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

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* # See prospectus/website for details

EHF NATIONAL INTERACTIVE MATHS OLYMPIAD

N I M O

12 Class **A1 Paper Code**

L E V E L - 1

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1. You are allowed additional 10 minutes to fill the required details in the **RESPONSE SHEET (OMR). STUDENTS OF CLASS 1 & 2 HAVE TO UNDERLINE** THE CORRECT ANSWER IN THE QUESTION PAPER ITSELF. THEY ARE NOT REQUIRED TO USE THE RESPONSE SHEET (OMR). THEY HAVE TO FILL THEIR NAME, ROLL NUMBER, CLASS, SCHOOL NAME IN THE SPACE PROVIDED IN THE QUESTION PAPER.
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 EXCEPT FOR CLASSES 1 AND 2.

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. If in certain code, STUDENT is written as RSTEDMS, then how would TEACHER be written in the same code ?
(1) SZZDGEQ (2) SZDDGEQ
(3) SDZDGDQ (4) None of these

3. Which group of letters is different from others ?
(1) CBAED (2) IJHGK
(3) TVWYZ (4) None of these

4. Find the next number in the sequence 6, 24, 60, 120 _____
(1) 180 (2) 210
(3) 240 (4) None of these

5. A sprinter goes off the starting block for 100 m run and at that instant the second-hand of a stopwatch had pointed towards North. He touches the finishing line exactly after 12 seconds. In which direction did the second hand point when he just crossed the finishing line ?
(1) 18° North of East (2) 18° East of North
(3) 72° North of East (4) None of these

6. Two candles are of different lengths and thickness. The short and the long ones can burn respectively for 3.5 hour and 5 hours. After burning for 2 hour, the lengths of the candles become equal in length. What fraction of the long candle's height was the short candle initially ?
(1) 2/7 (2) 5/7
(3) 3/5 (4) None of these

7. Mother was asked how many gifts she had in the bag. She replied that there were all dolls but six, all cars but six, and all books but six. How many gifts she had in all ?
(1) 9 (2) 18
(3) 27 (4) None of these

8. In a dairy, there are 60 cows and buffaloes. The number of cows is twice that of buffaloes. Buffalo X ranked seventeenth in terms of milk delivered. If there are 9 cows ahead of Buffalo. X, how many buffaloes are afterwards in rank in terms of milk delivered ?
(1) 10 (2) 11
(3) 12 (4) None of these

9. In a school 120 boys have registered for a Single's Carrom tournament. Each match eliminates one player.

How many matches are to be organized to determine the champion ?
(1) 60 (2) 61
(3) 119 (4) None of these

10. Take the given statement(s) as true and decide which of the conclusion logically follows from the statements.

All Actors are Musicians. No Musician is a Singer. Some Singers are Dancers. Some Dancers are Musicians.
Conclusions :
I : Some Actors are Singers
II : Some Dancers are Actors
III : No Actor is a Singer
(1) Only conclusion I follows.
(2) Only conclusion III follows.
(3) Exactly one of conclusion I, III follows.
(4) None of these

MATHEMATICS

11. The normal to the curve $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$ at any point q is such that
(1) It makes a constant angle with the x-axis.
(2) It passes through the origin.
(3) It is at a constant distance from the origin .
(4) None of these

12. If $P(1, 2)$, $Q(4, 6)$, $R(5, 7)$ and $S(a, b)$ are the vertices of a parallelogram $PQRS$, then
(1) $a = 2, b = 4$ (2) $a = 3, b = 4$
(3) $a = 2, b = 3$ (4) None of these

13. If $f(x) = \frac{1}{2}x - 1$ then, on the interval $[0, \pi]$
(1) $\tan[f(x)]$ and $1/f(x)$ are both continuous
(2) $\tan[f(x)]$ and $1/f(x)$ are both discontinuous
(3) $\tan[f(x)]$ and $f^{-1}(x)$ are both continuous
(4) none of these

14. Let $f(x) = ||x| - 1|$, then points where $f(x)$ is not differentiable is (are)
(1) 0 (2) ± 1
(3) Both (1) and (2) (4) None of these

15. Let A, B, C be three mutually independent events. Consider the two statements S_1 and S_2

S_1 : A and $B \cup C$ are independent

S_2 : A and $B \cap C$ are independent

Then,
(1) Both S_1 and S_2 are true
(2) Only S_1 is true
(3) Only S_2 is true
(4) Neither S_1 nor S_2 is true

16. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals,
(1) $\frac{1}{2}$ (2) $\frac{7}{15}$
(3) $\frac{2}{15}$ (4) None of these

17. If the sum of the first $2n$ terms of the A.P. 2, 5, 8 ..... is equal to the sum of the first n terms of the A.P. 57, 59, 61, ... then n equals,
(1) 100 (2) 12
(3) 11 (4) None of these

18. Suppose a, b, c are in A.P and a^2, b^2, c^2 are in G.P.

If $a < b < c$ and $a + b + c = \frac{3}{2}$, then the value of a is
(1) $\frac{1}{2\sqrt{2}}$ (2) $\frac{1}{2\sqrt{3}}$
(3) $\frac{1}{2} - \frac{1}{\sqrt{2}}$ (4) None of these

19. Let $a_1, a_2, \ldots a_{10}$ be in *A.P.* and $h_1, h_2, \ldots h_{10}$ be in *H.P.* If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $a_4 h_7$ is
(1) 2 (2) 3
(3) 6 (4) None of these

20. If $x > 1, y > 1, z > 1$ are in G.P, then $1/1+\ln x$, $1/1+\ln y$. $1/1+\ln z$ are in
(1) A.P. (2) H.P.
(3) G.P. (4) None of these

21. The expression $3\left[\sin^4\left(\frac{3\pi}{2} - \alpha\right) + \sin^4(3\pi + \alpha)\right]$

$- 2\left[\sin^6\left(\frac{\pi}{2} + \alpha\right) + \sin^6(5\pi - \alpha)\right]$ is equal to
(1) 0 (2) 1
(3) 3 (4) v

22. If ω is an imaginary cube root of unity then the value of $\sin\left\{(\omega^{10} + \omega^{23})\pi - \frac{\pi}{4}\right\}$ is
(1) $-\frac{\sqrt{3}}{2}$ (2) $-\frac{1}{\sqrt{2}}$
(3) $\frac{1}{\sqrt{2}}$ (4) None of these

23. If $z=\left(\frac{\sqrt{3}}{2}+\frac{i}{2}\right)^5+\left(\frac{\sqrt{3}}{2}-\frac{i}{2}\right)^5$, then:

(1) Re $(z) = 0$ (2) Im $(z) = 0$
(3) Re $(z) > 0$, Im $(z) > 0$ (4) None of these

24. Let z and w be two non-zero complex numbers such that $|z| = |w|$ and arg z + arg $w = \pi$, then z equals :
(1) w (2) $-w$
(3) $-\bar{w}$ (4) None of these

25. A five digit number divisible by 3 is to be formed using the numerals 0, 1, 2, 3, 4 and 5 without repetition. The total number of ways in which this can be done is
(1) 216 (2) 240
(3) 600 (4) None of these

26. The letters of the word COCHIN are permuted and all the permutations are arranged in an alphabetical order as in an English dictionary. The number of words that appear before the word COCHIN is
(1) 360 (2) 192
(3) 96 (4) None of these

27. If the line $2x + \sqrt{6}\,y = 2$ touches the hyperbola $x^2 - 2y^2 = 4$, then the point of contact is

(1) $\left(-2, \sqrt{6}\right)$ (2) $\left(-5, 2\sqrt{6}\right)$

(3) $\left(4, -\sqrt{6}\right)$ (4) None of these

28. If $x = 9$ is the chord of the contact of the hyperbola $x^2 - y^2 = 9$ then the equation of the corresponding pair of tangent is
(1) $9x^2 - 8y^2 + 18x - 9 = 0$
(2) $9x^2 - 8y^2 + 18x + 9 = 0$
(3) $9x^2 - 8y^2 - 18x - 9 = 0$
(4) $9x^2 - 8y^2 - 18x + 9 = 0$

29. The locus of a variable point whose distance from (–2, 0) is 2/3 times its distance from the line $x = -\frac{9}{2}$ is
(1) Ellipse (2) Parabola
(3) Hyperbola (4) None of these

30. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9} = 1$, and having its centre at (0, 3) is
(1) 4 (2) 3
(3) $\sqrt{\frac{1}{2}}$ (4) None of these

31. The value of $\tan\left(\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3}\right)$ is

(1) $\frac{6}{17}$ (2) $\frac{17}{6}$
(3) $\frac{16}{7}$ (4) none of these

32. The no. of real solutions of

$\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\sqrt{x^2+x+1}=\frac{\pi}{2}$ is
(1) Zero (2) One
(3) Two (4) None of these

33. If $y = (\sin x)^{\tan x}$, then $\frac{dy}{dx}$ is equal to
(1) $(\sin x)^{\tan x}(1 + \sec^2 x \log \sin x)$
(2) $\tan x\,(\sin x)^{\tan x - 1}\cdot \cos x$
(3) $(\sin x)^{\tan x} \sec^2 x \log \sin x$
(4) None of these

34. Let $f(x)=\begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$

where p is a constant. Then $\frac{d^3}{dx^3}(f(x))$ at $x = 0$ is
(1) p (2) $p + p^2$
(3) Independent of p (4) None of these

35. The value of the integral $\int\frac{\cos^3 x+\cos^5 x}{\sin^2 x+\sin^4 x}$ is
(1) $\sin x - 6\tan^{-1}(\sin x) + c$
(2) $\sin x - 2(\sin x)^{-1} + c$
(3) $\sin x - 2(\sin x)^{-1} - 6\tan^{-1}(\sin x) + c$
(4) none of these

36. Let $f(x) = \int e^x(x-1)(x-2)dx$ then f decreases in the interval
(1) $(-\infty, -2)$ (2) $(-2, -1)$
(3) $(1, 2)$ (4) None of these

37. Let $f(x)=\frac{x}{(1+x^n)^{1/n}}$ for $n \geq 2$ and

$g(x)=\underbrace{(f\circ f\circ ...\circ f)}_{f \text{ occurs } n \text{ times}}(x)$.

Then $\int x^{n-2}g(x)\,dx$ equals

(1) $\frac{1}{n(n-1)}(1+nx^n)^{1-\frac{1}{n}}+K$

(2) $\frac{1}{n-1}(1+nx^n)^{1-\frac{1}{n}}+K$

(3) $\frac{1}{n(n+1)}(1+nx^n)^{1+\frac{1}{n}}+K$

(4) None of these

38. $\int_0^1 (1+e^{-x^2})\,dx$

(1) –1 (2) 2
(3) $1+e^{-1}$ (4) None of these

39. If $g(x) = \int_0^x \cos^4 t\,dt$ then $g(x+\text{p})$ equals.

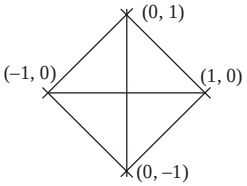
(1) $g(x)+g(\text{p})$ (2) $g(x)-g(\text{p})$
(3) $g(x)\,g(\text{p})$ (4) None of these

40. Let $f(x) = x - [x]$, for every real number x, where $[x]$ is the integral part of x, then $\int_{-1}^{1} f(x)\,dx$ is

(1) 1 (2) 2
(3) 0 (4) None of these

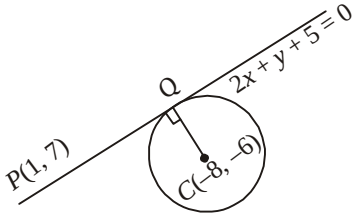
INTERACTIVE SECTION

41. If the sum of the distance of a point from two perpendicular lines in a plane is 1, then its locus is



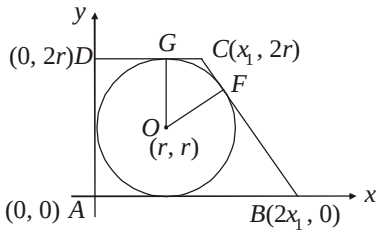
(1) Square
(2) Circle
(3) Straight line
(4) None of these

42. Tangent to the curve $y = x^2 + 6$ at a point $P(1, 7)$ touches the circle $x^2 + y^2 + 16x + 12y + c = 0$ at a point Q. Then the coordinates of Q are



(1) (–6, –7)
(2) (–10, –15)
(3) (–9, –13)
(4) None of these

43. Let $ABCD$ be a quadrilateral with area 18, with side AB parallel to the side CD and $AB = 2CD$. Let AD be perpendicular to AB and CD. If a circle is drawn inside the quadrilateral $ABCD$ touching all the sides, then its radius is



(1) 3 (2) 2
(3) 3/2 (4) None of these

44. Let PS be the median of the triangle with vertices $P(2, 2)$, $Q(6, -1)$ and $R(7, 3)$. The equation of the line passing through $(1, -1)$ and parallel to PS is

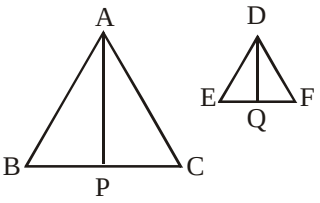
(1) $2x - 9y - 7 = 0$ (2) $2x - 9y - 11 = 0$
(3) $2x + 9y + 7 = 0$ (4) None of these

45. Area of the parallelogram formed by the lines $y = mx$, $y = mx + 1$, $y = nx$ and $y = nx + 1$ equals.

(1) $\frac{m+n}{(m-n)^2}$ (2) $\frac{2}{|m+n|}$

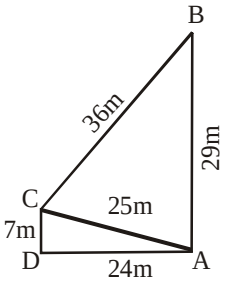
(2) $\frac{1}{|m-n|}$ (4) None of these

46. Triangles ABC and DEF are similar. If the length of perpendicular AP from A on the opposite side BC is 2 cm and the length of the perpendicular DQ from D on the opposite side EF is 1 cm, then what is the area of the triangle ABC?



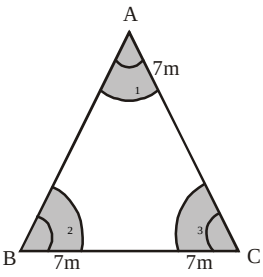
(1) One and half times the area of the triangle DEF.
(2) Four times the area of the triangle DEF.
(3) Twice the area of the triangle DEF.
(4) None of these

47. The sides of a quadrangular field, taken in order are 29 m, 36 m, 7 m and 24 m respectively, The angle contained by the last two sides is a right angle. Find its area.



(1) 360 Sqm
(2) 444 Sqm
(3) 845 Sqm
(4) None of these

48. Three horses are tethered with 7-metre long ropes at the three corners of a triangular field having sides 20 m, 34 m and 42 m. Find the area of the plot which remains ungrazed.



(1) 259 m^2
(2) 336 m^2
(3) 269 m^2
(4) None of these

49. Two vertices of a ΔABC are A(1, –1) and B (5, 1). If the co-ordinates of its centroid be $\left(\frac{5}{3}, 1\right)$ then, find the co-ordinates of the third vertex C.

(1) (–1, 3) (2) (3, 1)
(3) (–1, –3) (4) None of these

50. A card is drawn from a pack of 100 cards numbered 1 to 100. The probability of drawing a square card

(1) 0.4 (2) 0.3
(3) 0.1 (4) None of these

END OF THE EXAM