NATIONAL TEACHERS COUNCIL

NATIONAL LEVEL
MATHEMATICS OLYMPIAD

Class 10

Time Allowed: 90 Minutes   **Maximum Mark: 50**

This Test Booklet contains 10 pages. Do not open the Test Booklet until you are asked to do so.

Important instructions

1. ***The Answer Sheet is inside this Test Booklet.*** *When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully with **blue/black ball point pen**.*

2. *The question paper is divided into two sections. **Mathematical Reasoning** (40 Questions) and **Logical Reasoning** (10 Questions)*

3. *All the two Sections contain Multiple Choice Questions (MCQs). Each of these questions has four options out of which only one option is correct.*

4. *Each question should be answered by **darkening** the appropriate circle (A, B, C, or D) with a **blue or black ball pen**.*

5. *All questions are compulsory. There is no negative marks for wrong answer.*

6. *Answer recorded once in the answer sheet cannot be altered.*

7. *All rough works should be done only in the space provided for **rough work** in this question paper.*

8. *Calculator is not permitted in the examination hall.*

9. *Candidate should write his / her name in the space provided for the purpose.*

Candidate's Name:

Roll Number   :

....
Candidate's Signature   Invigilator's Signature

MATHEMATICAL REASONING

1   The least number which is a perfect square and is divisible by each of 16, 20 and 24 is

[A] 240   [B] 1600

[C] 2400   [D] 3600

2   *Read the following statement of assertion and statement of reason carefully and select correct option.*

Assertion: When a positive integer **a** is divided by 3, the value of reminder can be **0, 1** or **2**.

Reason: According to Euclid's Division Lemma, **a = bq + r**, **where 0 ≤ r < b** and **r** is an integer

[A] Assertion is true and Reason is false

[B] Assertion is false and Reason is true

[C] Both Assertion and Reason are true and Reason is the correct explanation of Assertion

[D] Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

3   A fraction becomes 4/5 when 1 is added to each of numerator and denominator. However, if we subtract 5 from each of them, it becomes ½. Then numerator of the fraction is

[A] 6   [B] 7

[C] 8   [D] 9

4   If one root of the quadratic equation $ax^2 + bx + c = 0$ is the reciprocal of the other, then

[A] b = c   [B] a = b

[C] ac = 1   [D] a = c

5   There are 60 terms in an AP of which the first term is 8 and the last term is 185. The 31st term is

[A] 56   [B] 94

[C] 85   [D] 98

6   Two poles of height 6m and 11m stand vertically upright on a plane ground. If the distance between their foot is 12 m, then distance between their tops is

[A] 12 m   [B] 14 m

[C] 13 m   [D] 11 m

7   Find the quotient and remainder when the polynomial $x^4 - 5x + 6$ divided by $2 - x^2$

[A] $-x^2 + 2, 5x - 10$ [B] $-x^2 - 2, -5x + 10$

[C] $x^2 + 2, 5x - 10$ [D] $x^2 - 2, -5x + 10$

8   If α, β are the zeroes of polynomial $x^2 - x - 6$, form a polynomial whose zeroes are $\frac{\alpha-1}{\alpha+1}, \frac{\beta-1}{\beta+1}$

        [A] $x^2 - 7x + 3$ [B] $x^2 + 7x + 3$

        [C] $2x^2 - 7x + 3$ [D] $2x^2 + 7x - 3$

9   The age of the father is twice the age of his two children. After 20 years, his age will be equal to the sum of the ages of his children. Find the age of the father.

        [A] 20 years   [B] 40 years

        [C] 60 years   [D] 45 years

10        $(\sqrt{3} + 1)(3\text{-cot}30) =$

        [A] $\tan^2 60 - 2\sin 60$ [B] $\cot^2 60 - 2\sin 60$

        [C] $\sqrt{3}$ [D] $\sqrt{3}$ +1

11   If the roots of the equation (a - b) x^2 + (b - c) x + (c - a) = 0 are equal then

        [A] 2a = b + c   [B] a = b + c

        [C] b = a + c   [D] 2b = a + c

12   If the sum of first 2n terms of AP 2, 5, 8…. is equal to sum of first n terms of AP 57, 59, 61…. then n=

        [A] 10   [B] 12

        [C] 11   [D] 13

13   A quadratic polynomial when divided by *(x + 2)* leaves a remainder of 1 and when divided by *(x − 1)*, leaves a reminder of **4**. What will be the remainder if it is divided by *(x + 2) (x − 1)*

        [A] 1   [B] 4

        [C] (x- 3)   [D] (x + 3)

14   The area of a right angled triangle is 40 cm^2 and its perimeter is 40 cm. The length of its hypotenuse is

        [A] 16 cm   [B] 18 cm

        [C] 17 cm   [D] Data insufficient

15   If the area of the triangle formed by the points (x, 2x), (-2, 6) and (3, 1) is 5 sq units, then x equals

        [A]2/3   [B] 3/5

        [C] 3   [D] 5

16 What does the abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data represent?

        [A] Mean   [B] Median

        [C] Mode   [D] None of these

17 From a point P on the ground the angle of elevation of the top of a 10m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff. ($\sqrt{3}=1.732$)

        [A] 17.32 m   [B] 10.32 m

        [C] 7.32m   [D] 1.732m

18 The probability that a non-leap year selected at random will contain 53 Sundays is

        [A] $\frac{1}{7}$ [B] $\frac{2}{7}$

        [C] $\frac{3}{7}$ [D] $\frac{4}{7}$

19 The minute hand of a clock is 10cm long. Find the area of the face of the clock described by the minute hand between 9am and 9.35am.

        [A] 183.3 cm^2 [B] 207.3 cm^2

        [C] 180.7 cm^2 [D] 211.3 cm^2

20 To draw a pair of tangents which are inclined to each other at an angle of 55°, it is required to draw tangents at the end points of those two radii of the circle, the angle between which is

        [A] 145°   [B] 55°

        [C] 140°   [D] 125°

21 AB and CD are two common tangents to circles which touch each other at a point C. If D lies on AB such that CD = 4 cm, then AB is

        [A] 12 cm   [B] 8 cm

        [C] 4 cm   [D] 6 cm

22 If the perimeter of one face of a cube 20 cm, then its surface area is

        [A] 120 cm^2 [B] 125 cm^2

        [C] 150 cm^2 [D] 400 cm^2

23 Find the length of the longest side of the triangle formed by the line $3x + 4y = 12$ with the coordinate axes.

        [A] 9   [B] 5

        [C] 7   [D] 16

24 The areas of two similar triangles are 81 cm^2 and 49 cm^2 respectively, then the ratio of their corresponding medians is

[A] 9:81   [B] 81:7

[C] 7:9   [D] 9:7

25 The condition for one root of the quadratic equation $ax^2 + bx + c = 0$ to be twice the other is

[A] $b^2 = 4ac$ [B] $2b^2 = 9ac$

[C] $c^2 = 4a + b^2$ [D] $c^2 = 9a - b^2$

26 Determine the ratio of the volume of a cube to that of a sphere which will exactly fit inside the cube.

[A] $3 : \pi$ [B] $4 : \pi$

[C] $6 : \pi$ [D] $7 : \pi$

27 A hollow cone is cut by a plane parallel to the base and the upper portion is removed. If the curved surface of the remaining is $\frac{8}{9}$ of the curved surface of the whole cone, find the ratio of the line segment into which the cone's altitude is divided by the plane.

[A] $1 : 4$ [B] $1 : 3$

[C] $2 : 3$ [D] $1 : 2$

28 P and Q are the midpoints of the sides CA and CB respectively of a $\triangle ABC$, right angled at C, Then

[A] $4AQ^2 = 4BC^2 + AC^2$ [B] $4BP^2 = 4AC^2 + BC^2$

[C] $4(AB^2 + AC^2) = 5BC^2$ [D] $4(AQ^2 + BP^2) = 5AB^2$

29 If points (3, 3), (h, 0), (0, k) are collinear then

[A] $\frac{1}{h} + \frac{1}{k} = \frac{1}{3}$ [B] $\frac{1}{h} + \frac{1}{k} = \frac{1}{2}$

[C] $\frac{1}{h} + \frac{1}{k} = \frac{1}{6}$ [D] None of these

30 Determine the ratio in which the line 2x + y - 4 = 0 divides the line segment joining the points A (2,-2) and B (3, 7)

[A] 1:3   [B] 2:9

[C] 2:7   [D] 3:5

31 The difference between two numbers is 642. When the greater number is divided by the smaller, the quotient is 8 and remainder is 19. What is the sum of cube of numbers?

    [A] 391322860   [B] 319322860

    [C] 319322680   [D] 391223860

32 From a point on the ground, the angle of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. What is the height of the tower?

    [A] 38.64 m   [B] 28.64 m

    [C] 19.64 m   [D] 14.64 m

33 If the area of a semi-circular field is 15400 m^2, then perimeter of the field is

    [A] $160\sqrt{2}$ m   [B] $260\sqrt{2}$ m

    [C] $360\sqrt{2}$ m   [D] $460\sqrt{2}$ m

34 In the figure given below, O is the centre of the circle, AC is the diameter and if $< APB = 120°$, then $< BQC$ is

    [A] 30° [B] 150°

    [C] 90° [D] 120°

35 A and B solved a quadratic equation. In solving it, A made a mistake in the constant term and obtained the roots 5,-3 while B made a mistake in the coefficient of x and obtained the roots as 1,-3.Find the correct roots of the equation.

    [A] 3, 1   [B] 1,-3

    [C] -1, 3   [D] 1, 3

36 The angle of elevation of a cloud from a point h metre above a lake is **α** and the angle of depression of its reflection in the lake is **β**. The distance of the cloud from the point of observation is

    [A] $\dfrac{\tan\alpha - \tan\beta}{\tan\alpha \cdot \tan\beta}$ [B] $\dfrac{2h\,\sec\alpha}{\tan\beta - \tan\alpha}$

    [C] $\dfrac{\tan\alpha + \tan\beta}{\tan\alpha - \tan\beta}$ [D] $\dfrac{h\,\sec\alpha}{\tan\alpha - \tan\beta}$

37 If $7x - 9y = 4$ and $(3a + b)x - (a + 2b - 3)y = 2a - b$ represent coincident lines, then **a** and **b** satisfy the equation

[A] a + 3b = 0   [B] 5a + b = 0

[C] 2a - 11b = 0   [D] 2a - 5b + 21 = 0

38 Three identical cones with base radius **r** are placed on their base so that each is touching the other two. The radius of the circle drawn through their vertices is

[A] Larger than r   [B] Smaller than r

[C] Equal to r   [D] depends on the height of the cones

39 The mean weight of 9 students is 25 Kg. If one more student is joined in the group the mean is unaltered, then the weight of the 10th student is

[A] 24 Kg   [B] 23 Kg

[C] 26 Kg   [D] 25 Kg

40 *Read the following statement of assertion and statement of reason carefully and select correct option.*

Assertion: If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason: Median = (Mode + 2 Mean)

[A] Assertion is true and Reason is false

[B] Assertion is false and Reason is true

[C] Both Assertion and Reason are true and Reason is the correct explanation of Assertion

[D] Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
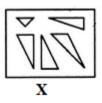
LOGICAL REASONING

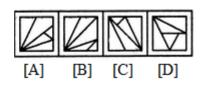41 Find the odd one from the given alternatives

[A] DEGJ   [B] QRTW

[C] YZBE   [D] JKNQ

42 Find out which of the figures [A], [B], [C] and [D] can be formed from the pieces given in figure (X).
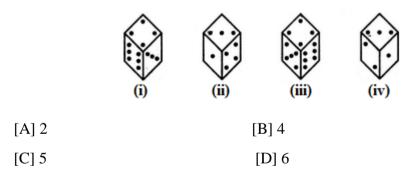

X   [A]   [B]   [C]   [D]

43 Some persons are sitting in a row, all are facing North. A sits second to the right B, who sits fifth from the right end of the row. Only one person sits between B and C. No one sits to the left of C. How many persons are sitting in the row?
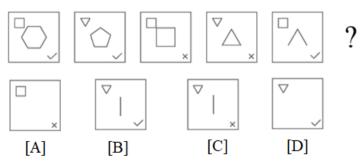
[A] 6

[B] 7

[C] 8

[D] 11

44 Read the following information carefully and answer the question that follows

P @ Q means Q is the mother of P

P $ Q means Q is the husband of P

P # Q means Q is the sister of P

P * Q means Q is the son of P

If A # B $ C *D * E, then how is E related with B?
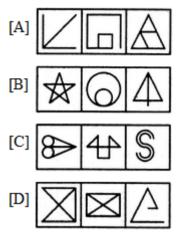
[A] Son

[B] Daughter

[C] Granddaughter

[D] Grand son

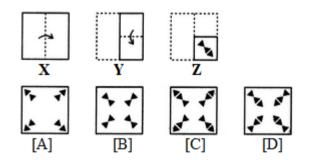45 Four Forms of a dice is shown below. How many dots are there on the dice face opposite the one with three dots?

(i)   (ii)   (iii)   (iv)

[A] 2

[B] 4

[C] 5

[D] 6

46 Replace the question mark

[A]   [B]   [C]   [D]

47 Choose the set of figures which follows the given rule.
    Rule: *Closed figures losing their sides and open figures gaining their side Any figure can be traced by a single unbroken line without retracting.*
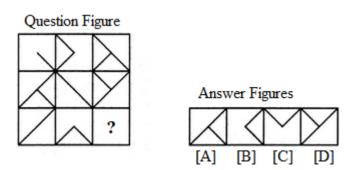

48 In the following question consists of a set of three figures X, Y and Z showing a sequence of folding of a piece of paper. Figure (Z) shows the manner in which the folded paper has been cut. These three figures are followed by four answer figures from which you have to choose a figure which would most closely resemble the unfolded form of figure (Z).

49 In certain code 'TRIPLE' is written as SQHOKD. How is 'DISPOSE' written in that code?

    [A] DSOESPI   [B] ESOPSID

    [C] CHRONRD   [D] CHRONRF

50 Select a suitable figure from the four alternatives that would complete the figure matrix

SPACE FOR ROUGH WORK