PREVIOUS YEAR PAPER

UP PGT 2021 — Mathematics (Series A)

UP PGT · 17 or 18 August 2021

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 17 or 18 August 2021. Each question is followed by its answer, and the answer key is repeated on the last page.

Take it as a timed practice test: exambharo.com/up-pgt/previous-year-papers/up-pgt-2021-mathematics-series-a/

Mathematics

1. Sum of the series
1/(1.2) − 1/(2.3) + 1/(3.4) − 1/(4.5) + ……..

(a) 2 log 2 − 1

(b) 2 log 2 − 3

(c) 2 log 2

(d) None of the above

Answer: (a)

2. If the horizontal range of a projectile is equal to its gained maximum height, then its angle of projection is

(a) π/4

(b) tan⁻¹2

(c) tan⁻¹4

(d) π/3

Answer: (c)

3. The real part of e^(sin(x+iy)) is

(a) e^(sinx coshy) [cos(cosx sinhy)]

(b) e^(sinx coshy) [sin(cosx sinhy)]

(c) e^(cosx sinhy) [cos(cosx sinhy)]

(d) e^(cosx sinhy) [sin(cosx sinhy)]

Answer: (a)

4. sinh(x + iy) is equal to

(a) sinx coshy + i coshx siny

(b) sinhx cosy + i coshx siny

(c) sinx coshy − i coshx siny

(d) sinhx cosy − i coshx siny

Answer: (b)

5. The equation of a right circular cone with vertex at the origin the axis the z axis and semi vertical angle π/4 is

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

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

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

(d) $xy = z^2$

Answer: (b)

6. $\lim_{(x,y)\to(2,1)} \sin^{-1}(xy - 2) / \tan^{-1}(3xy - 6)$ is equal to

(a) 1/3

(b) 1/2

(c) 1

(d) 2

Answer: (a)

7. The dimension of the vector space C(R) of the complex number over real numbers is

(a) 1

(b) 2

(c) 3

(d) 4

Answer: (b)

8. If the straight line y = mx lies outside the circle x^2 ^{2} − 20y + 90 = 0, then the value of m will satisfy

(a) $|m| < 3$

(b) $m < 3$

(c) $m > 3$

(d) $|m| > 3$

Answer: (a)

9. The sum of the series
$\lim_{n\to\infty} [1/n + 1/(n+1) + 1/(n+2) + ... + 1/(4n)]$
is equal to

(a) 0

(b) 1

(c) log 3

(d) log 4

Answer: (d)

10. The work done by the force $\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$, displacing a particle in the xy plane from (0, 0) to (1, 1) along the parabola $y^2 = x$, is

(a) 2

(b) 3

(c) 1/2

(d) none of these

Answer: (d)

11. The distinct eigen values of the matrix [[1, 1, 0], [1, 1, 0], [0, 0, 0]] are

(a) 0, 1

(b) 1, – 1

(c) 0, 2

(d) 1, 2

Answer: (c)

12. General solution of $x^2(y - px) = p^2y$ where $p = dy/dx$ is

(a) $y^2 - c^2 = 2cx^3$

(b) $x^2(y - cx) = c^2y$

(c) $xy^2 = cx4 + c^2$

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

Answer: (d)

13. Let (z, o), where $a \circ b \stackrel{def}{=} a + b + 1$, $a, b \in z$ is a cor utative group. Let a′ be inverse of a, then a′ is equal to

(a) – a + 1

(b) – a – 1

(c) – a – 2

(d) – a + 2

Answer: (c)

14. If the two roots of the equation $x^3 - 5x^2 - 16x + 80 = 0$ are 4 and – 4 then the third root of this equation is

(a) 1

(b) 2

(c) 6

(d) 5

Answer: (d)

15. A hemisphere rests in equilibrium on a sphere of equal radius. If the flat surface of the hemisphere rests on the sphere then this equilibrium is

(a) Stable

(b) Unstable

(c) Neutral

(d) None of the above

Answer: (a)

16. The line $y = mx + 1$ is a tangent to the parabola $y^2 = 4x$, if

(a) $m = 1$

(b) $m = 2$

(c) $m = -1$

(d) $m = -2$

Answer: (a)

17. $\int_0^{\infty} e^{(-x^2)}\, dx$ is equal to

(a) $(1/2)\sqrt{\pi}$

(b) $\pi/2$

(c) $\pi/\sqrt{2}$

(d) π

Answer: (a)

18. The moment of inertia of a circular ring of radius a and mass M about an axis through the centre perpendicular its plane is

(a) $(1/2)Ma^2$

(b) Ma^2

(c) $(2/3)Ma^2$

(d) $(4/3)Ma^2$

Answer: (b)

19. The eigen values of the matrix $A = [[5, 4], [1, 2]]$ are

(a) 6, 0

(b) 3, 2

(c) 6, 1

(d) 1, 2

Answer: (c)

20. If $f(x) = (x + 2)/(x + 3)$ and $y = f^{-1}(x)$, then dy/dx is equal to

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

(b) $1/(x - 1)^2$

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

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

Answer: (b)

21. The circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect at two distinct points. Which of the following is correct ?

(a) $r = 1$

(b) $1 < r < 1$

(c) $r = 2$

(d) $2 < r < 8$

Answer: (d)

22. If $y = \sin(\log x)$, then which of the following is correct ?
    (a) $d^2y/dx^2 + xy = 0$
    (b) $d^2y/dx^2 + y = 0$
    (c) $x^2\, d^2y/dx^2 + x\, dy/dx + y = 0$
    (d) $x^2\, d^2y/dx^2 - x\, dy/dx + y = 0$
    Answer: (c)

23. If B is a matrix such that $B^2 = B$ and $A = I - B$, then which of the following is not correct ?
    (a) $A^2 = A$
    (b) $A^2 = I$
    (c) $AB = 0$
    (d) $BA = 0$
    Answer: (b)

24. The orthogonal trajectories to the family of straight lines $y = k(x - 1)$, $k \in \mathbb{R}$, are given by
    (a) $(x - 1)^2 + y^2 = c^2$
    (b) $(x - 1)^2 + (y - 1)^2 = c^2$
    (c) $ky + x - 1 = 0$
    (d) $x^2 + y^2 = c^2$
    Answer: (a)

25. If $A = f(x) = [[\cos x, \sin x, 0], [-\sin x, \cos x, 0], [0, 0$ then A^{-1} is
    (a) $f(x)$
    (b) $-f(x)$
    (c) $f(-x)$
    (d) $-f(-x)$
    Answer: (c)

26. A and B throw a dice. The probability that A's throw is greater than B's throw in numbers is
    (a) 1/2
    (b) 5/6
    (c) 5/12
    (d) 7/12
    Answer: (c)

27. Asymptotes of the curve $x^2y^2 = a^2(x^2 + y^2)$ are
    (a) $x = 0, y = 0$
    (b) $x = \pm a, y = 0$
    (c) $x = 0, y = \pm a$
    (d) $x = \pm a, y = \pm a$
    Answer: (d)

28. The Cartesian equation of the common catenary is

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

(b) $y = c \cosh(x/c)$

(c) $y = c \sec x$

(d) $y = c \tan hx$

Answer: (b)

29. A five digit number is formed by the digits 1, 2, 3, 4, 5 without repetition, the probability that the number formed is divisible by 4, is

(a) 1/4

(b) 2/5

(c) 3/5

(d) 1/5

Answer: (d)

30. If $\sin(\theta + i\varphi) = \tan \alpha + i \sec \alpha$ then $\cos 2\theta \cosh 2\varphi$ is equal to

(a) 3

(b) 2

(c) 6

(d) 4

Answer: (a)

31. If $f(x) = ax + b$ and $f(f(f(x))) = 8x + 21$ and if a, b are real numbers then a + b is equal to

(a) 2

(b) 3

(c) 5

(d) 7

Answer: (c)

32. If the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x - az)\hat{k}$ is solenoidal then a is equal to

(a) 1

(b) −1

(c) 2

(d) −2

Answer: (c)

33. The radius of sphere $x^2 + y^2 + z^2 + x + y + z = 4$ is

(a) 3

(b) 4

(c) $\sqrt{19}/4$

(d) $\sqrt{19}/2$

Answer: (d)

34. The equation of the sphere passing through the origin and making intercepts 1, 3, 5 with the three coordinate axes is

(a) $x^2 + y^2 + z^2 + x + 3y + 5z = 0$

(b) $x^2 + y^2 + z^2 - x + 3y - 5z = 0$

(c) $x^2 + y^2 + z^2 + x - 3y + 5z = 0$

(d) $x^2 + y^2 + z^2 - x - 3y - 5z = 0$

Answer: (d)

35. If each element of a 3×3 matrix A is multiplied by 3 then the determinant of the newly formed matrix is

(a) $3\,|A|$

(b) $9\,|A|$

(c) $(|A|)^3$

(d) $27\,|A|$

Answer: (d)

36. The general solution of the partial differential equation $\partial^2 z/\partial x \partial y = x + y$ is of the form $z =$

(a) $(1/2)\,xy\,(x - y) + F(x) + G(y)$

(b) $(1/2)\,xy\,(x + y) + F(x) + G(y)$

(c) $(1/2)\,xy\,(x - y) + F(x)\,G(y)$

(d) $(1/2)\,xy\,(x + y) + F(x)\,G(y)$

Answer: (b)

37. Let G be a cyclic group of order 6. Then, the nur er of elements $g \in G$, such that $G = \langle g \rangle$ is

(a) 2

(b) 3

(c) 4

(d) 5

Answer: (a)

38. Let 'a' be an element of a group and $O(a) = 30$, $O(a^{18})$ is equal to

(a) 2

(b) 5

(c) 6

(d) 10

Answer: (b)

39. If the vectors $x\hat{i} - 3\hat{j} + 7\hat{k}$ and $\hat{i} - y\hat{j} - z\hat{k}$ are colinear then the value of xy^2/z is equal to

(a) 9/7

(b) 6/7

(c) −6/7

(d) none of the above

Answer: (d)

40. If complex numbers a1, a2, a3, ... are in G.P. having common ratio r such that $\Sigma_{k=1}^{n} a_{2k-1} = \Sigma_{k=1}^{n} a_{2k+2} \neq 0$ then number of possible values of r is

(a) 1

(b) 2

(c) 3

(d) 4

Answer: (c)

41. Real part of $\sin^2(x + iy)$ is

(a) $(1/2)[1 + \cos 2x \cosh 2y]$

(b) $(1/2)[1 - \cos 2x \cosh 2y]$

(c) $(1/2)[1 + \sin 2x \sinh 2y]$

(d) $(1/2)[1 - \sin 2x \cosh 2y]$

Answer: (b)

42. The distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$ the equation of hyperbola is

(a) $x^2 - y^2 = 32$

(b) $2x^2 - y^2 = 16$

(c) $x^2 - 2y^2 = 32$

(d) $x^2 - y^2 = 8$

Answer: (a)

43. The value of $5^2 + 6^2 + 7^2 + ... + 20^2$ is

(a) 2040

(b) 2540

(c) 2840

(d) 3840

Answer: (c)

44. If V is a n-dimensional vector space and T is a linear transformation on V such that rank and nullity of T are identical then

(a) n is even

(b) n is odd

(c) some times even some times odd

(d) none of the above

Answer: (a)

45. The function $f(x) = (1 - \cos x)/x^2$, $x \neq 0$ can be made continuous at $x = 0$ by defining f(0) to be equal to

(a) 1

(b) 1/2

(c) 0

(d) 2

Answer: (b)

46. If f(a − x) = f(x) then ∫0^a x f(x) dx is equal to

(a) (a/2) ∫0^a f(x) dx

(b) a ∫0^a f(x) dx

(c) 0

(d) 2 ∫0^a f(x) dx

Answer: (a)

47. If f(x) = (ae^(bx) + be^(ax))/(a + b), then f''(0) equals

(a) 0

(b) ab

(c) a + b

(d) ab(a + b)

Answer: (b)

48. If $\vec{A}$ and $\vec{B}$ are vectors such that $|\vec{A}| = |\vec{B}| = 5$ and $\vec{A} \times \vec{B} = 4\hat{i} - 3\hat{k}$, then $\vec{A} \cdot \vec{B}$ is equal to

(a) $5\sqrt{6}$

(b) $5\sqrt{2}$

(c) $10\sqrt{2}$

(d) $10\sqrt{6}$

Answer: (d)

49. If the line ax + by + c = 0 touches the parabola y^2 [illegible], then which of the following is correct ?

(a) abc = 1

(b) $b^2 = 4ac$

(c) $a^2 = 4bc$

(d) $c^2 = 4ab$

Answer: (b)

50. The solution of PDE $x\,\partial u/\partial x + y\,\partial u/\partial y = 0$ is of the form u =

(a) f(x + y)

(b) f(x − y)

(c) f(y/x)

(d) f(x y)

Answer: (c)

51. Let G be a group of order 30 and let A, B be normal subgroups of orders 2 and 5 respectively. Then O(G/AB) is

(a) 2

(b) 3

(c) 5

(d) 10

Answer: (b)

52. If α and β are roots of the equation $x^2 + x + 1 = 0$, then the equation whose roots are α^7 and β^4 is

(a) $x^2 - x - 1 = 0$

(b) $x^2 - x + 1 = 0$

(c) $x^2 + x - 1 = 0$

(d) $x^2 + x + 1 = 0$

Answer: (d)

53. Sum of the series
1/2! + (1+2)/3! + (1+2+3)/4! + (1+2+3+4)/5! + ...
is equal to

(a) 2e

(b) e

(c) e − 1

(d) e/2

Answer: (d)

54. Value of $\iint_S \vec{F}\cdot\hat{n}\,ds$, where $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ and S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1 is

(a) 1

(b) 3/2

(c) 3

(d) 5/2

Answer: (b)

55. If the nullity of the matrix [[k, 1, 2], [1, −[illegible]2], [[illegible]4]] is 1, then the value of k is

(a) 0

(b) 1

(c) 2

(d) −1

Answer: (d)

56. The smallest value of positive integer n, for which $(1 + i)^n = (1 - i)^n$, is

(a) 2

(b) 4

(c) 6

(d) 8

Answer: (b)

57. The area inside the cardioid $r = a(1 + \cos\theta)$ and outside the circle r = a is

(a) $a^2(\pi + 2)$

(b) $a^2(\pi/4 + 2)$

(c) $a^2(\pi - 2)$

(d) none of these

Answer: (b)

58. Let â and b̂ be two unit vectors and θ be the angle between them. Which of the following will be value of cos(θ/2) ?

(a) |â + b̂|/4

(b) |â − b̂|/4

(c) |â + b̂|/2

(d) |â − b̂|/2

Answer: (c)

59. If A and B are two sets such that n(A) = 4, n(B) = 3 then the maximum value of n(A∩B) is

(a) 0

(b) 1

(c) 4

(d) 3

Answer: (d)

60. The differential equation of y = ae^(−bx) (a and b are parameters) is

(a) $y\,(dy/dx) = (d^2y/dx^2)^2$

(b) $y\,(d^2y/dx^2) = (dy/dx)^2$

(c) $y\,(dy/dx)^2 = d^2y/dx^2$

(d) $y\,(d^2y/dx^2)^2 = dy/dx$

Answer: (b)

61. The sum of |1 4 7; 2 5 8; 3 6 9| and |4 4 7; 5 5 8; 7 9| will be

(a) zero

(b) |5 8 14; 7 10 16; 10 12 18|

(c) |5 4 7; 7 5 8; 10 6 9|

(d) |1 8 14; 2 10 16; 3 12 18|

Answer: (c)

62. The coefficient of xn in the expansion of $(1 − 2x + 3x^2 − 4x^3 + ...)^{-n}$

(a) $(-1)^{n+1}\,n$

(b) $(2n)!/(n!)^2$

(c) $(2n)!/((n+1)!\,(n-1)!)$

(d) None of the above

Answer: (b)

63. In the expansion of $(x^3/4 − 2/x^2)^9$ the 4^{th} term from the end is

(a) $48/x^3$

(b) $84/x^3$

(c) $64/x^3$

(d) $72/x^3$

Answer: (b)

64. A sphere after collision with a plane vertically downwards with velocity 20 cm per second returns upwards with velocity 4 cm/second then the value of the coefficient of restitution e is

(a) 1/2

(b) 1/3

(c) 1/4

(d) 1/5

Answer: (d)

65. Consider the following statements
I : $d/dx\ \text{sech}x = \text{sech}x\ \tanh x$
II : $d/dx\ \sinh^{-1}x = 1/\sqrt{(x^2 + 1)}$
which of the following is/are true ?

(a) only I

(b) only II

(c) I and II both

(d) neither I nor II

Answer: (b)

66. The straight lines $3x - 4y + 4 = 0$ and $6x - 8y + 13 = 0$ are tangents to the same circle. The radius of the circle is

(a) 1/2

(b) 1/4

(c) 3/2

(d) 2

Answer: (b)

67. The equation of the director sphere of the central conicoid $x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$ is

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

(b) $x^2 + y^2 + z^2 = 1/a^2 + 1/b^2 + 1/c^2$

(c) $ax^2 + by^2 + cz^2 = a^2 + b^2 + c^2$

(d) $x^2 + y^2 + z^2 = 1$

Answer: (a)

68. The probabilities of winning a race by three racers P, Q, R are 1/3, 1/4 and 1/5 respectively. The probability of none of them wins in the race is

(a) 1/5

(b) 13/60

(c) 2/5

(d) None of the above

Answer: (c)

69. The area lying between line y = x, x axis and ordinates x = 0 and x = 2 is revolved about x axis. The centre of gravity of the solid thus generated is at the following point.

(a) (1/2, 0)

(b) (3/2, 0)

(c) (3/4, 0)

(d) (1/4, 0)

Answer: (b)

70. If the plane x + 2y + 3z = p touches the conicoid $x^2 - 2y^2 + 3z^2 = 2$, then the value of p is

(a) 0

(b) 1

(c) 4

(d) 2

Answer: (d)

71. If a, b, c are in arithmetic progression then the value of |x+1 x+2 x+a; x+2 x+3 x+b; x+3 x+4 x+c| is

(a) 0

(b) 1

(c) 2

(d) a b c

Answer: (a)

72. If X = {1, 2, 3, 4} then the relation R = {(1, 1), (2, (3, 3), (4, 4), (3, 2), (2, 3), (2, 1), (1, 2)} defined on X is

(a) reflexive, symmetric and transitive

(b) reflexive, symmetric but not transitive

(c) symmetric, transitive but not reflexive

(d) reflexive, transitive but not symmetric

Answer: (b)

73. The solution of differential equation $(dy/dx)^2 - 7\,dy/dx + 12 = 0$ is

(a) (y − 4x + c) (y − 3x + c) = 0

(b) (y + x + c) (y − x + c) = 0

(c) (y + 4x + c) (y + 3x + c) = 0

(d) (y + 2x + c) (y + 3x + c) = 0

Answer: (a)

74. Equation of the curve passing through (1, 1) and satisfying the differential equation $dy/dx + y/x = x^2$ is

(a) xy = x4 + 3

(b) 4xy + x4 = 3

(c) ye^x = x4 + 3

(d) 4xy = x4 + 3

Answer: (d)

75. In the group (Z, +), the subgroup generated by 2 and 7 is

(a) 9Z

(b) 14Z

(c) Z

(d) 5Z

Answer: (c)

76. If $\vec{a}$ and $\vec{b}$ are irrotational vectors then div$(\vec{a} \times \vec{b})$ is equal to

(a) 1

(b) 2

(c) 3

(d) 0

Answer: (d)

77. The angle between the lines whose direction cosines satisfy the equations l + m + n = 0 and 2lm + 2nl − mn = 0 is

(a) 45°

(b) 90°

(c) 120°

(d) none of the above

Answer: (c)

78. If the difference of the roots of the equation $x^2 +$ $+ 12 = 0$ is one then the values of p are

(a) ± 7

(b) ± 2

(c) ± 3

(d) ± 1

Answer: (a)

79. The dimension of the vector space of all 3 × 3 real symmetric matrices is

(a) 3

(b) 6

(c) 3n

(d) 9

Answer: (b)

80. Sum of maximum and minimum values of $4(\sin^2\theta + \cos 4\theta)$ is

(a) 3

(b) 4

(c) 5

(d) 7

Answer: (d)

81. The value of the determinant $\begin{vmatrix} 1^2 & 2^2 & 3^2 & 4^2 \\ 2^2 & 3^2 & 4^2 & 5^2 \\ 3^2 & 4^2 & 5^2 & 6^2 \\ 4^2 & 5^2 & 6^2 & 7^2 \end{vmatrix}$ is

(a) 60

(b) 96

(c) 120

(d) None of the above

Answer: (d)

82. If $\hat{r} = \vec{r}/r$, $r = |\vec{r}|$, then div $\hat{r}$ is equal to

(a) 0

(b) −1

(c) 1/r

(d) 2/r

Answer: (d)

83. If N is the set of natural numbers then the mapping f : N → N defined by
f(x) = x + 1 if x is odd, x − 1 if x is even
is

(a) one-one and onto

(b) many to one and onto

(c) one-one and into

(d) many to one and into

Answer: (a)

84. Solution of the differential equation $\log_e(dy/dx) = x - y$, $y(0) = 0$ is

(a) $e^y = 2e^{2x} + 1$

(b) $2e^y = e^{2x} + 1$

(c) $e^y = 2e^{2x} + 3$

(d) $2e^y = e^{2x} - 1$

Answer: (b)

85. If $x = \log(\sec\theta + \tan\theta)$, then coshx is equal to

(a) tan θ

(b) cos θ

(c) sin θ

(d) sec θ

Answer: (d)

86. Which of the following functions $T : R^2 \to R^2$ is a linear transformation ?

(a) T(x, y) = (x + 1, y)

(b) T(x, y) = (x, y + 1)

(c) T(x, y) = (x + y, 0)

(d) T(x, y) = (x − 1, y)

Answer: (c)

87. The radius of curvature of the curve $s = a \log \tan(\pi/4 + \psi/2)$ at (s, ψ) is

(a) $a \tan\psi$

(b) $a \sec\psi$

(c) $a \sec^2\psi$

(d) $a \sec\psi \tan\psi$

Answer: (b)

88. If $f(2) = 4$ and $f'(2) = 1$ then $\lim_{x\to 2} (x f(2) - 2 f(x))/(x - 2)$ is equal to

(a) 2

(b) 0

(c) 1

(d) 4

Answer: (a)

89. If A is a singular matrix, then A. adj(A) is

(a) an identity matrix

(b) a null matrix

(c) a scalar matrix

(d) none of the above

Answer: (b)

90. A unit vector, which is normal to the surface $x^2 - [illegible] z^2 = 1$ at the point (1, 1, 1) is

(a) $(\hat{i} - \hat{j} + 2\hat{k})/\sqrt{6}$

(b) $(\hat{i} + \hat{j} - 2\hat{k})/\sqrt{6}$

(c) $(\hat{i} + \hat{j} + 2\hat{k})/\sqrt{6}$

(d) $(\hat{i} - \hat{j} - 2\hat{k})/\sqrt{6}$

Answer: (a)

91. Statement A : Every isomorphic image of a cyclic group is cyclic.
Statement B : Every cyclic group is abelian.
Then

(a) Both A and B are true

(b) Both A and B are false

(c) A is true only

(d) B is true only

Answer: (a)

92. The value of $\int 0^1 x7/(1 + x^16)\, dx$ is equal to

(a) $\pi/4$

(b) 0

(c) $\pi/32$

(d) 1

Answer: (c)

93. If normal at any point P of a common catenary meets the directrix at Q and ρ is the radius of curvature of the catenary at P then PQ is equal to

(a) ρ

(b) c sec ψ

(c) c tan ψ

(d) c^2 sec ψ

Answer: (a)

94. The value of sin log(ii) is

(a) 0

(b) 1

(c) −1

(d) 1/2

Answer: (c)

95. A stone just clears a wall of height 75 meters situated at a distance 150 meter and goes in horizontal direction, then the angle of projection is

(a) 30°

(b) 60°

(c) 45°

(d) 75°

Answer: (c)

96. The composite mapping fog(x) of the maps f : F R, f(x) = sinx; g : R → R, g(x) = x^2, is

(a) sin x + x^2

(b) $(\sin x)^2$

(c) sin x^2

(d) x^2 sin x

Answer: (c)

97. The area of the region bounded by the curve y = x^3, x axis and the ordinates x = − 2 and x = 1 is

(a) 1 square unit

(b) 1/4 square unit

(c) 3/4 square unit

(d) 17/4 square unit

Answer: (d)

98. Σ_(r=0)^n 3^r nC_r is equal to

(a) 2n

(b) 3n

(c) 4n

(d) 1

Answer: (c)

99. If w is cube root of unity, then $1 + w + w^2 + w^3 + ... + w5^2$, $w \neq 1$ is equal to

(a) w

(b) 1 – w

(c) $-w^2$

(d) $1 + w^2$

Answer: (c)

100. Two uniform solid spheres composed of the same material and having their radii 6 cm and 3 cm respectively are firmly united the distance of the centre of gravity of the whole body from the centre of the larger sphere is

(a) 4 cms

(b) 3 cms

(c) 2 cms

(d) 1 cm

Answer: (d)

101. Let T be a linear transformation from $R^3 \rightarrow R^2$, defined by $T(x, y, z) = (x + y, y - z)$ then the matrix T with respect to the ordered basis {(1, 1, 1), (1, −1, 0), (0, 1, 0)} and {(1,1), (1, 0)} is

(a) [[0, −1, 1], [2, 1, 0]]

(b) [[−2, 0, 1], [1, 1, −1]]

(c) [[2, 1], [0, −1], [1, 1]]

(d) [[0, 2], [−1, 1], [1, 0]]

Answer: (a)

102. Let V(F) be a finite dimensional vector space over the field F and W be a subspace of V. If dim V = 5, dim W = 3 then dim W° is

(a) 2

(b) 3

(c) 1

(d) 8

Answer: (a)

103. If $y = 4x - 5$ is equation of the tangent to a curve $y^2 = ax^3 + b$ at (2, 3), then (a, b) is equal to

(a) (2, 7)

(b) (2, −7)

(c) (−2, 7)

(d) (−2, −7)

Answer: (b)

104. Moment of inertia of a hollow sphere about a diameter whose mass is M and radius a, is

(a) $M.(2a^2/3)$

(b) $M.(2a^2/5)$

(c) $M.(a^2/4)$

(d) $M.(a^2/3)$

Answer: (a)

105. If $(G, *)$ is a group and $x * y = x + 2y - 3 \ \forall \ x, y \in G$, then inverse of x in the group is

(a) $(2x + 9)/4$

(b) $(9 - 2x)/4$

(c) $(x - 3)/4$

(d) $(x + 2)/4$

Answer: (b)

106. If W $(\neq 1)$ is a cube root of unity and $(1 + W)7 = A + BW$ then the value of $A^2 + B^2$ is

(a) 0

(b) 1

(c) 2

(d) 4

Answer: (c)

107. ∫0^(π/4) (cos 2θ)^(3/2) cosθ dθ is equal to

(a) $\pi/\sqrt{2}$

(b) $\pi/(4\sqrt{2})$

(c) $3\pi/(16\sqrt{2})$

(d) $3\pi/8$

Answer: (c)

108. If $y = -1$ when $x = 0$ then the solution of the diffe ial equation $(1 + e^{2x})\, dy + (1 + y^2)\, e^x\, dx = 0$ is

(a) $\tan^{-1}y + \tan^{-1}e^x = 0$

(b) $\tan^{-1}xy + \tan^{-1}e^x = 0$

(c) $\tan^{-1}y + \tan^{-1}(xe^x) = 0$

(d) none of the above

Answer: (a)

109. If $f(x) = ax^2 + 2bx + 1$, a and b are positive real numbers and $b^2 < a$, then which of the following is correct ?

(a) $f(x) = 0 \ \forall \ x \in R$

(b) $f(x) > 0 \ \forall \ x \in R$

(c) $f(x) < 0 \ \forall \ x \in R$

(d) None of the above

Answer: (b)

110. If H and K are subgroups of a group G such that $O(H) = 3$ and $O(K) = 5$, then what will be $O(H \cap K)$?

(a) 1

(b) 3

(c) 5

(d) 15

Answer: (a)

111. The equation of second degree $x^2 + 2\sqrt{2}\,xy + 2y^2 + 4x + 4\sqrt{2}\,y + 1 = 0$ represents a pair of straight lines, the distance between them is

(a) 4

(b) $4/\sqrt{3}$

(c) 2

(d) $2\sqrt{3}$

Answer: (c)

112. If $x^y = y^x$, then $(x/y)(dy/dx)$ is equal to

(a) $(x \log y + y)/(y \log x + x)$

(b) $(x \log y - y)/(y \log x - x)$

(c) $(y \log x + x)/(x \log y + y)$

(d) $(y \log x - x)/(x \log y - y)$

Answer: (b)

113. A particle moves along the curve $x = t^3 - 2$, $y = t^2 + t$, $z = 2t + 1$. The component of its acceleration at $t = 1$ in the direction $\hat{i} - \hat{j} + \hat{k}$ is

(a) 4

(b) $4\sqrt{3}$

(c) $4/\sqrt{3}$

(d) 2

Answer: (c)

114. If $V = (x^2 + y^2 + z^2)^{(-1/2)}$, then $x\,\partial V/\partial x + y\,\partial V/$ $+ z\,\partial V/\partial z$ is equal to

(a) V

(b) $(1/2)V$

(c) $-V$

(d) 0

Answer: (c)

115. If $f(x) = |x - 1| + |x|$ then $f'(1)$ is equal to

(a) 0

(b) 1

(c) -1

(d) does not exist

Answer: (d)

116. The solution of the partial differential equation $(mz - ny)\,\partial z/\partial x + (nx - lz)\,\partial z/\partial y = ly - mx$ is

(a) $f(x^2 + xz, y^2 + yz) = 0$

(b) $f(z^2 + xy, y^2 + xz) = 0$

(c) $f(x^2 + y^2, lx + my) = 0$

(d) $f(x^2 + y^2 + z^2, lx + my + nz) = 0$

Answer: (d)

117. If the equation $hxy + gx + fy = c$, $h \neq 0$ represents a pair of straight lines, then

(a) $fc + gh = 0$

(b) $fh + cg = 0$

(c) $gf + ch = 0$

(d) $gc + f^2 = 0$

Answer: (c)

118. For the function $f(x) = |x - 5|$, which of the following is not correct ?

(a) The function f(x) is continuous at x = 5

(b) The function f(x) is not continuous at x = − 5

(c) The function f(x) is differentiable at x = 0

(d) The function f(x) is differentiable at x = − 5

Answer: (b)

119. The order and degree of the differential equation $k\, d^2y/dx^2 = [1 + (dy/dx)^2]^{(3/2)}$ are

(a) order 2 degree 3

(b) order 2 degree 2

(c) order 3 degree 2

(d) none of the above

Answer: (b)

120. If the normal to curve y = f(x) at the point (a, b) m[illegible]es an angle $3\pi/4$ with the positive x axis then $f'(a)$ is equal to

(a) 1

(b) −1

(c) a/b

(d) b/a

Answer: (a)

121. If $u = \sin^{-1}((x^2 + y^2)/(x + y))$, then $x\, \partial u/\partial x + y\, \partial u/\partial y$ is equal to

(a) cos 2u

(b) tan u

(c) tan 2u

(d) cot u

Answer: (b)

122. If $W = \{(x, y, z) \in R^3 : x + y - z = 0\}$ is a subspace of the vector space R^3, then dim W is

(a) 0

(b) 1

(c) 2

(d) 3

Answer: (c)

123. If $y = \cos(3\cos^{-1}x)$, then d^3y/dx^3 is equal to

(a) 0

(b) 3

(c) 16

(d) 24

Answer: (d)

124. A non commutative group has at least

(a) 2 elements

(b) 3 elements

(c) 5 elements

(d) 6 elements

Answer: (d)

125. The equation of the tangents drawn from the point (−2, −1) to the hyperbola $2x^2 - 3y^2 = 6$ are

(a) $3x + y + 5 = 0,\ x - y + 1 = 0$

(b) $3x + y + 5 = 0,\ x + y + 1 = 0$

(c) $3x - y + 5 = 0,\ x + y + 1 = 0$

(d) $3x - y + 5 = 0,\ x - y + 1 = 0$

Answer: (d)

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