SCRA

Special Class Railway Apprentices Practice Paper

MATHEMATICS

1. If $A = \begin{vmatrix} \sin(\theta+\alpha) & \cos(\theta+\alpha) & 1 \\ \sin(\theta+\beta) & \cos(\theta+\beta) & 1 \\ \sin(\theta+\gamma) & \cos(\theta+\gamma) & 1 \end{vmatrix}$, then:

(a) $A = 0 \ \forall \ \theta$
(b) A is an add function of θ
(c) $A = 0$ for $\theta = \alpha + \beta + \gamma$
(d) A is indepedent of θ

2. If the line L in the $x - y$ plane and half the slope and twice the y-intercept of the line $y = \frac{2}{3}x + 4$, then an equation for L is:

(a) $y = \frac{1}{3}x + 8$ (b) $y = \frac{4}{3}x + 2$
(c) $y = \frac{1}{3}x + 4$ (d) $y = \frac{4}{3}x + 4$

3. Find the point on the ellipse $x^2 + 2y^2 = 6$ whose distance from the line $x + y = 7$ is least.

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

4. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + ... + C_nC^n$, then $C_0C_2 + C_1C_3 + C_2C_4 + ... + C_{n-2}\ C_n$ is equal to:

(a) $\frac{(2n)!}{(n!)^2}$ (b) $\frac{(2n)!}{(n-1)!(n+1)!}$
(c) $\frac{(2n)!}{(n-2)!(n+2)!}$ (d) none of these

5. The digit in the unit place of the number $(183)! + 3^{183}$ is:

(a) 0 (b) 3
(c) 6 (d) 7

6. If x, y, z are three consecutive positive integers, then $\frac{1}{2}\log_e x + \frac{1}{2}\log_e z + \frac{1}{2xz+1} + \frac{1}{3}\left(\frac{1}{2xz+1}\right)^3 + ...$ is equal to:

(a) $\log_e x$ (b) $\log_e y$
(c) $\log_e z$ (d) none of these

7. The equation of the normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the end of the latus rectum is:

(a) $x + ey + e^3 a$ (b) $x - ey - e^3 a$
(c) $x - ey - c^2 a$ (d) none of these

8. If $\int x^6 \sin(5x)^7\, dx = \frac{k}{5}\cos(5x^7)$, then:
(a) $k = 7$ (b) $k = -7$
(c) $k = \frac{1}{7}$ (d) $k = -\frac{1}{7}$

9. A particle moves in a straight line with a velocity by $\frac{dx}{dt} = x + 1$. (x is the distance described). The time taken by a particle to transverse a distance of 99 metres is:
(a) $\log_{10} e$ (b) $2\log_{10} e$
(c) $\frac{1}{2}\log_{10} e$ (d) $2\log_e 10$

10. Order and degree of the differential equation $\frac{d^2y}{dx^2} = \left[y + \left(\frac{dy}{dx}\right)^2\right]^{1/4}$ are:
(a) 4 and 2 (b) 1 and 2
(c) 1 and 4 (d) 2 and 4

11. The general solution of the differential equation $(1 + \tan y)(dx - dy) + 2x\, dy = 0$
(a) $x(\sin y + \cos y) = \sin y + ce^{y}$
(b) $x(\sin y + \cos y) = \sin y + ce^{-y}$
(c) $y(\sin x + \cos x) = \sin x + ce^{x}$
(d) none of these

12. The equation $\int_{-\pi/4}^{\pi/4}\left[\lambda|\sin|x| \frac{\mu \sin x}{1+\cos x} + v\right] dx = 0$
where λ, μ v are constants, given a relation between:
(a) λ, μ and v (b) μ and v
(c) λ and v (d) λ and μ

13. If $A(t) = \int_{-t}^{t} e^{-|x|}dx$, then $\lim_{t\to\infty} A(t)$ is equal to:
(a) 0 (b) 2
(c) – 2 (d) 4

14. $\int \frac{\sin x}{\sin(x-a)} dx$ is equal to:
(a) $(x - a)\cos a + \sin a \log \sin(x - a) + c$
(b) $\sin(x - a) + \sin x + c$
(c) $(x - a)\cos x + \log \sin(x - a) + c$
(d) $\cos(x - a) + \cos x + c$

15. $\int \frac{\sin x}{3 + 4\cos^2 x} dx$ is equal to:
(a) $-\frac{1}{2\sqrt{3}}\tan^{-1}\left(\frac{2\cos x}{\sqrt{3}}\right) + c$
(b) $\frac{1}{2\sqrt{3}}\tan^{-1}\left(\frac{2\cos x}{\sqrt{3}}\right) + c$
(c) $\log(3 + 4\cos^2 x) + c$
(d) $-\frac{1}{2\sqrt{3}}\tan^{-1}\left(\frac{\cos x}{\sqrt{3}}\right) + c$

16. The subtangent, ordinate and subnormal to the parabola $y^2 = 4ax$ at a point (different from the origin) are in:
(a) G.P (b) A.P
(c) H.P (d) none of these

17. The side of an equilateral triangle are increasing at the rate of 2 cm/sec. The rate at which the area increases, when the side is 10 cm is:
(a) $\sqrt{3}$ sq. units/sec.
(b) 10 sq. units/sec.
(c) $10\sqrt{3}$ sq. units/sec.
(d) $10\sqrt{2}$ sq. units/sec.

18. The points on the curve $y = x^3 - 3x$ as which the normals are parallel to the line $2x + 18y = 9$ are:
(a) (2, –2) (b) (2, 2)
(c) (2, –2), (–2, 2) (d) (2, 2), (–2, –2)

19. The function f is differentiable with f (1) = 8 anf f' (1) $= \frac{1}{8}$. If f is invertible and $g = f^{-1}$, then:

(a) $g'(1) = 8$ (b) $g'(1) = \frac{1}{8}$

(c) $g'(g) = 8$ (d) $g'(g) = \frac{1}{8}$

20. If $\sin(x + y) = \log(x + y)$, then $\frac{dy}{dx}$ is equal to:

(a) – 1 (b) 1

(c) – 2 (d) 2

21. Let f and g be differentiable functions satisfying $g'(a) = 2$, $g(a) = 6$ and $fog = 1$ (identity function). Then $f'(b)$ is equal to:

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

(c) 2 (d) none of these

22. $\lim_{\theta \to \frac{\pi}{2}} \frac{1-\sin\theta}{\left(\frac{\pi}{2}-\theta\right)\cos\theta}$ is equal to:

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

23. Let $f(x) = |x| \cos\frac{1}{x} + 15x^2$, $x \neq 0$

$= k$, $x = 0$, then $f(x)$ is

continuous at $x = 0$ if k is equal to:

(a) 15 (b) – 15

(c) 0 (d) 6

24. If the domain of the function $f(x) = x^2 - 6x + 7$ is $(-\infty, \infty)$, then the range to function is:

(a) $(-\infty, \infty)$ (b) $(-2, 3)$

(c) $(-\infty, -2)$ (d) $[-2, \infty)$

25. If $f(x) = 1 - \frac{1}{x}$ then $f(f(x))$ is:

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

26. The domain of the function $y = 3e^{\sqrt{x^2-1}}$ log $(x - 1)$ is:

(a) $(1, \infty)$ (b) $[1, \infty)$

(c) set of all reals different from 1

(d) $(-\infty, -1) \cup (1, \infty)$

27. The probability that a teacher will give an unannounced test during any class meeting is $\frac{1}{5}$. If a student is absent twice, then the probability that the student will miss atleast one test is:

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$ (c) $\frac{9}{25}$ (d) $\frac{7}{75}$

28. A natural number x is chosen at random from the first 100 natural number. The probability that $x + \frac{100}{x} > 50$ is:

(a) $\frac{1}{10}$ (b) $\frac{11}{50}$

(c) $\frac{11}{20}$ (d) none of these

29. A and B are two independent events the probability then both A and B occur is 1/8 and the probability that neither of them occurs is 3/8. The probability of the occurence of the event A is:

(a) 1/3 (b) 1/4 (c) 1/5 (d) 1/8

30. If the planes $x + 2y + kz = 0$ and $2x + y - 2z = 0$ are at right angles, then the value of k is:

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

31. If the vectors $a\hat{i}+\hat{j}+\hat{k}$, $\hat{i}+b\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+c\hat{k}$ ($a \neq 1$, $b \neq 1$, $c \neq 1$) are coplanar, then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is :

(a) 0 (b) 1
(c) 2 (d) none of these

32. If $\vec{A} = (1, 1, 1)$, $\vec{C} = (0, 1, -1)$ are two given vectors, then a vector B satisfying the equation $\vec{A}\times\vec{B} = \vec{C}$ and $\vec{A}\cdot\vec{B} = 3$ is:

(a) $\left(\frac{5}{3},\frac{2}{3},\frac{2}{3}\right)$ (b) $\left(-\frac{5}{3},\frac{2}{3},\frac{2}{3}\right)$

(c) $\left(\frac{5}{3},\frac{-2}{3},\frac{2}{3}\right)$ (d) $\left(\frac{5}{3},\frac{2}{3},\frac{-2}{3}\right)$

33. If $\vec{a},\vec{b},\vec{c}$ are three non-copalnar vectors, then $[\vec{a}+\vec{b}+\vec{c}, \vec{a}-\vec{c}, \vec{a}-\vec{b}]$ is equal to

(a) $-3[\vec{a}\,\vec{b}\,\vec{c}]$ (b) $-2[\vec{a}\,\vec{b}\,\vec{c}]$

(c) $2[\vec{a}\,\vec{b}\,\vec{c}]$ (d) $4[\vec{a}\,\vec{b}\,\vec{c}]$

34. If the unit vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle 2θ such that $|\vec{a}-\vec{b}| < 1$ and $0 \le \theta \le \pi$, then θ lies in the interval:

(a) $\left[0,\frac{\pi}{6}\right]$ or $\left[\frac{5\pi}{6},\pi\right]$ (b) $\left[\frac{\pi}{6},\pi\right]$

(c) $\left[\frac{\pi}{6},\frac{\pi}{2}\right]$ (d) $\left[\frac{\pi}{2},\frac{5\pi}{3}\right]$

35. If A and B are square matrices of the same order and A is not singular then for a positive integer n $(A^{-1} BA)$" is equal to:

(a) $A^{-n} B^n A^n$ (b) $A^n B^n A^{-n}$
(c) $A^{-1} B^n A$ (d) $(A^{-1} BA)$

36. If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $I = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and

$B = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ then B equals:

(a) I $\cos\theta + I\sin\theta$
(b) $I\sin\theta + I\cos\theta$
(c) I $\cos\theta - I\sin\theta$
(d) $-$ I $\cos\theta + I\sin\theta$

37. The value of λ for which the following system of equations does not have solution.

$$x + y + z = 0$$
$$4x + \lambda y - \lambda z = 0$$
$$3x + 2y - 4z = -8$$

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

38. If $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$ and $A^2 = I$, then x is equal to:

(a) 0 (b) 1
(c) 2 (d) 4

39. ${}^aC_0 + (a + b)\,C_1 + (a + 2b)\,C_2 + ... + (a +$ **n**$b)\,C_n$ is equal to:

(a) $(2n + nb)\,2^n$ (b) $(2a + nb)\,2^{n-1}$
(c) $(na + 2b)2^n$ (d) $(na + 2b)\,2^{n-1}$

40. The first the terms in the expansion of $(1 + ax)$" $(n \neq 0)$ are 1, $6x$ and $16x^2$. Then the values of a and n are respectively.

(a) 2 and 9 (b) 3 and 2

(c) $\frac{2}{3}$ and 9 (d) $\frac{3}{2}$ and 6

41. Observe the following lists:

List I	List II
(A) A is a matrix such that $A^2 = A$	(1) Nilpotent matrix
(B) A is square matrix such that $A^m = 0$	(2) Involutary matrix

(C)	A is a square matrix $A^2 = 1$	(3)	Symmetric matrix
(D)	A is a square matrix	(4)	Idempotent matrix such that $A^T = A$

The correct match for List I from List II is:

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

42. Observe the following lists:

List I	List II
(a) $\int_{-4}^{-5} e^{(x+5)^2} dx + 3\int_{1/3}^{2/3} e^{9\left(x-\frac{2}{3}\right)^2} dx$	(1) 0
(b) $\int_{-2}^{2} [x] dx$	(2) 2 π
(c) $\int_{-1}^{3}\left[\tan^{-1}\left(\frac{x^2+1}{x}\right) + \tan^{-1}\left(\frac{x}{1+x^2}\right)\right]$	(3) – 2
(d) The greater of $\int_0^{\pi/2} \frac{\sin x}{x} dx$ and $\pi/2$	(4) π/2

The correct match for List I from List II is:

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

43. Consider the following statements:

I. $f(x) = \frac{x}{1+|x|}$ is differentiable for x ε R.

II. $f(x) = |x^2 - 5x + 6|$ is not differentiable at $x = 2$.

Which of the above statement is correct?

(a) only I (b) only II
(c) both I and II (d) neither I and II

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 explanation of the Assertion. Select your answer to these items using the codes given below.*

Code:

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

44. Assertion (A): Let $f: R \to R$ be a function such that $f(x) = x^3 + x^2 + 3x + \sin x$. Then f is one-one.

Reason (R): $f(x)$ is an strictly increasing function.

Which of the above statement is correct?

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

45. Assertion (A): If $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} - \hat{k}$, then $(a + b, a - b) = 90°$.

Reason (R): Projection of $\vec{a} + \vec{b}$ on $\vec{a} - \vec{b}$ is zero.

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

46. Assertion (A): The function $f(t)$: $\frac{1-\cos(1-\cos t)}{t^4}$ is continuous every where then $f(0) = \frac{1}{8}$.

Reason (R): For continuous function $f(0) \neq \lim_{t \to 0} f(t)$.

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

47. Assertion (A): The circle described on the segment joining the points (–2, –1), (0, –3) as diameter cuts the circle $x^2 + y^2 + 5x + 4 = 0$ orthogonally.

Reason (R): (–2, –1) and (0, –3) are conjugate points w.r.t. the circle $x^2 + y^2 + 5x + y + 4 = 0$

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

48. Assertion (A): The minimum value of the expression $x^2 + 2bx + c$ is $c - b^2$.

Reason (R): The first order derivative of the expression at $x = -b$ is zero.

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

49. Consider the following statements:

I. $\int \frac{\sin 5x}{\cos 7x \cos 2x} dx$ is equal to $\frac{1}{7} \log |\sec 7x| - \frac{1}{2} \log |\sec 2x| + c$

II. $\int \sqrt{1 + \sec x}\, dx$ is equal to $2\cos^{-1}\left(\sqrt{2} \sin \frac{x}{2}\right) + c$

Which of the above statements is correct?

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

49. Consider the following statements:

I. The area of the triangle formed by $\left(1, \frac{\pi}{6}\right), \left(2, \frac{\pi}{3}\right)$ and $\left(2 \frac{\pi}{2}\right)$ is $2 - \sqrt{3}$

II. The randius of the circle $r^2 - 4r(\sqrt{3} \cos\theta + \sin\theta) + 7 = 0$

is which of the statement is correct:

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

51. If $\vec{a} = \hat{i} + \hat{j} + \hat{k},\ \vec{b} = \hat{i} + \hat{j},\ \vec{c} = \hat{i}$ and $(\vec{a} \times \vec{b}) \times \vec{c} = \lambda\vec{a} + \mu\vec{b}$, then $(\lambda + \mu)$ is equal to:

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

52. If D, E, F are respectively the mid points of AB, AC and BC in $\Delta\ ABC$, then $\overrightarrow{BE} + \overrightarrow{AF}$ is equal to:

(a) $\overrightarrow{DC}$ (b) $\frac{1}{2}\overrightarrow{BF}$

(c) $2\overrightarrow{BF}$ (d) $\frac{3}{2}\overrightarrow{BF}$

53. The line $y = mx + c$ touches the parabola $x^2 = 4ay$ if :

(a) c = – am (b) $c = -\frac{a}{m}$

(c) $c = -am^2$ (d) $c = \frac{a}{m^2}$

54. Maximum area of an isosceles triangle inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with the vertex at one end of the major axis is:

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

(c) $\frac{5\sqrt{3}}{4}ab$ (d) none of these

55. The equation of chord joining two points (x_1, y_1) and (x_2, y_2) on the rectangular hyperbola $xy = c_2$ is:

(a) $\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$

(b) $\frac{x}{x_1 - x_2} + \frac{y}{y_1 - y_2} = 1$

(c) $\frac{x}{y_1 + y_2} + \frac{y}{x_1 + x_2} = 1$

(d) $\frac{x}{y_1 - y_2} + \frac{y}{x_1 - x_2} = 1$

56. If the line joining of foci subtends an angle of 90° at an exterimity of minor axis, then eccentricity e is:

(a) $\frac{1}{\sqrt{6}}$ (b) $\frac{1}{\sqrt{3}}$

(c) $\frac{1}{\sqrt{2}}$ (d) none of these

57. The lengths of the chord joining the points in which the straight line $\frac{x}{3}+\frac{y}{4}=1$ cuts the circle $x^2 + y^2 = \frac{169}{25}$ is:

(a) 1 (b) 2
(c) 4 (d) 8

58. Matrix theory was introduced by:

(a) Newton (b) Calay-Hamilton
(c) Cauchy (d) Euclid

59. If $\theta \sin^{-1} x + \cos^{-1} x - \tan^{-1} x$, $x \geq 0$, then the smallest interval in which θ lies is:

(a) $\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{4}$ (b) $0 < \theta < \pi$

(c) $-\frac{\pi}{4} \leq \theta \leq 0$ (d) $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}$

60. The equation $\sin x + \sin y + \sin z = -3$ for $0 \leq x \leq 2\pi$, $0 \leq y \leq 2\pi$, $0 \leq z \leq 2\pi$, has:

(a) one solution
(b) two sets of solution
(c) four sets of solution
(d) no solution

61. If α, β ($\alpha \neq \beta$), satisfies the equation a cos θ + b sin θ = c, then the value of tan $\left(\frac{\alpha+\beta}{2}\right)$ is :

(a) $\frac{b}{a}$ (b) $\frac{c}{a}$ (c) $\frac{a}{b}$ (d) $\frac{c}{b}$

62. Convert Binary number 110011011 in decimal system:

(a) 402 (b) 411 (c) 456 (d) 481

63. If ω is a complex root of unity, then the value of $\frac{p+q\omega+r\omega^2}{r+p\omega+q\omega^2}+\frac{p+q\omega+rw^2}{q+r\omega+p\omega r}$, ($p$, q, r are real) is equal to

(a) 0 (b) 1
(c) –1 (d) 2

64. Find the area bounded by the curves $y = |x - 1|$ and $y = 3 - |x|$ is equal to:

(a) $\frac{1}{2}$ sq. units (b) $\frac{4}{3}$ sq. units

(c) 4 sq. units (d) 2 sq. units

65. Find the condition that the equation $ax^3 + bx^2 + cx + d = 0$ have all roots are equal to:

(a) $a^3c - b^3d$ (b) $ac^3 - b^3d$
(c) $ac^3 - bd^3$ (d) $a^3c - bd^3$

66. sin 47° – sin 25° + sin 61° – sin 11° is equal to:

(a) cos 7° (b) sin 7°
(c) 2 cos 7° (d) 2 sin 7°

67. If α, β, γ are the roots of the equation x3 + 4x + 1 = 0 then $(\alpha+\beta)^{-1} + (\beta+\gamma)^{-1} + (\gamma+\alpha)^{-1}$ is equal to:

(a) 2 (b) 3
(c) 4 (d) 5

68. A bag C contains 3 white and 3 black balls and another bag Y contains 4 white and 2 black balls, one bag is selected at random and a ball is drawn from it. Then the probability for the ball chosen be white is:

(a) 2/15 (b) 7/15
(c) 8/15 (d) 14/15

69. If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, then $I_n - n\, I_{n-1}$ is equal to:

(a) n (b) $n - 1$
(c) $n!$ (d) $(n - 1)!$

70. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} = \vec{b} + \vec{c}$ and the angle between b and c is $\pi/2$, then:
(a) $a^2 = b^2 + c^2$ (b) $b^2 = c^2 + a^2$
(c) $c^2 = a^2 + b^2$ (d) $2a^2 - b^2 = c^2$

71. The greatest of the numbers 1, $2^{1/2}$, $3^{1/3}$, $4^{1/4}$, $5^{1/5}$, $6^{1/6}$ and $7^{1/7}$ is:
(a) $2^{1/2}$ (b) $3^{1/3}$
(c) $7^{1/7}$ (d) all are equal

72. The straight line $x + y - 5 = 0$, $x = 3$ and $y = 3$ form a triangle. The ratio of the sides is:
(a) 1 : 1 : 1 (b) $\sqrt{2}:\sqrt{2}:1$
(c) $\sqrt{2}:1:1$ (d) 1 : 2 : 3

73. Orthocentre of the triangle formed by joining the points $\left(3,\frac{1}{3}\right),\left(4,\frac{1}{4}\right)$ and $\left(5,\frac{1}{5}\right)$ is:
(a) $\left(-\frac{1}{60},60\right)$ (b) $\left(-\frac{1}{60},-60\right)$
(c) $\left(-\frac{1}{24},-24\right)$ (d) none of these

74. A square matrix can always be expressed as a:
(a) sum of symmetric matrix and a skew symmetric matrix
(b) sum of a diagonal matrix and symmetric matrix
(c) skew matrix
(d) skew symmetric matrix

75. The solution set of the equation
$$\begin{vmatrix} 2 & 3 & x \\ 2 & 1 & x^2 \\ 6 & 7 & 3 \end{vmatrix} = 0 \text{ is:}$$
(a) ϕ (b) {0, 1}
(c) (1, –1) (d) {1, –3}

76. If $S_r = \begin{vmatrix} 2r & x & n(n+1) \\ 6r^2-1 & y & n^2(2n+3) \\ 4r^3-2nr & z & n^3(n+1) \end{vmatrix}$, then the value of $\sum_{r=1}^{n} S_r$ is independent of :
(a) x only (b) y only
(c) x, y, z, n (d) n only

77. If in the expansion of $(1 + x)^n$, co-efficient of 2nd, 3rd and 4th terms are in A.P, then x is equal to:
(a) 5 (b) 6
(c) 4 (d) 7

78. A parallelograms is cut by two sets of m lines parallel to its sides. The number of parallelograms then formed is:
(a) $({}^{m}C_2)^2$ (b) $({}^{m+1}C_2)^2$
(c) $({}^{m+2}C_2)^2$ (d) none of these

79. The number of ways in which a committee of 6 members can be formed from 8 gentlemen and 4 ladies so that the committee contains at least 3 ladies is:
(a) 420 (b) 444
(c) 252 (d) 672

80. If $\frac{a+b}{1-ab}, b, \frac{b+c}{1-bc}$ are in A.P, then $a, \frac{1}{b}, c$ are in:
(a) A.P. (b) G.P.
(c) H.P. (d) none of these

81. If $1+\frac{1+2}{2}+\frac{1+2+3}{3}+\ldots$ to n terms is S, then S is equal to:
(a) $\frac{n(n+3)}{4}$ (b) $\frac{n(n+2)}{4}$
(c) $\frac{n(n+1)(n+2)}{6}$ (d) n^2

82. If α, β are the roots of the equation $x^2 - ax + b = 0$ and $A_n = \alpha^n + \beta^n$. Then which of the following is true?
(a) $A_{n+1} = aA_n + bA_{n-1}$
(b) $A_{n+1} = bA_n + aA_{n-1}$
(c) $A_{n+1} = aA_n - bA_{n-1}$
(d) $A_{n+1} = bA_n - aA_{n-1}$

83. The value of p for which both the roots of the equation $4x^2 - 20px + (25p^2 + 15p - 66) = 0$ are less than 2, lies in:
(a) $(2, \infty)$ (b) $\left(\frac{4}{5}, 2\right)$
(c) $\left(-1, \frac{4}{5}\right)$ (d) $(-\infty, -1)$

84. If two towers of heights h_1 and h_2 subtend angles 60° and 30° respectively at the midpoint of the line joining their feet than $h_1 : h_2$ is equal to:
(a) 1 : 2 (b) 1 : 3
(c) 2 : 1 (d) 3 :1

85. If $\cos P = \frac{1}{7}$ and $\cos Q = \frac{13}{14}$, where P and Q both are acute angles. Then the value of $P - Q$ is :
(a) 30° (b) 60°
(c) 45° (d) 75°

86. If $\sec\theta - \tan\theta = \frac{a+1}{a-1}$, then $\cos\theta$ is equal to:
(a) $\frac{a^2+1}{a^2-1}$ (b) $\frac{a^2-1}{a^2+1}$
(c) $\frac{2a}{a^2+1}$ (d) $\frac{2a}{a^2-1}$

87. The lines $x\cos\alpha + y\sin\alpha = p_1$ and $x\cos\beta + y\sin\beta = p_2$ will be perpendicular if:
(a) $\alpha = \beta$ (b) $|\alpha - \beta| = \frac{\pi}{2}$
(c) $\alpha = \frac{\pi}{2}$ (d) $\alpha \pm \beta = \frac{\pi}{2}$

88. If for a variable line $\frac{x}{a} + \frac{y}{b} = 1$, then condition $a^{-2} + b^{-2} = c^{-2}$ (c is constant) is satisfied, then the locus of foot of the perpendicular drawn from the origin to this is:
(a) $x^2 + y^2 = \frac{c^2}{2}$ (b) $x^2 + y^2 = 2c^2$
(c) $x^2 + y^2 = c^2$ (d) $x^2 - y^2 = c^2$

89. If $x = a + b$, $y = a\omega + b\omega^2$, $z = a\omega^2 + b\omega$, then xyz equals:
(a) $(a + b)^3$ (b) $a^3 - b^3$
(c) $a^3 + b^3$
(d) $(a + b)^3 - 3ab(a + b)$

90. If z_1 and z_2 both satisfy $z + \bar{z} = 2|z - 1|$ and $\arg(z_1 - z_2) = \frac{\pi}{4}$, then the imaginary part of $(z_1 + z_2)$ is:
(a) 0 (b) 1
(c) 2 (d) none of these

91. If the cube roots of unity are 1, ω, ω², then the roots of the equation $(x - 1)^3 + 8 = 0$ are:
(a) $-1, 1 + 2\omega, 1 + 2\omega^2$
(b) $-1, 1 - 2\omega, 1 - 2\omega^2$
(c) $-1, -1, -1$
(d) none of the above

92. The average of n numbers $x_1, x_2, x_3, \ldots x_n$ is M. If x_n is replaced by x', the new average is:
(a) $M - x_n + x'$ (b) $\frac{nM - x_n + x'}{n}$
(c) $\frac{(n-1)M + x'}{n}$ (d) $\frac{M - x_n + x'}{n}$

93. The S.D. of a variate x is σ. Tnen the S.D. of the variate $\frac{ax+b}{c}$, where a, b, c are constant, is:

(a) $\left(\frac{a}{c}\right)\sigma$ (b) $\left|\frac{a}{c}\right|\sigma$

(c) $\left(\frac{a^2}{c^2}\right)\sigma$ (d) none of these

94. The equation of the line through the points (1, 2, 3) parallel to line $\frac{x-4}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$ are:

(a) $\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z-3}{8}$

(b) $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$

(c) $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$

(d) none of these

95. The equation of the sphere concentric with the sphere $x^2 + y^2 + z^2 - 4x - 6y - 8z = 0$, and which passes through (0, 1, 0) is:

(a) $x^2 + y^2 + z^2 - 4x - 6y - 8z + 1 = 0$
(b) $x^2 + y^2 + z^2 - 4x - 6y - 8z + 5 = 0$
(c) $x^2 + y^2 + z^2 - 4x - 6y - 5z + 2 = 0$
(d) $x^2 + y^2 + z^2 - 4x - 6y - 5z + 3 = 0$

96. If $|\alpha + \beta| = |\alpha - \beta|$, then:
(a) α is parallel to β
(b) α is perpendicular to β
(c) $\alpha = \frac{1}{2}\beta$
(d) angle between α and β is $\pi/3$

97. If $\vec{a}+\vec{b}+\vec{c}\ \alpha\vec{d}$, $\vec{b}+\vec{c}+\vec{d} = \beta\vec{a}$, and $\vec{a}+\vec{b}+\vec{c}$ are non-copalnar, then $a + b + c + d$ is equal to:
(a) 0 (b) α, a
(c) βb (d) (α + β) c

98. If G is the centriod of a triangle ABC, then $\overrightarrow{GA}+\overrightarrow{Gb}+\overrightarrow{GC}$ is equal to:
(a) 0 (b) $3\overrightarrow{GA}$
(c) $3\overrightarrow{Gb}$ (d) $\overrightarrow{GC}$

99. The shaded region in the given figure is:
(a) $A - (B \cup C)$ (b) $(B \cap C) - A$
(c) $A \cap (B \cap C)$ (d) $A \cap (B \cup C)$

100. If $A = \{(x, y) : x^2 + y^2 = 25\}$ and $B = \{(x, y) : x^2 + 9y^2 = 144\}$ then $A \cap B$ contains:
(a) one point (b) three points
(c) two points (d) four points

ANSWERS

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