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Invigilator's signature

Question Booklet No.

101482

2018

TGT — PAPER - I : MATHEMATICS

Time : 2 Hours

Maximum Marks : 100

ROLL NO. **INSTRUCTIONS FOR CANDIDATES**

1. This Question Booklet contains 50 optional questions. Each question comprises four responses (answers). You will select ONLY ONE response which you consider the best and darken the bubble on the OMR RESPONSE SHEET.
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5. No candidate shall have in his/her possession inside the Examination Hall any book, notebook or loose paper, calculator, mobile phone, etc., except his/her admit card and other things paper permitted by the Commission.
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NB: CANDIDATES ARE ALLOWED TO TAKE THIS QUESTION BOOKLET ONLY AFTER COMPLETION OF 2 (TWO) HOURS OF EXAMINATION TIME.

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1. One of the factors of the polynomial $2x^3 - 3x^2 - 17x + 30$ is
 - (A) $x - 3$
 - (B) $5x - 2$
 - (C) $x - 2$
 - (D) $x + 2$
2. The difference and the products of two numbers are 3 and 10 respectively. The difference of the cubes of the numbers can be
 - (A) 30
 - (B) 99
 - (C) 107
 - (D) 117
3. The n th root of $n + n + n + \dots$ up to n th term is
 - (A) n
 - (B) $n^{n/2}$
 - (C) n^n
 - (D) $n^{2/n}$
4. If $1^3 + 2^3 + 3^3 + \dots + n^3 = 225$, then $1 + 2 + 3 + \dots + n$ is equal to
 - (A) 125
 - (B) 75
 - (C) 25
 - (D) 15
5. A vertical cone of height h and base area a is cut horizontally at half the height. The volumes of the cut portions are at the ratio
 - (A) 1 : 8
 - (B) 1 : 7
 - (C) 7 : 8
 - (D) 1 : 2
6. The sum of all the elements of a 2×2 matrix cut from a calendar month is found to be 48. The smallest element of the matrix is
 - (A) 7
 - (B) 8
 - (C) 9
 - (D) 10
7. The sum of ${}^{10}C_7$ and ${}^{10}C_6$ is
 - (A) ${}^{11}C_6$
 - (B) ${}^{11}C_7$
 - (C) ${}^{11}C_8$
 - (D) ${}^{10}C_8$
8. ${}^nC_1 + {}^nC_2 + {}^nC_3 + \dots + {}^nC_{n-1}$ equals
 - (A) 2^n
 - (B) $2^n - 1$
 - (C) $2^{n-1} - 1$
 - (D) $2^n - 2$
9. If $i = \sqrt{-1}$, then $i^{101} + i^{102} + \dots + i^{150}$ equals
 - (A) $-1 + i$
 - (B) $1 - i$
 - (C) 1
 - (D) 0
10. The material of a cylinder of base area a and height h is melted to make solid cones of the same base area a and height $h/2$. The total number of cones that can be made is
 - (A) 6
 - (B) 8
 - (C) 10
 - (D) 12

11. A moderately symmetric distribution of data possesses a mean of 10 and median 12. The mode of the given distribution is estimated as
 (A) 16
 (B) 14
 (C) 13
 (D) 11
12. Evaluation of the integral $\int \log x dx$, apart from the constant of integration, yields
 (A) $\log x$
 (B) $\log x - x$
 (C) $x \log x$
 (D) $x \log x - x$
13. The derivative of x^n with respect to $\log x$ is
 (A) $x^n \log x$
 (B) nx^n
 (C) x^n/n
 (D) $x^n e^x$
14. If 1, ω , ω^2 are the cube roots of unity, then $\frac{1}{\omega}$ equals
 (A) ω^2
 (B) $-\omega^2$
 (C) ω^3
 (D) $-\omega^3$
15. The number of odd integers of three digits that can be formed with digits 1, 2, 3, 4 without repetition is
 (A) 12
 (B) 16
 (C) 20
 (D) 24
16. $\frac{1 + \sin 2\theta}{\cos 2\theta}$ equals
 (A) $\tan \theta$
 (B) $1 + \tan \theta$
 (C) $\frac{1}{1 + \tan \theta}$
 (D) $\frac{1 + \tan \theta}{1 - \tan \theta}$
17. If $\sin \theta = \frac{3}{5}$ ($\theta < \frac{\pi}{2}$), then $\tan 2\theta$ is given by
 (A) $\frac{9}{25}$
 (B) $\frac{22}{7}$
 (C) $\frac{7}{40}$
 (D) $\frac{24}{7}$
18. The rules for awarding marks in an MCQ type test with 80 questions are as follows :
 All questions must be attempted; 2 marks for each correct answer, and 0.5 mark deducted for each wrong answer.
 If a candidate scores 0 in the test, the number of questions correctly answered is
 (A) 12
 (B) 14
 (C) 16
 (D) 18

19. Evaluation of the limit $\lim_{x \rightarrow 0} \left(\frac{e^{5x} - 1}{\frac{x}{5}} \right)$

yields

- (A) 0
- (B) 1
- (C) 5
- (D) 25

20. The inequality $\frac{5x-2}{2x+4} > 3$ is correctly

satisfied by the values of x when

- (A) $0 < x < 14$
- (B) $-14 \leq x < 14$
- (C) $-2 < x \leq 14$
- (D) $-14 < x < -2$

21. The limit $\lim_{x \rightarrow 0} \left(\frac{\sin(a+x) - \sin a}{x} \right)$

results in

- (A) $\sin a$
- (B) $\sin x$
- (C) $\cos a$
- (D) $\cos x$

22. If ω is one of the cube root of unity, then the value of the determinant

$$\begin{vmatrix} 1 & \omega^3 & \omega^2 \\ \omega^3 & 1 & \omega \\ \omega^2 & \omega & 1 \end{vmatrix}$$
 is

- (A) ω^2
- (B) 1
- (C) 3
- (D) ω

23. A matrix A is termed as singular matrix if

- (A) all the elements of matrix A are 0
- (B) the determinant of the matrix A is 0
- (C) the inverse of matrix A is the matrix A itself
- (D) the product of the matrix A and its transpose is a null matrix

24. The inverse of the matrix $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ is

(A) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

25. If α, β are the roots of the quadratic equation $ax^2 + bx + c = 0$ ($a \neq 0$), then $\alpha - \beta$ equals
- (A) $\frac{\sqrt{b^2 - 4ac}}{a}$
- (B) $\frac{b^2 - 4ac}{\sqrt{a}}$
- (C) $\frac{b^2 - 4ac}{a}$
- (D) $\frac{\sqrt{b^2 - 4ac}}{a^2}$
26. P1 can complete a job in 2 hours, P2 can complete it in 4 hours and P3 can complete in 8 hours. The time required to complete the job by both P2 and P3 working together is
- (A) 1 hour and 30 minutes
- (B) 1 hour and 40 minutes
- (C) 2 hours and 40 minutes
- (D) 3 hours and 30 minutes
27. The remainder when -76 is divided by 3 is
- (A) -1
- (B) 1
- (C) -2
- (D) 2
28. The value of $-\log_2(\log_2(\log_2 16))$ is
- (A) 1
- (B) -1
- (C) 2
- (D) -2
29. A 2° angle is seen through a magnifying glass of 10 magnification. The angle seen is
- (A) 2°
- (B) 8°
- (C) 12°
- (D) 20°
30. The sum of A and B results C . The sum of B and C gives A . The conclusion is
- (A) $A = C$
- (B) $B = C$
- (C) $B = 0$
- (D) $A - B = 0$
31. 2 red balls, 3 green balls and 4 blue balls are kept inside a bag. One ball is randomly drawn from the bag. The probability that the ball drawn is red or blue, is
- (A) $1/3$
- (B) $2/3$
- (C) $1/9$
- (D) $5/9$
32. The number of cubes of size $10 \times 10 \times 10 \text{ cm}^3$ each that is cut from a block of $1 \times 1 \times 1 \text{ m}^3$ is
- (A) 10^3
- (B) 10^4
- (C) 10^5
- (D) 10^6

33. The standard deviation for the data set $\{1, 2, 3, 4, 5\}$ is
- (A) 3
(B) $\sqrt{3}$
(C) 2.5
(D) $\sqrt{2}$
34. Vector \vec{B} makes an angle 30° with vector \vec{A} . The angle between $\vec{A} \times \vec{B}$ and \vec{A} is
- (A) 0°
(B) 30°
(C) 60°
(D) 90°
35. A 1 cm^3 cube is cut into two pieces vertically down along the diagonal of the top face. The total surface area of the two pieces is
- (A) $6 + \sqrt{2} \text{ cm}^2$
(B) $3 + 2\sqrt{2} \text{ cm}^2$
(C) $6 + 2\sqrt{2} \text{ cm}^2$
(D) $2 + 3\sqrt{2} \text{ cm}^2$
36. If $\sin \theta + \cos \theta = 1$ and $0 < \theta \leq \pi/2$, then the angle θ is
- (A) $\pi/6$
(B) $\pi/4$
(C) $\pi/3$
(D) $\pi/2$
37. $2 \sin 150^\circ - \cos 180^\circ + \tan 225^\circ$ equals
- (A) 1
(B) 2
(C) 3
(D) 4
38. The area of a triangle formed by the x -axis, y -axis and the line $\frac{x}{5} + \frac{y}{12} = 1$ is
- (A) 30 square units
(B) 60 square units
(C) 27 square units
(D) 17 square units
39. The straight line $x + y + 1 = 0$ intersects the y -axis
- (A) at $(0, 1)$ with a positive slope
(B) at $(0, -1)$ with a positive slope
(C) at $(0, 1)$ with a negative slope
(D) at $(0, -1)$ with a negative slope
40. Two Ludo dice are thrown simultaneously. The probability that the sum of the dots in the two dice equal to 10 or less, is
- (A) $5/18$
(B) $11/12$
(C) $1/2$
(D) $5/6$
41. The probability of getting $1/2$ the head in a coin throw is
- (A) 0
(B) $1/4$
(C) $1/2$
(D) 1

42. One value of K for the quadratic equation $4x^2 - 3Kx + 1 = 0$ to have equal roots is

- (A) $4/3$
- (B) $3/4$
- (C) 4
- (D) 3

43. The locus of the point z satisfying the

condition $\arg\left[\frac{z-1}{z+1}\right] = \frac{\pi}{3}$ is

- (A) an ellipse
- (B) a circle
- (C) a parabola
- (D) None of the above

44. The integrating factor of the differential

equation $\frac{dy}{dx} + \frac{y}{2x} = e^x$ is

- (A) x
- (B) \sqrt{x}
- (C) $1/x$
- (D) $1/\sqrt{x}$

45. The solution of the differential equation

$\frac{d}{dx}\left(\frac{1}{y}\right) + \frac{1}{y} = 0, y(0) = 2$ is

- (A) $y = \frac{1}{2}e^x$
- (B) $y = 2e^{-x}$
- (C) $y = 2e^x$
- (D) $y = \frac{1}{2}e^{-x}$

46. The angle between two Cartesian vectors

$2\hat{i} + \hat{j}$ and $3\hat{i} - \hat{j}$ is

- (A) 0
- (B) $\pi/6$
- (C) $\pi/4$
- (D) $\pi/2$

47. $\lim_{x \rightarrow 0} \left(\frac{\sin(-x)}{x}\right)^2$ evaluates to

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

48. The direction cosine of the vector

$\vec{A} = \hat{i} + \frac{\hat{j}}{2} + \frac{\hat{k}}{4}$ is

- (A) $\left(\frac{1}{21}, \frac{2}{21}, \frac{4}{21}\right)$
- (B) $\left(\frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}, \frac{1}{\sqrt{21}}\right)$
- (C) $\left(\frac{1}{21}, \frac{4}{21}, \frac{2}{21}\right)$
- (D) $\left(\frac{4}{21}, \frac{1}{21}, \frac{2}{21}\right)$

49. Let a be the reciprocal of b , b be the reciprocal of c and c be the reciprocal of d . Then $ad + bc$ equals

- (A) 1
- (B) 2
- (C) $1/2$
- (D) $1/4$

50. The vector product $\vec{A} \times (\vec{A} \times \vec{B})$ is equal to

- (A) $\vec{A}(\vec{A} \times \vec{B}) - \vec{B}(\vec{A} \times \vec{A})$
- (B) $\vec{B}(\vec{A} \cdot \vec{A}) - \vec{A}(\vec{A} \cdot \vec{B})$
- (C) $\vec{B}(\vec{A} \times \vec{A}) - \vec{A}(\vec{A} \times \vec{B})$
- (D) $\vec{A}(\vec{A} \cdot \vec{B}) - \vec{B}(\vec{A} \cdot \vec{A})$