SEAL

DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

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.
2. DO NOT write your Name or anything else except Roll No. and the actual answers to the question, anywhere on the OMR RESPONSE SHEET.
3. DO NOT handle your OMR RESPONSE SHEET in such a manner as to mutilate, fold, etc.
4. No candidate shall be admitted to the Examination Hall **20 minutes** after commencement of distribution of the Test Booklet. The invigilator of the Examination Hall will be the time-keeper and his decision in this regard is final.
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.
6. Immediately after the final bell indicating the closure of the examination, stop bubbling. Be seated till the OMR RESPONSE SHEET is collected by the invigilator, thereafter you may leave the Examination Hall.
7. Violation of any of the above rules will render the candidate liable to expulsion from the examination and disqualification from the examination, and according to the nature and gravity of his/her offence, he/she may be debarred from future examinations and interviews to be conducted by the Commission and other such organization (i.e., UPSC, SSC and SPSCs).

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 nth root of $n + n + n + \ldots$ up to nth term is

(A) n

(B) $n^{n/2}$

(C) n^n

(D) $n^{2/n}$

4. If $1^3 + 2^3 + 3^3 + \ldots + n^3 = 225$, then $1 + 2 + 3 + \ldots + n$ 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. ${}^{n}C_1 + {}^{n}C_2 + {}^{n}C_3 + \ldots + {}^{n}C_{n-1}$ equals

(A) 2^n

(B) $2^n - 1$

(C) $2^{n-1} - 1$

(D) $2^n - 2$

9. If $i = \sqrt{-1}$, then $i^{101} + i^{102} + \ldots + i^{150}$ 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 $\sin\theta = \frac{3}{5}\left(\theta < \frac{\pi}{2}\right)$, 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 $\lim_{x\to 0}\left(\dfrac{e^{5x}-1}{\dfrac{x}{5}}\right)$ yields

(A) 0

(B) 1

(C) 5

(D) 25

20. The inequality $\dfrac{5x-2}{2x+4}>3$ is correctly satisfied by the values of x when

(A) $0<x<14$

(B) $-14\le x<14$

(C) $-2<x\le 14$

(D) $-14<x<-2$

21. The limit $\lim_{x\to 0}\left(\dfrac{\sin(a+x)-\sin a}{x}\right)$ 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) $\dfrac{\sqrt{b^2 - 4ac}}{a}$

(B) $\dfrac{b^2 - 4ac}{\sqrt{a}}$

(C) $\dfrac{b^2 - 4ac}{a}$

(D) $\dfrac{\sqrt{b^2 - 4ac}}{a^2}$

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 $10\times10\times10$ cm^3 each that is cut from a block of $1\times1\times1$ 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) $6+\sqrt{2}\,cm^2$

(B) $3+2\sqrt{2}\,cm^2$

(C) $6+2\sqrt{2}\,cm^2$

(D) $2+3\sqrt{2}\,cm^2$

36. If $\sin\theta + \cos\theta = 1$ and $0 < \theta \le \pi/2$, then the angle θ is

(A) $\pi/6$

(B) $\pi/4$

(C) $\pi/3$

(D) $\pi/2$

37. $2\sin 150° - \cos 180° + \tan 225°$ 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. $\lim_{x \to 0}\left(\frac{\sin(-x)}{x}\right)^2$ 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 $\vec{A}\times\left(\vec{A}\times\vec{B}\right)$ is equal to

(A) $\vec{A}.\left(\vec{A}\times\vec{B}\right)-\vec{B}.\left(\vec{A}\times\vec{A}\right)$

(B) $\vec{B}\left(\vec{A}.\vec{A}\right)-\vec{A}\left(\vec{A}.\vec{B}\right)$

(C) $\vec{B}.\left(\vec{A}\times\vec{A}\right)-\vec{A}.\left(\vec{A}\times\vec{B}\right)$

(D) $\vec{A}\left(\vec{A}.\vec{B}\right)-\vec{B}\left(\vec{A}.\vec{A}\right)$