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Level - 1 : All Level-1 successful* participants will get certificate, aptitude report and online subscription, and school toppers will be eligible for school hero medals.

Level - 2 : School toppers* will be selected for level-2-National level - online computer based interactive test held at exam centres all over India. Besides selection for level-3, winner will get merit certificate, medals, educational CDs, laptop, scholarship and other prizes. There is no level 2 in Art, Cricket, Cyber, NIPO and Biotech.

Level - 3 : Toppers will qualify* for level 3-International level-where you will compete with students globally. Get selected for EHF's International Olympiad training camp. Only Indian organization giving students exposure to global competitions. Represent India & win laurels. Guidance by top scientists. Prizes ranges from cash (millions of \$), gadgets, foreign trips, publicity, fame, scholarships, Internships, conference participation and more.

* # See prospectus/website for details

1. You are allowed additional 10 minutes to fill the required details in the **RESPONSE SHEET (OMR)**.
2. The question paper is made as per syllabus guidelines & pattern given in the information Booklet. The Question Paper for Classes 1 to 6 contains 25 Questions each to be answered in 40 minutes. The Question paper for classes 7 to 12 contains 50 Questions each to be answered in 60 minutes. All questions are compulsory. Further instructions are given in the instruction letter to the teacher.
3. Use the response sheet to mark your responses by darkening the required circle. The response sheet has to be returned to the foundation, duly filled in. **THE STUDENT CAN RETAIN THE QUESTION PAPER.**

EHF
NATIONAL
INTERACTIVE
MATHS
OLYMPIAD

N I M O

12
Class

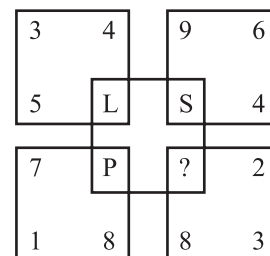
B1
Paper
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LEVEL - 1

MENTAL ABILITY

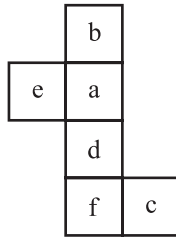
1. Here are some words translated from an artificial language
mie pie is blue light
mie tie is blue berry
aie tie is rasp berry
Which words could possibly mean "light fly"?
(1) pie zie
(2) pie mie
(3) aie zie
(4) None of these
2. Find the next number in the sequence 0, 2, 24, 252
· _____
(1) 620
(2) 1040

- (3) 3120
- (4) None of these
3. Find the letter to be placed in place of '?' in the figure given.



- (1) M
- (2) N
- (3) Q
- (4) None of these

4. If the given figure is folded to form a box, which among the boxes below will be formed?



- (1)
- (2)
- (3)
- (4) None of these
5. The letters L, M, N, O, P, Q, R, S and T in their order are substituted by nine integers 1 to 9 but not in that order. 4 is assigned to P. The difference between P and T is 5. The difference between N and T is 3. What is the integer assigned to N?
- (1) 7
(2) 5
(3) 6
(4) None of these
6. Six identical cards are placed on a table. Each card has number '1' marked on one side and number '2' marked on its other side. All the six cards are placed in such a manner that the number '1' is on the upper side. In one try, exactly four (neither more nor less) cards are turned upside down. In how many least number of tries can the cards be turned upside down such that all the six cards show number '2' on the upper side?
- (1) 3
(2) 5
(3) 7
(4) None of these
7. How many numbers lie between 300 and 500 in which 4 comes only one time?
- (1) 99
(2) 100

- (3) 110
(4) None of these
8. In a meeting, the map of a village was placed in such a manner that South-East becomes North, North-East becomes West and so on. What will South become?
- (1) North
(2) North-East
(3) North-West
(4) None of these
9. Running at a speed of 60 km/hr, a train passed through a 1.5 km long tunnel in two minutes. What is the length of the train?
- (1) 250 m
(2) 500 m
(3) 1000 m
(4) None of these
10. A candidate attempted 12 questions and secured full marks in all of them. If he obtained 60% in the test and all questions carried equal marks, then what is the number of questions in the test?
- (1) 36
(2) 30
(3) 20
(4) None of these

MATHEMATICS

11. The lines $a(a^2 + 1)x - y + b = 0$ and $(a^2 + 1)^2 x + (p^2 + 1)y + 2b$ are perpendicular to a common line for:
- (1) Exactly one value of a
(2) Exactly two values of a
(3) More than two values of a
(4) None of these
12. There are three circles with radii 3 cm, 4 cm and 5 cm touches each other internally. If P is the point of intersection of tangents to these circles at their point of contact, then the sum of the distances from points of contacts is?
- (1) $3\sqrt{5}$ cm
(2) $12\sqrt{5}$ cm
(3) $5\sqrt{3}$ cm
(4) None of these

13. Let $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If \vec{c} is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = \sqrt{5}$ and the angle between $\vec{a} \times \vec{b}$ and \vec{c} is 30° , then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to?

- (1) $\frac{2}{3}$ (2) $\frac{\sqrt{3}}{2}$
 (3) 2 (4) None of these

14. The value of $\int \frac{\sin x + \cos x}{\sqrt{1 - \sin 2x}} dx$ is equal to?

- (1) $\sqrt{\sin 2x} + c$
 (2) $\sqrt{\cos 2x} + c$
 (3) $\log(\sin x - \cos x) + c$
 (4) None of these

15. The shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$ is?

- (1) $\sqrt{3}$ (2) $2\sqrt{30}$
 (3) $3\sqrt{30}$ (4) None of these

16. A random variable has the following probability distribution.

$n:$	0	1	2	3	4	5	6	7
$p(n):$	0	$2p$	$2p$	$3p$	p^2	$2p^2$	$7p^2$	$2p$

The value of p is?

- (1) $\frac{1}{10}$ (2) -1
 (3) $-\frac{1}{10}$ (4) None of these

17. Let $f: R \rightarrow R$ be any function. Define $g: R \rightarrow R$ by $g(x) = |f(x)|$ for all x , then g is

- (1) onto if f is onto
 (2) continuous if f is continuous
 (3) one-one if f is one-one
 (4) none of these

18. The function $f(x) = 1$ is the same as the function defined by

- (1) $f(x) = x/x$

$$(2) f(x) = \begin{cases} \frac{x}{x}, & \text{if } x \neq 0 \\ 1, & \text{if } x = 0 \end{cases}$$

$$(3) f(x) = \begin{cases} \frac{x}{2}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$$

- (4) None of these

19. Matrix A has 4 rows and 3 columns, and Matrix B has 5 rows and 2 columns. The Matrix AB will have?

- (1) 4 rows and 2 columns
 (2) 5 rows and 3 columns
 (3) 2 rows and 4 columns
 (4) None of these

20. Which of the following is a rational function?

- (1) $\frac{\sqrt{1+x}}{2+5x}, x \neq -\frac{2}{5}$
 (2) $(3x^5 + 5x^3 + 2x + 7)/x^{3/2}, x > 0$
 (3) $(3x^3 - 7x + 1)/(x - 2), x \neq 2$
 (4) None of these

21. If A is a 3×3 non-singular matrix, then $\det [\text{Adj}(A)]$ is equal to

- (1) $(\det A)^2$ (2) $(\det A)^3$
 (3) $\det A$ (4) None of these

22. Consider the system of equations

$$a_1x + b_1y + c_1 = 0; \quad a_2x + b_2y + c_2 = 0;$$

$$a_3x + b_3y + c_3 = 0$$

If $\begin{pmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & c_3 & c_3 \end{pmatrix} = 0$, then the system of equations

- (1) is inconsistent
 (2) is consistent
 (3) may or may not be consistent
 (4) none of these

23. How many different nine digit number can be formed from the number 223355888 by rearranging its digits so that the odd digits occupy even positions?

- (1) 16 (2) 36
 (3) 60 (4) None of these

24. If $y = \log \left| x + \sqrt{x^2 + 1} \right|$ then $\frac{dy}{dx}$ is equal to

- (1) $\sqrt{x^2 + 1}$
- (2) $1/\sqrt{x^2 + 1}$
- (3) $x/\sqrt{x^2 + 1}$
- (4) None of these

25. $\lim_{x \rightarrow 0} \frac{\sin x^0}{x}$ is equal to

- (1) 1
- (2) $\pi/180$
- (3) π
- (4) None of these

26. If $\frac{x}{a} + \frac{y}{b} = \sqrt{2}$ touches the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, \text{ then its point of contact is}$$

- (1) $(\sqrt{2}a, \sqrt{2}b)$
- (2) $(a/\sqrt{2}, b/\sqrt{2})$
- (3) (a, b)
- (4) None of these

27. If e_1 and e_2 are eccentricities of the hyperbolas $xy = c^2$ and $x^2 - y^2 = c^2$, then $e_1^2 + e_2^2 =$

- (1) 2
- (2) 4
- (3) 6
- (4) None of these

28. A student appears for test I, II and III. The student is successful if he passes through either in tests I and II or in tests I and III. The probabilities of the student passing in tests I, II and III are p, q are $1/2$ respectively. If the probability that the student is successful is $1/2$, then

- (1) $p = q = 1$
- (2) $p = q = 1/2$
- (3) $p = 1/2, q = 1/2$
- (4) None of these

29. n biscuits are distributed among N boys at random. The probability that a particular boy gets $r (\leq n)$ biscuits is

- (1) r/n
- (2) ${}^n C_r$
- (3) ${}^n C_r (1/N)^r \{(N-1)/N\}^{n-r}$
- (4) None of these

30. If $\cos^{-1}x + \cos^{-1}y = 2\pi$, then $\sin^{-1}x + \sin^{-1}y$ is equal to

- (1) π
- (2) $-\pi$
- (3) 0
- (4) None of these

31. If R is a relation from a non-empty set A to a non-empty set B , then

- (1) $R \subset A \times B$
- (2) $R = A \cup B$
- (3) $R = A \times B$
- (4) None of these

32. Let R be the relation on N defined as $x R y$ if $x + 2y = 8$. The domain of R is

- (1) $\{2, 4, 6, 8\}$
- (2) $\{2, 4, 8\}$
- (3) $\{2, 4, 6\}$
- (4) None of these

33. What does du equal in $\int 2x(x^2 + 1)^5 dx$

- (1) $2x$
- (2) $2u du$
- (3) $2x dx$
- (4) None of these

34. Which of the following is the best integration technique to use for $\int 2x(x^2 + 1)^5 dx$?

- (1) The product rule
- (2) The chain rule
- (3) The substitution rule
- (4) None of these

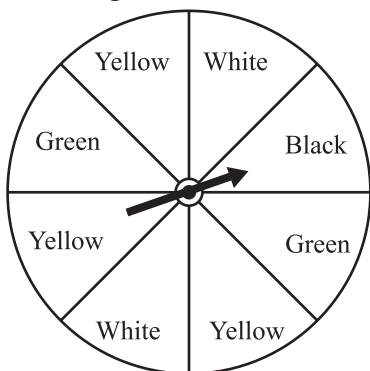
35. If the points $A(1, 0, -6)$, $B(-5, 9, 6)$ and $C(-3, p, q)$ are collinear, find the value of p and q .

- (1) $p = 6, q = 2$
- (2) $p = 2, q = 6$
- (3) $p = 2, q = 2$
- (4) None of these

36. If sum of first n terms of an A.P. is $2n^2 + 7n$, what is its n^{th} term.
- (1) $4n + 7$
 - (2) $7n + 5$
 - (3) $4n + 5$
 - (4) None of these
37. If in a G.P., $a_3 + a_5 = 90$ and if $x = 2$ find the first term of the G.P.
- (1) $\frac{9}{2}$
 - (2) $\frac{7}{2}$
 - (3) $\frac{2}{9}$
 - (4) None of these
38. If $A = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 4 \\ 7 & 2 \end{bmatrix}$, find $3A - 2B$.
- (1) $\begin{bmatrix} 4 & 11 \\ 5 & 1 \end{bmatrix}$
 - (2) $\begin{bmatrix} 4 & 11 \\ -5 & -1 \end{bmatrix}$
 - (3) $\begin{bmatrix} 4 & -11 \\ -5 & -1 \end{bmatrix}$
 - (4) None of these
39. Let f be defined by $f(x) = x^3 - kx^2 + 2x$, $x \in \mathbb{R}$. Find k , if f is an odd function.
- (1) 0
 - (2) 1
 - (3) 2
 - (4) None of these
40. Evaluate: $\lim_{x \rightarrow 0} \frac{(1-x)^n - 1}{x}$
- (1) n
 - (2) $-n$
 - (3) 0
 - (4) None of these

INTERACTIVE SECTION

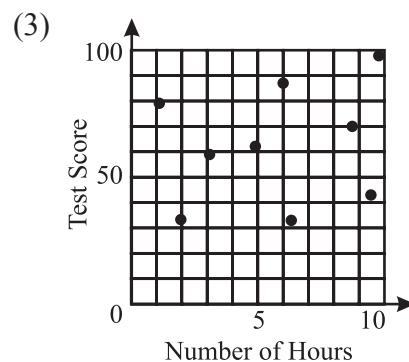
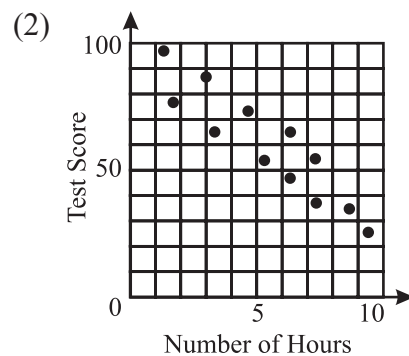
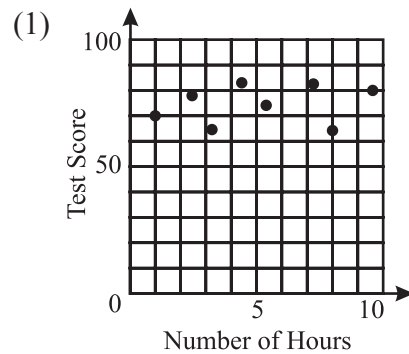
41. A spinner is divided into eight equal regions as shown in the diagram below.



Which event is most likely to occur in one spin?

- (1) The arrow will land in a yellow or green area.
- (2) The arrow will land in a green or black area.
- (3) The arrow will land in a yellow or black area.
- (4) None of these

42. There is a negative correlation between the number of hours a student watches television and his or her social studies test score. Which scatter plot below displays this correlation?



- (4) None of these
43. Pam is playing with red and black marbles. The number of red marbles she has is three more than twice the number of black marbles she has. She has 42 marbles in all. How many red marbles does Pam have?
- (1) 13
 - (2) 29
 - (3) 15
 - (4) None of these

44. The value of the determinant $\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix}$ is

- (1) $(x - y)(y - z)(z - x)$
- (2) $2(x - y)(y - z)(z - x)$
- (3) $(x - y)(y - z)(z - x)(x + y + z)$
- (4) None of these

45. For what real value of k will the equation below describe of circle of radius equal to 3?

$$x^2 + y^2 + 2x - 4y + k = 0$$

- (1) $K = 2$
- (2) $K = 8$
- (3) $K = -4$
- (4) None of these

46. An examination consists of 13 questions. A student must answer only one of the first two questions and only nine of the remaining ones. How many choices of questions does the student have?

- (1) ${}^{13}C_{10} = 286$
- (2) ${}^{11}C_8 = 165$
- (3) $2 \times {}^{11}C_9 = 110$
- (4) None of these

47. The graph of the function g passes through the point $(1, 2)$. The slope of the tangent to the graph at any point (x, y) is given by $g'(x) = 6x - 12$. What is $g(x)$?

- (1) $6x^2 - 12x + 11$
- (2) $6x^2 - 12x - 11$
- (3) $3x^2 - 12x + 11$
- (4) None of these

48. Which one of the following conics is represented by the equation $(x - 3y)(x + 3y) = 36$?

- (1) Hyperbola
- (2) Parabola
- (3) Ellipse
- (4) None of these

49. The value of $\lim_{h \rightarrow 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$ is:

- (1) 0
- (2) $\frac{1}{2\sqrt{2}}$
- (3) $1/2$
- (4) None of these

50. In how many ways can one arrange on a bookshelf 5 thick books, 4 medium sized books and 3 thin books so that the books of the same size remain together?

- (1) $5! 4! 3! 3! = 103,680$
- (2) $5! 4! 3! = 17,280$
- (3) $(5! 4! 3!) \times 3 = 51,840$
- (4) None of these



END OF THE EXAM