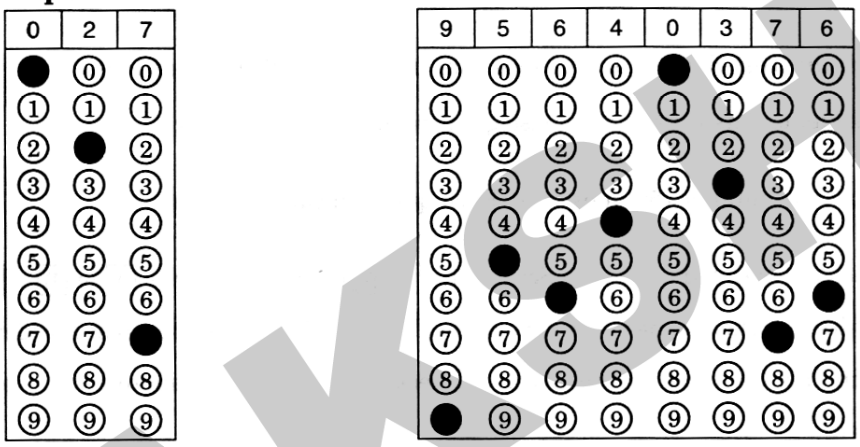
ASSISTANT CONSERVATOR OF FOREST
MATHEMATICS

5. Mark Paper Code and Roll No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in Part A of side 1 of the Answer Sheet. Incorrect/not encoding will lead to ***invalidation*** of your Answer Sheet.

***Example* :** If the Paper Code is **027**, and Roll No. is **95640376** fill as shown below :

Paper Code **Roll No.**



6. Please get the signature of the Invigilator affixed in the space provided in the Answer Sheet. An Answer Sheet without the signature of the Invigilator is liable for ***invalidation.***

7. The candidate should **not** do rough work or write any irrelevant matter in the Answer Sheet. Doing so will lead to ***invalidation.***

8. Do **not** mark answer choices on the Test Booklet. Violation of this will be viewed seriously.

9. Before leaving the examination hall, the candidate should hand over the original OMR Answer Sheet (top sheet) to the Invigilator and carry the bottom sheet (duplicate) for his/her record, failing which disciplinary action will be taken.

10. Use of whitener is prohibited. If used, the answer sheet is liable for invalidation.

1. The equation of the plane having (–3, 5, –8) as the foot of the perpendicular from the origin is

(1) $3x+5y+8z+98=0$

(2) $3x-5y+8z+98=0$

(3) $3x-5y-8z+98=0$

(4) $3x-5y+8z-98=0$

2. A plane cuts the coordinate axes in P, Q and R. If (a,b,c) is the centroid of the triangle PQR then equation of the plane is

(1) $ax+by+cz=1$

(2) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=3$

(3) $ax+by+cz=3$

(4) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

3. The equation of the plane through the line of intersection of the planes $x+y+z=6, 2x+3y+4z+5=0$ and the point (1, 1, 1) is

(1) $20x+23y+26z=69$

(2) $20x+23y+26z+69=0$

(3) $20x-23y-26z=69$

(4) $20x-23y+26z+69=0$

4. The volume of the tetrahedron having vertices at (0, 1, 2), (3, 0, 1), (4, 3, 6) and (2, 3, 2) is

(1) $\frac{1}{6}$

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

(3) $\frac{2}{3}$

(4) 1

5. The point of intersection of the line $\frac{x+1}{1}=\frac{y+3}{3}=\frac{z-2}{-2}$ and the plane $3x+4y+5z=5$ is

(1) (1, –3, 2)

(2) (1, 3, –2)

(3) (1, –3, –2)

(4) (1, 3, 2)

6. If the lines $x=az+b, y=cz+d$ and $x=a_1z+b_1, y=c_1z+d_1$ are perpendicular to each other then $aa_1+cc_1=$

(1) 0

(2) 1

(3) –1

(4) bb_1+dd_1

7. The equation of the plane containing $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and parallel to z-axis is

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

(2) $3x-2y=1$

(3) $3x+2y+1=0$

(4) $3x+2y=1$

8. The shortest distance between the lines $\frac{x-8}{3}=\frac{y+9}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ is

(1) $\sqrt{14}$

(2) 14

(3) $\sqrt{7}$

(4) 7

9. The equation of the sphere with (2, 3, –1) and (3, –1, 2) as the extremities of a diameter is

(1) $x^2+y^2+z^2+5x+2y+z+1=0$

(2) $x^2+y^2+z^2-5x+2y+z+1=0$

(3) $x^2+y^2+z^2-5x-2y-z+1=0$

(4) $x^2+y^2+z^2+5x-2y-z+1=0$

10. The radius of the sphere $x^2+y^2+z^2-6x+8y-10z+1=0$ is

(1) 3

(2) 4

(3) 7

(4) 10

11. The sequence $\left\{\sin\left(\frac{n\pi}{2}\right)\right\}_{n=1}^{\infty}$ is

(1) bounded but not convergent

(2) convergent

(3) unbounded

(4) bounded and convergent

12. If $\lim_{n\to\infty} a_n = A$ then $\lim_{n\to\infty}\frac{a_1+a_2+\ldots+a_n}{n}=$

(1) 0

(2) A

(3) ∞

(4) does not exist

13. If $s_n=\begin{cases} n & \text{if } n \text{ is odd} \\ \frac{1}{2^n} & \text{if } n \text{ is even}\end{cases}$ then $\lim_{n\to\infty} s_{2n}=$

(1) does not exist

(2) 0

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

(4) ∞

14. The series $\sum_{n=1}^{\infty}\frac{2^n-1}{2^n+1}$ is

(1) convergent

(2) divergent

(3) absolutely convergent

(4) conditionally convergent

15. The conditionally convergent series, among the following, is

(1) $\sum_{n=0}^{\infty}\frac{(-1)^{n+1}n}{n+1}$

(2) $\sum_{n=0}^{\infty}\frac{(-1)^n n^2}{n^3+1}$

(3) $\sum_{n=0}^{\infty}\frac{(-1)^n}{n^2+1}$

(4) $\sum_{n=0}^{\infty}\frac{(-1)^n n^2}{n^2+1}$

16. The convergent series, among the following, is

(1) $\sum_{n=1}^{\infty} \frac{n+1}{n+2}$

(2) $\sum_{n=1}^{\infty} \left(\frac{3}{5}\right)^n$

(3) $\sum_{n=1}^{\infty} \cos(n\pi)$

(4) $\sum_{n=1}^{\infty} \sqrt{\frac{n}{n+2}}$

17. The series $\sum_{n=1}^{\infty} (-1)^n \frac{1}{n}$ is

(1) absolutely convergent
(2) conditionally convergent
(3) convergent
(4) has no sum

18. The series $\sum_{n=1}^{\infty} \frac{(n+2)(n+3)}{n(n+1)} x^n$ converges if

(1) $x \le 1$
(2) $x = 1$
(3) $x > 1$
(4) $x = -1$

19. For $x \in \mathbb{R}$, the series $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots =$

(1) $\sin x$
(2) $\cos x$
(3) $\tan x$
(4) e^{-x}

20. The interval on which $-x^3 + 7x^2 - 8x - 18$ is strictly increasing is

(1) $\left(-\infty, \frac{2}{3}\right]$
(2) $[4, \infty)$
(3) $\left(\frac{2}{3}, 4\right)$
(4) $(5, \infty)$

21. The stationary point of $\frac{\log x}{x}$ is

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

22. The value of c of the Rolle's theorem for $f(x) = \frac{x^3}{3} - 3x$ in $[0,3]$ is

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

23. The radius of curvature at $\left(\frac{1}{4}, \frac{1}{4}\right)$ on the curve $\sqrt{x} + \sqrt{y} = 1$ is

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

24. The slope of the tangent to $\frac{x^n}{a^n}+\frac{y^n}{b^n}=2$ at (a,b) is

(1) $\frac{nb}{a}$

(2) $-\frac{nb}{a}$

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

(4) $-\frac{b}{a}$

25. The equation of the normal to the curve $y^4 = ax^3$ at (a, a) is

(1) $3x-4y+a=0$

(2) $3x+4y+a=0$

(3) $4x+3y=7a$

(4) $4x+3y+7a=0$

26. The value of k such that the length of the subnormal at any point on $y=a^{1-k}\cdot x^k$ is constant, is

(1) 1

(2) –1

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

(4) $-\frac{1}{2}$

27. If θ is the angle between the curves $xy=2$ and $x^2+4y=0$ then $\tan\theta=$

(1) 1

(2) 2

(3) 3

(4) 4

28. The maximum value of $f(x)=x\cdot e^{-x}$ is

(1) e

(2) $\frac{1}{e}$

(3) $\sqrt{e}$

(4) e^{1-e}

29. $\int_1^4 x\cdot\sqrt{x^2-1}\,dx=$

(1) $\sqrt{15}$

(2) $2\sqrt{15}$

(3) $3\sqrt{15}$

(4) $5\sqrt{15}$

30. $\int_{\pi/6}^{\pi/3}\frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx=$

(1) $\frac{\pi}{6}$

(2) $\frac{\pi}{12}$

(3) $\frac{\pi}{15}$

(4) $\frac{\pi}{18}$

31. If the frequency and maximum velocity of a simple harmonic motion are 30 oscillations per minute and 10 ft per second then the period (in seconds) is

(1) 1

(2) 2

(3) 3

(4) 4

32. A particle performs 150 complete oscillations per minute and its greatest acceleration is 10 ft/sec². Its greatest velocity (in ft/sec) is

(1) $\frac{1}{\pi}$

(2) $\frac{2}{\pi}$

(3) $\frac{3}{\pi}$

(4) $\frac{15}{\pi}$

33. A particle is projected with a velocity of 960 ft/sec at an elevation of 30°. The greatest height (in feet) attained is

(1) 990

(2) 32

(3) 3600

(4) 930

34. The time (in seconds) of flight of a projectile with velocity u ft/sec and angle of elevation α is

(1) $\frac{u \sin \alpha}{g}$

(2) $\frac{2u \sin \alpha}{g}$

(3) $\frac{u^2 \sin^2 \alpha}{g}$

(4) $\frac{u^2 \sin 2\alpha}{g}$

35. If v_1 and v_2 are the velocities at the ends of a focal chord of the projectile's path and v is the horizontal component of the velocity then

(1) $v_1 + v_2 = v$

(2) $v_1^2 + v_2^2 = v^2$

(3) $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{v^2}$

(4) $v_1 v_2 = v$

36. The minimum velocity required to project a particle from a height h to fall at a distance d from the point of projection is

(1) $\sqrt{g-dh}$

(2) $g-dh$

(3) $(g-dh)^2$

(4) $g+dh$

37. The range of a projectile on a plane inclined at an angle β is maximum if the angle of projection is

(1) $\frac{\pi}{2}$

(2) $\frac{\pi}{2}+\beta$

(3) $\frac{\pi}{4}+\beta$

(4) $\frac{\pi}{4}+\frac{\beta}{2}$

38. The greatest range with a given velocity of projectile on a horizontal plane is 3000 meters. The greatest range up the plane at 30° to the horizon is

(1) 1000 m

(2) 2000 m

(3) 4000 m

(4) 6000 m

39. The time of a projectile to reach a point on the enveloping parabola at a distance r from the origin is

(1) $\sqrt{\frac{2r}{g}}$

(2) $\sqrt{\frac{r}{g}}$

(3) $\frac{2r}{g}$

(4) $\frac{r}{g}$

40. Binary equivalent of the decimal number 29 is

(1) 01111

(2) 11101

(3) 11011

(4) 10111

41. The decimal equivalent of the binary number 1011011 is

(1) 91

(2) 19

(3) 90

(4) 89

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42. Octal equivalent of the binary number 101110 is

(1) 5

(2) 6

(3) 56

(4) 65

43. Hexa equivalent of $(673)_{10}$ is

(1) $(1A2)_{16}$

(2) $(A21)_{16}$

(3) $(21A)_{16}$

(4) $(2A1)_{16}$

44. EBCDIC stands for

(1) Extended Binary Coded Decimal Interchange

(2) Extended Binary Code Digital Interchange

(3) Extended Binary Critical Data Interchange

(4) Extended Binary Coded Data Interchange

45. The smallest unit in storage element

(1) Byte

(2) Word

(3) Char

(4) Bit

46. A word in the memory is identified by a unique number called its

(1) Base

(2) Address

(3) LAP

(4) Node

47. The volatile memory is

(1) Main memory

(2) ROM

(3) RAM

(4) Any memory

48. ———— memory permits the reading of information based on complete or partial knowledge

(1) RAM

(2) ROM

(3) Associate memory

(4) Register

49. Arithmetic and logical operations are performed by

(1) ALU

(2) Control Unit

(3) Keyboard

(4) Memory

50. The basic building block of logic circuits are

(1) ALU

(2) CPU

(3) Logic gates

(4) Keyboard

51. ———— gate has only one input. It produces a truth value which is the complement of input value

(1) OR

(2) AND

(3) NOT

(4) Exclusive OR

52. A method of representing the step-by-step logical procedure for solving a problem is called

(1) Flowchart

(2) Number System

(3) Algorithm

(4) CPU

53. Flowchart is a pictorial representation of

(1) Flowchart

(2) Number System

(3) Algorithm

(4) CPU

54. In a flowchart rectangle represents

(1) Flowchart

(2) Number System

(3) Algorithm

(4) Process

55. ________ circuit consists of an Exclusive OR gate and AND gate

(1) Half-adder circuit

(2) AND gate

(3) OR gate

(4) Logic gate

56. ROM is

(1) Volatile

(2) Non-volatile

(3) Speed

(4) Low speed

57. A fast memory is

(1) RAM

(2) Main memory

(3) Cache

(4) ROM

58. The decimal equivalent of octal number 235 is

(1) 213

(2) 312

(3) 325

(4) 525

59. ________ bit is an additional non-data bit used for checking errors

(1) ALU

(2) Control Unit

(3) Parity

(4) Memory

60. ________ is placed between CPU and Main Memory and is very costly

(1) RAM

(2) Main memory

(3) Cache

(4) ROM

61. If $f:\mathbb{R} \to \mathbb{R}$ is a continuous periodic function with period T then $\int_0^{nT} f(x)dx =$

(1) $\left(\int_0^T f(x)dx\right)^n$

(2) $\frac{1}{n}\int_0^T f(x)dx$

(3) $n\int_0^T f(x)dx$

(4) 0

62. $\int_0^{\pi/2} \sin^7 x\,dx =$

(1) $\frac{8}{15}$

(2) $\frac{16}{35}$

(3) $\frac{8\pi}{15}$

(4) $\frac{16\pi}{35}$

63. $\int_{-\pi/2}^{\pi/2} \sin^2 x \cdot \cos^4 x dx =$

(1) $\frac{\pi}{16}$

(2) $\frac{\pi}{8}$

(3) $\frac{\pi}{4}$

(4) $\frac{\pi}{2}$

64. The area (in square units) bounded by the curves $y = 6x - x^2$ and $y = 3x$ is

(1) $\frac{7}{2}$

(2) $\frac{9}{2}$

(3) $\frac{11}{2}$

(4) $\frac{13}{2}$

65. The area bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is

(1) ab

(2) a^2b^2

(3) πab

(4) $\pi^2a^2b^2$

66. The length of the curve $x=\frac{y^4}{4}+\frac{1}{8y^2}$ from $y=1$ to $y=2$ is

(1) $\frac{123}{32}$

(2) $\frac{32}{123}$

(3) $\frac{132}{23}$

(4) $\frac{23}{132}$

67. The volume when a loop of the curve $y^2 = x(2x-1)^2$ is revolved about the X-axis is

(1) $\frac{\pi}{12}$

(2) $\frac{\pi}{24}$

(3) $\frac{\pi}{36}$

(4) $\frac{\pi}{48}$

68. The surface area of a sphere of radius a is

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

(2) πa^2

(3) $4\pi a^2$

(4) $6\pi a^2$

69. If m and n respectively denote the order and degree of the differential equation

$$3 \cdot \frac{d^2y}{dx^2} + 2 \cdot \left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{1/3} - x^2 y = 0$$ then

the ordered pair $(m, n) =$

(1) (3, 2)

(2) (2, 3)

(3) (2, 1)

(4) (2, 4)

70. The differential equation of the family of parabolas with X-axis as its axis and foci at $(\alpha, 0)$ is

(1) $\frac{dy}{dx} = y$

(2) $2x \cdot \frac{dy}{dx} = y$

(3) $\frac{dy}{dx} = 2xy$

(4) $\frac{dy}{dx} = 2x - y$

71. The solution of $y - x\frac{dy}{dx} = 3\left(1 + x^2\frac{dy}{dx}\right)$ is

(1) $(y-3)(3x+1) = cx$

(2) $(y+3)(3x-1) = cx$

(3) $(y-3)(3x-1) = cx$

(4) $(y+3)(3x+1) = cx$

72. The solution of $\frac{dy}{dx} = xe^{y-x^2}$ with $y(0) = 0$ is

(1) $e^y - 2e^x = ce^{xy}$

(2) $e^y - 2e^x + e^{xy} = 0$

(3) $e^y - 2e^x = e^{xy}$

(4) $e^y - 2e^x + ce^{xy} = 0$

73. The solution of $(x+y+1)^2 \cdot \frac{dy}{dx} = 1$ is

(1) $x + y + 1 = \tan(y+1+c)$

(2) $(x+y+1)^2 = \tan(y+1+c)$

(3) $x + y + 1 = \tan^2(y+1+c)$

(4) $(x+y+1)^2 = \tan^2(y+1+c)$

74. The solution of $xdy - ydx = \sqrt{x^2 + y^2}dx$ is

(1) $y + \sqrt{x^2 + y^2} = cy^2$

(2) $x + \sqrt{x^2 + y^2} = cy^2$

(3) $y + \sqrt{x^2 + y^2} = cx^2$

(4) $x + \sqrt{x^2 + y^2} = cx^2$

75. The solution of

$(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$ is

(1) $x + ye^{x/y} = c$

(2) $y + xe^{x/y} = c$

(3) $x(1 + e^{x/y}) = c$

(4) $y(1 + e^{x/y}) = c$

76. The solution of $\frac{dy}{dx} = \frac{6x - 4y + 3}{3x - 2y + 1}$ is

(1) $4x - 2y + 2\log(3x - 2y + 3) = c$

(2) $4x - 2y - 2\log(3x - 2y + 3) = c$

(3) $4x + 2y + 2\log(3x - 2y + 3) = c$

(4) $4x + 2y - 2\log(3x - 2y + 3) = c$

77. The solution of

$(x^2 - ay)dx + (y^2 - ax)dy = 0$ is

(1) $x^3 - axy + y^3 = c$

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

(3) $x^3 - 3axy + y^3 = c$

(4) $x^3 - 4axy + y^3 = c$

78. The equation

$(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$

becomes exact if we multiply by

(1) $\frac{1}{x}$

(2) $\frac{1}{x^2}$

(3) $\frac{1}{y}$

(4) $\frac{1}{y^2}$

79. The solution of

$x\cos x \cdot \frac{dy}{dx} + y(x\sin x + \cos x) = 1$ is

(1) $xy\sec x = \tan x + c$

(2) $xy\tan x = \sec x + c$

(3) $xy\sec x + \tan x = c$

(4) $xy\tan x + \sec x = c$

80. The orthogonal trajectories of the family $y^2 = 4ax$ parabolas is

(1) $x^2 + y^2 = c_1$

(2) $x^2 + \frac{y^2}{2} = c_1$

(3) $\frac{x^2}{2} + y^2 = c_1$

(4) $x^2y^2 = c_1$

81. The general solution of $(D^2 - 3D + 2)(y) = 0$ is

(1) $y = c_1e^{x} + c_2e^{2x}$

(2) $y = c_1e^{-x} + c_2e^{2x}$

(3) $y = c_1e^{x} + c_2e^{-2x}$

(4) $y = c_1e^{-x} + c_2e^{-2x}$

82. $\frac{1}{D - \alpha}(X) =$

(1) $\int Xe^{-\alpha x}dx$

(2) $\int Xe^{\alpha x}dx$

(3) $e^{\alpha x}\int Xe^{-\alpha x}dx$

(4) $e^{\alpha x}\int Xe^{\alpha x}dx$

83. The particular integral of $(D^2+3D+2)(y)=\sin(e^x)$ is

(1) $e^{2x}\sin(e^x)$

(2) $-e^{2x}\sin(e^x)$

(3) $-e^{-2x}\sin(e^x)$

(4) $e^{-2x}\sin(e^x)$

84. The particular integral of $(D-1)(y)=x^3$ is

(1) $-(x^3+3x^2+6x+6)$

(2) x^3+3x^2+6x+6

(3) x^3-3x^2+6x-6

(4) x^3

85. $\frac{1}{f(D)}(e^{\alpha x}\cdot V)=$

(1) $e^{\alpha x}\cdot\frac{1}{f(D)}(V)$

(2) $e^{\alpha x}\cdot\frac{1}{f(D+\alpha)}(V)$

(3) $e^{-\alpha x}\cdot\frac{1}{f(\alpha)}V$

(4) $e^{-\alpha x}\cdot\frac{1}{f(\alpha)}\left(\frac{1}{V}\right)$

86. An express train moving at 30 m/sec reduces its speed to 10 m/sec in a distance of 240 meters. The distance (in meters) at which the train comes to a stop is

(1) 250

(2) 260

(3) 270

(4) 280

87. A particle is projected vertically upwards with a velocity of 4.9 m/sec reaches a point 9.8 meters below the point of projection. The time taken (in seconds) is

(1) 1

(2) 2

(3) 3

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

88. A mass of m kg is placed on a horizontal plane which is moving vertically downwards with an acceleration f m/sec². The pressure between the body and the plane (in Newtons) is

(1) mf

(2) mg

(3) $m(f+g)$

(4) $m(g-f)$

89. Two masses 7 lbs and 9 lbs are connected by a light inextensible string passing over a smooth pulley. Their common acceleration (in ft/sec²) is

(1) 2

(2) 4

(3) 8

(4) 16

90. The maximum velocity of a particle executing simple harmonic motion is 2 ft/sec and its period is $\frac{1}{5}$ of second. The amplitude (in feet) is

(1) $\frac{1}{\pi}$

(2) $\frac{2}{\pi}$

(3) $\frac{5}{\pi}$

(4) $\frac{6}{\pi}$

91. If V is a finite-dimensional vector space and if W_1, W_2 are subspaces with $\dim W_1 = m$, $\dim W_2 = n$ and $\dim(W_1 \cap W_2) = K$ then $\dim(W_1 + W_2) =$

(1) $\frac{m+n}{k}$

(2) $(m+n)k$

(3) $m+n-k$

(4) $m+n+k$

92. If V is a vector space of dimension n and W is a subspace of V with dimension m then the dimension of the quotient space $\frac{V}{W}$ is

(1) $\frac{n}{m}$

(2) nm

(3) $n+m$

(4) $n-m$

93. A basis for $\mathbb{R}^3$ among the following, is

(1) {(1, 0, 0), (1, 1, 0)}

(2) {(7, 0, 1), (1, 5, 3), (4, 3, –1), (6, 3, –5)}

(3) {(1, 2, 0), (3, 4, 5), (1, 0, 3)}

(4) {(1, 3, –1), (–2, 0, 3), (3, –3, –5)}

94. The dimension of the subspace generated by $u_1 = (1,-1,2)$ and $u_2 = (-6,6,12)$ in $\mathbb{R}^3$ is

(1) 3

(2) 2

(3) 1

(4) 0

95. If $T : \mathbb{R}^3 \to \mathbb{R}^3$ is defined by $T(x,y,z) = (3x-y, y+z, z-x)$ then $T(1, 1, 1) + T(2, 1, 1) =$

(1) (7, 4, –1)

(2) (3, 2, 2)

(3) (–1, 0, 0)

(4) (7, –4, 1)

96. If $T : \mathbb{R}^3 \to \mathbb{R}^3$ is defined by $T(x,y,z) = (0,x,y)$ then $(T \circ T \circ T)(a,b,c) =$

(1) $(0, a, b)$

(2) $(0, 0, a)$

(3) $(a, b, 0)$

(4) $(0, 0, 0)$

97. If $T : \mathbb{R}^4 \to \mathbb{R}^3$ is defined by $T(x,y,z,w) = (x-w, y+z, z-w)$ then the nullity of T is

(1) 1

(2) 2

(3) 3

(4) 4

98. The rank of $T : \mathbb{R}^4 \to \mathbb{R}^3$ defined by $T(x,y,z,w) = (x-y+z+w, x+2z-w, x+y+3z-3w)$ is

(1) 1

(2) 2

(3) 3

(4) 4

99. If $T: \mathbb{R}^n \to \mathbb{R}^m$ is a linear transformation with rank k then the dimension of the kernel of T is

(1) $m-k$

(2) mk

(3) $n-k$

(4) nk

100. If $T: \mathbb{R}^3 \to \mathbb{R}^2$ is defined by $T(x,y,z,w) = (3x-2y+z, x-3y-2z)$ the matrix of T, with respect to the bases $S = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$ and $S' = \{(1, 1), (1, 0)\}$ for $\mathbb{R}^3$ and $\mathbb{R}^2$ respectively, is

(1) $\begin{pmatrix} -4 & 6 \\ -2 & 3 \\ 1 & 2 \end{pmatrix}$

(2) $\begin{pmatrix} -4 & -2 & 1 \\ 6 & 3 & 2 \end{pmatrix}$

(3) $\begin{pmatrix} 3 & -2 & 1 \\ 1 & -3 & -2 \end{pmatrix}$

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

101. If $T: \mathbb{R}^3 \to \mathbb{R}^3$ is given by $T(x,y,z) = (3x-2z, y, 3x+4z)$ then $T^{-1}(-2,1,4) =$

(1) (0, 1, 1)

(2) (1, 0, 0)

(3) (1, 1, 0)

(4) (1, 0, 1)

102. The eigenvalues of the matrix $\begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$ are

(1) 1, –1, 2

(2) 1, –1, –2

(3) 1, 2, –2

(4) 1, 1, 2

103. The eigenvector of $\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$ corresponding to the eigenvalue 1 to it is

(1) $\begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$

(2) $\begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix}$

(3) $\begin{pmatrix} -1 \\ 1 \\ 1 \end{pmatrix}$

(4) $\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$

104. If $A(\theta) = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ for $\theta \in \mathbb{R}$ then $[A(\theta)]^{-1} =$

(1) $A(\theta)$

(2) $A(-\theta)$

(3) $-A(\theta)$

(4) $-A(-\theta)$

105. $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix} =$

(1) 14
(2) 15
(3) 16
(4) 0

106. The value of $k > 0$ such that the area of the triangle formed by the lines $x = 0, y = 0$ and $3x + 4y = k$ is 6 square units is

(1) 1
(2) 7
(3) 5
(4) 12

107. The foot of the perpendicular drawn from (–1, 3) as the line $5x - y = 18$ is

(1) (2, 4)
(2) (–2, 4)
(3) (4, 2)
(4) (–4, 2)

108. The centroid of the triangle formed by the pair of straight lines $12x^2 - 20xy + 7y^2 = 0$ and the line $2x - 3y + 4 = 0$ is

(1) (2, 3)
(2) (3, 2)
(3) $\left(\frac{8}{3}, \frac{8}{3}\right)$
(4) $\left(-\frac{2}{3}, \frac{2}{3}\right)$

109. The acute angle between the pair of lines $y^2 - xy - 6x^2 = 0$ is

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

110. The point of intersection of the pair of lines given by
$3x^2 + 7xy + 2y^2 + 5x + 5y + 2 = 0$ is

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

111. The radius of the circle $x^2 + y^2 + 2x - 4y - 4 = 0$ is

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

112. The centre of the circle passing through (0, 0), (0, 2) and (2, 0) is

(1) (0, 1)
(2) (1, 0)
(3) (1, 1)
(4) (2, 2)

113. The length of the tangent from (1, 3) to the circle $x^2+y^2-2x+4y-11=0$ is

(1) 1

(2) 2

(3) 3

(4) 4

114. The equation of the polar of (2, 3) with respect to the circle $x^2+y^2+6x+8y-96=0$ is

(1) $4x+7y=80$

(2) $4x-7y=80$

(3) $4x+7y+80=0$

(4) $4x-7y+80=0$

115. The radical axis of the circles $2x^2+2y^2+3x+6y-5=0$ and $3x^2+3y^2-7x+8y-11=0$ is

(1) $23x-2y+7=0$

(2) $23x+2y+7=0$

(3) $23x+2y-7=0$

(4) $23x-2y-7=0$

116. The focus of the parabola $y^2+6y-2x+5=0$ is

(1) (–2, –3)

(2) (2, –3)

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

(4) $\left(-\frac{3}{2},3\right)$

117. The point of contact of the line $7x+6y=13$ and the parabola $y^2-7x-8y+14=0$ is

(1) (1, –1)

(2) (–1, 1)

(3) (–1, –1)

(4) (1, 1)

118. The eccentricity of the ellipse $9x^2+16y^2=144$ is

(1) $\frac{1}{2}$

(2) $\frac{2}{3}$

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

(4) $\frac{4}{\sqrt{7}}$

119. The length of the latus rectum of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1 (a>b)$ is

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

(2) $\frac{b^2}{a^2}$

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

(4) $\frac{a^2}{b^2}$

120. The angle between the asymptotes of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ with eccentricity e is

(1) $\sec^{-1}(e)$

(2) $2\sec^{-1}(e)$

(3) $\sec^{-1}(a)$

(4) $\sec^{-1}(b)$

121. For sets A and B, the set $(A-B)\cup(B-A)=$

(1) $A\cup B$

(2) $A\cap B$

(3) $(A\cup B)-(A\cap B)$

(4) $(A\cap B)-(A\cup B)$

122. If E is the set of all even positive integers and P is the set of all primes then the number of elements in $E\cap P$ is

(1) 1

(2) 2

(3) 0

(4) infinite

123. In the set Q of non-zero rational numbers the relation R defined by "$aRb \Leftrightarrow ab=1$ for $a,b\in Q$" is

(1) reflexive

(2) symmetric

(3) transitive

(4) anti-symmetric

124. If $f:\mathbb{R}\to\mathbb{R}$ and $g:\mathbb{R}\to\mathbb{R}$ are defined by $f(x)=-x$ and $g(x)=e^{x^2}$ then $g(f(x))=$

(1) $g(x)$

(2) $-g(x)$

(3) $f(x)$

(4) $-f(x)$

125. The function $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=e^x$ is

(1) one-one but not onto

(2) one-one and onto

(3) onto but not one-one

(4) neither one-one nor onto

126. If $\frac{1-i}{1+i}=a+ib$ then $b=$

(1) 0

(2) 1

(3) –1

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

127. If α and β are any two irrational numbers then

(1) $\alpha+\beta$ is rational

(2) $\alpha\beta$ is rational

(3) $\frac{\alpha}{\beta}$ is rational

(4) $\alpha\beta$ is a real number

128. $(1+i)^7+(1-i)^7=$

(1) 7

(2) 8

(3) 16

(4) $16i$

129. If the equations $x^2+4ax+3=0$ and $2x^2+3ax-9=0$ have a common root then $a=$

(1) ± 1

(2) 1 only

(3) –1 only

(4) –3

130. If $x^2-2mx+7m-12=0$ has equal roots then $m\in$

(1) {3}

(2) {4}

(3) {3, 4}

(4) {0, 1, 2}

131. If α, β, γ are the roots of $x^3 - px^2 + qx - r = 0$ then $\alpha^2 + \beta^2 + \gamma^2 =$

(1) $q^2 - 2p$

(2) $p^2 - 2q$

(3) $p^2 - 2r$

(4) $q^2 - 2r$

132. The equation whose roots are the squares of the roots of $x^3 - x^2 + 8x - 6 = 0$ is

(1) $x^3 + 15x^2 - 52x + 36 = 0$

(2) $x^3 + 15x^2 + 52x - 36 = 0$

(3) $x^3 - 15x^2 + 52x - 36 = 0$

(4) $x^3 - 15x^2 - 52x + 36 = 0$

133. In the group $(Q', *)$ of non-zero rational numbers with $a * b = 5ab$ for $a, b \in Q'$ the inverse of $a \in Q'$ is

(1) $\frac{a}{5}$

(2) $\frac{5}{a}$

(3) $\frac{25}{a}$

(4) $\frac{1}{25a}$

134. If $G = \mathbb{R} - \{1\}$ and $a * b = a + b - ab$ for $a, b \in G$ then the solution of $(4 * 5) * x = 7$ in G is

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

(2) $\frac{3}{2}$

(3) $-\frac{2}{3}$

(4) $-\frac{3}{2}$

135. In the group $\mathbb{Z}_6$ of integers with addition modulo 6, the subgroup generated by 2 is

(1) {0}

(2) {2}

(3) {0, 2, 4}

(4) $\mathbb{Z}_6$

136. If $K\mathbb{Z}$ is the subgroup of multiples of K in the additive group of integers then $6\mathbb{Z} \cap 9\mathbb{Z} =$

(1) $15\mathbb{Z}$

(2) $3\mathbb{Z}$

(3) $18\mathbb{Z}$

(4) $\mathbb{Z}$

137. If G is a cyclic group of order 16 with a generator 'a', then one or more generator for G, among the following, is

(1) a^4

(2) a^5

(3) a^6

(4) a^8

138. If $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 1 \end{pmatrix}$ and $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 4 & 5 & 3 \end{pmatrix}$ are two elements of S_5 then $\tau^{-1}\sigma^2 =$

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

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

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

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

139. The representation of $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 3 & 1 & 4 & 6 & 5 \end{pmatrix}$ as product of disjoint cycles is

(1) (1 2 3) (5 6)

(2) (1 2) (3 5 6)

(3) (1 3) (2 5 6)

(4) (1 3 5 6)

140. The number of transpositions in the representation of $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 2 & 3 & 1 & 5 & 4 & 7 & 8 & 6 \end{pmatrix}$ as product of transpositions is

(1) 3

(2) 4

(3) 5

(4) 6

141. If a group G is of order 35 and H is a subgroup of G with order 5 then the number of distinct left cosets of H in G is

(1) 5

(2) 30

(3) 7

(4) 175

142. An example of a ring without unity, among the following, is

(1) The ring $(\mathbb{Z}, +, .)$ of integers with usual addition and multiplication

(2) The ring $(E, +, .)$ of even integers with usual addition and multiplication

(3) The ring $(Q, +, .)$ of rational integers with usual addition and multiplication

(4) The ring $(\mathbb{Z}_6, \oplus, \odot)$ of integers with addition and multiplication modulo 6

143. In the ring $(\mathbb{Z}_n, \oplus, \odot)$ of integers with addition and multiplication modulo n, where $n > 0$ is an integer, $0 \neq \overline{a} \in \mathbb{Z}_n$ is a zero-divisor if

(1) $(n,a) = 1$

(2) $(n,a) \neq 1$

(3) $n \neq a$

(4) $na = 1$

144. If $(\mathbb{Z}_n, \oplus, \odot)$ is a field then a possible value for n is

(1) 27

(2) 37

(3) 57

(4) 77

145. In a commutative ring $(R, +, \cdot)$ with unity if I is an ideal such that $1 \in I$ then

(1) $I = R$

(2) $I \neq R$

(3) $I = \phi$

(4) $R \cap I = R - I$

146. In the ring $(\mathbb{Z}, +, .)$ of integers with usual addition and multiplication the set $\{12K : K \in \mathbb{Z}\}$ is

(1) just an ideal

(2) a maximal ideal

(3) a prime ideal

(4) just a subset

147. The number of ideals in the ring of rational numbers with usual addition and multiplication is

(1) 1

(2) 2

(3) 3

(4) infinite

148. The polynomial $x^2 - 2$ is reducible on

(1) $\mathbb{Z}$

(2) Q

(3) $\mathbb{R}$

(4) no field

149. A subset of $\mathbb{R}^3$ which is not a subspace of it, among the following, is

(1) $\{(x,y,z) \in \mathbb{R}^3 : x + y + z = 0\}$

(2) $\{(x,y,z) \in \mathbb{R}^3 : ax + by + cz = 0\}$

(3) $\{(x,y,z) \in \mathbb{R}^3 : ax + by + cz = 5\}$

(4) $\{(x,y,z) \in \mathbb{R}^3 : x = 2y\}$

150. A linearly dependent set, among the following, in $\mathbb{R}^3$ is

(1) {(1, 0, 0), (0, 1, 0), (0, 0, 1)}

(2) {(1, 8, 3), (1, 3, 4), (1, –2, 5)}

(3) {(1, 1, 1), (1, 1, 0), (1, 0, 0)}

(4) {(2, 0, 0), (0, 3, 0), (0, 0, 4)}