MATHEMATICS

1. The number of arbitrary constant in the complete primitive of the differential equation $\phi\left(x, y, dy/dx, \frac{d^3y}{dx^3}\right) = 0$ is

a. 1

b. 2

c. 3

d. 4

2. The differential equation of the system of circles touching the axis at origin is

a. $(x^2-y^2)\frac{dy}{dx} - 2xy = 0$

b. $(x^2-y^2)\frac{dy}{dx} + 2xy = 0$

c. $(x^2+y^2)\frac{dy}{dx} + 2xy = 0$

d. $(x^2+y^2)\frac{dy}{dx} + 2xy = 0$

3. The singular solution of the equation p[illegible] 4xyp+$8p^2$=0 $\left(p \equiv \frac{dy}{dx}\right)$ is

a. 27y = 4x

b. $27y = 4x^2$

c. $27y = 4x^3$

d. $27y^3 = 4x$

4. The solutions of the differential equation 2y(y'+2)-xy'[illegible] are the function

1. y = 0

2. y = -[illegible]x

Select the correct answer using the codes given below:

a. None of 1 and 2 is a singular solution

b. both 1 and 2 are singular solutions

c. 1 is a singular solution but 2 is not

d. 2 is a singular solution but 1 is not

5. The orthogonal trajectories of the system of curves $\gamma^n \sin n\theta = K^n$ are

a. $\gamma^n \cos n\theta = a$

b. $\gamma \cos \theta = a$

c. $\gamma^2 \cos n\theta = a$

d. $\gamma^n \tan n\theta = a$

6. The equation whose solution family is self orthogonal is

a. $p - \frac{1}{p} = p^2$, $p = \frac{dy}{dx}$

b. $(px + y)(x + yp) - \lambda p = 0$, $p = \frac{dy}{dx}$

c. $(px - y)(x + yp) - \lambda p = 0$, $p = \frac{dy}{dx}$

d. $(px + y)(x - yp) - \lambda p = 0$, $p = \frac{dy}{dx}$

7. Which of the following statements associated with a first order non-linear differential equation f(x, y, dy/dx) = 0 are correct

1. Its general solution must contain only one arbitrary constant.
2. Its singular solution can be obtained by substituting particular value of the arbitrary constant in its general solution
3. Its singular solution is an envelope of its general solution which also satisfies the equation

Select the correct answer using the codes given below:

a. 1, 2 and 3

b. 1 and 2

c. 1 and 3

d. 2 and 3

8. A particular integral of $\frac{d^2y}{dx^2} - (a+b)\frac{dy}{dx} + aby = Q(x)$ is

a. $e^{ax}\int\left[e^{(a-b)x}\left(\int Qe^{bx}dx\right)\right]dx$

b. $e^{ax}\int\left[e^{(a-b)x}\left(\int Qe^{-bx}dx\right)\right]dx$

c. $e^{-ax}\int\left[e^{(b-a)x}\left(\int Qe^{bx}dx\right)\right]dx$

d. $e^{-ax}\int\left[e^{(b-a)x}\left(\int Qe^{-bx}dx\right)\right]dx$

9. The solution of the differential equation $x\left\{y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right\}=y\frac{dy}{dx}$ is

a. $ax + by = c$

b. $ax^2 + by = 0$

c. $ax^2 + by^2 = 1$

d. $ax + by^2 = 0$

10. A variable lines passes through the fixed point (a, b). The locus of the middle point of the segment intercepted between the axes is given by

a. $\frac{x}{a}+\frac{b}{y}=1$

b. $\frac{x}{a}+\frac{y}{b}=2$

c. $\frac{x}{a}+\frac{b}{y}=1$

d. $\frac{x}{a}+\frac{y}{b}=2$

11. The joint equation of the pair of the lines through the origin which are perpendicular to the lines represented by $ax^2+2hxy+by^2=0$ is

a. $bx^2+2hxy+ay^2=0$

b. $ax^2-2hxy+by^2=0$

c. $bx^2-2hxy+ay^2=0$

d. $bx^2-2hxy+ay^2=0$

12. If $u = ax^2+2hxy + by^2+2gx + 2$[illegible]$y + c = 0$ represents two straight [illegible] ,the[illegible] the third pair of straight line[illegible] [illegible]rou[illegible]h the four points in which the line[illegible] [illegible] = 0 meet the axis is

a. u + 4(fg- [illegible])[illegible]=0

b. cu+[illegible](fg-[illegible][illegible]y=0

c. [illegible](f[illegible]ch)xy=0

d. [illegible]u[illegible]fg-ch)xy=0

13. [illegible]e polar equation $\gamma = \frac{2}{4\cos\theta+5\sin\theta}$ represents

a. a straight line

b. a parabola

c. a hyperbola

d. an ellipse

14. If the normal drawn at a point $(at_1^2, 2at_1)$ of the parabola $y^2=4ax$ meets it again in point $(at_2^2, 2at_2)$, then

a. $t_2 = -t_1 - \frac{2}{t_1}$

b. $t_2 = \frac{t_1}{2}$

c. $t_2 = t_1 + \frac{1}{t_1}$

d. $t_1t_2 = -1$

15. The two circles $x^2 + y^2 - 4x + 2y +$ [illegible] $= 0$ and $x^2 + y^2 - 10x$ [illegible] $+ 18 = 0$

a. touch each other internal[illegible]

b. touch each other exter[illegible]lly

c. intersect each ot[illegible]er

d. neither intersect [illegible]r tou[illegible]h each other

16. The circles [illegible]=2 a cos (θ - α) and γ = 2b cos (θ- β) [illegible]nter[illegible]ect at an angle

a. [illegible]

b. [illegible]

c. [illegible]

d. $\alpha + \beta$

[illegible] The standard equation of the ellipse ,the length of whose major axis is 8 and the distance between whose directrices is 16 is given by

a. $\frac{x^2}{5}+y^2=1$

b. $\frac{x^2}{16}+\frac{y^2}{12}=1$

c. $\frac{x^2}{12}+\frac{y^2}{16}=1$

d. $\frac{x^2}{16}+\frac{y^2}{12}=1$

18. If a circle cuts the rectangular hyperbola $xy = c^2$ in points (x_r, y_r) (r =1, 2,3,4) ,then

a. $x_1 x_2 x_3 x_4 = -c^2$

b. $x_1 x_2 x_3 x_4 = c^4$

c. $x_1 x_2 x_3 x_4 = -c^4$

d. $x_1 x_2 x_3 x_4 = c^2$

19. The polar coordinates of the center of the circle γ = 6 cos (θ- α) are

a. (0, 0)

b. (0, α)

c. (6, α)

d. (3, α)

20. If a straight line makes angles 60^0, 45^0 and θ^0 respectively with the axes of co-ordinates OX, OY and OZ, then θ is equal to

a. 15^0

b. 30^0

c. 45^0

d. 60^0

21. If the plane $\frac{x}{2}+\frac{y}{3}+\frac{z}{6}=1$ cuts the axes of co-ordinates at point A,B,C ,then the area of the triangle ABC is

a. 18 sq. units

b. 35 sq. units

c. $3\sqrt{14}$ sq. units

d. $2\sqrt{14}$ sq. units

22. The diameter of the circle $x^2+y^2+z^2=9$, $x+y+z=3$ is

a. $2\sqrt{3}$

b. $\sqrt{3}$

c. $\sqrt{6}$

d. $2\sqrt{6}$

23. The equation to the cone which passes through the three co-ordinates axes as well as the lines $\frac{x}{1}=\frac{y}{-2}=\frac{z}{3}$ and $\frac{x}{3}=\frac{y}{-1}=\frac{z}{[illegible]}$ is

a. $yz - 2zx + 3xy = 0$

b. $3yz - zx + xy = 0$

c. $yz + zx + xy = 0$

d. $3yz + 16zx + 15xy = 0$

24. The equation of the cylinder, generated by lines parallel to the fixed line $\frac{x}{l}=\frac{y}{m}=\frac{z}{n}$ and having the ellipse $z=0$, $ax^2+by^2=1$, as the guiding curve is

a. $a(nx - lz)^2+b(ny+mz)^2=n^2$

b. $a(nx - lz)^2+b(ny-mz)^2=n^2$

c. $a(nx - lz)^2-b(ny-mz)^2=n^2$

d. $a(nx- lz)^2-b(ny-mz)^2=n^2$

25. A unit vector perpendicular to the two vectors $\vec{i}+2\vec{j}-\vec{k}$ and $2\vec{i}+3\vec{j}+\vec{k}$ is

a. $5\vec{i}-3\vec{j}-\vec{k}$

b. $\frac{1}{\sqrt{35}}(5\vec{i}-3\vec{j}-\vec{k})$

c. $\vec{i}+\vec{j}-2\vec{k}$

d. $\frac{1}{\sqrt{6}}(\vec{i}+\vec{j}-2\vec{k})$

26. The points A, B,C whose position vectors are $\vec{a}=3\vec{i}-4\vec{j}-4\vec{k}$, $\vec{b}=2\vec{i}-\vec{j}-\vec{k}$, $\vec{c}=\vec{i}-3\vec{j}-5\vec{k}$ are

a. an isosceles triangle

b. a acute-angled triangle

c. an obtuse –angled triangle

d. a right – angled triangle

27. The distance between the line $\vec{r}=(\vec{i}+\vec{j})+\lambda(2\vec{i}+\vec{j}+4\vec{k})$ and the plane $\vec{r}\cdot(-2\vec{i}+\vec{k})=5$ is

a. 7

b. $\sqrt{5}$

c. $7/\sqrt{5}$

d. $7\sqrt{2}$

28. The solution of the vector equation $\vec{r}\times\vec{a}$ = [illegible] $\vec{b}$ is (where k is any real number)

a. [illegible] $= k\vec{b}-\vec{a}$

b. $\vec{r}=k\vec{a}+\vec{b}$

c. $\vec{r}=k\vec{b}+\vec{a}$

d. $\vec{r}=k\vec{a}-\vec{b}$

29. The vector equation of the line passing through the point with position vector $2\vec{i}-3\vec{j}-5\vec{k}$ and perpendicular to the plane $\vec{r}\cdot(\vec{i}-3\vec{j}-5\vec{k})+2=0$ is (λ is a scalar in each case)

a. $\vec{r}=(-6\vec{i}+3\vec{j}+5\vec{k})+\lambda(2\vec{i}-3\vec{j}-5\vec{k})$

b. $\vec{r}=(2\vec{i}-3\vec{j}-5\vec{k})+\lambda(6\vec{i}-3\vec{j}-5\vec{k})$

c. $\vec{r}=(6\vec{i}-3\vec{j}-5\vec{k})+\lambda(2\vec{i}-3\vec{j}-5\vec{k})$

d. $\vec{r}=(-2\vec{i}+3\vec{j}+5\vec{k})-\lambda(6\vec{i}-3\vec{j}-5\vec{k})$

30. If three forces, acting upon a rigid body, be represented in magnitude, direction and line of action by the sides of a triangle taken in order, then

a. they will be in equilibrium

b. they will reduce to a single force

c. they will reduce to a couple

d. they will reduce to a single force and a couple

31. A necessary and sufficient condition that a body acted upon by coplanar forces be in

equilibrium is that the sum of the moments of all the forces about

a. a point is zero

b. any two points is zero

c. any three non-collinear points is zero

d. an axis is zero

32. If a particle in equilibrium is subjected to four forces viz $F_1 = 2\hat{i} - 5\hat{j} + 6\hat{k}$, $F_2 = -\hat{i} + 3\hat{j} - 7\hat{k}$, $F_3 = 2\hat{i} - 2\hat{j} - 3\hat{k}$ and F_4, then F_4 is equal to

a. $-5\hat{i} + 4\hat{j} + 4\hat{k}$

b. $5\hat{i} - 45\hat{j} - 4\hat{k}$

c. $3\hat{i} - 2\hat{j} - \hat{k}$

d. $3\hat{i} + \hat{j} - 10\hat{k}$

33. A steam boat is moving with velocity v_1 when steam is shut off. If the retardation at any subsequent time is equal to the magnitude of the velocity at that time, then the velocity in time t after the steam is shut off is

a. $v_1 e^t$

b. $v_1 e^{-t}$

c. $2v_1 e^t$

d. $2v_1 e^{-t}$

34. The least force that will move a weight W along a rough horizontal plane, where λ is the angle of friction is

a. W tan λ

b. W cos λ

c. W sin λ

d. W cot λ

35. The magnitude of a force which is acting on a body of mass 1 kg for 5 seconds to produce velocity of 1 m/sec in it is

a. 1000 dynes

b. 2000 dynes

c. 10,000 dynes

d. 20,000 dynes

36. If a body of mass m kg is carried by a lift moving with upward acceleration f ,then the pressure on the plane of the lift is

a. mf – mg

b. mg – mf

c. mg + mf

d. (mg)/ (mf)

37. If the equation of motion of a particle executing a simple harmonic motion is $\frac{d^2x}{dt^2} + 16x = 0$, then its frequency will be

a. π/2

b. π/8

c. 2/π

d. 8/π

38. If the particle is projected from a horizontal plane which velocity u at an angle α, then the time of flight of the particle will be

a. $\frac{u\sin\alpha}{g}$

b. $\frac{u\cos\alpha}{g}$

c. $\frac{2u\sin\alpha}{g}$

d. $\frac{2u\cos\alpha}{g}$

39. The escape velocity of a projectile from the earth is approximately

a. 101 km/sec

b. 7 km/sec

c. 11.2 km/sec

d. 112 km/sec

40. The hexadecimal number $(A\ 2F.\ D)_{16}$ when converted into the decimal system is equal to

a. 2608.6125

b. 2607.8125

c. 2507.8125

d. 2607.0125

41. In a flow chart a rectangle is a

a. start/ stop box

b. decision box

c. computation box

d. input/ output box

42. An algorithm is

a. a table of logarithms

b. a collection of results

c. a chart of formulae

d. a step by step procedure for finding the solution of a problem

43. Assertion (A) : If x and y are odd positive integers, then there exists no natural number n such that $x^2+y^2=n^2$.

Reason (R): If n is natural number, then either $n^2 = 4m$ for some integer $m \geq 1$ or $n^2 = 4l + 1$ for some integer $l \geq 0$.

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

44. **Assertion (A):** Given any arbitrarily large numbers L and M, there exists a number N such that $\int_L^N x^{-1}dx > M$

Reason (R): For any A>1, $\int_1^A x^{-1}dx = \log A$ and for a suitable A, log A can exceed M.

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

45. Assertion (A): $y = e^{2x}$ and $y = xe^{2x}$ are two solutions of differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$. The general solution of the equation is $y = (a + bx)e^{2x}$, where a and b are arbitrary constants.

Reason (R): If u and v are two solutions of the second order homogeneous linear differential equation, then au + bv is the general solution of the equations where a and b are arbitrary constant.

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

46. If $x = \sqrt[3]{9}$, $y = \sqrt[4]{11}$, $z = \sqrt[6]{17}$, then

a. $x < y < z$
b. $x > y > z$
c. $x < z < y$
d. $x > z > y$

47. The fraction 1/3 is

a. equal to 0.3333333
b. less than 0.333333 by $\frac{1}{3.10^7}$
c. greater than 0.3333333 by $\frac{1}{3.10^8}$
d. greater than 0.3333333 by $\frac{1}{10}$

48. Let z_1 and z_2 be two non-zero complex numbers, then $|z_1+z_2|^2 = |z_1|^2 + |z_2|^2$, if

a. z_1-z_2 is purely imaginary
b. z_1-z_2 is real
c. z_1+z_2 is purely imaginary
d. z_1+z_2 is real

49. If P is a point in the Argand diagram representing the complex number $4\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$ and OP is rotated through an angle $\frac{2\pi}{3}$ in the anti-clockwise direction , then P in the new position represents

a. $4(\cos \pi/2 + i \sin \pi/2)$
b. 4
c. $4(\cos \pi/3 + i \sin \pi/3)$
d. 3 + 2i

50. 220 cannot be the sum of the first n cubes for a suitable n , because 220 is

a. not an odd number
b. not a square
c. not a cube
d. divisible by 10

51. If f(x) is a polynomial in x and a, b are unequal ,then the remainder in the division of f(x) by (x- a) (x-b) is

a. $\frac{(x-a)f(a)-(x-b)f(b)}{a-b}$
b. $\frac{(x-b)f(a)-(x-a)f(b)}{a-b}$
c. $\frac{(x-a)f(b)-(x-b)f(a)}{a-b}$
d. None of the above

52. If x + a is a factor $x^4 - a^2x^2 + 3x - a$, then the value of a is

a. 0

b. 1

c. 2

d. 3

53. A quadratic equation with rational coefficients and with one roots as $2 - \sqrt{3}$ is

a. $x^2 - 4x + 1 = 0$

b. $x^2 + 4x + 1 = 0$

c. $x^2 - 4x - 1 = 0$

d. $x^2 + 4x - 1 = 0$

54. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then the value of (α- β) is

a. $\frac{b^2 + 4ac}{a^2}$

b. $\frac{b^2 - 4ac}{a^2}$

c. $\frac{-b^2 + 4ac}{2}$

d. $\frac{-b^2 - 4ac}{2}$

55. A repeated root of the equation $x^3 + 3x^2 + 3x + 1 = 0$ is

a. 0

b. −1

c. 1

d. 2

56. The values of $i^{1/6}$ are

a. $\sin\frac{n\pi}{12} + i\cos\frac{n\pi}{12}$, n = 1, 5, 9, 13, 17, 21

b. $\cos\frac{n\pi}{12} + i\sin\frac{n\pi}{12}$, n = 1, 5, 9, 13, 17, 21

c. $\sin\frac{n\pi}{6} + i\cos\frac{n\pi}{6}$, n = 0, 1, 2, 3, 4, 5

d. $\cos\frac{n\pi}{6} + i\sin\frac{n\pi}{6}$, n = 1, 2, 3, 4, 5, 6

57. For any three sets A, B and C which one of the following statements is correct?

a. $A \cap B = \Phi \Rightarrow A = \Phi$ or $B = \Phi$

b. $A - B = \Phi \Rightarrow A \subseteq B$

c. $A \cup B = \Phi \Rightarrow A \subseteq B$

d. $A \cap B \neq \Phi, A \cap C = \Phi \Rightarrow A \cap B \cap C = \Phi$

58. Let X be a non-empty finite set .For a subset Y of X let n(Y) denote the number of elements in Y. Let n(X)= 15 and let A, B, C be subsets of X such that $n(A \cup B) = 5$, n(C)=7 and $n(A' \cap B' \cap C') = 4$, (where for a subset Y of X, Y' denotes the complement of Y in X). Then $n[(A \cap C) \cup (B \cap C)]$ equals

a. 1

b. 2

c. 3

d. 4

59. Which of the following properties hold for a function $f: X \to Y$ and subsets $U, V \subseteq X$, $M, N \subseteq Y$

1. $f^{-1}(M \cup N) = f^{-1}(M) \cup f^{-1}(N)$

2. $f(U \cup V) = f(U) \cup f(v)$

3. $f^{-1}(M \cap N) = f^{-1}(M) \cap f^{-1}(N)$

4. $f(U \cap V) = f(U) \cap f(V)$

Select the correct answer using the codes given below;

a. 1 and 4

b. 1 and 2

c. 1 and 3

d. 1, 2 and 3

60. For any a, b∈N, the set of natural numbers define a ~ b if and only if a | b then ~ is

a. An equivalence relation

b. Symmetric and transitive but no reflexive

c. Reflexive but not transitive and symmetric

d. Reflexive and transitive but not symmetric

61. The set of integers modulo 7 is

a. a non-commutative ring without unity

b. a commutative ring without unity

c. a commutative ring with unity

d. none of the above

62. If R be the set (m, n, p, q) with addition and multiplication as defined below:

+	m	n	p	q

m	m	n	p	q
n	n	m	q	p
p	p	q	m	n
q	q	p	n	m

-	m	n	p	q
m	m	m	m	m
n	m	n	m	n
p	m	p	m	p
q	m	q	m	q

Then which one of the following is correct?

a. (R, +) is a group , but (R, +,.) is not a ring
b. (R, +, .) is a ring with unity
c. (R, + , .)is commutative ring
d. (R, +,.) is a non-commutative ring without unity element and has divisors of zero.

63. The set Z of all integers is not a vector space over the field R of real numbers under ordinary addition '+' and multiplication 'x' of real numbers because

a. (Z, +) is a ring
b. (Z, +, x) is not a field
c. (R, x) is not a group
d. Ordinary multiplication of real numbers does not define a scalar multiplication of Z by R.

64. Which of the following sets of vectors in R^3 are linearly independent

1. [(1, [illegible], 0), ([illegible], 1,0) ,(1, 1, 0)]
2. [(1, 0, 0), (0, 1, 0), (0, 0,1)]
3. [(0, 1, 0), (1, 0, 1), (1, 1, 0)]
4. [(0, 0, 1),(0, 1, 0) , (0, 1,1)]

Select the correct answer using the codes given below:

a. 1 and 2
b. 2 and 3
c. 3 and 4
d. 1 and 4

65. Which one of the following statements is correct?

a. There is no vector space of dimension 1
b. Any three vectors of a vector space of dimension 3 are linearly independent
c. There is one and only one basis of a vector space of finite dimension
d. If a non-zero vector space V is generated by a finite set S ,then V can be generated by a linearly independent subset of S

66. If T is a linear transformation from R^2 to R^2 which T (1, 0) = (a, b), T(0, 1)= (c, d) then T (x, y) , x, y∈R is

a. (ax + by, cx + dy)
b. (ax + dy, bx + cy)
c. (ax + cy, bx + dy)
d. None of the above

67. If $A = \begin{pmatrix} [illegible] & 1 & 2 \\ 2 & 1 & 0 \end{pmatrix}$ and $B=\begin{pmatrix} 1 & 2 \\ 2 & 0 \\ -1 & 1 \end{pmatrix}$, then AB^T [(AB^T denotes the transpose of AB)] is

a. $\begin{pmatrix} 1 & 4 \\ 4 & 4 \end{pmatrix}$
b. $\begin{pmatrix} 1 & 4 \\ 4 & 4 \end{pmatrix}$
c. $\begin{pmatrix} 1 & 4 \\ 4 & 1 \end{pmatrix}$
d. $\begin{pmatrix} 1 & 4 \\ 4 & 4 \end{pmatrix}$

68. If $A = \begin{pmatrix} 0 & \alpha \\ \beta & 0 \end{pmatrix}$, then $A^3 + A = 0$ whenever

a. αβ = 0
b. αβ = 1
c. αβ = 0
d. αβ = - 1

69. If the have of the determinant $\begin{vmatrix} a_1 & a_2 & a_3 & a_4 \\ b_1 & b_2 & b_3 & b_4 \\ c_1 & c_2 & c_3 & c_4 \\ d_1 & d_2 & d_3 & d_4 \end{vmatrix}$ is equal to K, then the value of the determinant $B=\begin{vmatrix} a_2 & a_1+3a_3 & a_3 & a_4 \\ b_2 & b_1+3b_3 & b_3 & b_4 \\ c_2 & c_1+3c_3 & c_3 & c_4 \\ d_2 & d_1+3d_3 & d_3 & d_4 \end{vmatrix}$ is equal to

a. 3K

b. –K

c. K

d. –3K

70. If A= $\begin{pmatrix} 1 & 0 & -1 \\ -2 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$, then inverse of matrix A will be

a. $\begin{pmatrix} -1 & 0 & 1 \\ 2 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}$

b. $\begin{pmatrix} 1 & -2 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$

c. $\begin{pmatrix} 0 & 0 & 1 \\ 2 & 2 & 0 \\ 1 & 0 & 1 \end{pmatrix}$

d. $\begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 2 \\ -1 & 0 & -1 \end{pmatrix}$

71. Consider the equation AX= B, where A= $\begin{pmatrix} -1 & 2 \\ 2 & -1 \end{pmatrix}$ B= $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$, then

a. the equation has no solution

b. $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ is a solution of the equation

c. there exists a non-zero unique solution

d. the equation has infinitely many solutions

72. The limit of a convergent sequence of rational numbers

a. need not exist at all

b. exists and is always rational

c. exists and is always irrational

d. exists but it may be rational or irrational

73. If $f(x) = \begin{cases} x & 0 \le x \le \frac{1}{2} \\ x & \frac{1}{2} < x \le 1 \end{cases}$ then $\lim_{x \to \frac{1}{2}} f(x)$

a. has the value 1/2

b. has the value 1

c. has the value 2

d. does not exist

74. If $\lim_{x \to \frac{1}{2}} \frac{\sin 2x + a \sin x}{x^2} = b$, where b is finite ,then the values of a and b respectively will be

a. –2, -1

b. 2, 1

c. –2, 1

d. 2, -1

75. The function f defined by $f(x) = \begin{cases} \frac{x^2}{a} - a & (0 < x < a) \\ a - \frac{a^3}{x^2} & (x \ge a) \end{cases}$

a. is not continuous on (0, ∞)

b. is not differentiable on(0, ∞)

c. is differentiable on (0, ∞)

d. is differentiable on (0, ∞) except at x = a

76. If y = sin x , then for any positive integer n, $\frac{d^n y}{dx^n}$ is given by

a. $\cos\left(x + \frac{n\pi}{2}\right)$

b. $-\sin\left(x + \frac{n\pi}{2}\right)$

c. $\sin\left(x + \frac{n\pi}{2}\right)$

d. – sin x for all even n

77. If $y = \tan^{-1}\frac{2x}{1-x^2}$ and $z = \tan^{-1}\frac{1+x}{1-x}$ then $\frac{dy}{dz}$ is equal to

a. $\frac{2x}{(1+x)^2}$

b. 1

c. 2

d. 1/2

78. The derivative of $\tan^{-1}(\sec x + \tan x)$ with respect to x is

a. $\frac{1}{1+(\sec x + \tan x)^2}$

b. 2

c. 1/2

d. $\{\sec^{-1}(\tan x + \sec x)\}^2$

79. If $f(x) = -x^{1/3}$, $-1 \le x \le 0$ and $f(x) = x^{1/3}$, $0 < x \le 1$, then

a. Rolle's theorem does not apply to f in [-1, 1]

b. Rolle's theorem applies to f in [-1, 1]

c. f is not continuous at $x = 0$

d. $f'(0) = 0$

80. The expansion of tan x in powers of x by Maclaurin's theorem is valid in the interval

a. $(-\infty, \infty)$

b. $(-3\pi/2, 3\pi/2)$

c. $(-\pi, \pi)$

d. $-\pi/2, \pi/2)$

81. The first three terms in the power series for log (1 + sin x) are

a. $x-\frac{1}{2}x^3+\frac{1}{4}x^5$

b. $x-\frac{1}{2}x^2+\frac{1}{4}x^3$

c. $-x-\frac{1}{2}x^2+\frac{1}{4}x^4$

d. $x-\frac{1}{2}x^2+\frac{1}{6}x^3$

82. The minimum value of $\frac{(x+1)(x+4)}{(x-1)(x-4)}$ is

a. –1/3

b. –1/6

c. –1/9

d. –1/12

83. The maximum area of a sector whose perimeter is l given by

a. $l/16$

b. $l^2/16$

c. $l^2/4$

d. None of the above

84. The normal to the parabola $y^2=4a$ at the point $(am^2 - 2am)$ is

a. $y = mx - 2am - am^3$

b. $y = 2mx - 2am - 2am^3$

c. $y + mx = am^3 - 2am$

d. $x - my = 3am^2$

85. If the line $y = x$ touches the parabola $y = x^2 + ax + b$ at the point (1, 1) then a ,b are respectively

a. 1, -1

b. 1, 1

c. –1, -1

d. –1, 1

86. The ratio of the subtangent to the subnormal for any point on the curve

$x = a(\theta + \sin\theta)$

$y = a(1 - \cos\theta)$

a. $\tan^2\theta/2$

b. $\cot^2\theta/2$

c. $\sin^2\theta/2$

d. $\cos^2\theta/2$

87. If $x^2+\frac{2}{x}=\sqrt{(y^2-x^2)}$, then the expression $x^2\frac{\partial z}{\partial x}+\frac{1}{y}\frac{\partial z}{\partial y}$ equals

a. $1/z$

b. z

c. z^2

d. $2z$

88. If $u = f\left(\frac{y}{x}\right)$, then

a. $x\frac{\partial u}{\partial x}-y\frac{\partial u}{\partial y}=0$

b. $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$

c. $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=-u$

d. $x\frac{\partial u}{\partial x}-y\frac{\partial u}{\partial y}=0$

89. If $z = f(x+ay) + \phi(x-ay)$, then

a. $\frac{\partial^2 z}{\partial x^2}=a^2\frac{\partial^2 z}{\partial y^2}$

b. $\frac{\partial^2 z}{\partial y^2}=-\frac{1}{a^2}\frac{\partial^2 z}{\partial x^2}$

c. $\frac{\partial^2 z}{\partial y^2}=a^2\frac{\partial^2 z}{\partial x^2}$

d. $\frac{\partial^2 z}{\partial x^2}=2a^2\frac{\partial^2 z}{\partial y^2}$

90. Let $f(x,y) = x^2\sin\frac{1}{x}+y^2\sin\frac{1}{y}$ when $(x, y)\neq(0, 0)$; $(x, 0)= x^2\sin\frac{1}{x}$ when $x\neq 0$

$f(0, y) = y^2 \sin \frac{1}{y}$ when $y \neq 0$

$f(0, 0) = 0$, then at $(0, 0)$

a. fx is continuous but not fy

b. fy is continuous but not fx

c. fx and fy are both continuous

d. neither fx and fy is continuous

91. The double point on the curve $(x-2)^2 = y(y-1)^2$ is

a. (1, 2)

b. (3, 4)

c. (4, 3)

d. (2, 1)

92. The value of $\int_0^{\pi/2} \frac{\sqrt{\cos x}}{\sqrt{\cos x}+\sqrt{\sin x}} dx$ is

a. $\pi/2$

b. $\pi/4$

c. $\pi/8$

d. $\pi/6$

93. The value of $\int \frac{dx}{(e^x-1)}$ (c is constant of integration)

a. $\log (e^{-x} - 1) + c$

b. $\log |(e^{-x}-1)| + c$

c. $\log (e^{-x}-e^{x}) + c$

d. $\log (e^{x}-1)$

94. The length of the arc of the parabola $y^2 = 4kx$ measured from the vertex to one extremity of the latus rectum is

a. $k\{\sqrt{2}+\log(1+\sqrt{2})\}$

b. $\frac{1}{k}\{\sqrt{2}+\log(1+\sqrt{2})\}$

c. $k\{\sqrt{2}-\log(1+\sqrt{2})\}$

d. $\frac{1}{k}\{\sqrt{2}-\log(1+\sqrt{2})\}$

95. The area of the cradiod $\gamma = a(1+\cos\theta)$ is equal to

a. $4\pi a^2$

b. $8\pi a$

c. $\frac{3\pi a^2}{2}$

d. $2\pi a^2$

96. The volume of the solid generated by revolving the curve $x = a \cos t$, $y = b \sin t$, about the x axis is

a. $4\pi ab$

b. $\frac{4\pi ab^2}{3}$

c. $4\pi ab$

d. $\frac{4\pi ab^2}{3}$

97. The arc of the sine curve $y = \sin x$ from $x = 0$ to $x = \pi$ revolved about the x-axis. The area of the surface of the solid generated is

a. $2\pi\{\sqrt{2}+\log(\sqrt{2}+1)\}$

b. $\frac{2\pi^2}{3}\{\sqrt{2}+\log(\sqrt{2}+1)\}$

c. $\frac{\pi}{3}\{\sqrt{2}+\log(\sqrt{2}+1)\}$

d. $\frac{\pi^2}{3}\{\sqrt{2}+\log(\sqrt{2}+1)\}$

98. The series whose n^{th} term is $t_n = \sqrt{n^2+1} - n$

a. converges to the sum 0

b. converges to the sum 1/2

c. converges to the sum 1

d. diverges

99. The series $1+\frac{2}{6}+\frac{2.5}{6.12}+\frac{2.5.8.}{6.12.18}+\ldots$ is

a. divergent

b. convergent

c. oscillates finitely

d. oscillates infinitely

100. Match list I with list II and select the correct answer:

List I

A. $\sum_1^\infty (-1)^{n-1} \frac{n^2}{(n+1)!}$

B. $\sum_1^\infty \frac{n^n}{n!}$

C. $\sum_1^\infty (-1)^{n-1} \frac{n^2}{\angle n+1}$

D. $\sum_1^\infty (-1)^{n-1} \frac{n^3}{\angle n+1}$

List II

1. Divergent
2. Convergent
3. Converges conditionally
4. Converges absolutely

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