Sr. No. : 110513

CET (PG) – 2017

Booklet Series Code : A

Important : *Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.*

(In Figures) (In Words)

Roll No. : | | | | | | | ....

O.M.R. Answer Sheet Serial No. : | | | | | | |

Signature of the Candidate : ....

Subject : MATHEMATICS

Time : 90 Minutes] **[Maximum Marks : 75**

No. of Questions : 75] **[Total No. of Printed Pages : 16**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS :

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal gently when asked to do so.
5. Please check that this Question Booklet contains **75** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
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13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculator is not allowed.**

1. The directional derivative of the function $f = xy^2 + yz^2$ at the point (2, −1, 1) in the direction of the normal to the surface $x \log z - y^2 + 4 = 0$ at (−1, 2, 1) is :

(A) $-\frac{15}{\sqrt{17}}$
(B) $\frac{15}{\sqrt{17}}$
(C) $\frac{9}{\sqrt{17}}$
(D) $-\frac{9}{\sqrt{17}}$

2. Using Stoke's theorem, the value of $\oint_C e^x\,dx + 2y\,dy - dz$ where C is the curve $x^2 + y^2 = 4,\ z = 2$:

(A) e^2
(B) 1
(C) 0
(D) 4

3. If $x_r = \cos\frac{\pi}{2^r} + i\sin\frac{\pi}{2^r}$, then the infinite product $x_1 x_2 x_3 x_4 x_5 \ldots\ldots\ldots\ldots x_\infty$ is :

(A) 0
(B) −1
(C) $1-i$
(D) $1+i$

4. A monic cubic polynomial $f(x)$ with integral coefficients having the properties $f(0) = 1$, $f(1) = 3$ and sum of its roots is 2, is :

(A) $f(x) = 2x^3 - 2x^2 + 2x + 1$
(B) $f(x) = x^3 + 2x^2 + 3x + 1$
(C) $f(x) = x^3 - 2x^2 + 3x + 1$
(D) $f(x) = 4x^3 - 4x^2 + 2x + 1$

5. The transformed equation of $f(x) = x^4 + 16x^3 + 83x^2 + 152x + 84 = 0$ which removes the cubic term by a suitable linear transformation is :

(A) $x^4 - 9x^2 + 36 = 0$
(B) $x^4 - 9x^2 + 12 = 0$
(C) $x^4 + 13x^2 - 36 = 0$
(D) $x^4 - 13x^2 + 36 = 0$

6. The value of $\sum \alpha^2\beta$ for the cubic equation $x^3 - px^2 + qx - r = 0$ whose roots are α, β and γ is :

(A) $q^2 - 2rp$
(B) $pq - 3r$
(C) $pq - 2r$
(D) $p^2 - 2q$

7. The radius of the convergence of the power series $\sum_{n=1}^{\infty} \frac{(x-2)^{4n}}{4^n}$ is :

(A) 4
(B) $\sqrt{2}$
(C) $\frac{1}{4}$
(D) $\frac{1}{\sqrt{2}}$

8. The Laplace transform of $t^2u(t-2)$, where $u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$ is :

(A) $\frac{2(1+2s+2s^2)}{s^3}$ (B) $\frac{2(1+2s+2s^2)}{s^3}e^{-2s}$

(C) $\frac{2(1+2s+2s^2)}{s^3}e^{2s}$ (D) $\frac{2(1+4s+2s^2)}{s^3}e^{-2s}$

9. The Laplace transform of $\frac{e^{-\alpha t}\sin\beta t}{t}$ is :

(A) $\tan^{-1}\frac{s+\alpha}{\beta}$ (B) $\tan^{-1}\frac{s+\beta}{\alpha}$

(C) $\cot^{-1}\frac{s+\beta}{\alpha}$ (D) $\cot^{-1}\frac{s+\alpha}{\beta}$

10. If $z = \cos\Theta + i\sin\Theta$, then the value $\frac{z^{2n}-1}{z^{2n}+1}$ is :

(A) $-i\tan n\Theta$ (B) $i\cot n\Theta$ (C) $-i\cot n\Theta$ (D) $i\tan n\Theta$

11. The general value of Θ which satisfies the equation :

$(\cos\Theta + i\sin\Theta)(\cos 2\Theta + i\sin 2\Theta)(\cos 3\Theta + i\sin 3\Theta)$ ....

$(\cos n\Theta + i\sin n\Theta) = 1$

is :

(A) $\Theta = \frac{2m\pi}{n(n+1)}, m \in \mathbb{Z}$ (B) $\Theta = \frac{4m\pi}{n(n+1)}, m \in \mathbb{Z}$

(C) $\Theta = \frac{m\pi}{n(n+1)}, m \in \mathbb{Z}$ (D) $\Theta = \frac{m\pi}{4n(n+1)}, m \in \mathbb{Z}$

12. The period of simple harmonic motion is 8 seconds and the amplitude is 6 metres. For the motion from the extreme in the path to the centre, the average acceleration is :

(A) $\frac{3\pi}{4}$ m/sec^2 (B) $\frac{\pi}{4}$ m/sec^2 (C) $\frac{3\pi}{2}$ m/sec^2 (D) $\frac{\pi}{2}$ m/sec^2

13. A particle of mass 0.2 kg lies on a smooth table at a distance of 9.8 metres from the edge of the table. It is connected to a mass of 0.4 kg by a light string which passes over a smooth pulley fixed at the edge of the table. The 0.4 kg mass is hanging freely. If the system starts from rest, how long will it take the 0.2 kg mass to reach the edge of the table ? (Take $g = 9.8$ m/sec^2)

(A) $\sqrt{3}$ sec (B) $\sqrt{\frac{4}{3}}$ sec (C) 2 sec (D) $\frac{1}{\sqrt{3}}$ sec

14. The equation of sphere whose centre is (1, –1, 1) and whose radius is the same as that of the sphere $2x^2 + 2y^2 + 2z^2 - 2x + 4y - 6z = 1$ is :

(A) $x^2 + y^2 + z^2 - 2x + 2y - 2z = 6$ (B) $x^2 + y^2 + z^2 + 2x - 2y + 2z = 6$

(C) $x^2 + y^2 + z^2 - 2x + 2y - 2z = 1$ (D) $x^2 + y^2 + z^2 + 2x - 2y + 2z = 1$

15. Which of the following statements are not true ?

(i) The resultant of a system of concurrent coplanar forces is a force coplanar with them.

(ii) The dimension of force is $[M][L^2][T^{-1}]$.

(iii) The resultant of two unequal forces is nearer to the smaller force.

(iv) If the algebraic sum of the moments of a system of coplanar forces about a point in their plane is zero, then either the resultant is zero or the resultant passes through that point.

(A) (ii) and (iii) (B) (i) and (iii) (C) (ii) and (iv) (D) (i) and (iv)

16. If $f_1(x, y) = \sqrt{x^2 + y^2}$, $f_2(x, y) = \tan^{-1}\frac{y}{x}$; $x \neq 0$, then $\frac{\partial(f_1, f_2)}{\partial(x, y)}$ at (1, 2) equals :

(A) 0 (B) $\frac{1}{\sqrt{3}}$ (C) $\frac{1}{\sqrt{7}}$ (D) $\frac{1}{\sqrt{5}}$

17. If $u^3 + v^3 + w^3 = x + y + z$, $u^2 + v^2 + w^2 = x^3 + y^3 + z^3$, $u + v + w = x^2 + y^2 + z^2$, then $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ is :

(A) $\frac{(y-z)(z-x)(x-y)}{(u-v)(v-w)(w-u)}$ (B) $\frac{(u-v)(v-w)(w-u)}{(y-z)(z-x)(x-y)}$

(C) $\frac{(y-z)(z-x)(x-y)}{(u-v)(w-v)(w-u)}$ (D) $\frac{(u-v)(w-v)(w-u)}{(y-z)(z-x)(x-y)}$

18. The sequence $<s_n>$ where $s_n = \frac{1}{\sqrt{n^2+1}} + \frac{1}{\sqrt{n^2+2}} + \frac{1}{\sqrt{n^2+3}} + \ldots\ldots + \frac{1}{\sqrt{n^2+n}}$.

(A) Diverges to ∞ (B) Converges to 0

(C) Converges to 1 (D) Converges to $\frac{1}{\sqrt{2}}$

19. The rank of matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ is :

(A) 1 (B) 2 (C) 3 (D) 4

20. If 1 is a zero of $2x^4 - 5x^3 + (2a + 3)x^2 - (a + 2)x + 1$, what is its multiplicity ?

(A) 1 (B) 2 (C) 3 (D) 4

21. The condition for the cubic equation $x^3 + 3bx^2 + 3cx + d = 0$ has exactly two equal roots, is when each root is equal to :

(A) $\frac{bc-ad}{2(b^2-ac)}$ (B) $\frac{bc-d^2}{2(ac-bd)}$ (C) $\frac{ad-b^2}{2(ac-bd)}$ (D) $\frac{bc-ad}{2(ac-b^2)}$

22. The sum of the infinite series :

$$\left(\frac{2}{3}+\frac{1}{7}\right)-\frac{1}{3}\left(\frac{2}{3^3}+\frac{1}{7^3}\right)+\frac{1}{5}\left(\frac{2}{3^5}+\frac{1}{7^5}\right)-....$$

is :

(A) $\frac{\pi}{8}$ (B) $\frac{\pi}{4}$ (C) π (D) $\frac{\pi}{2}$

23. The sum of n terms of the series :

$$\sin\ \alpha + \sin\ (\alpha + \beta) + \sin(\alpha + 2\ \beta) + ... + \sin(\alpha + (n-1)\ \beta)$$

is :

(A) $\sin\left(\alpha+\frac{(n+1)\beta}{2}\right)\sin\left(\frac{n\beta}{2}\right)/\sin\left(\frac{\beta}{2}\right)$ (B) $\sin\left(\alpha+\frac{(n-1)\beta}{2}\right)\sin\left(\frac{n\beta}{2}\right)/\sin\left(\frac{\beta}{2}\right)$

(C) $\cos\left(\alpha+\frac{(n-1)\beta}{2}\right)\sin\left(\frac{n\beta}{2}\right)/\sin\left(\frac{\beta}{2}\right)$ (D) $\cos\left(\alpha+\frac{(n+1)\beta}{2}\right)\sin\left(\frac{n\beta}{2}\right)/\sin\left(\frac{\beta}{2}\right)$

24. Which of the following groups are not cyclic ?

(i) $G = <\mathbb{Z},+>$ (ii) $G = <\mathbb{Q},+>$

(iii) $G = <6^n, n \in \mathbb{Z}>$

(A) (ii) (B) (ii) and (iii) (C) (i) and (ii) (D) (i) and (iii)

25. The inverse of the matrix $\begin{bmatrix} A & 0 \\ B & C \end{bmatrix}$ where A and C are non-singular matrices is :

(A) $\begin{bmatrix} A^{-1} & 0 \\ -C^{-1}B^{-1}A^{-1} & C^{-1} \end{bmatrix}$ (B) $\begin{bmatrix} A^{-1} & 0 \\ -C^{-1}BA^{-1} & C^{-1} \end{bmatrix}$

(C) $\begin{bmatrix} C^{-1} & 0 \\ -C^{-1}B^{-1}A^{-1} & A^{-1} \end{bmatrix}$ (D) $\begin{bmatrix} A^{-1} & -C^{-1}BA^{-1} \\ 0 & C^{-1} \end{bmatrix}$

26. The product $(x-\alpha)\ (x-\alpha^3)\ (x-\alpha^5)\ (x-\alpha^7)$ where α is primitive 8th root of unity :

(A) $x^4 + 1$ (B) $x^4 + 4x^2 + 1$

(C) $x^4 - 4x^2 + 1$ (D) $x^4 - 1$

27. The set of value of x for which the inequality $|x-1|+|x+3|<6$ holds is :

(A) $\mathbb{R}-(-4, 2)$ (B) $\mathbb{R}-(-2, 4)$ (C) $[2, 4]$ (D) $(-4, 2)$

28. State which of the following statements are always true ?

(i) A is not bounded and $A \neq \phi$, then $B \subset A$, $B \neq \phi$ is also not bounded.

(ii) If A and B be two non-empty sets of reals such that $A \subset B$, $A \neq B$, then lub A < lub B.

(iii) The set $\{x; x \in \mathbb{R}, |x| \le a, a > 0\}$ is bounded.

(iv) The lub and the glb of a set if they exist must belong to the set.

(A) (ii) and (iv) (B) (iv) (C) (iii) (D) (i) and (iii)

29. For what values of x the inequality $x^3+1 > x^2+x$ holds :

(A) $(1, \infty)$ (B) $(-1, 1) \cup (1, \infty)$

(C) $(-1, 1)$ (D) $(-1, \infty)$

30. The values of x the inequality $4x^2+9x<9$ holds :

(A) $\left(-3, \frac{3}{4}\right]$ (B) $\left(-\frac{3}{4}, 3\right)$ (C) $\left(-3, \frac{3}{4}\right)$ (D) $\left[-3, \frac{3}{4}\right)$

31. Forces of magnitudes 3 F, $\sqrt{13}$ F, 4F acting on a particle are in equilibrium. The angle between forces of magnitudes 3F and 4F is :

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{4}$ (D) $\frac{2\pi}{3}$

32. Forces of magnitudes P, 2P, 3P act long the sides BC, CA and AB of an equilateral triangle ABC. The magnitude of the resultant force is :

(A) $\sqrt{21}$P (B) $\sqrt{17}$P

(C) $\sqrt{3}$P (D) $\sqrt{5}$P

33. Two particles of mass 11 kg and 13 kg are connected by a light string over a smooth pulley. The velocity at the end of 4 seconds is (Take acceleration due to gravity as 9.8 m/sec^2) :

(A) 3.27 m/sec (B) 6.53 m/sec

(C) 2.58 m/sec (D) 8.76 m/sec

34. **Given that the acceleration due to gravity is 9.8 m/sec^2 and radius of the earth is 6370 km. The escape velocity of a particle projected from the surface of earth is :**

(A) 11.2 km/sec
(B) 1.12 km/sec
(C) 0.353 km/sec
(D) 3.53 km/sec

35. **The $\lim_{x \to \infty} \left(\tan\left(\frac{\pi}{4} + x \right) \right)^{\frac{1}{x}}$ is :**

(A) e^2
(B) $\frac{1}{e^2}$
(C) limit does not exist
(D) 0

36. **The $\lim_{x \to 0} \left(\frac{1}{x^2} \right)^{\tan x}$ is :**

(A) 0
(B) $\sqrt{2}$
(C) $\frac{1}{\sqrt{2}}$
(D) 1

37. **The area of the region bounded by the curves $y = x^2+1$ and $y = x$; $x = 0$, $y = 2$ is :**

(A) 19/7 square units
(B) 4/3 square units
(C) 3/4 square units
(D) 23/7 square units

38. **The eccentricity of the conic satisfying the equation $\frac{25}{144}x^2 + \frac{9}{144}y^2 = 1$ is :**

(A) 4/3
(B) 5/4
(C) 3/4
(D) 4/5

39. **In which of these intervals is the function $f(x) = \sin^4 x$ decreasing ?**

(A) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$
(B) $\left[\pi, \frac{5\pi}{4}\right]$
(C) $\left[0, \frac{\pi}{4}\right]$
(D) $\left[\frac{3\pi}{4}, \pi\right]$

40. **Bessel's differential equation of order n is given by :**

(A) $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + n(n+1)y = 0$
(B) $x^2 \frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + n(n+1)y = 0$
(C) $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$
(D) $x^2 \frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + (x^2 + n^2)y = 0$

41. If (1, –2) is the point of inflexion of $f(x) = \alpha x^3 + \beta x^2$, then values of α and β are :

(A) $\alpha = 1, \beta = 3$
(B) $\alpha = -1, \beta = 5$
(C) $\alpha = -1, \beta = 3$
(D) $\alpha = 1, \beta = 5$

42. The points of inflexion for $f(x) = (\sin x + \cos x)\, e^x$; $0 \leq x \leq 2\pi$ are :

(A) $x = \frac{\pi}{4}$ and $\frac{5\pi}{4}$
(B) $x = \frac{\pi}{4}$ and $\frac{3\pi}{4}$
(C) $x = \frac{3\pi}{4}$ and $\frac{5\pi}{4}$
(D) $x = \frac{3\pi}{4}$ and $\frac{7\pi}{4}$

43. If $\frac{d^2y}{dx^2} = 4y$, then for arbitary constants c_1 and c_2, its general solution is :

(A) $c_1 e^{2x} + c_2 x\, e^{2x}$
(B) $c_1 \cos 2x + c_2 \sin 2x$
(C) $c_1 \cosh 2x + c_2 \sinh 2x$
(D) $c_1 e^{2x} + c_2 x\, e^{-2x}$

44. The particular solution of $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x}$ is :

(A) $\frac{x^2 e^{-2x}}{2}$
(B) $\frac{x e^{2x}}{2}$
(C) $\frac{x e^{-2x}}{2}$
(D) $\frac{x^2 e^{2x}}{2}$

45. The general solution of $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \sin 3x$, for arbitrary constants c_1 and c_2 is :

(A) $c_1 e^{x} + c_2 e^{2x} - \frac{7}{130}\sin 3x + \frac{9}{130}\cos 3x$

(B) $c_1 e^{-x} + c_2 e^{-2x} - \frac{7}{30}\sin 3x + \frac{9}{30}\cos 3x$

(C) $c_1 e^{x} + c_2 e^{-2x} + \frac{7}{130}\sin 3x - \frac{9}{130}\cos 3x$

(D) $c_1 e^{x} + c_2 e^{2x} - \frac{7}{30}\sin 3x + \frac{9}{30}\cos 3x$

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46. **If the auxiliary equation of a differential equation has pair of imaginary roots $\alpha \pm i\beta$ occuring r times, then the corresponding part of the complementary solution ordinary differential equation $\frac{d^n y}{dx^n} + a_1 \frac{d^{n-1} y}{dx^{n-1}} + \ldots\ldots + a_n y = 0$; a_1, a_2, ... a_n are constants is.**

(A) $e^{\alpha x}(c_1 + c_2 x + \ldots\ldots + c_{r-1} x^{r-1})\cos\beta x + e^{\alpha x}(c_r + c_{r+1} x + \ldots\ldots + c_{2r-2} x^{r-1})\sin\beta x$

(B) $e^{\alpha x}(c_1 + c_2 x + \ldots\ldots + c_r x^{r-1})\cos\beta x + e^{\alpha x}(c_{r+1} + c_{r+2} x + \ldots\ldots + c_{2r} x^{r-1})\sin\beta x$

(C) $e^{\alpha x}(c_1 + c_2 x + \ldots\ldots + c_{r+1} x^{r})\cos\beta x + e^{\alpha x}(c_{r+2} + c_{r+3} x + \ldots\ldots + c_{2r+2} x^{r})\sin\beta x$

(D) $e^{\alpha x}(c_1 + c_2 x + \ldots\ldots + c_{r-1} x^{r-1})\cos\beta x + (c_r + c_{r+1} x + \ldots\ldots + c_{2r-2} x^{r-1})\sin\beta x$

47. **The nature of roots of cubic equation $x^3 + 18x - 35 = 0$ is :**

(A) One real and other two complex
(B) All real and two equal
(C) All real and equal
(D) All real and distinct

48. **The solution of $(D^2 + 1)^2 (D^2 + D + 1)^2 y = 0$, where D denotes d/dx, is :**

(A) $(c_1 + c_2 x)\cos x + (c_3 + c_4 x)\sin x + e^{x/2}$

$$\left((c_5 + c_6 x)\cos\frac{\sqrt{3}x}{2} + (c_7 + c_8 x)\sin\frac{\sqrt{3}x}{2}\right)$$

(B) $(c_1 + c_2 x)\cos x + (c_3 + c_4 x)\sin x + e^{-x/2}$

$$\left((c_5 + c_6 x)\cos\frac{\sqrt{3}x}{2} + (c_7 + c_8 x)\sin\frac{\sqrt{3}x}{2}\right)$$

(C) $(c_1 + c_2 x)e^{x} + (c_3 + c_4 x)e^{-x} + e^{-x/2}$

$$\left((c_5 + c_6 x)\cos\frac{\sqrt{3}x}{2} + (c_7 + c_8 x)\sin\frac{\sqrt{3}x}{2}\right)$$

(D) $(c_1 + c_2 x)e^{x} + (c_3 + c_4 x)e^{-x} + e^{x/2}$

$$\left((c_5 + c_6 x)\cos\frac{\sqrt{3}x}{2} + (c_7 + c_8 x)\sin\frac{\sqrt{3}x}{2}\right)$$

49. The particular solution of $\frac{d^3y}{dx^3}-\frac{d^2y}{dx^2}-6\frac{dy}{dx}=1+x^2$ is :

(A) $\frac{1}{108}\left(6x^3-3x^2+25x\right)$ (B) $-\frac{1}{108}\left(6x^3-3x^2+25x-3\right)$

(C) $\frac{1}{108}\left(6x^3-3x^2+25x-3\right)$ (D) $-\frac{1}{108}\left(6x^3-3x^2+25x\right)$

50. The set of all real numbers under the usual multiplication operation is not a group since :

(A) multiplication is not a binary operation

(B) multiplication is not associative

(C) identity element does not exist

(D) zero has no inverse

51. In the group G = {2, 4, 6, 8} under multiplication modulo 10, the identity element is :

(A) 6 (B) 8 (C) 4 (D) 2

52. A subset H of a group (G, *) is a subgroup if :

(A) $a, b \in H \Rightarrow a * b \in H$ (B) $a \in H \Rightarrow a^{-1} \in H$

(C) $a, b \in H \Rightarrow a * b^{-1} \in H$ (D) H contains the identity element

53. Let R be a relation defined on the set of integers as xRy if $x-y$ is even. Then :

(A) R is not an equivalence relation

(B) R is an equivalence relation having only one equivalence class.

(C) R is an equivalence relation whose equivalence classes partitions the set of integers into two disjoints subsets

(D) R is an equivalence relation whose equivalence classes partitions the set of integers into three disjoint subsets

54. The system of linear equations :

$$(4d-1)\,x+y+z=0$$
$$-y+z=0$$
$$(4d-1)\,z=0$$

has a non-trivial solution, if d equals :

(A) 1/2 (B) 1/4 (C) 3/4 (D) 1

55. **Eigen values of a symmetric matrix are always :**

(A) Positive
(B) Real and imaginary
(C) Negative
(D) Real

56. **The order of the differential equation of all circles of radius r, having centre on y-axis and passing through the origin is :**

(A) 1
(B) 2
(C) 3
(D) 4

57. **If the mean and standard deviation of 20 observations $x_1, x_2, ..., x_{20}$ are 50 and 10 respectively, then $\sum_{i=1}^{10} x_i^2$ is equal to :**

(A) 2500
(B) 50000
(C) 52000
(D) 26000

58. **If the Rolle's theorem holds for the function $f(x) = 2x^3 + ax^2 + bx$ in the interval $[-1, 1]$ for the point $c = \frac{1}{2}$, then the value of $2a + b$ is :**

(A) 1
(B) -1
(C) 2
(D) -2

59. **The number of elements in a finite field of characteristic p (p prime number) is :**

(A) 2^p
(B) 3^p
(C) $p^n, n \in \mathbb{N}$
(D) $np, n \in \mathbb{N}$

60. **The number of elements in S_n, the symmetric group on n symbols, is :**

(A) $n!$
(B) $n!/2$
(C) n^2
(D) n

61. **The condition for a system AX = *b* of *m* linear equations in *n* variables to be consistent is :**

(A) Rank A = rank (A|b)−1
(B) Rank A = rank (A|b)+1
(C) Rank A = rank (A|b)
(D) Rank A − Rank (A|b) = 2

62. **Consider the following two statements :**

(i) Two finite-dimensional vector spaces over the same field are isomorphic.

(ii) Two finite-dimensional vector spaces over the same field and of the same dimension are isomorphic.

Then :

(A) (i) is true but (ii) is not true.
(B) (ii) is true, but (i) is not true
(C) None of them is true
(D) Both of them are true

63. **One bag contains 4 white balls and 2 black balls, another contains 3 white balls and 5 black balls. If one ball is drawn from each bag, then the probability that both are white :**

(A) 1/4
(B) 1/3
(C) 1/2
(D) 3/4

64. **For any two events A and B ($B \subseteq A$) in the class of events, then the probability $P(A \cap B^c)$ is equal to :**

(A) P(A) + P(B)
(B) 1− P(B)
(C) P(B) − P(A)
(D) P(A) − P(B)

65. **The probability when a hand of 7 cards is dealt from well shuffled deck of 52 cards it contains exactly three kings is :**

(A) 1/7735
(B) 46/7735
(C) 36/1547
(D) 9/1547

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66. **In geometric distribution, the variance and mean are related as :**

(A) Variance > mean

(B) Variance < Mean

(C) Variance = mean

(D) Variance ≤ mean

67. **A random variable X has the density function $f(x) = \frac{c}{x^2+1}, -\infty < x < \infty$, then the value of constant c is :**

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

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

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

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

68. **The probabilities of X, Y, Z becoming managers are 4/9, 2/9 and 1/3 respectively. The probability that bonus scheme will be introduced if X, Y, Z becomes managers are 3/10, 1/2 and 4/5 respectively, then the probability that bonus scheme will be introduced is :**

(A) 6/23

(B) 1/3

(C) 23/45

(D) 2/11

69. **The line $lx + my + n = 0$ touches the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is :**

(A) $a^2n^2 + b^2l^2 = m^2$

(B) $a^2l^2 + b^2m^2 = n^2$

(C) $al + bm = n$

(D) $a^2l^2 + b^2n^2 = m^2$

70. **The radical axis of the system of coaxial circles $3(x^2 + y^2) - 16x - 14y + 39 + \lambda(x^2 + y^2 - 5x - 5y + 13) = 0$ is :**

(A) $x - y = 0$

(B) $x + y = 0$

(C) $3x - y = 0$

(D) $x - 3y = 0$

71. The pole of the line $lx + my + n = 0$ w. r. t. a cirlce $x^2 + y^2 = a^2$ is :

(A) $\left(\frac{a^2 l}{n}, \frac{a^2 m}{n}\right)$ (B) $\left(\frac{al^2}{n}, \frac{am^2}{n}\right)$

(C) $\left(-\frac{a^2 l}{n}, -\frac{a^2 m}{n}\right)$ (D) $\left(-\frac{al^2}{n}, -\frac{am^2}{n}\right)$

72. The angle between the pair of straight lines represented by $x^2 + xy - 6y^2 + 7x + 31y - 18 = 0$ is :

(A) 30° (B) 45°

(C) 60° (D) 90°

73. The condition that two circles $x^2 + y^2 + 2gx + 2fy + c = 0$ and $x^2 + y^2 + 2g'x + 2f'y + c' = 0$ cut orthogonally is that :

(A) $2gg' + 2ff' = c + c'$ (B) $gg' + ff' = c + c'$

(C) $gg' + c = ff' + c'$ (D) $2gg' - 2ff' = c - c'$

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74. The value of k so that the equation $kx^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represent a pair of straight lines :

(A) –2 (B) 2

(C) –3 (D) 3

75. The pair of straight lines given by $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ are coincident when :

(A) $a + b = 0$ (B) $h^2 - ab > 0$

(C) $h^2 - ab < 0$ (D) $h^2 - ab = 0$