MATHEMATICS

1. Every non-empty subset of the real line R is
   a. ordered as well as complete
   b. complete but not necessarily ordered
   c. ordered but not necessarily complete
   d. neither ordered nor complete

2. If α,β are the roots of the equation $ax^2+bx+c=0$, then $\lim_{x\to\alpha} \frac{1-\cos(ax^2+bx+c)}{(x-\alpha)^2}$ is equal to
   a. 0
   b. $\frac{a}{2}(\alpha-\beta)^2$
   c. $-\frac{a}{2}(\alpha-\beta)^2$
   d. $\frac{a^2}{2}(\alpha-\beta)^2$

3. If $f(x)=\begin{cases} x^{\alpha}\cos 1/x, & x\neq 0 \\ 0, & x=0 \end{cases}$ is continuous at x = 0 then
   a. $\alpha < 0$
   b. $\alpha > 0$
   c. $\alpha = 0$
   d. α may be positive negative or zero

4. Consider the following function :
   1. y = x sin1/x if x ≠ 0, and y = 0 if x = 0
   2. y = x^2 sin 1/x if x ≠ 0 , and y = 0 if x = 0
   3. y = x^2 cos 1/x if x ≠ 0; y = 0 if x = 0
   4. y = x cos 1/x if x≠0; and y = 0 if x = 0

   The functions differentiable at x = 0 are
   a. 1 and 2
   b. 2 and 3
   c. 3 and 4
   d. 1 and 4

5. If $\sin^{-1}\left(\frac{x^2-y^2}{x^2+y^2}\right)=\log_e a$ then $\frac{dy}{dx}$ is equal to
   a. $\frac{x}{y}$
   b. $\frac{y}{x^2}$
   c. $\frac{(x^2-y^2)}{(x^2+y^2)}$
   d. $\frac{y}{x}$

6. If y = f(u), u = g(x), where f and g are differentiable functions, then $\frac{d}{dx}$ fog (x) at $x = x_0$ is
   a. $f'(g(x_0)).g(x_0)$
   b. $f'(g(x_0)).g'(x_0)$
   c. $f'(x_0)g(x_0))+g'(x_0)f(x_0)$
   d. $f'(x_0)+g'(x_0)$

7. The derivative of $\frac{1+x^2}{\sqrt{x}}$ w.r.t. x is
   a. $\frac{3x^2+1}{[illegible]x^{1/2}}$
   b. $\frac{3x^2+1}{2x^{3/2}}$
   c. $\frac{3x^2-1}{2x^2}$
   d. $\frac{3x^2-1}{2x^{3/2}}$

8. If $\lim_{x\to 0}\frac{x(1-\cos x)-ax^2\sin x}{x^5}$ exists and is finite, then the value of a must be
   a. 1
   b. 1/2
   c. 1/3
   d. 1/4

9. Consider the function f(x)= sin x in the interval [0, 2π] . The number of roots of the equation $f'(x) = 0$ in the interval [0, 2π] is
   a. One
   b. Two
   c. Three
   d. Four

10. The difference between the maximum and minimum values of the functions a sin x + b cos x is
    a. $2\sqrt{a^2+b^2}$

b. $2(a^2+b^2)$

c. $\sqrt{a^2+b^2}$

d. $-\sqrt{a^2+b^2}$

11. The maximum value of $(1/x)^x$ is equal to

a. E

b. 1

c. $e^{1/e}$

d. $(1/e)^e$

12. Which one of the following is the equation of the envelope for the family of curves x cos α + y sin α + y sin α- p = 0 (p is constant and p > 0)?

a. $x^2+y^2=p^2$

b. $x^2-y^2=p^2$

c. $x^2=py$

d. $y^2=px$

13. If $u=\frac{xy}{x+y}$, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ is equal to

a. 1

b. u

c. –u

d. 0

14. The points of inflexion of the curve $y=x^4-6x^3+12x^2-5+7$ are

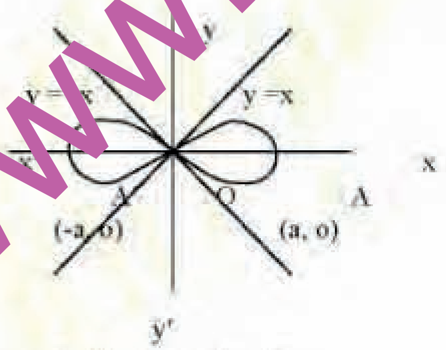
a. (1, 19), (1, 12)

b. (1, 19), (2, 33)

c. (1, 2),(2, 1)

d. (1, 7), (2, 6)

15. The following figure



represents the curve given by

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

b. $x^3+y^3=x$

c. $y^2(a+x)=x^2(3a-x)$

d. $y^2=(x-a)(x-b)(x-c)$

16. Using Riemann's definition of definite integral, the sum of the series $\lim_{n\to\infty}\sum_{r=1}^{n}\frac{r}{n^2+r^2}$ can be found to be

a. log 2

b. $\log\sqrt{2}$

c. π/4

d. π/2

17. If $f(x)=\int \sin t^2\,dt$, then f'(x) is equal to

a. $2x\sin x^2$

b. $2x\cos x^2$

c. $\cos x^2$

d. $-\sin x^2$

18. The value of $\int \frac{x\sin x}{1+\cos^2 x}dx$ is equal to

a. [illegible]

b. π/[illegible]

c. [illegible]/4

d. $\pi^3/4$

19. The arc of the parabola $y^2=4ax$ bounded at both the ends by latus rectum is rotated about the latus rectum . The volume of the solid generated is

a. $\frac{16}{7}\pi a^3$

b. $\frac{32}{7}\pi a^3$

c. $\frac{16}{15}\pi a^3$

d. $\frac{32}{15}\pi a^3$

20. The area of the region enclosed between the curve $y=x^3$ and the line y = x is

a. 1/2

b. 1/3

c. 1/4

d. 1/6

21. If $\sum_{n=1}^{\infty}a_n$ converges the $\lim_{n\to\infty}\frac{a_n-1}{\sqrt[n]{n}}$ is equal to

a. 0

b. 1

c. –1

d. $-1/\sqrt[n]{n}$

22. The series $\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x^3}{3.4}+\ldots$ is convergent if

a. $|x| \le 1$

b. $|x| \le 2$

c. $|x| > 2$

d. $|x| \ge 4$

23. Which one of the following differential equations is exact?

a. $(3x^3+2y \sin 2x)dx + (2 \sin 2x + 3y^3)dy = 0$

b. $ye^{xy}\, dx + (e^{xy} + 2y)\, dy = 0$

c. $(2xy \cos x^2+2xy + 1)\, dx + (\sin x^2 - x^2)dy = 0$

d. $y\left(1+\frac{1}{x}\right)+\cos y + (x + \log x - x \sin y)\frac{dy}{dx} = 0$

24. The general solution of the differential equation $\frac{dy}{dx}=\frac{y}{x}+\tan\frac{y}{x}$ is

(Where c is an arbitrary constant)

a. y = cx sin x

b. y/x = sin x

c. sin (y/x) = cx

d. sin (y/x) = c sin x

25. The singular solution of the [illegible] equation $(xp - y)^2 = p^2 - 1$, where p = [illegible], is

a. $x^2 + y^2 = 1$

b. $x^2 - y^2 = 1$

c. $x^2 + 2y^2$ [illegible]

d. $2x^2$ [illegible]

26. The singular solution of the equation [illegible] $\frac{2}{3x}\left(\frac{dy}{dx}\right)^2$, x > 0 is

a. $y = x^3$

b. y = x

c. $y = x^3/6$

d. $y = x^3/2$

27. The orthogonal trajectories of the system of parabolas $y^2=4a(x+a)$, a being the parameter is given by the system of the curves

a. $y^2 = 4a(x + a)$

b. $y^2 = 4a (x - a)$

c. $y^2 = 4ax$

d. $x^2 = 4ay$

28. x dx + y dy + z dz = 0 is the first order differential equation of

a. a sphere

b. an ellipsoid

c. a right circular cone

d. a hyperboloid

29. The solution of the equati[illegible]dx [illegible] 2xdy = 0 gives parabolas wh[illegible]e com[illegible]non axis and the tangent at the [illegible] respectively, are

a. x = c, y = 0

b. y = 0, x [illegible]

c. x = 0, y [illegible]

d. [illegible] = c, y [illegible]

30. [illegible] solution of $\frac{d^4y}{dx^4}+y=0$ is

a. [illegible] = $\exp\left(\frac{x}{\sqrt{2}}\right)\left[c_1\cos\frac{x}{\sqrt{2}}+c_2\sin\frac{x}{\sqrt{2}}\right]+\exp\left(\frac{-x}{\sqrt{2}}\right)\left[c_3\cos\frac{x}{\sqrt{2}}+c_4\sin\frac{x}{\sqrt{2}}\right]$

b. $y = c_1 \sin x + c_2 \cos x + c_3 \sin hx + c_4 \cos hx$

c. $y = c_1 e^{x} + c_2 e^{-x} + c_3 e^{-2x} + c_4 e^{2x}$

d. $y = c_1 \sin 2x + c_2 \cos 2x + c_3 \sin h\, 2x + c_4 h\, 2x$

31. The solution of the equation $\frac{d^2y}{dx^2}-y=k$ (k = a non zero constant) which vanishes when x = 0 and which tends to a finite limit as x tends to infinity, is

a. $y = k(1+e^{-x})$

b. $y = k(e^{-x}-1)$

c. $y = k(e^{x}+e^{-x}-2)$

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

32. The number of linearly independent solutions of the differential equation $\frac{d^4y}{dx^4}-\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+5\frac{dy}{dx}-2y=0$ of the e^{ax} (a is real number) is

a. one

b. two

c. three

d. four

33. If the diagonals of the parallelogram formed by the straight line

$\sqrt{3}x + y = A$, $x + \sqrt{3}y = B$

$\sqrt{3}x + y = C$ and $x + \sqrt{3}y = D$

are perpendicular ,then

a. A+ B=C+D

b. A+ D= B+ C

c. A- B = D – C

d. A- D = B + C

34. The bisectors of angles between pair of lines $(\sqrt{A}+\sqrt{K})x^2 + 2\sqrt{H}xy + (\sqrt{B}+\sqrt{K})y^2 = 0$; (A, K, H> 0 are given by

a. $\sqrt{H}(x^2 + y^2) = (\sqrt{A} + \sqrt{B})xy$

b. $\sqrt{H}(x^2 - y^2) = (\sqrt{A} + \sqrt{B})xy$

c. $\sqrt{H}(x^2 + y^2) = (\sqrt{A} - \sqrt{B})xy$

d. $\sqrt{H}(x^2 - y^2) = (\sqrt{A} - \sqrt{B})xy$

35. If by any change of rectangular axes, without changing the origin, the quantity $Ax^2+2Hxy+By^2$ becomes $Cx^2+2Gxy+Dy^2$ then

a. B+C = A + D

b. A- B = D- C

c. A + B = C + D

d. A- D = B + C

36. Area of the triangle with angular points $(-5, 30^0)$, $(7, 150^0)$, $(11, 210^0)$ is

a. $21\sqrt{3}/2$

b. $3\sqrt{[illegible]}/2$

c. $11\sqrt{2}/3$

d. $2\sqrt{11}/[illegible]$

37. If PQRS is a square of side μ/λ (taking PQ and PS as axes), then the equation of the circle circumscribing the square is

a. $\lambda(x^2+y^2)-\mu(x-y)=0$

b. $\lambda(x^2+y^2)-\mu(x+y)=0$

c. $\mu(x^2+y^2)-\lambda(x-y)=0$

d. $\mu(x^2+y^2)+\lambda(x+y)=0$

38. The circle $ax^2+ay^2+2gx+2fy+c=0$ touches the axis of x provided

a. $f^2>ac$

b. $g^2>ac$

c. $f^2=bc$

d. $g^2=ac$

39. If the length of the tangent drawn from a variable point to one given circle is K(≠ 1) times the length of the tangent from it to another circle, then the locus of the variable point is

a. an ellipse

b. a parabola

c. a circle

d. a hyperbola

40. Two circles $x^2+y^2+2ax+c=0$ and $x^2+y^2+2by+c=0$ touch each other externally if

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

b. $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c^2}$

c. $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c}$

d. $a^2+b^2=c^2$

41. The equation of the tangent of circles having radical axis same as that of $x^2+y^2+4x+8y+19=0$ and $x^2+y^2+8x+4y+19=0$

a. $x^2+y^2+8x+4y+\lambda(x^2-y^2)=0$

b. $x^2+y^2+8y+19+\lambda(x+y)=0$

c. $x^2+y^2+4x+8y+19+\lambda(x-y)=0$

d. $x^2+y^2+4x+8y+\lambda(x-y)=0$

42. The line $l/r = A\cos\theta + b\sin\theta$ touches the conic $l/r = 1+e\cos\theta$ provided

a. $(A-e)^2+B^2=1$

b. $(A-e)^2-B^2=1$

c. $(A+e)^2+B^2=1$

d. $(A+e)^2-B^2=1$

43. If two tangents to the parabola $y^2=4Kx$ make angles α and β with the axis of x such that α+ β = λ(constant), then the locus of their point of intersection is

a. $y = (x - K)\tan\lambda$

b. $y = (x + K)\tan\lambda$

c. $y = (x- K)\cot\lambda$

d. $y = (x + K)\cot\lambda$

44. Section of the surface $Ax^2+By^2+Cz^2=1$, cut by the plane $\sqrt{L}.x + \sqrt{M}.y + \sqrt{N}.z = K$ is a parabola provided

a. $\frac{A}{L}+\frac{B}{M}+\frac{C}{N}>0$

b. $\frac{A}{L}+\frac{B}{M}+\frac{C}{N}=0$

c. $\frac{A}{L}+\frac{B}{M}+\frac{C}{N}>0$

d. $\frac{A}{L}+\frac{B}{M}+\frac{C}{N}=0$

45. The cone $ax^2+by^2+cz^2+2fyz + 2gzx + 2hxy = 0$ shall have three mutually perpendicular generators, if

a. $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$

b. $\frac{1}{f}+\frac{1}{g}+\frac{1}{h}=0$

c. $a+b+c=0$

d. $f+g+h=0$

46. The surface $x^2 - z^2 = 1$ represents

a. a circular cylinder

b. a hyperbola cylinder

c. an elliptic cylinder

d. a parabolic cylinder

47. The enveloping cylinder whose generators touch the sphere $x^2+y^2+z^2=1$ and are parallel the line $x = y = z$, has equation

a. $x^2+y^2+z^2+xy+yz+zx=3/2$

b. $x^2+y^2+z^2-xy-yz-zx=3/2$

c. $x^2+y^2+z^2+xy+yz+zx=$ [illegible]/3

d. $x^2+y^2+z^2-xy-yz-zx=$ [illegible]/3

48. The unit vector perpendicular to both the vector $\bar{a}=3$[illegible]$\hat{k}$ and $\bar{b}=\hat{i}-\hat{j}+2\hat{k}$ is

a. $\frac{(\hat{i}-\hat{j}-\hat{k})}{\sqrt{3}}$

b. $\frac{(\text{[illegible]}\hat{j}-\hat{k})}{\sqrt{3}}$

c. $\frac{(\hat{i}-\hat{j}-\hat{k})}{3}$

d. $\frac{(\hat{i}-+\hat{j}-\hat{k})}{\sqrt{3}}$

49. Two forces, each equal to P, are acting at a point of a body. If the resultant is also P, then the angle between them will be

a. 30^0

b. 45^0

c. 90^0

d. 120^0

50. If M denotes the moment of a force $\overrightarrow{AB}$ about a point P(not on the line AB) and Δ denotes the area of the triangle PAB, then M/Δ is equal to

a. 1/2

b. 1/3

c. 2

d. 3

51. A uniform rod weigh[illegible]00 N and carries a load of 100 N at one end. If it balances at a point 6 meters from the same end, then the length of the rod is

a. 10 meter

b. 1[illegible] meter

c. [illegible].1 meter

d. 50 meter

52. If a system of three force acting on a rigid body is represented in magnitude direction and line of action by the side of a triangle, taken in order, then the body will

a. be in equilibrium

b. move along the smallest side

c. move along the largest side

d. be acted upon by a couple

53. The velocity of jet projected vertically upwards to each a height of 4 km is ($g = 9.8\ m/s^2$)

a. 28.0 km/s

b. 2.8 km/s

c. 0.28 km/s

d. 0.028 km/s

54. A particle of mass m moves along the x-axis according the equation $x = c \sin pt$ (c and p are constants). The force acting on the particle is

a. cp^2x

b. $-cp^2x$

c. p^2mx

d. $-p^2mx$

55. A body of mass 50 gm is acted upon by a constant force F= 100 dynes. The time required to move the body through a distance 25 cm from rest is

a. 10 s

b. 5.5 s

c. 5 s

d. 3.5 s

56. A person having a mass of 98 kg is descending in a lift with an acceleration of $2 m/s^2$. The thrust of his feet on the lift while descending is, nearly equal to (take $g = 9.8 m/s^2$)

a. 76.4×10^6 dynes

b. 96.0×10^6 dynes

c. 115.6×10^6 dynes

d. 196×10^6 dynes

57. A cyclist moving at a uniform speed of 7 km per hour inclines his cycle to the vertical so as to keep himself on a circular path of radius 10m. The angle of inclination to the vertical is ($g = 9.8 m/s^2$)

a. $\tan^{-1}(1/2)$

b. $\tan^{-1}(25/162)$

c. $\tan^{-1}(25/648)$

d. $\tan^{-1}(25/324)$

58. A particle is executing a Simple Harmonic Motion such that its period of oscillation is π seconds. If its maximum acceleration is $8 cm/s^2$, then its amplitude will be

a. 2 cm

b. 4 cm

c. 8 cm

d. 16 cm

59. When a particle is projected at an angle of 45^0 to the horizontal then the maximum horizontal range is

a. u^2/g

b. [illegible]

c. [illegible]

d. u/g

60. [illegible] particle is moving in a circle of radius r with uniform speed v. The acceleration directed towards range is

a. v/ r

b. v^2/r

c. vr

d. v/r^2

61. If the position of a moving point at any point t is given by x = a cos nt , y = a sin nt. Then the acceleration of the point is

a. n a

b. $n a^2$

c. $n^2 a^2$

d. $n^2 a$

62. If the acceleration due to gravity on the surface of the earth is g = 980 cm/s^2 and the radius of the earth R = 6400 km , then the escape velocity on the surface of the earth is

a. 112 km/s

b. $56\sqrt{2}$ km/s

c. 11.2 km/s

d. (11.2) [illegible]

63. The decimal number corresponding to the binary number $(111000.0101)_2$ is

a. [illegible]

b. [illegible]

c. $(563.125)_{10}$

d. $(5631.2)_{10}$

64. The octal number corresponding to the decimal number $(372.21875)_{10}$ is

a. $(564.16)_8$

b. $(56.416)_8$

c. $(5.6416)_8$

d. $(56.641)_8$

65. Subtraction of $(11101010)_2$ from $(111010110101)_2$ gives

a. $110111001010)_2$

b. $(110110001011)_2$

c. $(111001001011)_2$

d. $(110111001011)_2$

66. The product of the two numbers 0.3541 E 11 and 0.2672 E- 09 is

a. 0.9460 E 02

b. 0.9460 E 01

c. 0.9460 E –99

d. 0.9460 E 20

67. For AND operation, the distributive law a. b + a .c is expressed

a. a. (b + c)

b. (a +b). (a + c)

c. (a +b).c

d. b. (a+c)

68. **Assertion (A)**

$\lim\limits_{n\to\infty}\frac{1^m+2^m+3^m+\ldots+n^m}{n^m+1}=\frac{1}{m+1}(m\neq-1)$

Reason (R): The above limit equals $\int_0^1 x^m\,dx$

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 a correct explanation of A

c. A is true but R is false

d. A is false but R is true

69. **Assertion (A):** If the polynomial f(x) has two real roots α and β such that $\alpha < \beta$,then the polynomial f'(x) has a root δ such that $\alpha < \delta < \beta$.

Reason (R): Rolle's theorem

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 a correct explanation of A

c. A is true but R is false

d. A is false but R is true

70. **Assertion (A):** The series $\sum_{n=1}^{\infty}\frac{(-1)^n}{n}$ converges .

Reason (R): The series $\sum_{n=1}^{\infty}\frac{(-1)^n}{n}$ converges absolutely.

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 a correct explanation of A

c. A is true but R is false

d. A is false but R is true

71. Which one of the following statements is NOT correct?

a. Every positive integer is either even or odd

b. No integer is both even and odd

c. For any integer , a , a^2 is even if and only if , a is even

d. No integer is both even and prime

72. The number having a recurring decimal representation 1.414141… is

a. real but irrational

b. not real

c. rational

d. neither rational nor real

73. Which one of the following is correct?

a. Between any two rational numbers, there is an integer

b. Between any two irrational numbers, there is a rational number

c. Between any two irrational numbers, there is an integer

d. Sum of two irrational numbers is always irrational

74. Multiplication of a complex number z by (1 + i) rotates the radius vector to z in the complex plane by an angle

a. 90^0 clockwise

b. 45^0 clockwise

c. 90^0 anticlockwise

d. 45^0 anticlockwise

75. If the complex number z and its conjugate $\bar{z}$ satisfy $z\bar{z} + 2(z+\bar{z}) = 12 + 8i$, then the values of z are

a. $2 \pm 2\sqrt{2}\,i$

b. $2\sqrt{2} \pm 2i$

c. $2 \pm \sqrt{2}\,i$

d. $2 \pm 3\,i$

76. The g.c.d of $x^3 - 3x^2 + 3x - 1$ and (x- 3) (x-1) is

a. $x^2 + x + 1$

b. x + 1

c. x − 3

d. x- 1

77. The l.c.m. of the two polynomials $(x^2 - 3x + 2)$ and $(x^2 - 5x + 6)$ is

a. $(x-1)(x-2)^2(x-3)$

b. $(x-1)(x-2)(x-3)^2$

c. (x-1)(x-2)(x-3)

d. $(x-1)^2(x-2)(x-3)$

78. If integers a, b> 1; then the set of all integers of the form ma + nb(m, n integers) includes

a. both their g.c.d. and l.c.m

b. their g.c.d but not l.c.m.

c. their l.c.m. but not g.c.d.

d. neither their *l*.c.m nor g.c.d.

79. A polynomial f(x) is divisible by x- a if and only if

a. $f'(a) = 0$

b. $f(a) = 0$

c. $f(a) > 0$

d. $f(a) < 0$

80. f(x) and g(x) are two polynomials with real coefficients . If the degrees of f(x) and g(x) be respectively 3 and 4 , then the degree of the polynomial f(x). g(x)is

a. 12

b. 4

c. 3

d. 7

81. If $f(x) = x^3 + 5x^2 + 5x + 1$ and α is a root of the equation f(x) = 0, then

a. $f(\alpha) \neq 0$ and $f(1/\alpha) \neq 0$

b. $f(\alpha) = 0$ an $f(1/\alpha) = 0$

c. $f(\alpha) = 0$ and $f(1/\alpha) \neq 0$

d. $f(\alpha) \neq 0$ and $f(1/\alpha) = 0$

82. If the polynomial x^2+x+1 is divided by x[illegible] over the complex field ,then the rem[illegible]der is

a. x + i

b. i

c. $-i$

d. 0

83. The number [illegible] elementary symmetry functions in [illegible] x_2 [illegible] an[illegible] x_4 is

a. 2

b. 4

c. 6

d. [illegible]

84. [illegible]hich one of the following is an e[illegible]mentary symmetric function of x_1, x_2, x_3, x_4?

a. $x_1 x_2 x_3 + x_2 x_3 x_4$

b. $x_1 x_2 + x_1 x_3 + x_2 x_3$

c. $x_1^2 + x_2^2 + x_3^2 + x_4^2$

d. $x_1x_2+x_1x_3+x_1x_4+x_2x_3+x_2x_4+x_3x_4$

85. If α, β, γ and δ are the roots of the equation $3x^4-40x^3+130x^2-120x + 90 = 0$ then the value of $(\alpha+\beta)(\gamma+\delta)+\alpha\beta+\gamma\delta$ is

a. 40/3

b. 130/3

c. 40

d. 30

86. If we add a fixed number h to the r[illegible]ots o[illegible] the equation $x^4- 6x^3- 38x^2-3x +$ [illegible]7=[illegible] then the equation with new values a[illegible] the ro[illegible]ts is $y^4-22y^3+130y^2-243y+61$[illegible]0 . Th[illegible] value of h is

a. 1

b. 2

c. 3

d. 4

87. If a [illegible] integers and $b^2=4(ac + 5d^2)$ for [illegible]ome p[illegible]sitive integer d. then the roots [illegible] equatio[illegible] $ax^2+bx+c = 0$ are

a. [illegible]tional

b. [illegible]ational but not equal

c. complex conjugates

d. rational and equal

88. If A and B are sets with 10 and 6 elements respectively with 4 common elements, then the number of elements in $(A\times B) \cap (B\times A)$ is

a. 60

b. 36

c. 16

d. 4

89. Which one of the following statements for sets A, B, C is correct?

a. $A- (B\cup C) = (A- B)\cup (A- C)$

b. $A\cup (B-C) = (A\cup B)- (A\cup C)$

c. $A- (B\cap C) = (A-B)\cap (A-C)$

d. $A- (B\cup C) = (A- B) \cap (A-C)$

90. Which one of the following relations defines y as a function of x on the whole of R?

a. $x^2 + y^2 = 1$

b. x = sin y

c. $x^2- y^2=1$

d. $x- y^3 = 0$

91. Consider a mapping f from the set of natural numbers N to the set of integer Z defined by

$$f(n)=\begin{cases}\dfrac{n-1}{2}, & \text{when } n \text{ is odd}\\ -n/2, & \text{when } n \text{ is even}\end{cases}$$ Then

$f: N \to Z$ is

a. one-one but not onto
b. onto but not one-one
c. both one-one and onto
d. neither one-one nor onto

92. Which one of the following is NOT an equivalent relation (~) ?

a. Congruence modulo relation in the set of all integers
b. Congruence relation in the set of all triangles in a given plane
c. Similarity relation in the set of all triangles in a given
d. For all a, b∈N (N is a set of natural numbers)~ is defined as a~ b iff a – b is a positive number.

93. If the set Z of integers is a group under the binary operation * defined as m*n =m+n +1 , m, n∈Z, then the inverse of the element 5 is

a. 5
b. –5
c. –6
d. –7

94. In an Abelian group the order of an element a is 4 and the order of an element b is 3 ,then $(ab)^{[illegible]}$ is equal to

a. $a^2 b$[illegible]
b. [illegible]
c. $a^{[illegible]}$
d. b

95. If A= [x, y, z] , B= $\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ and C= $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$ then $[ax^2+by^2+cz^2+2hxy+2gzx+2fyz]$ can be expressed as

a. (BA)C
b. (AB)C
c. (AC)B
d. (AB)A

96. If A and B are any two square matrices of order 2×2, then $(A+B)^2$ is equal to

a. $A^2+2AB+B^2$
b. $A^2+2BA+B^2$
c. $A^2+AB-BA+B^2$
d. $A^2+AB+BA+B^2$

97. If any two rows (or two columns) of a determinant are interchanged, then the value of the determinant is multiplied by

a. 0
b. 1
c. –1
d. the order of the determinant

98. The value of the determinant $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$ is equal to

a. $(a+b+c)(a^2+b^2+c^2)$
b. $(a+b+c)^3$
c. a+b+c
d. $a^3+b^3+c^3$

99. If A is an invertible matrix whose inverse is the matrix $\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$,then A is the matrix

a. $\begin{bmatrix} 6 & -4 \\ -5 & 3 \end{bmatrix}$
b. $\begin{bmatrix} 1/3 & 4 \\ 5 & 1/6 \end{bmatrix}$
c. $\begin{bmatrix} -3 & 2 \\ 5/2 & -3/2 \end{bmatrix}$
d. $\begin{bmatrix} 1/3 & 1/4 \\ 1/5 & 1/6 \end{bmatrix}$

100. The system of equation

$4x_1+x_2-3x_3-x_4=0$
$2x_1+3x_2+x_3-5x_4=0$
$x_1-2x_2-2x_3+3x_4=0$ has

a. no solution
b. only one solution (0, 0, 0 , 0)
c. infinite number of solutions
d. only two solutions (0, 0, 0, 0) and (3/5, 1, 4/5 , 1)