

CET-2015

Sr. No. :

138517

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.

Roll No.

In Figures

In Words

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O.M.R. Answer Sheet Serial No.

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Signature of the Candidate : _____

Subject : MATHEMATICS

Time : 70 minutes

Number of Questions : 60

Maximum Marks : 120

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 staple(s) gently when asked to do so.
5. Please check that this Question Booklet contains **60** 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.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
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 calculators is not allowed.**

- Let A and B be two sets containing 3 and 4 elements respectively. The number of functions from A to B is :
 (A) 12 (B) 81
 (C) 64 (D) 24
- Let $f: (2, 3) \rightarrow (0, 1)$ be defined by $f(x) = x - [x]$, where $[\cdot]$ denotes the greatest integer value function, then $f^{-1}(x)$ equals :
 (A) $x - 2$ (B) $x + 1$
 (C) $x - 1$ (D) $x + 2$
- Let $R = \{(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. The relation R is :
 (A) an equivalence relation (B) reflexive and symmetric
 (C) reflexive and transitive (D) only reflexive
- Let $f(x) = x^2 - 2x - 3$, $g(x) = f(|x|)$. The number of solutions of $g(x) = 0$ is/are :
 (A) 2 (B) 3
 (C) 4 (D) 0
- In a right angle triangle ABC, with right angle at C, the value of $\tan A + \tan B$ is :
 (A) $a + b$ (B) c^2/ab
 (C) a^2/bc (D) b^2/ac
- Which one of the following is true ?
 (A) $\tan 1 = \tan^{-1} 1$ (B) $\tan 1 > \tan^{-1} 1$
 (C) $\tan 1 < \tan^{-1} 1$ (D) $\tan 1 \cdot \tan^{-1} 1 = 1$
- Given that $\sum_{k=0}^{n-1} \cos \frac{2k\pi}{n} = 0$, the value of $\sum_{k=1}^{n-1} \cos^2 \frac{k\pi}{n}$ is :
 (A) 0 (B) 1
 (C) $\frac{1}{2}(n-2)$ (D) $\frac{1}{2}(n-1)$
- If $\sin x + \sin^2 x + \sin^3 x = 1$ then $\cos^6 x - 4 \cos^4 x + 8 \cos^2 x$ equals :
 (A) 1 (B) 2
 (C) 3 (D) 4

9. Let $S(k) = 1 + 3 + 5 + \dots + (2k - 1) = 3 + k^2$. Then which of the following is true ?
- (A) $S(1)$ is correct
 (B) $S(k) \Rightarrow S(k + 1)$
 (C) $S(k) \not\Rightarrow S(k + 1)$
 (D) Principle of Mathematical Induction can be used to prove the formula for $S(k)$
10. If $1, w, w^2, \dots, w^{n-1}$ are the n th roots of unity then $(2 - w)(2 - w^2) \dots (2 - w^{n-1})$ equals :
- (A) $2^n - 1$ (B) 2^n
 (C) 0 (D) -1
11. If $n > 1$ and if $z^n = (z + 1)^n$ then :
- (A) $\operatorname{Re} z = \frac{1}{2}$ (B) $\operatorname{Re} z = -\frac{1}{2}$
 (C) $\operatorname{Im} z = \frac{1}{2}$ (D) $\operatorname{Im} z = -\frac{1}{2}$
12. If $a_n = \left(1 + \frac{1}{n}\right)^n$ then for $n \in \mathbf{N}$, which one of the following is not true ?
- (A) $a_n \geq 2$ (B) $a_n < 3$
 (C) $a_n < 4$ (D) $a_n < 2$
13. The remainder when 2^{2015} is divided by 17 is :
- (A) 1 (B) 2
 (C) 8 (D) 9
14. The sum to n terms of the series

$$\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16} + \dots$$

is equal to :

- (A) $2^n - n - 1$ (B) $1 - 2^{-n}$
 (C) $2^{-n} + n - 1$ (D) $2^n - 1$

15. If a, b, c are digits then the rational number represented by $0.\overline{c a b a b a b \dots}$ is :

(A) $\frac{cab}{990}$

(B) $\frac{99c + ab}{990}$

(C) $\frac{99c + 10a + b}{99}$

(D) $\frac{99c + 10a + b}{990}$

16. If f is a function satisfying

$$f(x + y) = f(x) \cdot f(y) \text{ for all } x, y \in \mathbb{N},$$

such that $f(1) = 3$ and $\sum_{x=1}^n f(x) = 120$ then value of n is :

(A) 4

(B) 5

(C) 6

(D) 7

17. If $a\left(\frac{1}{b} + \frac{1}{c}\right), b\left(\frac{1}{c} + \frac{1}{a}\right), c\left(\frac{1}{a} + \frac{1}{b}\right)$ are in AP then a, b, c are in :

(A) AP

(B) GP

(C) HP

(D) nothing can be said

18. If the straight lines

$$a x + m a y + 1 = 0$$

$$b x + (m + 1) b y + 1 = 0$$

$$c x + (m + 2) c y + 1 = 0, m \neq 0$$

are concurrent, then a, b, c are in :

(A) AP only for $m = 1$

(B) AP for all m

(C) GP for all m

(D) HP for all m

19. From the point $A(0, 3)$ on the circle $x^2 + 4x + (y - 3)^2 = 0$, a chord AB is drawn and extended to a point M such that $AM = 2 AB$. Then the locus of M is a :

(A) Straight line

(B) Circle

(C) Parabola

(D) Hyperbola

20. The radius of the circle having the lines $3x - 4y + 4 = 0$ and $6x - 8y - 7 = 0$ as tangents is :

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

21. The product of the lengths of the perpendiculars drawn from two foci of the hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \text{ to any tangent to this hyperbola is :}$$

- (A) a^2 (B) $2a^2$
(C) b^2 (D) $2b^2$

22. If A and B are the points (3, 4, 5) and (-1, 3, -7) respectively then the set of points P such that $PA^2 + PB^2 = K^2$, where K is a constant lie on a proper sphere if :

- (A) $K^2 < \frac{161}{2}$ (B) $K^2 > \frac{161}{2}$
(C) $K^2 = \frac{161}{2}$ (D) $K = 1$

23. Which of the following functions is an even function ?

- (A) $f(x) = \frac{a^x + a^{-x}}{a^x - a^{-x}}$ (B) $f(x) = \frac{a^x + 1}{a^x - 1}$
(C) $f(x) = x \cdot \frac{a^x - 1}{a^x + 1}$ (D) $f(x) = \log_2 \left(x + \sqrt{x^2 + 1} \right)$

24. If $f(x) = \frac{\sin [x]}{[x]}$ for $[x] \neq 0$. Then $\lim_{x \rightarrow 0^-} f(x)$ equals :

- (A) 1 (B) 0
(C) $\sin 1$ (D) no number i.e. does not exist

25. The set of all points where the function $f(x) = x|x|$ is differentiable is :

- (A) $(-\infty, \infty)$ (B) $(-\infty, 0) \cup (0, \infty)$
(C) $(0, \infty)$ (D) $[0, \infty)$

26. Let f be a function satisfying

$$f\left(\frac{x+y}{2}\right) = \frac{f(x)+f(y)}{2}, \text{ for all real } x \text{ and } y.$$

If $f'(0)$ exists and equal -1 and $f(0) = 1$, then $f(2)$ equals :

- (A) 0 (B) -1
(C) 1 (D) $3/2$

27. Which of the following statements is true ?

- (A) $p \vee \sim(p \wedge q)$ is a tautology (B) $\sim(p \wedge q) = \sim p \wedge \sim q$
(C) If $p \rightarrow q$ is true, then p is true (D) $p \rightarrow q = q \rightarrow p$

28. The mean deviation from mean of the observations $a, a+d, a+2d, \dots, a+2nd$ is :

- (A) $\frac{n(n+1)d^2}{3}$ (B) $\frac{n(n+1)d^2}{2}$
(C) $a + \frac{n(n+1)d^2}{2}$ (D) $\frac{n(n+1)|d|}{2n+1}$

29. Nine digit numbers are formed using 1, 2, 3, ..., 9 without repetition. The probability that the number is divisible by 4 is :

- (A) $2/7$ (B) $3/8$
(C) $1/9$ (D) $2/9$

30. An ellipse of eccentricity $\frac{2\sqrt{2}}{3}$ is inscribed in a circle and a point within the circle is chosen at random. The probability that this point lies outside the ellipse is :

- (A) $\frac{1}{9}$ (B) $\frac{4}{9}$
(C) $\frac{1}{3}$ (D) $\frac{2}{3}$

31. The relation R defined on the set of reals by $(a, b) \in R$ if and only if $1 + ab > 0$ is :

- (A) Reflexive but not symmetric (B) Symmetric but not reflexive
(C) Symmetric but not transitive and reflexive (D) Reflexive, symmetric but not transitive

32. If $f: [0, 1] \rightarrow \mathbb{R}$ is defined by the rule

$$f(x) = \begin{cases} x & \text{if } x \text{ is a rational number} \\ 1 - x & \text{if } x \text{ is an irrational number} \end{cases}$$

then :

(A) $f \circ f(x) = x$ for all $x \in [0, 1]$

(B) $f \circ f(x) = 1 - x$ for all $x \in [0, 1]$

(C) $f \circ f(x) = 1$ for all $x \in [0, 1]$

(D) $f \circ f(x) = 0$ for all $x \in [0, 1]$

33. If $f: \mathbb{R} \rightarrow \mathbb{R}$ is given by $f(x) = 3x - 5$ then $f^{-1}(x)$:

(A) is given by $\frac{1}{3x - 5}$

(B) is given by $\frac{x + 5}{3}$

(C) does not exist as f is not one-one

(D) does not exist as f is not onto

34. If $\sin^{-1}x + \sin^{-1}(1 - x) = \cos^{-1}x$, then x equals :

(A) 1, -1

(B) 1, 0

(C) 0, 1/2

(D) 1, 1/2

35. $\tan^{-1}\frac{x}{y} - \tan^{-1}\frac{x - y}{x + y}$ equals :

(A) $\pi/2$

(B) $\pi/3$

(C) $\pi/4$

(D) $\pi/6$

36. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = -[A^2 + B^2]$ then a, b are :

(A) 1, -4

(B) -1, 4

(C) -1, -4

(D) 1, 4

37. Let $A = \begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$. The only correct statement about the matrix A is :

(A) $A^2 = I$

(B) $A = -I$

(C) A^{-1} does not exist

(D) A is the zero matrix

38. If $a_1, a_2, \dots, a_n, \dots$ are in G.P., then the value of the determinant

$$\begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix} \text{ is :}$$

(A) -2

(B) 1

(C) 2

(D) 0

39. If $D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$ for $x \neq 0, y \neq 0$ then D is :

(A) divisible by x but not by y

(B) divisible by y but not by x

(C) divisible by neither x nor y

(D) divisible by both x and y

40. Let $A = \begin{bmatrix} 1 & \sin \theta & 1 \\ -\sin \theta & 1 & \sin \theta \\ -1 & -\sin \theta & 1 \end{bmatrix}$ where $0 \leq \theta \leq 2\pi$. Then :

(A) $\det A = 0$

(B) $\det A \in (2, \infty)$

(C) $\det A \in [2, 4]$

(D) $\det A \in (2, 4)$

41. If $a^2 + b^2 + c^2 = -2$ and

$$f(x) = \begin{vmatrix} 1 + a^2x & (1 + b^2)x & (1 + c^2)x \\ (1 + a^2)x & 1 + b^2x & (1 + c^2)x \\ (1 + a^2)x & (1 + b^2)x & 1 + c^2x \end{vmatrix}$$

then $f(x)$ is a polynomial of degree :

(A) 1

(B) 2

(C) 0

(D) 3

42. Suppose $f(x)$ is differentiable at $x = 1$ and $\lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h} = 5$. Then $f'(1)$ equals :

(A) 5

(B) 3

(C) 4

(D) 6

43. Let f be differentiable for all x . If $f(1) = -2$ and $f'(x) \geq 2$ for $x \in [1, 6]$, then :
- (A) $f(6) < 8$ (B) $f(6) < 5$
 (C) $f(6) \geq 8$ (D) $f(6) = 5$
44. If f is a real valued differentiable function satisfying $|f(x) - f(y)| \leq (x - y)^2$ for all real x and y and $f(0) = 0$ then $f(1)$ equals :
- (A) -1 (B) 1
 (C) 2 (D) 0
45. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = \min \{(x + 1), |x| + 1\}$. Then which of the following is true ?
- (A) $f(x)$ is differentiable everywhere (B) $f(x)$ is not differentiable at $x = 0$
 (C) $f(x) \geq 1$ for all real x (D) $f(x)$ is not differentiable at $x = 1$
46. If $\int \frac{\sin x}{\sin(x - \alpha)} = Ax + B \log \sin(x - \alpha) + C$, then the value of (A, B) is :
- (A) $(-\cos \alpha, \sin \alpha)$ (B) $(\cos \alpha, \sin \alpha)$
 (C) $(-\sin \alpha, \cos \alpha)$ (D) $(\sin \alpha, \cos \alpha)$
47. $\int \frac{dx}{\cos x - \sin x}$ is equal to :
- (A) $\frac{1}{\sqrt{2}} \log \left| \tan \left(\frac{x}{2} + \frac{3\pi}{8} \right) \right| + c$ (B) $\frac{1}{\sqrt{2}} \log \left| \cot \left(\frac{x}{2} \right) \right| + c$
 (C) $\frac{1}{\sqrt{2}} \log \left| \tan \left(\frac{x}{2} - \frac{3\pi}{8} \right) \right| + c$ (D) $\frac{1}{\sqrt{2}} \log \left| \tan \left(\frac{x}{2} - \frac{\pi}{8} \right) \right| + c$
48. The value of $\int_{-2}^3 |1 - x^2| dx$ is :
- (A) $1/3$ (B) $14/3$
 (C) $7/3$ (D) $28/3$

49. $\int_0^{\pi} x f(\sin x) dx$ is equal to :

(A) $\pi \int_0^{\pi} f(\cos x) dx$

(B) $\pi \int_0^{\pi} f(\sin x) dx$

(C) $\frac{\pi}{2} \int_0^{\pi/2} f(\sin x) dx$

(D) $\pi \int_0^{\pi/2} f(\cos x) dx$

50. The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minimum at :

(A) $x = 2$

(B) $x = -2$

(C) $x = 0$

(D) $x = 1$

51. The area enclosed between the curve $y = \log_e(x + e)$ and the coordinate axes is :

(A) 3

(B) 2

(C) 1

(D) 4

52. The differential equation for the family of circle $x^2 + y^2 - 2ay = 0$ where a is an arbitrary constant is :

(A) $(x^2 + y^2)y' = 2xy$

(B) $2(x^2 + y^2)y' = xy$

(C) $(x^2 - y^2)y' = 2xy$

(D) $2(x^2 - y^2)y' = xy$

53. If a, b, c are distinct non negative numbers and the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is :

(A) The Geometric Mean of a and b

(B) The Arithmetic Mean of a and b

(C) Equal to zero

(D) The Harmonic Mean of a and b

54. If $\vec{a}, \vec{b}, \vec{c}$ are non Coplanar vectors and λ is a real number, then

$$\left[\lambda(\vec{a} + \vec{b}), \lambda^2 \vec{b}, \lambda \vec{c} \right] = \left[\vec{a}, \vec{b} + \vec{c}, \vec{b} \right] \text{ for :}$$

(A) exactly one value of λ

(B) no value of λ in reals

(C) exactly three values of λ

(D) exactly two values of λ

55. Distance between two planes $2x + 3y + 4z = 4$ and $4x + 6y + 8z = 12$ is :
- (A) 2 units (B) 4 units
(C) 8 units (D) $\frac{2}{\sqrt{29}}$ units
56. A line makes the same angle θ , with each of x and z -axis. If the angle β , which it makes with y -axis is such that $\sin^2\beta = 3 \sin^2\theta$, then $\cos^2\theta$ equals :
- (A) $2/5$ (B) $1/5$
(C) $3/5$ (D) $2/3$
57. The probability that A speaks truth is $4/5$ while this probability for B is $\frac{3}{4}$. The probability that they contradict each other when asked to speak on a fact is :
- (A) $4/5$ (B) $1/5$
(C) $7/20$ (D) $3/20$
58. The mean of the numbers obtained on throwing a die having written 1 on three faces, 2 on two faces and 5 on one face is :
- (A) 1 (B) 2
(C) 5 (D) $8/3$
59. The corner points of the feasible region determined by the following system of linear inequalities : $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are $(0, 0)$, $(5, 0)$, $(3, 4)$ and $(0, 5)$. Let $Z = px + qy$, $p, q > 0$. The condition on p and q so that maximum of Z occurs at both $(3, 4)$ and $(0, 5)$ is :
- (A) $p = q$ (B) $p = 2q$
(C) $p = 3q$ (D) $q = 3p$
60. The maximum value of $Z = 4x + 2y$ subjected to the constraints $2x + 3y \leq 18$, $x + y \geq 10$; where $x, y \geq 0$ is :
- (A) 36 (B) 40
(C) 20 (D) never attained

Panjab University, Chandigarh
CET(UG)-2015

FINAL ANSWERS / KEY

Subject: MATHEMATICS

Booklet Series Code: A

1	2	3	4	5	6	7	8	9	10
C	D	C	A	B	B	C	D	B	A
11	12	13	14	15	16	17	18	19	20
B	D	D	C	D	A	A	D	B	D
21	22	23	24	25	26	27	28	29	30
C	B	C	C	A	B	A	D	D	D
31	32	33	34	35	36	37	38	39	40
D	A	B	C	C	A	A	D	D	C
41	42	43	44	45	46	47	48	49	50
B	A	C	D	A	B	A	D	D	A
51	52	53	54	55	56	57	58	59	60
C	C	A	B	D	C	C	B	D	D

Note: An 'X' in the key indicates that either the question is ambiguous or it has printing mistake. All candidates will be given credit for this question.