SCRA
Special Class Railway Apprentices
Practice Paper (Set - II)

MATHEMATICS

1. The value of

$$\int_{1/e}^{\tan x} \frac{t}{1+t^2}\,dt + \int_{1/e}^{\cot x} \frac{1}{t(1+t^2)}\,dt,$$ is:

(a) – 1 (b) 1
(c) 0 (d) none of these

2. If $f(x) = \begin{vmatrix} 0 & x^2 - \sin x & \cos - 2 \\ \sin x - x^2 & 0 & 1 - 2x \\ 2 - \cos x & 2x - 1 & 0 \end{vmatrix}$,

then $\int f(x)dx$ is equal to:

(a) $\frac{x^3}{3} - x^2$ sin x + sin 2x

(b) $\frac{x^3}{x} - x^2$ sin x – sin 2x

(c) $\frac{x^3}{3} - x^2$ cos x – cos 2x

(d) constant

3. The angle between two tangents from the origin to the circle $(x-7)^2 + (y+1)^2 = 25$ is:

(a) $\pi/3$ (b) 0

(c) $\pi/6$ (d) $\pi/2$

4. Two circles each of radius 5 units touch each other at (1, 2). If the equation of their common tangent is $4x + 3y = 10$, then the centres of the two circles are:

(a) (3, 4), (–1, 0)

(b) (5, 7), (–3, – 3)

(c) (5, 5), (–3, –1)

(d) None of the above

5. If the number $\frac{(1-i)^n}{(1+i)^{n-2}}$ is real and positive, then n is:

(a) any integer

(b) any even integer

(c) any odd integer

(d) none of these

6. Solution of the differential equation $y_3 - 8y_2 = 0$, where $y(0) = \frac{1}{8}$, $y_1(0) = 0$, $y_2(0) = 1$ is equal to:

(a) $y = \frac{1}{8}\left(\frac{e^{8x}}{8} + x - \frac{7}{8}\right)$

(b) $y = \frac{1}{8}\left(\frac{e^{8x}}{8} - x + \frac{7}{8}\right)$

(c) $y = \frac{1}{8}\left(\frac{e^{8x}}{8} + x + \frac{7}{8}\right)$

(d) none of these

7. Differetial equation of the family of curves $v = \frac{A}{r} + B$, where A and B are arbitrary constants, is:

(a) $\frac{d^2v}{dr^2} + \frac{1}{r}\frac{dv}{dr} = 0$ (b) $\frac{d^2v}{dr^2} - \frac{2}{r}\frac{dv}{dr} = 0$

(c) $\frac{d^2v}{dr^2} + \frac{2}{r}\frac{dv}{dr} = 0$ (d) none of these

8. The point of extremum of

$f(x) = \int_0^{x^2} \frac{t^2 - 5t + 4}{2 + e^t} dt$:

(a) $x = 0, \pm 1$ (b) $x = -3$

(c) $x = 3$ (d) $x = \pm 3$

9. $\int_0^{3/2} [x^2]\, dx$ equal to:

(a) 3/2 (b) 3

(c) $2 - \sqrt{2}$ (d) $2 + \sqrt{2}$

10. The value of $\int_{1/n}^{(an-1)/n} \frac{\sqrt{x}}{\sqrt{a - x} + \sqrt{x}} dx$ is equal to:

(a) $\frac{na-2}{2n}$ (b) $\frac{a}{2}$

(c) $\frac{1}{2n}(na+2)$ (d) none of these

11. If $f(x)$ and $g(x)$ are continuous functions satisfying $f(x) = f(a - x)$ and $g(x) + g(a - x) = 2$, then $\int_0^a f(x) g(x)\, dx$ is equal to:

(a) $\int_0^a g(x)\, dx$ (b) $\int_0^a f(x)\, dx$

(c) 0 (d) none of these

12. If $I_n = \int_0^{\pi/4} \tan^n x\, dx$, then:

(a) $I_{10} + I_8 = \frac{1}{9}$ (b) $I_5 + I_7 = \frac{1}{16}$

(c) $I_8 + I_{12} = \frac{2}{99}$

(d) $I_{12} + 2I_{10} + 3I_8 = \frac{20}{99}$

13. $\int \frac{\sin 2x}{a\cos^2 x + b\sin^2 x}dx$ is equal to:

(a) $(b - a) \log (a - \cos^2 x + b \sin^2 x)$
(b) $1/(b - a) \log (a \cos^2 x + b \sin^2 x)$
(c) $1/b - a \log (a \cos^2 x - b \sin^2 x)$
(d) none of these

14. $f(x) = \sin x + \cos 2x\ (x > 0)$ has minima for x is equal to:

(a) $n\pi/2$ (b) $\frac{3}{2}(n+1)\pi$
(c) $\frac{1}{2}(2n+1)\pi$ (d) none of these

15. If $y = a \log |x| + bx^2 + x$ has its extremum values at $x = -1$ and $x = 2$, then:

(a) $a = 2, b = -1$ (b) $a = 2, b = -1/2$
(c) $a = -2, b = 1/2$
(d) none of these

16. If the curves $y^2 = 16x$ and $9x^2 + by^2 = 16$ cut each other at right angles, then the value of b is:

(a) 2 (b) 4
(c) 9/2 (d) none of these

17. The tangent to the curve $y = e^{2x}$ at the point (0, 1) meets the x-axis at:

(a) $(0, a)$ (b) $(2, 0)$
(c) $(-1/2, 0)$ (d) None of these

18. If $y = \sqrt{\cos x + \sqrt{\cos x + \sqrt{\cos x + \ldots}}}$, then $\frac{dy}{dx}$ is equal to:

(a) $\frac{\cos x}{1-2y}$ (b) $-\frac{\cos x}{1-2y}$
(c) $-\frac{\sin x}{1-2y}$ (d) $\frac{\sin x}{1-2y}$

19. If $x = a(1 - \cos\theta)$, $y = a(\theta - \sin\theta)$, then $\left(\frac{dy}{dx}\right)_{\theta=\pi/2}$ is equal to:

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

20. If $f'(x_0)$ exists, then:

$\lim\limits_{h\to 0}\frac{f(x_0+h)-f(x_0-h)}{2h}$ is equal to:

(a) $\frac{1}{2}f'(x_0)$ (b) $f'(x_0)$
(c) $2f'(x_0)$ (d) none of these

21. Let f''(x) be continuous at $x = 0$ and f''(0) = 4 value of

$\lim\limits_{x\to 0}\frac{2f(x)-3f(2x)+f(4x)}{x^2}$ is:

(a) 11 (b) 12
(c) 2 (d) none of these

22. $\lim\limits_{x\to\infty}\left[\frac{a^x+b^x+c^x}{3}\right]^{2/x}$, $a, b, c > 0$, is equal to:

(a) abc (b) $a^2 b^2 c^2$
(c) $(a\ b\ c)^{2/3}$ (d) $(a\ b\ c)^3$

23. If a, b, c, d are positive, then

$\lim\limits_{x\to\infty}\left(1+\frac{1}{a+bx}\right)^{c+dx}$:

(a) $e^{d/b}$ (b) $e^{c/a}$
(c) $e^{(c+d)(a+d)}$ (d) e

24. The set of values of a for which the function $f(x) = x^2 + ax + 1$ is an increasing function on [1,2] is :

(a) $(-\infty, 4)$ (b) $[-4, \infty)$
(c) $[4, \infty)$ (d) $(-\infty, 4]$

25. The function $f(x) = \int_0^x \log_e\left(\frac{1-x}{1+x}\right)dx$ is :

(a) an even function
(b) an odd function
(c) a periodic function
(d) none of these

26. If (a sec θ, b tan θ) and (a sec ϕ, b tan ϕ) are the eznds of a focal chord of $\frac{x^2}{a^2}-\frac{y^2}{b^2}$ = 1, then tan $\frac{\theta}{2}\tan\frac{\phi}{2}$ equals:

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

(c) $\frac{e+1}{e-1}$ (d) $\frac{1-e}{1+e}$

27. The equation $\frac{x^2}{12-\lambda}+\frac{y^2}{8-\lambda}$ = 1 represents:

(a) a hyperbola if h < 8
(b) an ellipse if h > 8
(c) a hyperbola if 8 < λ < 12
(d) none of the above

28. If the segment intercepted by the parabola $y^2 = 4ax$ with the line $lx + my + n = 0$ subtends a right angle at the vertex, then:

(a) $4al + n = 0$
(b) $4al + 4am + n = 0$
(c) $4am + n = 0$
(d) $al + n = 0$

29. If the line $y = x\sqrt{3}-3$ cuts the paraboly $y^2 + x + 2$ at P and Q and if A be the point $(\sqrt{3},0)$, then $AP.AQ$ is:

(a) $2\sqrt{3}$ (b) $\frac{4}{3}(2-\sqrt{3})$

(c) $\frac{2}{3}(\sqrt{3}+2)$ (d) $\frac{4}{3}(\sqrt{3}+2)$

30. Two vertices of a triangle are (5 – 1) and (–2, 3). If the orthocentre of the triangle is the origin, then co-ordinates of the third vertex are:

(a) (4, 7) (b) (–4, –7)
(c) (–4, 7) (d) none of these

31. A line through A (–5, – 4) meets the lines $x + 3y + 2 = 0$, $2x + y + 4 = 0$, and $x - y - 5 = 0$ at B, C and D respectively.

If $\left(\frac{15}{AB}\right)^2+\left(\frac{10}{AC}\right)^2 = \left(\frac{6}{AD}\right)^2$, then the equation of the line is:

(a) $2x + 3y + 22 = 0$
(b) $5x - 4y + 7 = 0$
(c) $3x - 2y + 3 = 0$
(d) none of these

32. The lines $2x - 3y = 5$ and $3x - 4y = 7$ are diameters of a circle of area 144 sq units. Then the equation of this circle is:

(a) $x^2 + y^2 + 2x - 2y = 62$
(b) $x^2 = y^2 + 2x - 2y = 47$
(c) $x^2 + y^2 - 2x + 2y = 47$
(d) $x^2 + y^2 - 2x + 2y = 62$

33. If $\frac{1+3p}{3},\frac{1-p}{4}$ and $\frac{1-2p}{2}$ are the probabilities of three mutually exclusive and exhaustive events, then p equals:

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$

(c) $\frac{1}{6}$ (d) none of these

34. The probabilitiy that a man can hit a target is $\frac{3}{4}$. He tries 5 times. The probability that he will hit the target at least three times is:

(a) $\frac{291}{364}$ (b) $\frac{371}{464}$ (c) $\frac{471}{502}$ (d) $\frac{459}{512}$

35. Two persons A and B appear in an interview for the two vacancies. If the probability of their selctions are $\frac{1}{4}$ and

$\frac{1}{6}$ respectively. Then the probability that none of them is selected is:

(a) $\frac{5}{8}$ (b) $\frac{5}{12}$ (c) $\frac{19}{12}$ (d) $\frac{1}{24}$

36. The system of linear equations $ax + by = 0$, $cx + dy = 0$, has a non-trivial solution if:

(a) $ad - bc < 0$ (b) $ad - bc > 0$
(c) $ad + bc = 0$ (d) $ad - bc = 0$

37. $\log_3 2, \log_3 (2x - 5), \log_3 \left(2^x - \frac{7}{2}\right)$ are in A.P, then the value of x is:

(a) 2 (b) 3
(c) 4 (d) none of these

38. If the sum of odd numbered terms and the sum of even numbered terms in the expansion of $(x + a)^n$ are A and B respectively, then the value of $(x^2 - a^2)^n$ is:

(a) $A^2 - B^2$ (b) $A^2 + B^2$
(c) $4AB$ (d) none of these

39. Angles made with the x-axis by two lines drawn through the point (1, 2) and cutting the line $x + y = 4$ at a distance $\frac{1}{3}\sqrt{6}$ from the point (1, 2) are:

(a) $\frac{\pi}{6}$ and $\frac{\pi}{3}$ (b) $\frac{\pi}{12}$ and $\frac{5\pi}{12}$

(c) $\frac{\pi}{8}$ and $\frac{3\pi}{8}$ (d) none of these

40. If the angle 2θ is acute, then the acute angle between $x^2 (\cos\theta - \sin\theta) + 2xy \cos\theta + y^2 (\cos\theta + \sin\theta) = 0$

(a) θ (b) $\theta/2$

(c) $\frac{\theta}{3}$ (d) 2θ

41. If $4P(A = 6P(B) = 10 P (A \cap B) = 1$, then $P(B/A)$ is equal to:

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$

(c) $\frac{7}{10}$ (d) $\frac{19}{60}$

42. The solution of $\frac{d^2y}{ax^2} = \cos x - \sin x$ is:

(a) $y = -\cos x + \sin x + c_1x + c_2$
(b) $y = -\cos x - \sin x + c_1x + c_2$
(c) $y = \cos x - \sin x + c_1 x^2 + c_2x$
(d) $y = \cos x + \sin x + c_1x^2 + c_2 x$

43. $\lim_{n\to\infty} n \cos\frac{\pi}{4n} \sin\frac{\pi}{4n} = k$, then k is equal to:

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$

(c) π (d) none of these

44. If one-distance between a focus and corresponding directrix of an ellipse be 8 and the ecentricity be $\frac{1}{2}$, then the length of one minor axis is:

(a) 3 (b) $4\sqrt{2}$
(c) 6, (d) none of these

45. A circle is given by $x^2 + y^2 - 6x + 8y - 11 = 0$ and are two points (0, 0) and (1, 8). These points lie:

(a) both inside the circle
(b) both outside and one inside the circle
(c) both outside the cirlce
(d) one on and other inside the circle

46. $2x^2 + 7xy + 3y^2 + 8x + 14y + \lambda = 0$ will represent a pair of straight lines, whne λ is equal to:

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

47. The distance of middle point of the line joining the points (a sin θ, 0) and (0, a cos θ) from the origin is:

(a) $\frac{a}{2}$ (b) $\frac{1}{2}a(\sin\theta + \cos\theta)$

(c) a (sin θ + cos θ)

(d) a

48. If $\sin\alpha = \frac{1}{\sqrt{5}}$ and $\sin\beta = \frac{3}{5}$, then (β – α) lies in the interval:

(a) $\left[0, \frac{\pi}{4}\right]$ (b) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$

(c) $\left[\frac{3\pi}{2}, \pi\right]$ (d) $\left[\pi, \frac{5\pi}{4}\right]$

49. If $p_{n+1} = \sqrt{1/2(1+p_n)}$, then cos $\left(\frac{\sqrt{1-p_0^2}}{p_1 p_2 \ldots \infty}\right)$ is equal to:

(a) 1 (b) –1

(c) p_0 (d) $1/p_0$

50. The probability that a leap year selected at random contains either 63 Sudays or 53 Mondays is:

(a) $\frac{2}{7}$ (b) $\frac{4}{7}$ (c) $\frac{3}{7}$ (d) $\frac{1}{7}$

51. Three integers are chosen at random from the first 20 integers. The probability that their product is even, is:

(a) 2/19 (b) 3/29

(c) 17/19 (d) 4/29

52. If α, β, γ and a, b, c are complex numbers such that $\frac{\alpha}{a} + \frac{\beta}{b} + \frac{\gamma}{c} = 1 + i$ and $\frac{a}{\alpha} + \frac{b}{\beta} + \frac{c}{\gamma} = 0$ then the value of $\frac{\alpha^2}{a^2} + \frac{\beta^2}{b^2} + \frac{\gamma^2}{c^2}$ is equal to:

(a) 0 (b) –1

(c) $2i$ (d) – $2i$

53. If the complex number $z = x + iy$ is taken always $\frac{\pi}{4}$, then:

(a) $x^2 + y^2 - 2y = 1$

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

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

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

54. The complex numbers z_1, z_2, z_3 are vertices A, B, C of a parallelogram $ABCD$, the fourth vertex D is:

(a) $\frac{1}{2}(z_1 + z_2)$

(b) $\frac{1}{2}(z_1 + z_2 + z_3)$

(c) $(z_1 + z_3 - z_2)$

(d) $\frac{1}{4}(z_1 + z_2 + z_3 + z_4)$

55. If the equation $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have a common root, then the numerical value of $a + b$ is:

(a) 1 (b) 0

(c) – 1 (d) none of these

56. Ramesh and Mahesh solve an equation. In solving Ramesh commits a mistake in constant term and finds the roots 8 and 2. Mahesh commits a mistake in the coefficient of x and finds the roots – 9 and – 1. The correct roots are:

(a) – 8, 2 (b) 9, 1

(c) 9, – 1 (d) – 8, – 2

57. If [g (x)] = $ax + b$ and g (x) = $cx + d$, then f [g (x)] = g [f(x)] is equivalent to:

(a) $f(a) = g(c)$ (b) $f(c) = g(a)$

(c) $f(d) = g(b)$ (d) $f(b) = g(b)$

58. If the d.c's of the rays $\overrightarrow{AB}, \overrightarrow{AC}$ are $\left(\frac{6}{7}, \frac{2}{7}, \frac{-3}{7}\right)\left(\frac{1}{3}, \frac{2}{3}, \frac{-2}{3}\right)$ then the direction ratios of an angular bisector of $\overrightarrow{AB}, \overrightarrow{AC}'$ are:

(a) 25, 209, 23 (b) –23, 20, 23
(c) 25, 20, –23 (d) 25, – 20, 23

59. A plane is at a distance $3p$ from the origin and meets co-ordinates axis in A, B, C. The locus of centroid of ΔABC is:

(a) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$

(b) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{1}{p}$

(c) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{9}{p^2}$

(d) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{3}{p}$

60. If α, β are different values of θ satisfying $p \cos 2\theta + q \sin 2\theta = r$, then $\tan(\alpha+\beta)$ is equal to:

(a) $\frac{p}{q}$ (b) $\frac{q}{p}$ (c) $\frac{r}{p}$ (d) $\frac{r}{p}$

Directions: *The following FIVE items consists of two statements, one labelled the 'Assertion A' and the other labelled the 'Reason R'. You are to examine these two statements carefully and decide if the Assertion A and Reason R are individually true and if so, whether the reason is a correct exaplanation of the Assertion. Select your answer to these items using the codes given below.*

Code:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false
(d) A is false but R is true

61. Assertion (A): The product of three consecutive natural numbers is divisible by 6.

Reason (R): The product of n consecutive natural numbers is divisible by $n!$.

(a) A (b) B
(c) C (d) D

62. Assertion (A): Let $f(x) = [\cos x + \sin x]$, $0 < x < 2\pi$, where $[x]$ denotes the integral part of x then the $f(x)$ is discontinuous, at 5 points.

Reason (R): For $x = \frac{\pi}{2}, \frac{3\pi}{4}, \pi, \frac{4\pi}{4}, \frac{3\pi}{2}$ right hand limit not equal to left hand limit.

(a) A (b) B
(c) C (d) D

63. Assertion (A):

If $f(x) = \frac{(e^{kx}-1)\sin kx}{4x^2} (\neq 0)$ and $f(0) = 9$ is continuous at $x = 0$ then $k = \pm 6$.

Reason (R): For continuous function $\lim_{x\to 0} f(x) = f(0)$

(a) A (b) B
(c) C (d) D

64. Assertion (A): If $\alpha = 1 - s - t$, then the vector equation of the plane through three non-collinear points $\vec{r} = \alpha\vec{a} + s\vec{b} + t\vec{c}$.

Reason (R): Equation of the plane through three non-collinear points is $\vec{r} = (1-s-t)\vec{a} + s\vec{b} + t\vec{c}$.

(a) A (b) B
(c) C (d) D

65. **Assertion (A):** $f(x) = \frac{1}{x-[x]}$ is discontinuous for integral of x.

Reason (R): For integral values of x, $f(x)$ is undefined.

(a) A (b) B
(c) C (d) D

66. Consider the following statements:

(I) $\lim_{x\to\infty}\sqrt{\frac{x+\sin x}{x-\cos x}} = 1$

(II) $\lim_{x\to\infty}\frac{\sin(\pi\cos^2 x)}{x^2} = \pi$

Which of the above statement is correct?

(a) only I (b) only II
(c) both I and II (d) neither I nor II

67. The vertices of a triangle ABC are A (1, 1), B (–3, 4), C (2, – 5).

(I) The equation to the altitude through the vertex A is $5x + 9y + 4 = 0$

(II) The equation of the median through the vertex A is $x - y = 0$

(a) only (I)
(b) only (II)
(c) both (I) and (II)
(d) neither (I) nor (II)

68. Observe the following lists:

List-I	List-II
(a) Domain of $\sin^{-1}(5x)$	1. 1
(b) Range of $\sqrt{1-25x^2}$	2. x
(c) If $f(x) = \frac{x+1}{x-1}$, $x \neq 1$	3. $\left[-\frac{1}{5},\frac{1}{5}\right]$
(d) Period of $x - [x]$ is	4. $\left[0,\frac{1}{5}\right]$

Match the correct answer

Code:

	A	B	C	D
(a)	3	4	2	1
(b)	4	3	2	1
(c)	3	4	1	2
(d)	1	2	3	4

69. Observe the following lists:

List-I	List-II
(a) $\int_0^{\pi/4}(\tan^4+\tan^2 x)dx$	1. $\log\left(\frac{4}{3}\right)$
(b) $\int_0^1 \frac{x}{(1-x)^{5/4}}dx$	2. $\frac{1}{3}$
(c) $\int_0^{\pi/2}\sin^8 x\cos^2 x\,dx$	3. $-\frac{16}{3}$
(d) $\int_0^3 \frac{dx}{x^2-x}$	4. $\frac{7\pi}{512}$

Correct match for list-I from list-II is:

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	4	3	2	1
(d)	3	2	1	4

70. Observe the following lists:

List-I	List-II
(a) Angle between two diagonals	1. $\cos^{-1}\left(\frac{1}{2}\right)$
(b) Angle between one diagonal of a cube and a diagonal of one face	2. $\cos^{-1}\left(\sqrt{\frac{4}{6}}\right)$
(c) Angle between the rays wiht direction consine	3. $\cos^{-1}\left(\frac{2}{6}\right)$

4, – 3, 5 and 3, 4, 5.

Correct match for **list-I** from **list-2** is:

	A	B	C
(a)	1	2	3
(b)	3	2	1
(c)	3	1	1
(d)	2	3	1

71. A flat-staff of 5 m high stands on a building of 25 m high. At an observe at a height of 30 m. The flag staff and the building subtend equal angles. The distance of the observer from the top of the flag-staff is:

(a) $\frac{5\sqrt{3}}{2}$ (b) $5\sqrt{\frac{2}{3}}$

(c) $5\sqrt{\frac{3}{2}}$ (d) none of these

72. If p_1, p_2, p_3 are attitudes of a triangle ABC from the vertices A, B, C and Δ be the area of the triangle, then $p_1^{-1}+p_2^{-1}+p_3^{-1}$ is equal to:

(a) $\frac{a+b+c}{\Delta}$ (b) $\frac{a^2+b^2+c^2}{\Delta^2}$

(c) $\frac{a^2+b^2+c^2}{4\Delta^2}$ (d) none of these

73. The sides of a triangle are $3x + 4y$, $4x + 3y$ and $5x + 5y$ units, where $x, y > 0$, the triangle is :

(a) right angled

(b) equilateral

(c) obtuse

(d) none of the above

74. If $\tan\theta + \tan 2\theta + \tan 3\theta = \tan\theta \tan 2\theta \tan 3\theta$, then the general value of θ is:

(a) $n\pi$ (b) $\frac{n\pi}{6}$ (c) $n\pi \pm \frac{\pi}{3}$ (d) $\frac{n\pi}{2}$

75. $2\sin^2\beta + 4\cos(\alpha+\beta)\sin\alpha\sin\beta + \cos 2(\alpha+\beta)$ is equal to:

(a) $\sin 2\alpha$ (b) $\cos 2\beta$

(c) $\cos 2\alpha$ (d) $\sin 2\beta$

76. For $0 < \phi < \pi/2$, if $x = \sum_{n=0}^{\infty}\cos^{2n}\phi$, $y = \sum_{n=0}^{\infty}\sin^{2n}\phi$, $z = \sum_{n=0}^{\infty}\cos^{2n}\phi\sin^{2n}\phi$, then:

(a) $xyz = xz + y$ (b) $xyz = xy + z$

(c) $xyz \le x + y + z$ (d) $xyz = yz + x$

77. If $\cot\theta\tan\theta = m$ and $\sec\theta - \cos\theta = n$, then which of the following is correct:

(a) $m(mn^2)^{1/3} - n(nm^2)^{1/3} = 1$

(b) $m(m^2n)^{1/3} - n(nm^2)^{1/3} = 1$

(c) $n(mn^2)^{1/3} - m(nm^2)^{1/3} = 1$

(d) $n(m^2n)^{1/3} - m(mn^2)^{1/3} = 1$

78. If $\alpha + \beta - \gamma = \pi$, then $\sin 2\alpha + \sin^2\beta - \sin^2\gamma$ is equal to:

(a) $2\sin\alpha\sin\beta\sin\gamma$

(b) $2\cos\alpha\cos\beta\cos\gamma$

(c) $2\sin\alpha\sin\beta\cos\gamma$

(d) none of these

79. If $\sin A + \sin B = C$, $\cos A + \cos B = D$, then the value of $\sin(A + B)$ is equal to:

(a) CD (b) $\frac{2CD}{C^2+D^2}$

(c) $\frac{CD}{C^2+D^2}$ (d) $\frac{C^2+D^2}{2CD}$

80. The inverse of $\begin{bmatrix} 2 & -3 \\ -4 & 2 \end{bmatrix}$ is :

(a) $-\frac{1}{8}\begin{bmatrix} 2 & 3 \\ 4 & 2 \end{bmatrix}$ (b) $-\frac{1}{8}\begin{bmatrix} 3 & 2 \\ 2 & 4 \end{bmatrix}$

(c) $-\frac{1}{8}\begin{bmatrix} 2 & 2 \\ 4 & 2 \end{bmatrix}$ (d) $-\frac{1}{8}\begin{bmatrix} 3 & 2 \\ 2 & 4 \end{bmatrix}$

81. If the matrix $\begin{vmatrix} 0 & 1 & -2 \\ -1 & 0 & 3 \\ \lambda & -3 & 0 \end{vmatrix}$ is singular, then λ is equal to:

(a) -2 (b) -1
(c) 1 (d) 2

82. If $D_p = \begin{vmatrix} p & 15 & 8 \\ p^2 & 55 & 9 \\ p^3 & 225 & 10 \end{vmatrix}$, then $D_1 + D_2 + D_3 + D_4 + D_5$ is equal to:

(a) 0 (b) 25
(c) 625 (d) none of these

83. If A is a square matrix and $A + A^{-1}$ is symmetrix matric, then $A - A^T$ is equal to:

(a) unit matrix
(b) symmetric matrix
(c) skew-symmetric matrix
(d) zero matrix

84. In the determinant $= \begin{vmatrix} 0 & 1 & -2 \\ -1 & 0 & 3 \\ 2 & -3 & 0 \end{vmatrix}$, the ratio of the co-factor to its minor of the element -3 is:

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

85. $\begin{vmatrix} 1+i & 1-i & i \\ 1-i & i & 1+i \\ i & 1+i & 1-i \end{vmatrix}$ is equal to:

(a) $-4-7i$ (b) $4+7i$
(c) $3+7i$ (d) $7+4i$

86. If $x + y = 1$, then $\sum_{r=0}^{n} i^2 \, {}^nC_r x^r y^{n-r}$ equals:

(a) nxy (b) $nx(x + yn)$
(c) $nx(nx + y)$ (d) none of these

87. The equation $x^{\log_x (2+x)^2} = 25$ holds for:

(a) $x = 6$ (b) $x = -3$
(c) $x = 3$ (d) 7

88. The coefficient of x in the expansion of $[\sqrt{1+x^2} - x]^{-1}$ in ascending powers of x, when $|x| < 1$, is:

(a) 0 (b) $-\frac{1}{2}$ (c) $\frac{1}{2}$ (d) 1

89. The ratio of the coefficient of terms $x^{n-r}\ ax$ and $x^{rx}\ a^{n-r}$ in the binomial expansion of $(x + a)^n$ will be:

(a) $x : a$ (b) $n : r$
(c) $x : n$ (d) none of these

90. If $\alpha = {}^mC_2$, then ${}^{\alpha}C_2$ is equal to:

(a) ${}^{m+1}C_4$ (b) ${}^{m-1}C_4$
(c) $3.\ {}^{m+2}C_4$ (d) $3.\ {}^{m+1}C_4$

91. The value of k for which the quadratic equation $kx^2 + 1 = kx + 3x - 11x^2$ has real and equal roots are:

(a) $-11, -3$ (b) $5, -7$
(c) $5, 7$ (d) $-5, -7$

92. The number of ways in which the letters of the word ARRANGE can be arranged such that both R do not come together is:

(a) 360 (b) 900
(c) 1260 (d) 1620

93. If the roots of equation $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$ are equal in magnitude but opposite in sign, then the product of the roots will be:

(a) $\frac{p^2+q^2}{2}$ (b) $-\frac{(p^2+q^2)}{2}$

(c) $\frac{p^2-q^2}{2}$ (d) $-\frac{(p^2-q^2)}{2}$

94. If $a_1, a_2, a_3, ..., a_n$ are in A.P., where $a_i > 0$ for all i, then the value of

$$\frac{1}{\sqrt{a_1}+\sqrt{a_2}}+\frac{1}{\sqrt{a_2}+\sqrt{a_3}}+...+\frac{1}{\sqrt{a_{n-1}}+\sqrt{a_n}}$$

(a) $\frac{n-1}{\sqrt{a_1}-\sqrt{a_n}}$ (b) $\frac{n+1}{\sqrt{a_1}-\sqrt{a_n}}$

(c) $\frac{n+1}{\sqrt{a_1}-\sqrt{a_n}}$ (d) $\frac{n-1}{\sqrt{a_1}+\sqrt{a_n}}$

95. The sums of n terms of three A.P's whose first terms is 1 and common differences are 1, 2, 3 and S_1, S_2, S_3 respectively. The true relation is :

(a) $S_1 + S_2 = S_2$ (b) $S_1 + S_2 = 2S_2$
(c) $S_1 + S_2 = 2S_3$ (d) $S_1 + S_2 = S_3$

96. The maximum value of $|z|$, where z satisfies the condition $\left|z+\frac{2}{z}\right| = 2$ is:

(a) $\sqrt{3}-1$ (b) $\sqrt{3}+1$

(c) $\sqrt{3}$ (d) $\sqrt{2}+\sqrt{3}$

97. The equation $z\bar{z}+a\bar{z}+\bar{a}z+b = 0$, b ε R represents a circle if:

(a) $|a|^2 = b$ (b) $|a|^2 < b$
(c) $|a|^2 > b$ (d) none of these

98. If $z(1 + a) = b + ic$ and $a^2 + b^2 + c^2 = 1$, then $\frac{1+iz}{1-iz}$ is equal to:

(a) $\frac{a+ib}{1+c}$ (b) $\frac{a+ib}{1+b}$

(c) $\frac{b-ic}{1+a}$ (d) $\frac{b+ic}{1+b}$

99. For real numbers x and y, we write xRy $\Leftrightarrow$ $x - y + \sqrt{2}$ is an irrational number. Then the relation R is:

(a) reflexive (b) symmetric
(c) transitive (d) none of these

100. Find the solution set of $(x)^2 + (x + 1)^2 = 25$, where (x) is the least integer greater than equals to x:

(a) $[-5, -4] \cup (2, 3]$
(b) $(-5, -4) \cup (2, 3]$
(c) $(-5, -4) \cup (2, 3)$
(d) $(-5, -4] \cup [2, 3]$

ANSWERS

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