PREVIOUS YEAR PAPER

UP PGT 2016 — Mathematics (Series A)

UP PGT · 1 or 2 February 2019

125 questions · +3.4 for a correct answer, −0 for a wrong one · 120 minutes

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Questions from the U.P. Secondary Education Services Selection Board's paper of 1 or 2 February 2019. Each question is followed by its answer, and the answer key is repeated on the last page.

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Mathematics

1. If A and B are symmetric matrices, then AB is symmetric matrix if and only if

(a) AB = BA

(b) AB = – BA

(c) $AB^{-1} = B^{-1}A$

(d) None of the above

Answer: (a)

2. If the roots of the equation $x^2 + x + a = 0$, $a > 0$ are real and distinct, then the roots of the equation $x^2 - 4\sqrt{a}\,x + 1 = 0$ are

(a) rational

(b) irrational

(c) imaginary

(d) none of the above

Answer: (c)

3. The matrix A =

$$\begin{bmatrix} \sin\theta & \cos\theta \\ -\cos\theta & \sin\theta \end{bmatrix}$$

is

(a) Symmetric

(b) Skew-symmetric

(c) Orthogonal

(d) Singular

Answer: (c)

4. If 1, ω, ω² are the cube roots of unity, then value of the determinant

$$\begin{vmatrix} 1 & \omega^7 & \omega^{14} \\ \omega^{14} & 1 & \omega^7 \\ \omega^7 & \omega^{14} & 1 \end{vmatrix}$$

is

(a) ω²
(b) ω
(c) 1
(d) 0

Answer: (d)

5. Number of terms in the expansion of $(2x - y + 3z)^{20}$ is

(a) 228
(b) 230
(c) 231
(d) 236

Answer: (c)

6. The sum of two distinct roots of the equation

$$\begin{vmatrix} 6-x & 3 & 3 \\ 3 & 6-x & 3 \\ 3 & 3 & 6-x \end{vmatrix}$$

= 0 is

(a) 3
(b) 12
(c) 15
(d) 9

Answer: (c)

7. What is

$$\lim_{x \to 0} \frac{\sin x - x}{2x^3}$$

equal to ?

(a) –1/2

(b) –1/4

(c) –1/12

(d) does not exist

Answer: (c)

8. If Q is a non-singular matrix and P is a square matrix such that $\det(Q^{-1}P^2Q) = 4$, then det P is equal to

(a) 0

(b) 1

(c) 2

(d) 4

Answer: (c)

9. If A =

$$\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

, then A^3 is equal to

(a) A

(b) 4A

(c) 3A

(d) 2A

Answer: (b)

10. If a, b, c are rational numbers and $ax^2 + bx + c = 0$ and $2x^2 + x - 2 = 0$ have a common root, then $4a - 2b + 3c$ is equal to

(a) –1

(b) –2

(c) 0

(d) 4

Answer: (c)

11. If H and K are subgroups of a group G and O(H) = 3, O(K) = 5, O(G) = 30 then O(H ∩ K) is

(a) 1

(b) 2

(c) 3

(d) 5

Answer: (a)

12. If A^{-1} = $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then 2A is equal to

(a) $\begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}$

(b) $\begin{bmatrix} 4 & -2 \\ -3 & -1 \end{bmatrix}$

(c) $\begin{bmatrix} -4 & 2 \\ 3 & -1 \end{bmatrix}$

(d) $\begin{bmatrix} -4 & -2 \\ 3 & 1 \end{bmatrix}$

Answer: (c)

13. If x, y are elements of a group G and O(y) = 3, then $O(xyx^{-1})$ is

(a) 1

(b) 2

(c) 3

(d) 6

Answer: (c)

14. If $f : G \to G'$ is a group isomorphism then which of the following is true ?

(a) $O(a) < O(f(a))$

(b) $O(a) = O(f(a))$

(c) $O(a) > O(f(a))$

(d) None of the above

Answer: (b)

15. If $A = \{4n - 3n - 1, n \in N\}$ and $B = \{9(n - 1), n \in N\}$, then which of the following is true ?

(a) $A \subseteq B$

(b) $B \subseteq A$

(c) $A \cup B = A$

(d) None of the above

Answer: (a)

16. In the additive group of integers the order of every element except zero is

(a) finite

(b) infinite

(c) some times finite and some times infinite

(d) none of the above

Answer: (b)

17. If W is a subspace of R4 spanned by {(1, 0, –1, 0), (, 0, 1)}, then which of the following is in W ?

(a) (1, 2, 1, 2)

(b) (1, 2, –1, 2)

(c) (2, 2, 3, 2)

(d) (0, 1, 1, 1)

Answer: (b)

18. Let V be a vector space over R consisting of solutions of $d^2y/dx^2 - 4y = 0$. Dimension of V is

(a) 0

(b) 1

(c) 2

(d) 4

Answer: (c)

19. For what value of m, the vector (m, 3, 1) is a linear combination of the vectors (3, 2, 1) and (2, 1, 0) ?

(a) 2

(b) 3

(c) 5

(d) 1

Answer: (c)

20. Vectors x = (1, 0, 1), y = (–4, a, 4) and z = (a, –1, –a) are linearly dependent in R^3, if a is equal to
    (a) 2 only
    (b) –2 only
    (c) ± 2 both
    (d) 0
    Answer: (c)

21. The equation $r(6 – 4\cos\theta) = 5$ represents
    (a) a parabola
    (b) an ellipse
    (c) a hyperbola
    (d) a circle
    Answer: (b)

22. The focus of the parabola $4y^2 – 6x – 4y = 5$ is
    (a) (–5/8, 1/2)
    (b) (–3/8, 1/2)
    (c) (–7/8, –1/2)
    (d) (–5/8, –1/2)
    Answer: (a)

23. Equation $9x^2 + 2hxy + 4y^2 + 6x + 2fy = 3$ represe two parallel lines if (h + f) is equal to
    (a) 2
    (b) 6
    (c) 8
    (d) 0
    Answer: (c)

24. If the line y = x + 3 meets the circle $x^2 + y^2 = 9$ at A and B, then the equation of the circle whose diameter is AB, is
    (a) $x^2 + y^2 + 3x – 3y = 0$
    (b) $x^2 + y^2 – 3x + 3y = 0$
    (c) $x^2 + y^2 + 3x + 3y = 0$
    (d) $x^2 + y^2 – 3x – 3y = 0$
    Answer: (a)

25. Circles $x^2 + y^2 – 2x – 4y = 0$ and $x^2 + y^2 – 8y – 4 = 0$
    (a) touch externally
    (b) touch internally
    (c) do not touch
    (d) none of the above
    Answer: (b)

26. The centre of the conic $5x^2 - 6xy + 5y^2 + 22x - 26y + 29 = 0$ is

(a) (–1, 1)

(b) (–1, 2)

(c) (2, 2)

(d) (0, 3)

Answer: (b)

27. If e and e′ be the eccentricities of the hyperbola $x^2/a^2 - y^2/b^2 = 1$ and its conjugate hyperbola, then

(a) $e^2 + e'^2 = 1$

(b) $e = e'$

(c) $1/e^2 + 1/e'^2 = 1$

(d) $1/e^2 - 1/e'^2 = 1$

Answer: (c)

28. Centre of circle passing through the points (2, 0), (0, 6) and (5, 1) is

(a) (3/2, 1)

(b) (2, 3)

(c) (5/2, 2)

(d) (5/2, 7/2)

Answer: (d)

29. The vertices of a hyperbola are (1, 0) and (–1, 0) , the foci are (2, 0) and (–2, 0). The equation of the hyperbola is

(a) $3x^2 - y^2 = 3$

(b) $2x^2 - 3y^2 = 3$

(c) $x^2 - 3y^2 = 2$

(d) $3x^2 - 2y^2 = 6$

Answer: (a)

30. Equation of a cone, whose vertex is at origin and base is the curve z = k, f(x, y) = 0, is

(a) f(xk/z, yk/z) = 0

(b) f(k, xyz) = 0

(c) f(ky, kxz) = 0

(d) none of the above

Answer: (a)

31.

$$\lim_{x\to 0} \frac{(x+1)^5 - 1}{(x+1)^7 - 1}$$

is equal to

(a) 7/5

(b) 5/7

(c) 2/7

(d) 2/5

Answer: (b)

32. If $f(x + 1/x) = x^3 + 1/x^3$, then $f(1)$ is equal to

(a) −3

(b) −2

(c) −1

(d) 0

Answer: (b)

33. Number of points, where the function $f(x) = |x + 3| + |x^2 - 4|$ is not differentiable, is

(a) 0

(b) 1

(c) 2

(d) 3

Answer: (d)

34. What is the general solution of the differential equation
$ydx - (x + 2y^2)dy = 0$?

(a) $x = y^2 + cy$

(b) $x = 2cy^2$

(c) $x = 2y^2 + cy$

(d) $x = 2y + cy^2$

Answer: (c)

35.

$$\int_{1/e}^{e^2} \left| \frac{\log_e x}{x} \right| dx$$

is equal to

(a) 1/2

(b) 3/2

(c) 5/2

(d) 2

Answer: (c)

36. If $f(x) = \sqrt{(4 - x^2)}$, then

$$\lim_{x \to 1} \frac{f(1) - f(x)}{x - 1}$$

is equal to

(a) $1/\sqrt{3}$

(b) $\sqrt{3}$

(c) 0

(d) $2/\sqrt{3}$

Answer: (a)

37. Value of

$$\int_{-\pi/2}^{\pi/2} \sqrt{\cos x - \cos^3 x}\, dx$$

is equal to

(a) 0

(b) 1/3

(c) 2/3

(d) 4/3

Answer: (d)

38. Solution of the differential equation

$$\frac{x\,dx + y\,dy}{\sqrt{x^2 + y^2}} = \frac{y\,dx - x\,dy}{y^2}$$

, $y(0) = 1$ is

(a) $y\sqrt{(x^2 + y^2)} = 2x + y$

(b) $x\sqrt{(x^2 + y^2)} = x + y$

(c) $y\sqrt{(x^2 + y^2)} = x + y$

(d) $x\sqrt{(x^2 + y^2)} = 2x + y$

Answer: (c)

39. Maclaurin's expansion of $\tan^{-1}x$ is

(a)

$$x + \frac{x^3}{3} + \frac{x^5}{5} + \cdots$$

(b)

$$x - \frac{x^3}{3} + \frac{x^5}{5} - \cdots$$

(c)

$$x + \frac{x^3}{\lfloor 3} + \frac{x^5}{\lfloor 5} + \ldots$$

(d)

$$x - \frac{x^3}{\lfloor 3} + \frac{x^5}{\lfloor 5} - \ldots$$

Answer: (b)

40. Number of asymptotes of the curve $x^2y - 3x^2 - 5xy + 6y + 2 = 0$ is

(a) 0

(b) 1

(c) 2

(d) 3

Answer: (d)

41. If y = $\sec^{-1}\sqrt{\frac{x+1}{x-1}} + \sin^{-1}\sqrt{\frac{x-1}{x+1}}$, then value of dy/dx at x = 2 is

(a) 1
(b) 2
(c) 0
(d) 3

Answer: (c)

42. The differential equation for the family of curves $y = Ae^{2x} + Be^{-2x}$, where A and B are arbitrary constants, is

(a) $d^2y/dx^2 + 4y = 0$
(b) $d^2y/dx^2 - 4y = 0$
(c) $d^2y/dx^2 + dy/dx - 4y = 0$
(d) $d^2y/dx^2 + 4\,dy/dx - y = 0$

Answer: (b)

43. $\tan^{-1}x > \cot^{-1}x$ is true for

(a) x = 1
(b) x > 1
(c) x < 1
(d) All values of x

Answer: (b)

44. Which one of the following is correct ?

(a) $\sinh^{-1}x = i \sin^{-1}(ix)$
(b) $\cosh^{-1}x = \log(x + \sqrt{(1 - x^2)})$
(c) $\cosh^{-1}x = i \cos^{-1}(ix)$
(d) $\tanh^{-1}x = -i \tan^{-1}(ix)$

Answer: (d)

45. Value of $i \log\frac{x-i}{x+i}$ is

(a) $\pi + 2\tan^{-1}x$
(b) $\pi/2 + 2\tan^{-1}x$
(c) $\pi/2 - 2\tan^{-1}x$
(d) $\pi - 2\tan^{-1}x$

Answer: (d)

46. If $|z + 5| \leq 2$, $z = x + iy$, then the greatest value of $|z + 2|$ is

(a) 2

(b) 4

(c) 5

(d) 6

Answer: (c)

47. If $i = \sqrt{-1}$, then the general value of i^i is equal to

(a)

$$e^{(4n+1)\frac{\pi}{2}}$$

(b)

$$e^{-(4n+1)\frac{\pi}{2}}$$

(c)

$$e^{(2n+1)\frac{\pi}{2}}$$

(d) none of the above

Answer: (b)

48. $\text{Sinh}^{-1}(\cot x)$ is equal to

(a) log(cosx + sinx)

(b) log(cosx – sinx)

(c) log(cotx + cosecx)

(d) log(tanx + cotx)

Answer: (c)

49. If $A + iB = \dfrac{3-2i}{7+4i}$, then value of A – B is

(a) 1/5

(b) 2/5

(c) 3/5

(d) –1/5

Answer: (c)

50. If $|\vec{a}| + |\vec{b}| = |\vec{c}|$ and $\vec{a} + \vec{b} = \vec{c}$, then angle between $\vec{a}$ and $\vec{b}$ is
    (a) 0°
    (b) 45°
    (c) 90°
    (d) 180°
    Answer: (a)

51. If vectors $\vec{p} = x\hat{i} + 3\hat{j} + 2\hat{k}$, $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ are coplanars, then value of x is
    (a) 2
    (b) −2
    (c) 3
    (d) −3
    Answer: (b)

52. If $\hat{a}$ and $\hat{b}$ are two unit vectors inclined at an angle 30° to each other, then $|\hat{a} + \hat{b}|$ is equal to
    (a) $\sqrt{3} - 1$
    (b) $\sqrt{3} + 1$
    (c) $(\sqrt{3} - 1)/\sqrt{2}$
    (d) $(\sqrt{3} + 1)/\sqrt{2}$
    Answer: (d)

53. If $\vec{F} = \text{grad}\,(x^3 + y^3 + z^3 - 3xyz)$, then $\vec{F}$ is
    (a) solenoidal
    (b) irrotational
    (c) solenoidal and irrotational both
    (d) none of the above
    Answer: (b)

54. A vector, which is normal to the surface $x^2 - xy + yz = 5$ at the point (1, 2, 3) is
    (a) $\hat{i} + 2\hat{j}$
    (b) $2\hat{j} + 2\hat{k}$
    (c) $2\hat{i} + \hat{k}$
    (d) $\hat{j} + 2\hat{k}$
    Answer: (b)

55. Which one of the following is not correct for a common catenary ?

(a) $y + s = ce^{x/c}$

(b) $ds/d\psi = c \sec^2\psi$

(c) $\sec\psi + \tan\psi = e^{y/c}$

(d) $s = c\sinh\frac{x}{c}$

Answer: (c)

56. A ball is thrown vertically upward with a given velocity. It reaches a maximum height 100 m. If on second time its initial velocity is doubled then the ball will reach a maximum height of

(a) 100 m

(b) 150 m

(c) 200 m

(d) 400 m

Answer: (d)

57. A stone is projected horizontally with a velocity ' m/s from a tower of height 100 m. Its speed after 1 sec. of projection is ($g = 9.8$ m/s^2)

(a) 9.8 m/s

(b) 4.9 m/s

(c) $9.8\sqrt{2}$ m/s

(d) None of the above

Answer: (c)

58. If a body is acted upon by three forces and body is in equilibrium, then

(a) All of them are parallel

(b) They meet at a point

(c) Any two of them are parallel

(d) Either they are all parallel or they meet in a point

Answer: (d)

59. Two projectiles are projected with same velocity but with angles of projection $(45° - \theta)$ and $(45° + \theta)$. Ratio of their horizontal range is

(a) 1 : 2

(b) 1 : 3

(c) 2 : 1

(d) 1 : 1

Answer: (d)

60. The Cartesian equation of a common catenary is

(a) $y = c \cos\frac{x}{c}$

(b) $y = c \sinh\frac{x}{c}$

(c) $y = c \tanh\frac{x}{c}$

(d) $y = c \cosh\frac{x}{c}$

Answer: (d)

61. Domain of the function $f(x) = \sqrt{(2^x - 5^x)}$ is

(a) $x < 0$

(b) $x \leq 0$

(c) $x > 0$

(d) $x \geq 0$

Answer: (b)

62. If $f(x) = (x - 1)/(x + 2)$ and $y = f^{-1}(x)$, then dy/dx is equal to

(a) $3/(1 - x)$

(b) $3/(1 + x)$

(c) $3/(1 - x)^2$

(d) $3/(1 + x)^2$

Answer: (c)

63. The value of $1^2 + 3^2 + 5^2 + \ldots + (2n - 1)^2$ is

(a) $(1/3)\, n(4n^2 - 1)$

(b) $(1/3)\, n(4n^2 + 1)$

(c) $(1/6)\, n(4n^2 - 1)$

(d) $(1/6)\, n(4n^2 + 1)$

Answer: (a)

64. The least value of 'n', for which $1 + 3 + 3^2 + \ldots + 3n^{-1} > 700$, is equal to

(a) 4

(b) 5

(c) 6

(d) 7

Answer: (d)

65. If

$$^{2n+1}P_{n-1} : {}^{2n-1}P_n$$

= 3 : 5, then n is equal to

(a) 2

(b) 3

(c) 4

(d) 5

Answer: (c)

66. The inverse of a skew-symmetric of order 3

(a) is a skew-symmetric matrix

(b) is a symmetric matrix

(c) is a diagonal matrix

(d) does not exist

Answer: (d)

67. If the sum of the coefficients of powers in expansion of $(a^2x^3 - 8ax^2 + 16)48$ is zero, then a is equal to

(a) –2

(b) –1

(c) 2

(d) 4

Answer: (d)

68. Value of

$$\left(1+\frac{1}{\lfloor 2}+\frac{1}{\lfloor 3}+\ldots\right)\left(1-\frac{1}{\lfloor 2}+\frac{1}{\lfloor 3}-\ldots\right)$$

is

(a) $e^{\frac{1}{2}}-e^{-\frac{1}{2}}$

(b) $e^{\frac{1}{2}}+e^{-\frac{1}{2}}$

(c) $\left(e^{\frac{1}{2}}-e^{-\frac{1}{2}}\right)^2$

(d) $\left(e^{\frac{1}{2}}+e^{-\frac{1}{2}}\right)^2$

Answer: (c)

69. The system of linear equations
x1 + 2×2 + x3 = 3
2×1 + 3×2 + x3 = 3
3×1 + 5×2 + 2×3 = 1 has

(a) infinitely many solutions

(b) exactly 3 solutions

(c) unique solution

(d) no solution

Answer: (d)

70. If 5^{th} term of a harmonic progression is 7 and 7^{th} term is 5, then 35^{th} term is

(a) 0

(b) 1

(c) 7/12

(d) 1/35

Answer: (b)

71. If log3, log(3^x – 2) and log(3^x + 4) are in arithmetical progression, then x is equal to

(a) log34
(b) log23
(c) log38
(d) log83

Answer: (c)

72. There are 15 points in a plane such that no three of them are collinear. The number of triangles formed by joining them is

(a) 455
(b) 2730
(c) 355
(d) 454

Answer: (a)

73. If G is a cyclic group of order 30, then total number of subgroups of G is

(a) 6
(b) 7
(c) 8
(d) 9

Answer: (c)

74. If every element of a group G is its own inverse, t[illegible] G is

(a) finite
(b) infinite
(c) abelian
(d) non-abelian

Answer: (c)

75. $1^3 – 2^3 + 3^3 – 4^3 + ... –10^3 + 11^3$ is equal to

(a) 512
(b) 756
(c) 848
(d) 954

Answer: (b)

76. In the group G = {{2, 4, 6, 8}, ·10} the identity element is

(a) 2
(b) 4
(c) 6
(d) 8

Answer: (c)

77. Let G be a group with binary operation $*$ defined by
$a * b = a + b + 1, \forall\ a, b \in G$.
Inverse of element C of G is

(a) 2 + C

(b) 2 – C

(c) –2 + C

(d) –2 – C

Answer: (d)

78. Number of all onto functions from the set {1, 2, 3, 4, 5} to itself is

(a) 25

(b) 25 – 1

(c)



(d)



Answer: (c)

79. Every subgroup of a cyclic group is

(a) normal

(b) normal only when order of subgroup is prime

(c) non-normal

(d) normal when order of group is prim

Answer: (a)

80. Which one of the following is a subspace of vector space R^3 ?

(a) $\{(a, b, c) \in R^3 : a + b = 0\}$

(b) $\{(a, b, c) \in R^3 : a - b = 2\}$

(c) $\{(a, b, c) \in R^3 : a + b = 1\}$

(d) $\{(a, b, c) \in R^3 : a - b = 1\}$

Answer: (a)

81. If $T : U \rightarrow V$ be a linear transformation then Kernel T is a subspace of

(a) $U \cap V$

(b) U

(c) V

(d) U/V

Answer: (b)

82. If T : V2(R) $\rightarrow$ V3(R) be defined as T(a, b) = (a + b, a – b, b) is a linear transformation, then nullity T is

(a) 0
(b) 1
(c) 2
(d) 3

Answer: (a)

83. If V = R^3, W = {(a, 0, 0) $\in R^3$}, then dimension of vector space V/W is

(a) 1
(b) 2
(c) 3
(d) 4

Answer: (b)

84. Let α, β be the roots of the equation $x^2 + ax + a^3 = 0$, $a \neq 0$. If (α, β) lies on the parabola $y^2 = x$, then the roots of the equation are

(a) 2, 3
(b) 4, –2
(c) 4, 2
(d) 2, – 3

Answer: (b)

85. If 2x – y + z + 4 = 0 is a tangent plane to the sp e whose centre is (1, 0, 1), then radius of sphere is

(a) 7
(b) 7/√6
(c) 5/√6
(d) 5

Answer: (b)

86. If the slope of one of lines represented by $ax^2 – 6xy + y^2 = 0$ is square of the slope of the other line, then the value of a are

(a) 8, – 27
(b) – 8, 27
(c) 6, – 24
(d) – 6, 24

Answer: (a)

87. Distance of the point P(1, –2) from the centre of the circle x = 2 + 3cosθ, y = –4 + 3sinθ is

(a) √7
(b) √5
(c) √3
(d) √2

Answer: (b)

88. The equations of the lines bisecting the angles between the pair of lines $3x^2 + xy - 2y^2 = 0$ is

(a) $x^2 - 10xy - y^2 = 0$

(b) $x^2 + 10xy - y^2 = 0$

(c) $x^2 + 10xy + y^2 = 0$

(d) $x^2 + xy - y^2 = 0$

Answer: (a)

89. In three dimensional geometry equation $x^2 + y^2 = r^2$ represents a

(a) circle

(b) sphere

(c) cylinder

(d) cone

Answer: (c)

90. The equation of a plane containing x-axis is

(a) $ax + by = 0$

(b) $by + cz = 0$

(c) $ax + cz = 0$

(d) $x + y + z = 0$

Answer: (b)

91. Let S and S′ be the foci and BB′ be the minor axis of an ellipse. If $\angle BSS' = \theta$, then eccentricity of the ellipse is

(a) $\cos\theta$

(b) $\sin\theta$

(c) $\tan\theta$

(d) $\cot\theta$

Answer: (a)

92. If line $ax + by + c = 0$ is a normal to the curve $xy = 4$, then

(a) $a < 0, b < 0$

(b) $a > 0, b > 0$

(c) $a > 0, b < 0$

(d) $a < 0, b = 0$

Answer: (c)

93. Maximum value of the function f(x) =

$$3^{1+2x-x^2}$$

is equal to

(a) 3
(b) 9
(c) 27
(d) 81

Answer: (b)

94. If xy = 1, then

$$\frac{dy}{\sqrt{1+y^4}}+\frac{dx}{\sqrt{1+x^4}}$$

is equal to

(a) 0
(b) 1
(c) y
(d) not defined

Answer: (a)

95. If z =

$$\sin^{-1}\left(x^2+y^2\right)^{\frac{1}{5}}$$

, then

$$x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}$$

is equal to

(a) (1/5) sin z
(b) (2/5) tan z
(c) (2/5) sin z
(d) tan z

Answer: (b)

96. If

$$\int \frac{3^x}{\sqrt{1-9^x}}$$

$dx = a \sin^{-1} 3^x + C$, then a is equal to

(a) log 3

(b) 1/log3

(c) 1/2

(d) 1

Answer: (b)

97. What is

$$\lim_{n\to\infty} \frac{1}{n^{a+1}}\left[1^a + 2^a + 3^a + \ldots + n^a\right]$$

, a > – 1, equal to ?

(a) 1/(a + 1)

(b) 2/(a + 1)

(c) a/(a + 1)

(d) (a – 1)/(a + 1)

Answer: (a)

98. If 2y = x + 3 is a tangent line to the cur ^{3} = + b at the point (1, 2), then 3b – 5a is equal to

(a) 0

(b) 2

(c) 3

(d) 4

Answer: (a)

99. The least possible value of 'a' for which the function $f(x) = x^2 + ax + 1$ may be increasing in the interval [1, 2] is

(a) 2

(b) 1

(c) 0

(d) –2

Answer: (d)

100. The area bounded by the curve y = sinx + cosx and the co-ordinate axes in the first quadrant is

(a) $\sqrt{2} - 1$

(b) $\sqrt{2}$

(c) $\sqrt{2} + 1$

(d) 1

Answer: (c)

101. If $z = f(x - y, y - t, t - x)$, then $\partial z/\partial x + \partial z/\partial y + \partial z/\partial t$ is equal to

(a) $x + y + t$

(b) $x + y + t + 1$

(c) 1

(d) 0

Answer: (d)

102. If $y = \tan^{-1}\dfrac{3ax^2 - x^3}{a\left(a^2 - 3x^2\right)}$, then dy/dx is equal to

(a) $3x/(x^2 + a^2)$

(b) $3a/(x^2 + a^2)$

(c) $3/(x^2 + a^2)$

(d) $a/(x^2 + a^2)$

Answer: —

103. If a and b are arbitrary constants, then the partial differential equation of $z = ax + a^2y^2 + b$ is

(a) $q = 2py$

(b) $p = 2q^2y$

(c) $q = 2p^2y$

(d) $p = xq^2$

Answer: (c)

104. Solution of the differential equation $(y - px)(p - 1) = p$, $p = dy/dx$ is (Where c is an arbitrary constant)

(a) $y = cx + c/(c - 1)$

(b) $y = x^2 + c$

(c) $y = cx + 2$

(d) $y^2 = cx + 3$

Answer: (a)

105. If $\lim\limits_{x\to 0} x\sin\dfrac{1}{x} = A$ and $\lim\limits_{x\to\infty} x\sin\dfrac{1}{x} = B$, then

(a) $A = 1, B = 0$

(b) $A = 0, B = 1$

(c) $A = 1, B = \infty$

(d) $A = \infty, B = 1$

Answer: (b)

106. Which one of the following is not correct ?

(a) tan iθ = i tanh θ

(b) cos iθ = cosh θ

(c) cot iθ = i coth θ

(d) sin iθ = i sinh θ

Answer: (c)

107. Sum of the series

$$\frac{1}{1.3}+\frac{1}{5.7}+\frac{1}{9.11}$$

+ . . . is

(a) π/4

(b) π/2

(c) π/8

(d) 3π/4

Answer: (c)

108. Value of $\tan^{-1}(1/2) + \tan^{-1}(1/5) + \tan^{-1}(1/8)$ is

(a) π/4

(b) π/2

(c) π

(d) $\tan^{-1}2$

Answer: (a)

109. The equation $\sin 4\theta - 2\cos^2\theta + a^2 = 0$ will have atleast one solution, if

(a) $|a| \leq 1½$

(b) $|a| \leq 2$

(c) $|a| \leq \sqrt{2}$

(d) $|a| \geq 1$

Answer: (c)

110. If

$e^{\sin(x + iy)}$

= A + iB, where A and B are real, then $\sqrt{(A^2 + B^2)}$ is equal to

(a)

$e^{\sin x \cosh y}$

(b)

$e^{\sinh x \cos y}$

(c)

$e^{\sinh x \sinh y}$

(d)

$e^{\sin x \sin y}$

Answer: (a)

111. 2 sinh(x + y) cosh(x – y) is equal to

(a) sin 2x + sin 2y

(b) sin 2x + sinh 2y

(c) sinh 2x + sinh 2y

(d) sinh 2x + sin 2y

Answer: (c)

112. In a triangle ABC, a = 5, b = 7 and sin A ow many such triangles are possible ?

(a) 0

(b) 1

(c) 2

(d) 3

Answer: (a)

113. If div $(r^n \vec{r}) = 0$, then n is equal to

(a) –3

(b) 1

(c) 2

(d) –1

Answer: (a)

114. If $\vec{A} = \hat{i} + \hat{j} + \hat{k}$, $\vec{A}.\vec{B} = 2$ and $\vec{A} \times \vec{B} = \hat{j} - \hat{k}$, then $|3\vec{B}|$ is equal to

(a) $2\sqrt{2}$

(b) $3\sqrt{2}$

(c) $2\sqrt{3}$

(d) $3\sqrt{3}$

Answer: (b)

115. If $(\vec{A} \times \vec{B})^2 + (\vec{A} \cdot \vec{B})^2 = 81$ and $|\vec{B}| = 3$, then $|\vec{A}|$ is equal to

(a) 9

(b) 3

(c) 27

(d) 1

Answer: (b)

116. Value of $[\hat{i} - \hat{j}, \hat{j} - \hat{k}, \hat{k} - \hat{j}]$ is

(a) 1

(b) 2

(c) 3

(d) 0

Answer: (d)

117. The directional derivative of $\phi = xy + yz + zx$ at (1, 1, 1) in the direction of the vector $\hat{i} - 2\hat{j} + 2\hat{k}$ is

(a) 1/3

(b) 2/3

(c) 5/3

(d) 7/3

Answer: (b)

118. If $\vec{u}$ and $\vec{v}$ are vector point function and ϕ is a scalar function, then which statement of the following is meaningful ?

(a) $\nabla \vec{u}$

(b) $\nabla(\vec{u} \times \vec{v})$

(c) $\nabla(\phi \vec{u})$

(d) $\nabla(\vec{u} \cdot \vec{v})$

Answer: (d)

119. The motion of a projectile is described by the equation $y = ax - bx^2$. Range of projectile is

(a) a/b

(b) a/2b

(c) 2a/b

(d) none of the above

Answer: (a)

120. If two equal perfectly elastic bodies impinge directly, then after impinge

(a) Both interchange their velocities

(b) Both come to rest

(c) Velocities of both do not change

(d) None of the above

Answer: (a)

121. The centre of gravity of a solid right circular cone of height h is

(a) At distance h/4 from vertex

(b) At distance 3h/4 from vertex

(c) At distance h/2 from vertex

(d) None of the above

Answer: (b)

122. The resultant of $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{P}$ is reversed and $\vec{Q}$ remaining the same the new resultant becomes $\vec{R'}$. If $\vec{R}$ is perpendicular to $\vec{R'}$, then $|\vec{P}| : |\vec{Q}|$ is

(a) 1 : 2

(b) 1 : 1

(c) 2 : 1

(d) 2 : 3

Answer: (b)

123. The number of numbers between 100 and 300 that are divisible by 5 but not by 15 is

(a) 20

(b) 26

(c) 32

(d) 35

Answer: (b)

124. The coefficient of the middle term in the expansion of $(1 + 3x + 3x^2 + x^3)^8$ in powers of x is

(a) $^{12}C_6$

(b) $^{12}C_8$

(c) $^{24}C_8$

(d) $^{24}C_{12}$

Answer: (d)

125. Two constant forces $\vec{P} = 2\hat{i} - 5\hat{j} + 6\hat{k}$ and $\vec{Q} = -\hat{i} + 2\hat{j} - \hat{k}$ act on a particle at the point A(4, −3, −2). Moment of the resultant force about O(0, 0, 0) is

(a) $21\hat{i} + 22\hat{j} + 9\hat{k}$

(b) $-21\hat{i} - 22\hat{j} - 9\hat{k}$

(c) $21\hat{i} - 22\hat{j} + 9\hat{k}$

(d) $21\hat{i} - 22\hat{j} - 9\hat{k}$

Answer: (b)

Answer key

Answer key from the U.P. Secondary Education Services Selection Board's official answer key for this sitting. "—" means the key gave none.

Mathematics

1	**(a)**	2	**(c)**	3	**(c)**	4	**(d)**	5	**(c)**	6	**(c)**	7	**(c)**	8	**(c)**
9	**(b)**	10	**(c)**	11	**(a)**	12	**(c)**	13	**(c)**	14	**(b)**	15	**(a)**	16	**(b)**
17	**(b)**	18	**(c)**	19	**(c)**	20	**(c)**	21	**(b)**	22	**(a)**	23	**(c)**	24	**(a)**
25	**(b)**	26	**(b)**	27	**(c)**	28	**(d)**	29	**(a)**	30	**(a)**	31	**(b)**	32	**(b)**
33	**(d)**	34	**(c)**	35	**(c)**	36	**(a)**	37	**(d)**	38	**(c)**	39	**(b)**	40	**(d)**
41	**(c)**	42	**(b)**	43	**(b)**	44	**(d)**	45	**(d)**	46	**(c)**	47	**(b)**	48	**(c)**
49	**(c)**	50	**(a)**	51	**(b)**	52	**(d)**	53	**(b)**	54	**(b)**	55	**(c)**	56	**(d)**
57	**(c)**	58	**(d)**	59	**(d)**	60	**(d)**	61	**(b)**	62	**(c)**	63	**(a)**	64	**(d)**
65	**(c)**	66	**(d)**	67	**(d)**	68	**(c)**	69	**(d)**	70	**(b)**	71	**(c)**	72	**(a)**
73	**(c)**	74	**(c)**	75	**(b)**	76	**(c)**	77	**(d)**	78	**(c)**	79	**(a)**	80	**(a)**
81	**(b)**	82	**(a)**	83	**(b)**	84	**(b)**	85	**(b)**	86	**(a)**	87	**(b)**	88	**(a)**
89	**(c)**	90	**(b)**	91	**(a)**	92	**(c)**	93	**(b)**	94	**(a)**	95	**(b)**	96	**(b)**
97	**(a)**	98	**(a)**	99	**(d)**	100	**(c)**	101	**(d)**	102	—	103	**(c)**	104	**(a)**
105	**(b)**	106	**(c)**	107	**(c)**	108	**(a)**	109	**(c)**	110	**(a)**	111	**(c)**	112	**(a)**
113	**(a)**	114	**(b)**	115	**(b)**	116	**(d)**	117	**(b)**	118	**(d)**	119	**(a)**	120	**(a)**
121	**(b)**	122	**(b)**	123	**(b)**	124	**(d)**	12	**(b)**						