{4} f(x)dx=$

A. 0
B. 1
C. 2
D. 4

60. If $I=\int_0^{1.7}\left[x^2\right]dx$, then I equals

A. $2.4+\sqrt{2}$
B. $2.4-\sqrt{2}$
C. $2.4+\frac{1}{\sqrt{2}}$
D. $2.4-\frac{1}{\sqrt{2}}$

61. If $I=\int_{-2}^{2}\left|1-x^{4}\right|dx$, then I equals

A. 6
B. 8
C. 12
D. 21

62. The degree of the differential equation satisfying $\sqrt{1-x^{2}}+\sqrt{1-y^{2}}=a(x-y)$ is

A. 1
B. 2
C. 3
D. None of these.

63. The differential equation of all ellipses centred at the origin is

A. $y^{2}+xy_{1}^{2}-yy_{1}=0$
B. $xyy_{2}+xy_{1}^{2}-yy_{1}=0$
C. $yy_{2}+xy_{1}^{2}-xy_{1}=0$
D. None of these.

64. A particular solution of $\log\left(\frac{dy}{dx}\right)=3x+4y,\ y(0)=0$ is

A. $e^{3x}+3e^{-4y}=4$
B. $4e^{3x}-3e^{-4y}=3$
C. $3e^{3x}+4e^{4y}=7$
D. $4e^{3x}+3e^{-4y}=7$

65. The orthogonal trajectories of the families of curve $y=cx^{k}$ are given by

A. $x^{2}+cy^{2}=\text{constant}$
B. $x^{2}+ky^{2}=\text{constant}$
C. $kx^{2}+y^{2}=\text{constant}$
D. $x^{2}-ky^{2}=\text{constant}$

66. The curve $\frac{dy}{dx}=\frac{(1+y^{2})}{(1+x^{2})},\ x=0,\ y=1$ represents

A. an ellipse
B. a parabola
C. a hyperbola
D. None of these.

67. Which one of the following is not a solution of the equation $\left(\frac{dy}{dx}\right)^{2}+x\frac{dy}{dx}-y=0$

A. $x^{2}+4y=0$
B. $y=x+1$
C. $y+x=1$
D. $y^{2}-4x+0$

68. The solution of the differential equation $\frac{d^2s}{dt^2} = g$, where g is a constant, $s = 0$ and $\frac{ds}{dt} = u$, when $t = 0$, is given by

A. $s = gt$
B. $s = ut + \frac{1}{2}gt^2$
C. $s = \frac{gt^2}{2}$
D. None of these.

69. The degree of the differential equation $\sqrt[3]{y + x\left(\frac{dy}{dx}\right)^2} = \frac{d^2y}{dx^2}$ is

A. not defined
B. 1
C. 2
D. 3

70. If ω is complex cube root of unity, and $A = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then A^{100} is equal to

A. A
B. −A
C. 0
D. None of these.

71. The inverse of a skew symmetric matrix (if it exists) is

A. a symmetric matrix
B. a skew symmetric matrix
C. a diagonal matrix
D. None of these.

72. If $A(\theta) = \begin{pmatrix} 1 & \tan\theta \\ -\tan\theta & 1 \end{pmatrix}$ and AB = I, then $(\cos^2\theta)B$ is equal to

A. $A(\theta)$
B. $A(-\theta)$
C. $A\left(\frac{\theta}{2}\right)$
D. $A\left(-\frac{\theta}{2}\right)$

73. If A and B are two invertible matrices of the same order, then $adj\,(AB)$ is equal to

A. $adj(B) \cdot adj(A)$
B. $adj(A) \cdot adj(B)$
C. $|B||A|A^{-1}B^{-1}$
D. None of these.

74. The system of linear equations $x + y + z = 2$, $2x + y - z = 3$, $3x + 2y + kz = 4$ has a unique solution if

A. $k \neq 0$
B. $-1 < k < 1$
C. $-2 < k < 2$
D. $k = 0$

75. The matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 3 \\ 0 & 8 & 4 \end{bmatrix}$ satisfies the equation

A. $x^3 - 7x^2 + 22x + 16 = 0$

B. $x^3 + 7x^2 - 4x - 16 = 0$

C. $x^3 + 7x^2 + 22x + 16 = 0$

D. $x^3 - 7x^2 - 10x + 16 = 0$

76. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, then the matrix A^4 is

A. $\begin{bmatrix} 290 & 634 \\ 199 & 435 \end{bmatrix}$

B. $\begin{bmatrix} 634 & 290 \\ 199 & 435 \end{bmatrix}$

C. $\begin{bmatrix} 634 & 290 \\ 435 & 199 \end{bmatrix}$

D. $\begin{bmatrix} 199 & 435 \\ 290 & 634 \end{bmatrix}$

77. The eigen values of $\begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ are

A. 6 and 4

B. 3 and 2

C. 1 and 2

D. None of these.

78. In an election, candidate A has 0.4 chance of winning. B has 0.3 chance, C has 0.2 chance and D has 0.1 chance. Just before the election C withdraws. Then the chances of winning of A, B and D are respectively

A. 0.45, 0.35, 0.15

B. 0.35, 0.6, 0.3

C. 0.5, 0.375, 0.125

D. None of these.

79. If m is a natural number such that $m \leq 5$, then the probability that the quadratic equation $x^2 + mx + \frac{1}{2} + \frac{m}{2} = 0$ has real roots is

A. $\frac{1}{5}$

B. $\frac{2}{3}$

C. $\frac{3}{5}$

D. $\frac{1}{5}$

80. If from each of the three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls, one ball is drawn at random, then the probability that two white and one black ball will be drawn is

A. $\frac{13}{32}$ B. $\frac{1}{4}$

C. $\frac{1}{32}$ D. $\frac{3}{16}$

81. There are two balls in an urn whose colours are not known (each ball can be either white or black). A white ball is put into the urn. A ball is drawn from the urn. The probability that it is white is

A. $\frac{1}{4}$ B. $\frac{1}{3}$

C. $\frac{2}{3}$ D. $\frac{1}{6}$

82. From an urn containing a white and b black balls, $k(<a,b)$ balls are drawn and laid aside, their colour unnoted. Then one more ball is drawn. Find probability that it is white.

A. $\frac{a}{a+b}$ B. $\frac{b}{a+b}$

C. $\frac{a}{a+b-1}$ D. None of these.

83. The probability that a doctor diagnoses a disease correctly is 80%. The probability that a patient dies after correct diagnosis is 40% and the probability that he dies after wrong diagnosis is 70%. The patient died. The chance that the disease was correctly diagnosed is

A. $\frac{1}{14}$ B. $\frac{16}{23}$

C. $\frac{4}{15}$ D. None of these.

84. A bag contains 10 identical white balls, 10 identical black balls and 10 identical red balls. Nine balls are drawn at random from the bag and are put into a box. The probability that the box contains 3 balls of each colour is

A. $\frac{3!}{10!}$

B. $\frac{3^3}{10^3}$

C. $\frac{\left({}^{10}C_3\right)^3}{{}^{30}C_9}$

D. $\frac{1}{55}$

85. The number $\tan 15''$ is

A. an integer

B. a rational number but not an integer

C. an irrational number

D. Not a real number

86. The period of $\sin n\theta$ is

A. $\frac{2\pi}{n}$

B. $\frac{\pi}{n}$

C. $\frac{\pi}{2n}$

D. None of these.

87. If $0 < x < 2\pi$, then

A. $\sin x < x$

B. $\sin x > x$

C. $\tan x > x$

D. None of these.

88. $\cos 20^0 \cos 40^0 \cos 80^0 =$

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{6}$

D. $\frac{1}{8}$

89. In a triangle ABC, the maximum value of $\cos A + \cos B + \cos C =$

A. $\frac{3\sqrt{3}}{2}$

B. $\frac{3}{2}$

C. 3

D. None of these.

90. In a triangle $a^2 = bc, b^2 = ca$ and $c^2 = ab$, then $\tan A + \tan B =$

A. $\frac{2}{\sqrt{3}}$ B. $\frac{2}{3}$

C. 2 D. $2\sqrt{3}$

91. $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 =$

A. 0 B. $-\frac{\pi}{2}$

C. π D. 2π

92. If $\tan A = \frac{a}{a+1}$ and $\tan B = \frac{1}{2a+1}$, then $\tan(A+B) =$

A. 0 B. $\frac{\pi}{2}$

C. $\frac{\pi}{3}$ D. $\frac{\pi}{4}$

93. If $m \neq n$, then $\int_0^{\pi} \cos mx \cos nx \, dx$ is

A. 0 B. $\frac{\pi}{2}$

C. π D. 2π

94. If A and B are independent events, then $P(A \cap B)$ is

A. $P(A) + P(B)$ B. $P(A)P(B)$

C. $P(A/B)$ D. $P(B/A)$

95. If a, b, c are in HP, $0 < a, b, c < 1$ and $x = a + a^2 + \ldots, y = b + b^2 + \ldots, z = c + c^2 + \ldots$ Then x, y, z are in

A. AP B. GP

C. HP D. None of these.

96. The points (1, 2), (3, 4), (5, 7) are vertices of a

A. acute-angled triangle B. obtuse-angled triangle

C. right-angled triangle D. None of these.

97. If the points (x_i, y_i), $i = 1, 2, 3$ are vertices of a triangle with area 12, then the area of the triangle with vertices
$\left(\frac{(x_2+x_3)}{2}, \frac{(y_2+y_3)}{2}\right), \left(\frac{(x_1+x_3)}{2}, \frac{(y_1+y_3)}{2}\right)$ and $\left(\frac{(x_2+x_1)}{2}, \frac{(y_2+y_1)}{2}\right)$ is

A. 4
B. 6
C. 12
D. 3

98. Tangents at two points A and B on a parabola $(x-2y)^2 = 4(2x+y)+2$ meet in a point P. If the line AB passes through its focus, P lies on the

A. axis
B. directrix
C. tangent at the vertex
D. None of these.

99. If a variable circle touches two fixed circles externally. Then the locus of the centre of the variable circle is a

A. parabola
B. hyperbola
C. ellipse
D. circle.

100. If the circles $x^2+y^2=1$ and $x^2+y^2-8x-xy+c=0$ touch each other externally, then the value of c is

A. 16
B. 9
C. 1
D. cannot be determined.

101. The number of common tangents to the circles $(x-1)^2+(y-2)^2=9$ and $(x-2)^2+(y-5)^2=1$ is

A. 1
B. 4
C. 3
D. 2

102. Let P be a variable point on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with foci F_1 and F_2. If A is the area of the triangle PF_1F_2, then the maximum value of A is ...

A. $2abc$
B. $2ab$
C. abc
D. None of these.

103. The equation $x-y=4$ and $x^2+4xy+y^2=0$ represent the sides of

A. an equilateral triangle
B. a right angled triangle
C. an isosceles triangle
D. None of these.

104. The equation $ax^2+2xy+by^2+by^2+2ax+2by=0$ represents a pair of straight lines if

A. $a \neq 0$
B. $b \neq 0$
C. $a+b \neq 2$
D. $a+b=2$

105. The focus of the parabola $(y-1)^2=12(x-2)$ is

A. (2, 1)
B. (1, -1)
C. (5, 1)
D. (3, 0)

106. The directrix of the parabola $y^2+4x+3=0$ is

A. $x-\frac{3}{4}=0$
B. $x+\frac{1}{4}=0$
C. $x-\frac{1}{4}=0$
D. $x-\frac{4}{3}=0$

107. A normal to the parabola $y^2=4ax$ with a slope m touches the rectangular hyperbola $x^2-y^2=a^2$, if

A. $m^6+4m^4-3m^2-1=0$
B. $m^6-4m^4+3m^2-1=0$
C. $m^6+4m^4+3m^2+1=0$
D. $m^6-4m^4-3m^2+1=0$

108. The equation of a tangent to the hyperbola $3x^2-y^2=3$, parallel to the line $y=2x+4$ is

A. $y=2x+3$
B. $y=2x+1$
C. $y=2x-10$
D. $y=2x+2$

109. For the ellipse $\frac{x^2}{5}+\frac{y^2}{4}=1, x=\sqrt{5}$ is

A. a directrix
B. a lotus rectum
C. minor axis
D. tangent at an end of major axis.

110. The radius of the circle having centre at (4, 5) and passing through the centre of $x^2+y^2+4x-6y=12$ is

A. $2\sqrt{2}$
B. $2\sqrt{17}$
C. $2\sqrt{10}$
D. None of these.

111. A point P moves so that the sum of the squares of its distances from n fixed points is given. The locus of P

A. is a straight line
B. is a circle
C. depends on n
D. None of these.

112. The length of the tangent from (5, 1) to the circle $x^2 + y^2 + 6x - 4y - 3 = 0$ is

A. 81
B. 29
C. 7
D. 21

113. A line makes equal angle θ with x and y axes. If θ is acute, the minimum and maximum values of θ are (in 3-dimensional space)

A. $\frac{\pi}{6}, \frac{\pi}{3}$
B. $\frac{\pi}{3}, \frac{\pi}{2}$
C. $\frac{\pi}{4}, \frac{\pi}{2}$
D. $\frac{\pi}{6}, \frac{\pi}{2}$

114. In 3 – dimensional space, the equation $y^2 + z^2 = 0$ represents

A. origin
B. y - z plane
C. x - axis
D. None of these.

115. The foot of the perpendicular from (0, 2, 3) to the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$ is

A. $(-2,3,4)$
B. $(2,-1,3)$
C. $(2,3,-1)$
D. $(3,2,-1)$

116. If $L: \frac{x+1}{3} = \frac{y+1}{2} = \frac{z-3}{-1}$ is a line and $P: x - 2y - z = 0$ be a plane, then

A. L is parallel to P
B. L is perpendicular to P
C. L lies in the plane P
D. None of these.

117. If $\omega \neq 1$ is a cube root of unity and $(\omega + x)^n = 1 + 12\omega + 69\omega^2 + ...$ the values of n and x are respectively

A. 36, 1
B. 12, 2
C. $24, \frac{1}{2}$
D. $18, \frac{1}{3}$

118. The lines $\frac{x-1}{2}=\frac{y-2}{4}=\frac{z-2}{7}$ and $\frac{x-1}{4}=\frac{y-2}{5}=\frac{z-3}{7}$ are

A. parallel
B. intersecting
C. skew
D. perpendicular

119. The radius of the circle given by the equations $x^2+y^2+z^2=9$ and $x+y+z=3$ is

A. $\sqrt{3}$
B. $\sqrt{6}$
C. 3
D. 6

120. The remainder when 2^{2003} is divided by 17 is

A. 1
B. 2
C. 8
D. None of these.

121. The co-efficient of x^7 in the expansion of $(1-2x+x^3)^6$ is

A. 28-
B. 360
C. −450
D. −280

122. If every element of a group G is its own inverse then G is

A. finite
B. infinite
C. cyclic
D. abelian

123. Let G denote the set of all $n\times n$ non-singular matrices with rational numbers as entries $(n\geq 2)$ then under multiplication

A. G is a subgroup
B. G is a finite abelian group
C. G is infinite non – abelian group
D. G is infinite abelian group

124. In a group $(G,*)$ for some a of G, $a^2=e$ where e is the identity element then

A. $a=\sqrt{e}$
B. $a=a^{-1}$
C. $a=e$
D. None of these.

125. The set of fourth roots of unity forms a group of order

A. 4 under addition
B. 4 under multiplication
C. 4 under division
D. None of these.