Choose the correct or the most suitable answer from the given four alternatives:

1. If A = $\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$, then $|adj(AB)|$ =

(1) -40 (2) – 80 (3) – 60 (4) – 20

2. If A is a non-singular matrix such that $A^{-1} = \begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$, then $(A^T)^{-1}$ =

(1) $\begin{bmatrix} -5 & 3 \\ 2 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$ (3) $\begin{bmatrix} -1 & -3 \\ 2 & 5 \end{bmatrix}$ (4) $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

3. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is

(1) 1 (2) 2 (3) 4 (4) 3

4. If $\rho(A) = \rho([A|B])$, then the system AX=B of linear equations is

(1) consistent and has a unique solution (2) consistent

(3) consistent and has infinitely many solution (4) inconsistent

5. If A^TA^{-1} is symmetric , then A^2 =

(1) A^{-1} (2) $(A^T)^2$ (3) A^T (4) $(A^{-1})^2$

6. The area of the triangle formed by the complex numbers $z, i\,z$ and $z + i\,z$ in the Argand's diagram is

(1) $\frac{1}{2}|z|^2$ (2) $|z|^2$ (3) $\frac{3}{2}|z|^2$ (4) $2|z|^2$

7. If $|\,z\,| = 1$, then the value of $\frac{1+z}{1+\bar{z}}$ is

(1) z (2) $\bar{z}$ (3) $\frac{1}{z}$ (4) 1

8. If $|\,z_1\,| = 1, |\,z_2\,| = 2, |\,z_3| = 3$ and $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 12$, then the value $|z_1 + z_2 + z_3|$ is

(1) 1 (2) 2 (3) 3 (4) 4

9. The principal argument of the complex number $\frac{(1+i\sqrt{3})^2}{4i(1-i\sqrt{3})}$ is

(1) $\frac{2\pi}{3}$ (2) $\frac{\pi}{6}$ (3) $\frac{5\pi}{6}$ (4) $\frac{\pi}{2}$

10. If $\omega \neq 1$ is a cubic root of unity and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2 - 1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix} = 3k$, then k is equal to

(1) 1 (2) -1 (3) $\sqrt{3}i$ (4) $-\sqrt{3}i$

11. A zero of $x^3 + 64$ is

(1) 0 (2) 4 (3) $4i$ (4) -4

12. If $x^3 + 12x^2 + 10ax + 1999$ definitely has a positive zero, if and only if

(1) $a \geq 0$ (2) $a > 0$ (3) $a < 0$ (4) $a \leq 0$

13. If $sin^{-1}x + sin^{-1}y = \frac{2\pi}{3}$; then $cos^{-1}x + cos^{-1}y$ is equal to

(1) $\frac{2\pi}{3}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{6}$ (4) π

14. The domain of the function defined by $f(x) = sin^{-1}\sqrt{x-1}$ is

(1) [1 ,2] (2) $[-1,1]$ (3) [0,1] (4) $[-1,0]$

15. $tan^{-1}\left(\frac{1}{4}\right) + tan^{-1}\left(\frac{2}{9}\right)$ is equal to

(1) $\frac{1}{2}\,cos^{-1}\left(\frac{3}{5}\right)$ (2) $\frac{1}{2}\,sin^{-1}\left(\frac{3}{5}\right)$ (3) $\frac{1}{2}\,tan^{-1}\left(\frac{3}{5}\right)$ (4) $tan^{-1}\left(\frac{1}{2}\right)$

16. The equation $tan^{-1}x - cot^{-1}x = tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

(1) no solution (2) unique solution

(3) two solutions (4) infinite number of solutions

17. The equation of the circle passing through (1,5) and (4,1) and touching y -axis is

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$x^2+y^2-5x-6y+9+\lambda(4x+3y-19)=0$,where λ is equal to

(1) $0,-\frac{40}{9}$ (2) 0 (3) $\frac{40}{9}$ (4) $-\frac{40}{9}$

18. The centre of the circle inscribed in a square formed by the lines $x^2-8x-12=0$ and $y^2-14y+45=0$ is

(1) (4,7) (2) (7,4) (3) (9,4) (4) (4,9)

19. If the normals of the parabola $y^2=4x$ drawn at the end points of its latus rectum are tangents to the circle $(x-3)^2+(y+2)^2=r^2$, then the value of r^2 is

(1) 2 (2) 3 (3) 1 (4) 4

20. Let C be the circle with centre at (1,1) and radius =1. If T is the circle centered at $(0,y)$ passing through the origin and touching the circleC externally, then the radius of T is equal to

(1) $\frac{\sqrt{3}}{\sqrt{2}}$ (2) $\frac{\sqrt{3}}{2}$ (3) $\frac{1}{2}$ (4) $\frac{3}{4}$

21. If the two tangents drawn from a point P to the parabola $y^2=4x$ are at right angles then the locus of P is

(1) $2x+1=0$ (2) $x=-1$ (3) $2x-1=0$ (4) $x=1$

22. If the length of the perpendicular from the origin to the plane $2x+3y+\lambda z=1$, $\lambda>0$ is $\frac{1}{5}$, then the value of λ is

(1) $2\sqrt{3}$ (2) $3\sqrt{2}$ (3) 0 (4) 1

23. The distance between the planes $x+2y+3z+7=0$ and $2x+4y+6z+7=0$ is

(1) $\frac{\sqrt{7}}{2\sqrt{2}}$ (2) $\frac{7}{2}$ (3) $\frac{\sqrt{7}}{2}$ (4) $\frac{7}{2\sqrt{2}}$

24. The angle between the lines $\frac{x-2}{3}=\frac{y+1}{-2}=z=2$, and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+5}{2}$ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

25. If $\vec{a},\vec{b},\vec{c}$ are three non-coplanar vectors such that $\vec{a}\cdot(\vec{b}\times\vec{c})=\frac{\vec{b}+\vec{c}}{\sqrt{2}}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(1) $\frac{\pi}{2}$ (2) $\frac{3\pi}{4}$ (3) $\frac{\pi}{4}$ (4) π

26. If $[\vec{a},\vec{b},\vec{c}]=1$ then the value of $\frac{\vec{a}\cdot(\vec{b}\times\vec{c})}{(\vec{c}\times\vec{a})\cdot\vec{b}}+\frac{\vec{b}\cdot(\vec{c}\times\vec{a})}{(\vec{a}\times\vec{b})\cdot\vec{c}}+\frac{\vec{c}\cdot(\vec{a}\times\vec{b})}{(\vec{c}\times\vec{b})\cdot\vec{a}}$ is

(1) 1 (2) −1 (3) 2 (4) 3

27. A stone is thrown up vertically. The height it reaches at time t seconds is given by x = 80t – 16t^2. The stone reaches the maximum height in time t seconds is given by

(1) 2 (2) 2.5 (3) 3 (4) 3.5

28. The point on the curve 6y = x^3 + 2 at which y-coordinate changes 8 times as fast as x-coordinate is

(1) (4,11) (2) (4,-11) (3) (-4,11) (4) (-4,-11)

29. The maximum slope of the tangent to the curve y = $e^x \sin x$, x ∈ $[0,2\pi]$ is at

(1) x = $\frac{\pi}{4}$ (2) x = $\frac{\pi}{2}$ (3) x = π (4) x = $\frac{3\pi}{2}$

30. The maximum value of the function x^2e^{-2x}, x > 0 is

(1) $\frac{1}{e}$ (2) $\frac{1}{2e}$ (3) $\frac{1}{e^2}$ (4) $\frac{4}{e^4}$

31. A circular template has a radius of 10 cm. The measurement of radius has an approximate error of 0.02 cm. Then the percentage error in calculating area of this template is

(1) 0.2% (2) 0.4% (3) 0.04% (4) 0.08%

32. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31?

(1) $\frac{1}{31}$ (2) $\frac{1}{5}$ (3) 5 (4) 31

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33. If $U(x,y) = e^{x^2+y^2}$, then $\frac{\partial u}{\partial x}$ is equal to

(1) $e^{x^2+y^2}$ (2) $2xu$ (3) $x^2\,u$ (4) $y^2\,u$

34. The value of $\int_0^{\frac{2}{3}} \frac{dx}{\sqrt{4-9x^2}}$ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{4}$ (4) π

35. The value of $\int_{-4}^{4}\left[tan^{-1}\left(\frac{x^2}{x^4+1}\right) + tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right]\,dx$ is

(1) π (2) 2π (3) 3π (4) 4π

36. The value of $\int_0^1 x\,(1-x)^{99}\;dx$ is

(1) $\frac{1}{11000}$ (2) $\frac{1}{101000}$ (3) $\frac{1}{10010}$ (4) $\frac{1}{10001}$

37. The value of $\int_0^{\pi} sin^4\,x\,dx$ is

(1) $\frac{3\pi}{10}$ (2) $\frac{3\pi}{8}$ (3) $\frac{3\pi}{4}$ (4) $\frac{3\pi}{2}$

38. The volume of solid of revolution of the region bounded by $y^2 = x(a-x)$ about $x-axis$ is

(1) πa^3 (2) $\frac{\pi a^3}{4}$ (3) $\frac{\pi a^3}{5}$ (4) $\frac{\pi a^3}{6}$

38. Let X be random variable with probability density function $f(x) = \begin{cases} \frac{2}{x^3} & x \geq 1 \\ 0 & x < 1 \end{cases}$ Which of the following statement is correct

(1) both mean and variance exist (2) mean exists but variance does not exist

(3) both mean and variance do not exist (4) variance exists but Mean does not exist.

39. Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry, respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. One of the 4 bus drivers is also randomly selected. Let Y denote the number of students on that bus. Then E[X] and E[Y] respectively are

(1) 50 ,40 (2) 40, 50 (3) 40, 75, 40 (4) 41,41

40. If $P\{X = 0\} = 1 - P\{X = 1\}$. If $E[X] = 3Var(X)$, then $P\{X = 0\}$.

(1) $\frac{2}{3}$ (2) $\frac{2}{5}$ (3) $\frac{1}{5}$ (4) $\frac{1}{3}$

41. Let X have a Bernoulli distribution with mean 0.4, then the variance of $(2X - 3)$ is

(1) 0.24 2) 0.48 (3) 0.6 (4) 0.96

42. If $a * b = \sqrt{a^2 + b^2}$ on the real numbers then * is

(1) commutative but not associative (2) associative but not commutative

(3) both commutative and associative (4) neither commutative nor associative

43. If a compound statement involves 3 simple statements, then the number of rows in the truth table is

(1) 9 (2) 8 (3) 6 (4) 3

44.

p	q	$(p \wedge q) \vee \neg p$
T	T	a
T	F	b
F	T	c
F	F	d

Which one of the following is correct for the truth value of $(p \wedge q) \vee \neg p$?

(1) T T T T (2) F T T T (3) F F T T (4) T T T F

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45. Which one of the following is not true?

(1) Negation of a negation of a statement is the statement itself.
(2) If the last column of the truth table contains only T then it is a tautology.
(3) If the last column of its truth table contains only F then it is a contradiction
(4) If p and q are any two statements then $p \leftrightarrow q$ is a tautology.

46. If y = f(x^2+2) $and\ f'(3)=5$, then $\frac{dy}{dx}$ at x = 1 is

(1)5 (2)25 (3)15 (4)10

47. If y = $\frac{1}{a-z}$, then $\frac{dz}{dy}$ is

(1)$(a-z)^2$ (2) $-(z-a)^2$ (3) $(z+a)^2$ (4)$-(z+a)^2$

48. If x = a sin θ and y = b cos θ, then $\frac{d^2y}{dx^2}$ is

(1)$\frac{a}{b^2}sec^2\theta$ (2)$-\frac{b}{a}sec^2\theta$ (3)$-\frac{b}{a^2}sec^3\theta$ (4)$-\frac{b^2}{a^2}sec^3\theta$

49. If f(x) = $\begin{Bmatrix} x+1 & \vert when\ x<2 \\ 2x-1 & \vert when\ x\geq 2 \end{Bmatrix}$, then f'(2) is

(1)0 (2)1 (3)2 (4)does not exists

50. If f(x) =$\begin{Bmatrix} x+2 & \vert -1<x<3 \\ 5 & \vert x=3 \\ 8-x & \vert x>3 \end{Bmatrix}$, then at x = 3, f'(x) is

(1)1 (2)-1 (3)0 (4)does not exists

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