MATHEMATICS

1. If $z = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 3 \end{bmatrix}$, then $|z^* z|$ is equal to
   a. 2
   b. 4
   c. 8
   d. 6

2. If $A+B=\begin{bmatrix} 0 & 0 \\ 2 & 1 \end{bmatrix}$ and $A-B=\begin{bmatrix} 0 & 2 \\ 0 & 1 \end{bmatrix}$ then A is equal to
   a. $\begin{bmatrix} 0 & 2 \\ 2 & 2 \end{bmatrix}$
   b. $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$
   c. $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$
   d. $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

3. The co-factors of the elements of the second row of the determinant $\begin{bmatrix} 1 & 2 & 3 \\ -4 & 3 & 6 \\ 2 & -7 & 9 \end{bmatrix}$ are
   a. −39, 3, 11
   b. 6, 5, 4
   c. 3, 11, -39
   d. 13, 1, 3

4. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & b \\ a^2 & b^2 & c^2 \end{vmatrix}$ is equal to
   a. (a-b)(c-b)(c-a)
   b. (a-b)(b-c)(c-b)
   c. $a^2+b^2+c^2$
   d. a+b+c

5. If $A=\begin{bmatrix} 3 & 8 \\ 2 & 1 \end{bmatrix}$ then A^{-1} is
   a. $\frac{1}{13}\begin{bmatrix} 3 & 2 \\ 8 & 1 \end{bmatrix}$
   b. $\frac{1}{-13}\begin{bmatrix} 1 & -8 \\ -2 & 3 \end{bmatrix}$
   c. $\frac{1}{-13}\begin{bmatrix} 3 & 2 \\ 8 & 1 \end{bmatrix}$
   d. $\frac{1}{13}\begin{bmatrix} 1 & -8 \\ -2 & 8 \end{bmatrix}$

6. The value of α for which the system of equations $x + y + z = 0$

   $y + 2z = 0$

   $\alpha x + z = 0$ has more than one solution is
   a. −1
   b. 0
   c. $\frac{1}{2}$
   d. 1

7. If [y] denotes the greatest integer less than or equal to the real number x, then the range of the function, $f(x) = 1 + x[x-3]$ is
   a. [4, 5]
   b. [4, ∞]
   c. the set Z of all integers
   d. the set IR of all real numbers

8. Which of the following statements is/are correct?
   1. The sum and difference of any two irrational numbers need not be irrational.
   2. Product of any two irrational numbers is irrational.
   3. For any two distinct irrational numbers a and b, the number a/b is irrational

   Select the correct answer using the codes given below:
   a. 1, 2 and 3
   b. 1 and 2
   c. 2 and 3
   d. 1 alone

9. $\lim_{n\to\infty} \left\{ \left(1+\frac{1}{n}\right)^n + \left(1+\frac{1}{n}\right)^{-n} \right\}$
   a. exists and is equal to 0
   b. does not exist
   c. exists and is equal to $e + \frac{1}{e}$
   d. exists and is equal to e

10. Consider the following statements:
    If $f(x) = \begin{cases} x & 0 \le x < 1 \\ 3-x & 1 \le x \le 2 \end{cases}$, then
    1. $\lim_{x\to 1^-} f(x) = 1$
    2. $\lim_{x\to 1^+} f(x) = 2$

3. $\lim_{x\to 2} f(x) = 2$

Of these statements

a. 1 and 3 are correct
b. 1, 2 and 3 are correct
c. 1 and 2 are correct
d. 2 alone is correct

11. A function which is continuous nowhere on R but is bounded on R is f defined by

a. $f(x) = x$, x rational ; $f(x) = -x$, x irrational
b. $f(x) = n, n \le x < n+1, n \in Z$
c. $f(x) = -1$, x rational ; $f(x) = 1$, x irrational
d. $f(x) = 1, x = n, n \in Z; f(x) = 0$ otherwise

12. Let $D = \{f \mid f$ is differentiable on $(0, 1)\}$ $C = \{f \mid f$ is continuous on $(0, 1)\}$, then

a. $C \cap D = \phi$
b. $C \subset D$
c. $C = D$
d. $D \subset C$

13. Let f, g, h, k be differentiable in (a, b), if F is defined as $F(x) = \begin{vmatrix} f(x) & g(x) \\ h(x) & k(x) \end{vmatrix}$ for all $x \in (a,b)$ then F′(x) is given by

a. $\begin{vmatrix} f'(x) & g(x) \\ h(x) & k(x) \end{vmatrix} + \begin{vmatrix} f(x) & g(x) \\ h'(x) & k(x) \end{vmatrix}$

b. $\begin{vmatrix} f'(x) & g'(x) \\ h(x) & k(x) \end{vmatrix} + \begin{vmatrix} f'(x) & g(x) \\ h(x) & k'(x) \end{vmatrix}$

c. $\begin{vmatrix} f(x) & g'(x) \\ h(x) & k'(x) \end{vmatrix} + \begin{vmatrix} f'(x) & g(x) \\ h(x) & k(x) \end{vmatrix}$ [illegible]

d. $\begin{vmatrix} f(x) & g(x) \\ h'(x) & k'(x) \end{vmatrix} + \begin{vmatrix} f'(x) & g(x) \\ h(x) & k(x) \end{vmatrix}$ [illegible]

14. The slope of the curve $y = ae^{-x/b}$ at the point where it crosses the y-axis is

a. $\frac{a}{[illegible]}$
b. [illegible]
c. $\frac{b}{a}$
d. $-\frac{b}{a}$

15. The derivative of the function x^x is

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

16. If $y = \log_u v$, where u and v are function of x, then $\frac{dy}{dx}$ is equal to

a. $\frac{-\log v}{u(\log u)^2}\cdot\frac{du}{dx}+\frac{1}{v(\log u)}\cdot\frac{dv}{dx}$
b. $\frac{1}{v}\frac{dv}{dx}+\log v\frac{du}{dx}$
c. $\frac{1}{v}\frac{dv}{dx}$
d. $\frac{1}{u}\frac{du}{dx}+\frac{1}{v}\frac{dv}{dx}$

17. If $x^m . y^n = (x+y)^{m+n}$, then $\frac{dy}{dx}$ [illegible]

a. $\frac{x}{y}$
b. $\frac{1}{y}$
c. 1x [illegible]
d. - [illegible]

18. If [illegible] be the quadratic function defined on [a, b] [illegible] $f(x) = \alpha x^2 + \beta x + \gamma$, $\alpha \neq 0$, then [illegible] real number 'c' guaranteed by the Lagrange's Mean Value theorem is equal to

a. $\frac{(a+b)}{2}$
b. $\sqrt{(ab)}$
c. $\frac{2ab}{(a+b)}$
d. $\left(\frac{a}{b}+\frac{b}{a}\right)$

19. The sum of the series $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots$ is

a. a positive integer
b. a negative integer
c. a proper fraction
d. an irrational number

20. Which one of the following statements is correct for the function $f(x) = x^3$?

a. $f(x)$ has a maximum at x = 0
b. $f(x)$ has a minimum at x = 0
c. $f(x)$ has neither a maximum nor a minimum at x = 0
d. $f(x)$ has no point of inflexions

21. The tangent to the curve $y = 2x^3 - x^2 + 3$ at the point (1,4) passes through

a. (0, 0)
b. (1, 3)
c. (2, 4)

d. (2, 3)

22. The value of p for which the radius of curvature of the curve x = 2py at the point (0, 0) is 3, is:

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

23. If $u = (x^2 + y^2 + z^2)^{1/2}$, then $\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right)$ is equal to

a. 4u
b. 2/u
c. 2u
d. – u/4

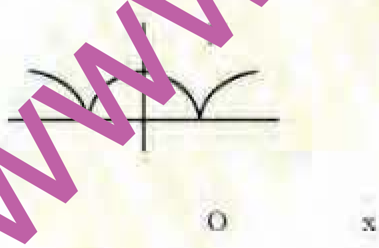
24. If $z = f(x + ay) + \phi(x - ay)$, then:

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

25. The points of inflextion of the curve $y=3x^4-4x^3$ correspond to

a. $x=\frac{2}{3}, x=0$
b. $x = \frac{1}{3}, x = \frac{2}{3}$
c. x = 0 , x = 1
d. x = 1, x = 2

26. Figure



The parametric equations of the given curve are

a. x = a(t – sin t)
y = a(1- cos t)
b. x = a (t + sin t)
y = a (1- cos t)
c. x = a (t- sin t)
y = a (1+ cos t)
d. x = a (t + sin t)
y = a(1 + cos t)

27. The value of $\int_0^1 xe^x dx$ is

a. –1
b. 1
c. e
d. 2e

28. $\int_0^{2a} f(x)dx = 2\int_0^{a} f(x)dx$

a. is always true
b. is true only when f(x) = f (a+x)
c. is true only when f (x) = (2a- x)
d. is true only when f (2a-x)= -f (x)

29. Let f (x) be bounded and integrable on [a, b] and let $F(x)=\int_a^x f(t)dt$, a ≤ x ≤ b , then

a. If f (x) is continuous at a point c of [a, b] then F′(c)=f (c)
b. continuity of f (x) on [a, b] does not imply derivability of F(x) on [a, b]
c. F(x) is not uniformly continuous on [a, b]
d. A continuous function f (x) may not possess a primitive F(x)

30. $\int_0^x \cosh\frac{x}{a}dx$ is equal to

a. a sin h $\frac{y}{a}$
b. $-\frac{1}{a}$ sin h $\frac{x}{a}$
c. a sin h $\frac{x}{a}$
d. $\frac{1}{a}$ sin h $\frac{x}{a}$

31. For definite integrals, the formula of integration by parts is

a. $\int_a^b u\,dv = uv\Big|_a^b + \int_a^b v\,du$
b. $\int_a^b u\,dv = uv\Big|_a^b + \int_a^b v\,du$
c. $\int_a^b u\,dv = uv\Big|_a^b + \int_a^b v\,du$
d. $\int_a^b u\,dv = uv\Big|_a^b + \int_a^b v\,du$

32. The correct value of the volume of the prolate spheroid formed by the revolution of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ about x -axis is

a. $\frac{1}{3}\pi a^2b$

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

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

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

33. The length of the arc of the curve $6xy = x^4+3$ from $x = 1$ to $x = 2$ is

a. $\frac{13}{12}$ units

b. $\frac{17}{12}$ units

c. $\frac{19}{12}$ units

d. None of the above

34. The volume of ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ is

a. $\frac{4}{5}\pi$ abc cubic units

b. $\frac{4}{3}\pi$ abc cubic units

c. 4π abc cubic units

d. None of the above

35. For a positive term series Σa_n the Ratio Test states that

a. the series converges if $\lim_{n\to\infty}\frac{a_{n+1}}{a_n} > 1$

b. the series converges if $\lim_{n\to\infty}\frac{a_{n+1}}{a_n} < 1$

c. the series diverges if $\lim_{n\to\infty}\frac{a_{n+1}}{a_n} = 1$

d. None of the above

36. The series $x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+.....$ is convergent for

a. all real values of x

b. $|x| < 1$ only

c. $|x| \le 1$

d. $-1 < x \le 1$

37. The differential equation of the system of circles touching the y-axis at the origin is

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

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

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

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

38. The differential equation M(x, y) dx + N(x, y)dy = 0 is an exact equation if

a. $\frac{\partial M}{\partial y}+\frac{\partial N}{\partial x}=0$

b. $\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}=0$

c. $\frac{\partial N}{\partial y}+\frac{\partial M}{\partial x}=0$

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

39. The equation of (4x + 3y + 1) dx + (3x + 2y + 1)dy = 0 represents a family of

a. circles

b. parabolas

c. ellipses

d. hyperbolas

40. The general solution of the differential equation $(x^2+y^2)dx - 2xy\,dy = 0$ is

a. $x^2-cx-y^2=0$, where c is an arbitrary constant

b. $(x-y)^2=cx$, where c is an arbitrary constant

c. $x+y+2xy = c$, where c is an arbitrary constant

d. $y= x^2-2x+c$, where c is an arbitrary constant

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

a. $y = cx - c^2$, c is an arbitrary constant

b. $y = cx + c$, c is an arbitrary constant

c. $y= cx - c$, c is an arbitrary constant

d. $y = cx + c^2$, c is arbitrary constant

42. The singular solution of the differential equation $(xp - y)^2=p^2-1$ is

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

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

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

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

43. The orgthogonal trajectories of the parabolas $y^2=4a(x+a)$, a being the parameter , are the curves given by

a. $y^2=4b(x+b)$, b being a parameter
b. $y^2=4b(x+b)$,b being a parameter
c. $y^2=4bx$, b being a parameter
d. $x^2=4by$, being a parameter

44. The general solution of the differential equation $\frac{d^4y}{dx^4}+2\frac{d^2y}{dx^2}+y=0$

a. $y=(c_1+c_2)\sin x+(c_3+c_4)\cos x$
b. $y=c_1\sin x+c_2\cos x+x\sin x+x\cos x$
c. $y=c_1\sin x+c_2\cos x+c_3\tan x+c_4\cot x$
d. $y=c_1\sin x+c_2\cos x+c_3x+c_4$

45. The general solution of the differential equations $(D^2+D-2)y=e^x$ is given by

a. $y=c_1e^x+c_2e^{-2x}+\frac{1}{3}xe^x$
b. $y=c_1e^x+c_2e^{-2x}$
c. $y=c_1e^x+c_2e^{-2x}+\frac{1}{6}x^2e^x$
d. $y=\frac{1}{3}xe^x+(c_1+c_2x)e^{-2x}$

46. A particular integral of the differential equation $\frac{d^2y}{dx^2}+a^2y=\sin ax$ is

a. $\frac{1}{2a}\cos ax$
b. $-\frac{1}{2a}x\cos ax$
c. $\frac{1}{2a}x\cos 2ax$
d. $-\frac{1}{[illegible]}\cos$ [illegible]

47. P(1, [illegible]) and Q(7, 0) are two vertices of a [illegible] PQR . If the slope of side PR is twice the slope of the side QR, then the [illegible] of the third vertex R is

a. $x^2+y^2-5y+2x-14=0$
b. $2x+5y-14=0$
c. $x=4, y=1$
d. $xy+2x+5y-14=0$

48. If the three lines $x+y=1$, $x-y=5$ and $2x+3y=k$ are concurrent ,then the value of k is

a. 1
b. -1
c. 0
d. 2

49. The straight lines represented by the equation $(x^2+y^2)\sin^2\alpha\ (x\cos\theta-y\sin\theta)^2$ are inclined to each other an angle

a. 2α
b. $\frac{\pi}{2}+\alpha$
c. α
d. $\frac{\alpha}{2}$

50. If λx^2 10xy [illegible] $12y^2$ [illegible] 5x [illegible] 16[illegible] $-3=0$ represents a pair of the straight lines, then the value of λ is

a. 1
b. 2
c. 3
d. [illegible]

51. [illegible] condition for the two circles
[illegible] $y^2+5k_1x+k^2=0$ and
$x^2+y^2+5k_2y+k^2=0$
to touch each other externally is

a. $k_1^2+k_2^2=k^2$
b. $k_1^2-k_2^2=k^2$
c. $k_1^2+k_2^2=k^2$
d. $k^2(k_1^2+k_2^2)=k_1^2k_2^2$

52. The locus of the point of intersection of two normals to the parabola $y^2=4ax$ which are at right angles to one another is

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

53. If the locus of the point of intersection of perpendicular tangents to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is a circle with center at (0, 0) then the radius of the circle would be

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

54. The center of the hyperbola $2x^2+y^2-3xy-5x+4y+6=0$ is the point

a. (1, 2)
b. (2, 1)

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

55. The circles $\gamma = a \cos \theta(\theta - \alpha)$ and $\gamma = b \sin (\theta - \alpha)$ cut each other at an angle of
a. 90^0
b. 60^0
c. 45^0
d. 30^0

56. The parametric equations $x = \frac{a}{2}\left(t + \frac{1}{t}\right)$, $y = \frac{b}{2}\left(t - \frac{1}{t}\right)$ represents
a. an ellipse
b. a hyperbola
c. a parabola
d. a circle with center at origin

57. A straight line passes through the point (2, -1, -1) .It is parallel to the plane $4x + y + z + 2 = 0$ and is perpendicular to the line $\frac{x}{1} = \frac{y}{-2} = \frac{z-5}{1}$
The equations of the straight line are:
a. $\frac{x-2}{4} = \frac{y+1}{1} = \frac{z+1}{1}$
b. $\frac{x+2}{4} = \frac{y-1}{1} = \frac{z-1}{3}$
c. $\frac{x-2}{-1} = \frac{y+1}{1} = \frac{z+1}{3}$
d. $\frac{x+2}{-1} = \frac{y-1}{1} = \frac{z-1}{3}$

58. Perpendicular is drawn from the point (0, 3, 4) to the plane $2x - 2y + z = 10$. The coordinates of the foot of the perpendicular are:
a. $\left(-\frac{8}{3}, \frac{1}{3}, \frac{16}{3}\right)$
b. $\left(-\frac{8}{3}, [illegible], \frac{16}{3}\right)$
c. $\left([illegible], \frac{-1}{3}, \frac{[illegible]}{3}\right)$
d. $\left(-\frac{8}{3}, \frac{1}{3}, \frac{16}{3}\right)$

59. A sphere $x^2+y^2+z^2 = 9$ is cut by the plane $x + y + z = 3$. The radius of the circle so formed is
a. $\sqrt{6}$
b. $\sqrt{3}$
c. 3
d. 6

60. The equation $fyz + gzx + hxy = 0$ represents a
a. a pair of planes
b. sphere
c. cylinder
d. cone

61. The equation of a cylinder, whose generating lines have the direction cosines (l,m ,n) and which passes through the fixed circle $x^2+z^2=a^2$ in the ZOX plane is
a. $(mx - ly)^2 + (mz - ny)^2 = a^2$
b. $(mx-ly)^2+(mz-ny)^2=a^2m^2$
c. $(ly-my)^2+(ny-mz)^2=a^2m^2$
d. $(mx+ly)^2+(mz+ny)^2=a^2m^2$

62. If there vector A,B,C are such that A×B=C, then
a. A.C = 0
b. B.C = 0
c. [illegible] C = [illegible].C
d. A. C = B. C

63. The resultant of two forces P and Q is R. If one of the forces is reversed in direction, the resultant becomes R′, then
a. $R^2=P^2+Q^2+2PQ \cos \alpha$
b. $R'^2=P^2-Q^2-2PQ \cos \alpha$
c. $R^2+R^2=2(P^2+Q^2)$
d. $R^2+R'^2=2(P^2-Q^2)$

64. Two weights of 10 gms and 2 gms hang from the ends of a uniform lever one meter long and weighing 4 gms. The point in the lever about which it will balance is from the weight of 10 gms at a distance of
a. 5 cm
b. 25 cm
c. 45 cm
d. 65 cm

65. The angle between two forces F and 2F acting at a point when the resultant is perpendicular to F is
a. 60^0
b. 135^0
c. 120^0
d. 150^0

66. If a body is in equilibrium under the action of three coplanar forces, then
a. they must act in a straight line
b. they must meet in a point

c. their horizontal and vertical components must be equal

d. none of the above

67. If a particle moves in one dimension under the potential energy $V = V_0(e^{-ax} + bx)$ where V_0 a, b are positive constants, then the nature of the equilibrium position is

a. unstable

b. stable

c. neutral

d. undecided

68. Which one of the following statements is correct?

a. Newton's three laws of motion are independent

b. First law of motion is contained in the second law as a special case

c. Second law of motion can be deduced from the third law

d. Third law of motion can be deduced from the second law.

69. Newton's second law of motion is given by

a. velocity = $\frac{mass}{force}$

b. acceleration = $\frac{moving\ mass}{moving\ force}$

c. acceleration = $\frac{moving\ force}{mass\ moved}$

d. none of the above

70. The pedal equation of the path of a central orbit is

a. $F = \frac{h^2}{p^3}\frac{dr}{dp}$

b. $F = \frac{h^2}{p^3}\frac{dp}{dr}$

c. $F = \frac{h^2}{p^3}\frac{dp}{dr}$

d. $F = \frac{h^2}{p^2}\frac{d^2p}{dr^3}$

71. For the motion of a particle in plane in a central orbit, the angular velocity of the particle varies

a. inversely as the distance

b. inversely as the square of the distance

c. directly as the distance

d. directly as the square of the distance

72. A particle executing a simple harmonic motion has acceleration 8cm/sec^2 when it is at a distance 2 cm from the center. The time period will be

a. $\frac{2}{\pi}$ seconds

b. $\frac{1}{\pi}$ seconds

c. $\frac{\pi}{2}$ seconds

d. π seconds

73. A particle is projected from a point on the x-axis in the vertical x- y plane .If the trajectory above the x-axis is given by $x^2 + 4y - 8 = 0$, then the velocity of projection is

a. $\sqrt{3g}$

b. $\sqrt{4g}$

c. $\sqrt{5g}$

d. $\sqrt{6g}$

74. A particle moving along a circular path with constant speed

a. is not accelerated

b. has a constant velocity

c. has radial acceleration away from the center

d. has radial acceleration towards the center

75. If a particle moves along a circle of radius 'a' so that r = a, then transverse velocity is equal to

a. $a\frac{d\theta}{dt}$

b. $r\frac{d\theta}{dt}$

c. $\frac{dr}{dt}.\theta$

d. $\frac{dr}{dt}.\theta$

76. The escape velocity for a body projected vertically upwards is 11.2 kg/sec. If the body is projected in a direction making angle of 60^0 with the vertical , then the escape velocity will be

a. 11.2 km/sec

b. $5.6\sqrt{3}$ km/sec

c. 5.6 km/sec

d. none of the above

77. Which of the following statements are correct for the integers p , m and n?

1. if p < m then m ≮ p.

2. if $p \neq m$, then either $m < p$ or $p < m$
3. $mn \leq mp$ if and only if $n \leq p$
4. $mn < mp$ if and only if $n < p$, provided $m \neq 0$

Select the correct answer using the codes given below:

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

78. Consider the following numbers:

$$\pi, \frac{22}{7}, \frac{223}{71}$$

The correct sequence in increasing order would be:

a. $\pi, \frac{22}{7}, \frac{223}{71}$
b. $\pi, \frac{223}{71}, \frac{22}{7}$
c. $\frac{223}{71}, \pi, \frac{22}{7}$
d. $\frac{223}{71}, \frac{22}{7}, \pi$

79. If n is a positive integer, then $\sqrt{n+1}+\sqrt{n-1}$ is

a. rational for only one value of n
b. rational for more than one value of n
c. rational for no value of n
d. rational for at least one value of n

80. If w be an imaginary cube root of unity, then $(1-w+w^2)^5+(1+w-w^2)^5$ is equal to

a. 64
b. 32
c. 16
d.

81. The conjugate of $(1+i)^2$ is given by

a. $(1-i)^2$
b. $(1+i)^{-1}$
c. $-2i$
d. $2i$

82. If m and x be positive integers a and b such that $a \equiv b \pmod{m}$, then consider the following statements:

1. $a + x \equiv b + x \pmod{m}$
2. $a - x \equiv b - x \pmod{m}$
3. $ax \equiv bx \pmod{m}$
4. $a^x \equiv b^x \pmod{m}$

Of these statements

a. Only one of the statement is correct
b. Only two of the statements are correct
c. Only three of the statements are correct
d. All the statement are true

83. The equation, in the set of integers $2x \equiv 3$ (modulo 20) has

a. a unique solution
b. no solution
c. infinite number of solutions
d. only 2 solutions

84. Consider the following statements:

1. if d is g.c.d. of integers h and k, then d = mh + nk, where m and n are uniquely determined
2. if h and k are primes and m | hk, then m | h or m | k

Of these statements:

a. 1 is true, but 2 is false
b. 2 is true, but 1 is false
c. both 1 and 2 are true
d. both 1 and 2 are false

85. If the quotient on dividing $x^4+2x^3+2x^2-3x+1$ by $x+2$ is $x^3+2ax^2+2bx+c$, then the values of a, b, c are respectively,

a. 1, 2, -7
b. 0, 2, 7
c. 0, -2, 7
d. 0, 1, -7

86. If $a(x)=x^2+2x+3$, $b(x)=3x^2+2x$ and $c(x)=2x+2$ be three members of the ring $I_4(x)$ over the ring I_4 of integers modulo 4, then consider the following statements :

1. $\deg[a(x)+b(x)] = 0$
2. $\deg[c(x)]=0$
3. $\deg[a(x)b(x)]=4$

Of these statements:

a. 1 and 2 are correct
b. 1 and 3 are correct
c. 2 and 3 are correct
d. 1, 2 and 3 are correct

87. The G.C.D. and L.C.M of f(x) and g(x) are respectively x^2+x-2 and $x^4+3x^3-3x^2-7x+6$. If $f(x) = x^3+4x^2+x-6$, then g(x) is

a. x^3-3x^2+2
b. x^3-3x^2-2

c. x^3-3x+2
d. x^3-3x-2

88. If α, β, γ are the roots of the equation $x^3+px^2+qx+r=0$, then the value of $(\alpha+\beta)(\beta+\gamma)(\gamma+\alpha)$ is
a. $r+pq$
b. r^2-pq
c. r^2+pq
d. $r-pq$

89. If $x+y+z=6$ and $xy+yz+zx=10$, then the value of $x^3+y^3+z^3-3xyz$ is
a. 56
b. 36
c. 26
d. 16

90. If the roots of the equation
$x^4-6x^3-38x^2-3x+17=0$
are greater by k than the roots of the equation $x^4-22x^3+130x^2-243x+61=0$, then value of k would be
a. 4
b. −4
c. 6
d. −6

91. Given that x^2+1 is a factor, the number of real roots of the equation $2x^4-11x^3+17x^2-11x+15=0$ is
a. 0
b. 1
c. 2
d. 4

92. The equation $x^3+x^2-16x+20=0$ has a repeated root. The root is
a. 2 repeated twice
b. 2 repeated thrice
c. −5 repeated twice
d. −5 repeated thrice

93. Let U = {1, 2, 3,......8} be a universal set and A={1,2,3,4} and B={2,4,5,7} be subsets of U = then $A^C \cup B^C$ is equal to
a. {1,2,3,0,5,6,7,8}
b. {1,3,4,6,7,8}
c. {1,3,5,6,8}
d. {1,3,5,6,7,8}

94. If A= {1,2,5,6} and B={1,2,3},then $(A\times B)\cap(B\times A)$ is
a. {(1,1)(1,2)(2,1)(2,2)}
b. {(1,1)(2,2)(5,1)(1,6)}
c. {(1, 1)(2,1)(6,1)(3,2)}
d. {(2,3)(3,1)(3,2)(5,3)}

95. On the set R of real number we define $x \sim y$ if and only if $xy \geq 0$, then the relation $\sim$ is
a. reflexive but not symmetric
b. symmetric but not transitive
c. transitive but not reflexive
d. an equivalence relation

96. If $f(x+1)-2f(x)+f(x-1)=2$ for all x, then
a. $f(x)=-x$
b. $f(x)=x$
c. $f(x)=-x^3$
d. $f(x)=-x^2$

97. Consider the statements
1. Two equivalence classes are either identical or they have a vacuous intersection
2. The quotient set of a set S relative to an equivalence relation is a subset of S
3. The partition of a set S into disjoint subsets defines an equivalence relation on S

Of these statements
a. 1 and 2 are correct
b. 1 and 3 are correct
c. 2 and 3 are correct
d. 1, 2 and 3 are correct

98. On the set of integers define a relation R by setting $(a, b)\in R$ if and only if a^2 and b^2 are not prime to each other.
The relation is not a equivalence relation because if fails to be
a. Reflexive
b. Symmetric
c. Anti-symmetric
d. Transitive

99. Consider $A=\{3n:n\in Z\}$
$B=\{4n:n\in Z\}$
The subgroups of the additive group Z is
a. $\{A\cup B, +\}$
b. $\{A\cap B, +\}$
c. $\{A\cup B, .\}$
d. $\{A\cap B, .\}$

100. If Q and Z are the sets of rational numbers and integers respectively, then which one of the following triplets is a field?
a. (Q, +, •)
b. (Q, -, •)
c. (Z, +, •)
d. (Z, -, •)