

MATHS OLYMPIAD

ROUND 1:

Logical Reasoning

1. Starting from noon, what is the angle swept by the hour hand of a clock when the time is 4:48 p.m.? (In Degrees)
 - A. 120
 - B. 144
 - C. 150
 - D. 160
2. A solid cube has two of its opposite faces coloured black and rest four with red. It is then cut into 81 smaller cubes. What is the ratio of cubes that have (two faces coloured, one red and one black) : (two faces coloured, both red) : (one face coloured black)
 - A. 1:1:7
 - B. 2:2:7
 - C. 1:2:7
 - D. 2:4:7
3. A clock is set right at 6:00 a.m. It gets ahead by 2 minutes in every 90 minutes (with respect to correct time frame). What is the time shown in the clock on the third day when actual time is 7:30 p.m.?
 - A. 8:42 p.m.
 - B. 8:40 p.m.
 - C. 8:38 p.m.
 - D. 8:36 p.m.
4. Answering to variety of balls in his bag, a boy says all are red but eight, all are blue but three and all are green but five. How many red balls are present in the bag?
 - A. 6
 - B. 5
 - C. 11
 - D. No red balls
5. Monday falls on 4th April 1998. What was the day 3rd November 1987?
 - A. Monday
 - B. Sunday
 - C. Tuesday
 - D. Wednesday
6. In a certain code "MOUSE" is written as "PRUQC". How is "SHIFT" written in that code?
 - A. VKIDR
 - B. VJIDR
 - C. VIKRD
 - D. RKIVD

7. Some equations are solved based on a certain system. On the same basis find out the correct answer for unsolved equation on that basis:
- $$41-27+34=201$$
- $$19-63+48=031$$
- $$51-35+63=?$$
- A. 79
B. 914
C. 149
D. 941
8. In a row at bus-stop, 'A' is 7th from the left and 'B' is 9th from the right. They both interchange their positions. Now A becomes 11th from the left. How many people are there in a row?
- A. 10
B. 20
C. 19
D. 18
9. Find the odd one out.
- A. UZDGI
B. JOSVX
C. RWACE
D. FKORT
10. If 'P' denotes 'multiplied by', 'T' denotes 'subtracted from', 'M' denotes 'added to' and 'B' denotes 'divided by' then: What should be the correct response of 12 P 6 M 15 T 16 B 4?
- A. 70
B. 83
C. 75
D. 110

Mathematical Reasoning

11. Krishna has exams for 12 subjects. Overall, to succeed he must pass in a greater number of subjects than the subjects he fails. In how many ways can he fail?
- A. 1586
B. 1585
C. 2509
D. 2510
12. The locus of middle points of a system of parallel chords of a parabola $y^2 = 4ax$, if m is the slope of parallel chords is,
- A. $y = m/2a$
B. $y = 2m/a$
C. $y = a/2m$

D. $y = 2a/m$

13. The coefficients of three consecutive terms of $(1+x)^{(n+5)}$ are in the ratio 5:10:14. Then $n =$
- 6
 - 8
 - 5
 - 7
14. The maximum volume of a right circular cone having slant height 3m is
- $3\pi\sqrt{3}$
 - $2\pi\sqrt{3}$
 - 3π
 - $(4/3)\pi$
15. The sum of the coefficients of all the even powers of x in the expansion of $(2x^3 - 3x + 1)^{11}$
- 2.6^{10}
 - 3.6^{10}
 - 6^{10}
 - 6^{11}
16. Number of values of n for which,
- $${}^{22}C_{n-2} + 2 \cdot {}^{22}C_{n-1} + {}^{22}C_n \geq {}^{24}C_{18}$$
- 12
 - 13
 - 14
 - 15
17. Two vessels contain a mixture of spirit and water. In the first vessel the ratio of spirit to water is 8:3 and in the second vessel the ratio is 5:1. A 35-litre cask is filled from these vessels to contain a mixture of spirit and water in the ratio of 4:1. How many liters are taken from the first vessel?
- 11 litres
 - 22 litres
 - 16.5 litres
 - 17.5 litres
18. The price of raw materials has gone up by 15%, labour cost has also increased from 25% of the cost of raw material to 30% of the cost of raw material. By how much percentage should there be a reduction in the usage of raw materials to keep the cost same?
- 24%
 - 28%
 - 17%
 - 25%
19. A sold a table to B at a profit of 20%. B sold the same table to C for Rs.75 thereby making a profit of 25%. Find the price at which A bought the table from X if it is known that X gained 25% in the transaction?

- A. Rs.30
B. Rs.40
C. Rs.50
D. Rs.60
20. A cone, a hemisphere and a cylinder stand on equal bases and have the same height. What is the ratio of their volumes?
A. 2:1:3
B. 25:1:3
C. 1.5:2:3
D. 1:2:3
21. How many numbers are there between 100 and 1000, which have exactly one of their digits are 8?
A. 300
B. 1444
C. 225
D. 729
22. Given x , y and z are three real numbers which satisfies the three conditions: $(x + y + z = 10)$, $(x^2 + y^2 + z^2 = 62)$ and $(x^3 + y^3 + z^3 = 340)$. Find the value of $(x^4 + y^4 + z^4)$?
A. 1920
B. 1925
C. 1922
D. None of these
23. Given that 'a' and 'b' are positive real numbers such that $a + b = 1$, then what is the minimum value of $\sqrt{(12 + 1/a^2)} + \sqrt{(12 + 1/b^2)}$?
A. 8
B. 24
C. 4
D. 16
24. Find the no. of zeroes in $(100^1 * 99^2 * 98^3 * 97^4 * 96^5 * \dots * 1^{100})$?
A. 970
B. 1070
C. 1120
D. 1124
25. The number of rational points $x = (p/5)$ satisfying $\frac{\log(2x - 0.75)}{\log x} > 2$, where p is an integer and $\gcd(p, 5) = 1$ is?
A. 2
B. 3
C. 5
D. 1
26. Consider the set $T_x = (x, x+1, x+2, x+3, x+4, x+5)$. For $x = 1, 2, 3, 4, \dots, 999$ How many of these sets do not contain any 7 or any integral multiple of 7?
A. 121
B. 143

- C. 144
- D. 145

27. For what values of the parameter a does the equation $x^4 + 2ax^3 + x^2 + 2ax + 1 = 0$ has at least two distinct negative roots?
- A. $(0, \infty)$
 - B. $(1/2, \infty)$
 - C. $(1/4, \infty)$
 - D. $(3/4, \infty)$
28. An infinite rod is hinged at the focus of the parabola $y^2 = 4x$ so that it can rotate freely about the focus. The only impediment to its rotation is the parabola $x^2 = 4(y - 1)$. What is the maximum angle through which it can rotate?
- A. 80°
 - B. 90°
 - C. 100°
 - D. 270°
29. Length of the curved line traced by the point represented by z , when $\arg \frac{z-1}{z+1} = \frac{\pi}{4}$ is
- A. $2\pi\sqrt{2}$
 - B. $\pi\sqrt{2}$
 - C. $\pi/\sqrt{2}$
 - D. *None*
30. $|Z_1| = 1$, $|Z_2| = 2$, $|Z_3| = 3$ and $|9Z_1 Z_2 + 4Z_1 Z_3 + Z_2 Z_3| = 12$. Then, $|Z_1 + Z_2 + Z_3|$ is
- A. 3
 - B. 2
 - C. 6
 - D. 1

ROUND 2

1. If $(8\sqrt{+i})^{50} = (3^{49}) * \{(a + ib)\}$, then find the value of $(a^2 + b^2)$.
2. A quadratic curve and a straight-line $y = ax + b$ ($a > 0$) intersect each other at points that lie on the axes. One of the points is $(-4, 0)$. The points of intersection of the curve and x -axis are 6 units apart. Find $a + b$.
3. Let f be a twice differentiable function such that $f\left(\frac{1}{n}\right) = \frac{n^2}{n^2+1}$, $n = 1, 2, 3, \dots$. Then the magnitude of $f''(0)$ is?
4. What is the sum of all the five-digit numbers that can be formed using the digits 1, 2, 3, 4 and 5 if no digit is repeated?

5. Two non-negative integers a and b are chosen at random from the set of non-negative integers. In terms of percentages, what is the probability of $a^2 + b^2$ being divisible by 10?
6. Find all pairs of a, b such that $(a^2+b)/(b^2-a)$ and $(b^2+a)/(a^2-b)$ are both integers?
7. Determine all pairs (x, y) of positive integers such that (x^2y+x+y) is divisible by (xy^2+y+7) ?
8. Suppose that a and b are natural number, such that $P=\frac{b}{4}\sqrt{2a-b}/\sqrt{2a+b}$ is a prime number. Find all possible values of a, b and p ?
9. Let a, b , and c be given positive numbers. Determine all positive real numbers x, y , and z such that $x+ y+ z = a+ b+ c$, $4xyz-(a^2 x+b^2 y+c^2 z) = abc$?
10. Find all solutions to the system of equations $6(x-y^{-1}) = 3(y-z^{-1}) = 2(z-x^{-1}) = xyz-(xyz)^{-1}$ in nonzero real numbers x, y, z ?