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LEARNING FOR LIFE

EDUHEAL FOUNDATION

CLASS 10

LEVEL – 1

Set A1

EHF OLYMPIADS

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NIMO™

EHF
NATIONAL INTERACTIVE
MATHS OLYMPIAD™

Name : .....

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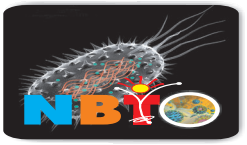
art and Sports clinic contest

NATIONAL BIOTECHNOLOGY OLYMPIAD



NATIONAL INTERACTIVE MATHS OLYMPIAD

NATIONAL INTERACTIVE SCIENCE OLYMPIAD

INTERNATIONAL CYBER OLYMPIAD

INTERNATIONAL ENGLISH OLYMPIAD

INTERNATIONAL GENERAL KNOWLEDGE OLYMPIAD

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Business & international finance olympiad (BIFO)

NATIONAL IIT-NEET OLYMPIAD (NINO)

Level - 1 : All Level-1 successful* participants will get certificate, apititude report 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. Winner will get merit certificate, medals, laptop, scholarship and other prizes.

Level - 3 Senior Class Toppers will qualify# for level-3-International level- where you will compete with students globally. Get selected for MIT-Harvard Maths Tournament (Online). Represent India & win laurels. Guidance by top scientists. HMMT

* # See prospectus/website for details

WEBSITE : WWW.EDUHEALFOUNDATION.ORG
E-MAIL : INFO@EDUHEALFOUNDATION.ORG

ROUGH WORK

Instructions for the Candidate

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 40 Questions each to be answered in 60 minutes. The Question paper for classes 7 to 12 contains 60 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.

MENTAL ABILITY

Directions (Q.No. 1 – 4) Choose the correct alternative:

1. Which term of the series 5,10,20,40.... is 1280?

(1) 10th (2) 9th

(3) 8th (4) None of these

2. m n o n o p q o p q r s _ _ _ _ _

(1) m n o p q (2) o q r s t

(3) p q r s t (4) q r s t u

3. Dog : Bark : : Goat : ?

(1) Bleat (2) Howl

(3) Grunt (4) Bray

4. Menu : Food :: Catalogue : ?

(1) Rack (2) News paper

(3) Library (4) Books

5. Mitali walked towards North from a point. She took a turn to the right after a while. Then she turned to left and after sometime again to her left. Then after a while she took a turn to her right and after sometime again took a turn to the right. Give the direction in which she was walking at the last point of time ?

(1) East (2) West

(3) South (4) North

6. A cube of 5 cm has been painted on its surfaces in such a way that two opposite surfaces have been painted blue and two adjacent surfaces have been painted red. Two remaining surfaces have been left unpainted. Now the cube is cut into smaller cubes of side 1 cm each. Then how many cubes will have only two side painted ?

(1) 16 (2) 18

(3) 19 (4) 24

7. Imagine a clock where the hour hand makes only one revolution in 1 day (i.e., 24 hr) whereas the minute hand completes one revolution in one hour. What is the angle between the two hands at 6:30

(1) 90° (2) 120°

(3) 82.5° (4) 162.5°

8. **Direction:** In a school, there were five teachers. A and B were teaching Hindi and English. C and D were teaching English and Geography. D and A were teaching Mathematics and Hindi. E and B were teaching History and French.

Who among the following teachers was teaching maximum number of subjects?

(1) A (2) B

(3) C (4) E

9. At watch which gains uniformly is 2 minutes slow at 4 am on Sunday and is 3 minutes 24 second fast at 10 pm on Wednesday. Find when was the clock correct?

(1) 40 minutes past 2 pm on Monday

(2) 20 minutes past 1 pm on Monday

(3) 20 minutes past 1 am on Monday

(4) 10 minutes past 1 pm on Monday

10. In a cricket season, India defeated Australia twice, West Indies defeated India twice, Australia defeated West Indies twice, India defeated New Zealand twice, and West Indies defeated New Zealand twice. Which country has lost most number of times?

(1) India

(2) Australia

(3) New Zealand

(4) West Indies

11. Which of the following rational numbers have non-terminating repeating decimal expansion?

(1) $\frac{31}{3125}$ (2) $\frac{17}{512}$

(3) $\frac{23}{200}$ (4) none of these

12. The decimal expansion of the rational number $\frac{14587}{1250}$ will terminate after

(1) one decimal place (2) two decimal places

(3) three decimal places (4) four decimal places

13. If $m^n = 32$, where m and n are positive integers, then the value of $(n)^{mn}$ is

(1) 2^2 (2) 5^2

(3) 5^{10} (4) 5^{25}

14. If $\left(\frac{9}{7}\right)^3 \times \left(\frac{49}{81}\right)^{2x-6} = \left(\frac{7}{9}\right)^9$, then the value of x is

(1) 12 (2) 9

(3) 8 (4) 6

15. If the LCM of a and 18 is 36 and the HCF of a and 18 is 2, then a =

(1) 2 (2) 3

(3) 4 (4) 1

16. The smallest rational number by which 1/3 should be multiplied so that its decimal expansion terminate after one place of decimal, is

(1) 3/10 (2) 1/10

(3) 3 (4) 3/100

17. The HCF of 95 and 152, is

(1) 57 (2) 1

(3) 19 (4) 38

18. The remainder when the square of any prime number greater than 3 is divided by 6, is

(1) 1 (2) 3

(3) 2 (4) 4

19. The exponent of 2 in the prime factorisations of 144, is

(1) 4 (2) 5

(3) 6 (4) 3

20. If two positive integers m and n are expressible in the form $m = pq^3$ and $n = p^3q^2$, where p, q are prime numbers, then HCF (m, n) =

(1) pq (2) pq^2

(3) p^3q^3 (4) p^2q^3

21. If n is a natural number, then $9^{2n} - 4^{2n}$ is always divisible by

(1) 5 (2) 13

(3) both 5 and 13 (4) None of these

22. If 3 is the least prime factor of number a and 7 is the least prime factor of number b, then the least prime factor of a + b, is

(1) 2 (2) 3

(3) 5 (4) 10

23. The LCM of two numbers is 1200. Which of the following cannot be their HCF?

(1) 600 (2) 500

(3) 400 (4) 200

24. The LCM and HCF of two rational numbers are equal, then the numbers must be

(1) prime

(2) co-prime

(3) composite

(4) equal

25. If $2^3 \times 3^4 \times 5^4 \times 7$, then the number of consecutive zeros in n, where n is a natural number, is

(1) 2 (2) 3

(3) 4 (4) 7

26. The smallest number by which $\sqrt{27}$ should be multiplied so as to get a rational number

(1) $\sqrt{27}$ (2) $3\sqrt{3}$

(3) $\sqrt{\ }$ (4) 3

27. If HCF (26, 169) = 13, then LCM (26, 169) =

(1) 26 (2) 52

(3) 338 (4) 13

28. Which of the following rational numbers have terminating decimal?

(i) $\frac{16}{25}$ (ii) $\frac{5}{18}$

(iii) $\frac{2}{21}$ (iv) $\frac{}{250}$

(1) (i) and (ii) (2) (ii) and (iii)

(3) (i) and (iii) (4) (i) and (iv)

29. If the sum of LCM and HCF of two numbers is 1260 and their LCM is 900 more than their HCF, then the product of two numbers is

(1) 203400

(2) 194400

(3) 198400

(4) 205400

30. If p_1 and p_2 are two odd prime numbers such that $p_1 > p_2$, then $p_1^2 - p_2^2$ is

(1) an even number

(2) an odd number

(3) an odd prime number

(4) a prime number

31. The first term of an A.P. is 4, last term is 44, there are 7 terms. Hence their sum is .....

(1) 48 (2) 333

(3) 168 (4) 280

32. $\sum_{k=1}^{n}(2k-1)$ is .....

(1) k^2 (2) $(2k-1)^2$

(3) n^2 (4) $\frac{n(n+1)}{2}$

33. If a, b, c are in A.P. then $\frac{1}{bc}, \frac{1}{ca}, \frac{1}{ab}$

(1) not in A.P. (2) not in G.P.

(3) G.P. (4) A. P.

34. If $\begin{pmatrix} 3 & 9 \\ x & 12 \end{pmatrix} = 3\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$. Find x .....

(1) 5 (2) 6

(3) 2 (4) 3

35. If $(-1\ -2\ 4)\begin{pmatrix} 2 \\ a \\ -3 \end{pmatrix} = (-10)$ then the value of a is .....

(1) 4

(2) 2

(3) 3

(4) –2

36. If $A = \begin{pmatrix} 7 & 2 \\ 1 & 3 \end{pmatrix}$ and $A+B = \begin{pmatrix} -1 & 0 \\ 2 & -4 \end{pmatrix}$ then the matrix B = ...

(1) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(2) $\begin{pmatrix} 6 & 2 \\ 3 & -1 \end{pmatrix}$

(3) $\begin{pmatrix} -8 & -2 \\ 1 & -7 \end{pmatrix}$

(4) $\begin{pmatrix} 8 & 2 \\ -1 & 7 \end{pmatrix}$

37. In a triangle, the sides are given as 11 cm, 12 cm and 13 cm. The approximate length of the altitude corresponding to the side having length 12 cm.

(1) 10.5 cm

(2) 10.25 cm

(3) 10 cm

(4) 7.25 cm

38. The angle of inclination of the line $\sqrt{3}x - y + 2 = 0$ is.....

(1) 90º

(2) 0º

(3) 30º

(4) 60º

39. The point of intersection of the straight line 9x – y – 2 = 0 and 2x + y – 9 = 0 is.....

(1) (–1, 7)

(2) (7, 1)

(3) (1, 7)

(4) (–1, –7)

40. $\sin^2\theta + \frac{1}{1+\tan^2\theta} = ...$

(1) $\text{cosec}^2\theta + \cot^2\theta$

(2) $\text{cosec}^2\theta - \cot^2\theta$

(3) $\cot^2\theta - \text{cosec}^2\theta$

(4) $\sin^2\theta - \cos^2\theta$

41. For any three sets A, B and C, $A \cap (B \cup C)$ is.....

(1) $(B \cup A) \cup (B \cap A)$

(2) $(A \cap B) \cup (A \cap C)$

(3) $A \cup (B \cap C)$

(4) $(A \cup B) \cap (B \cup C)$

42. If $a_1, a_2, a_3 ...., a_n$ are in A. P., such that $\frac{a_4}{a_7} = \frac{3}{2}$, then the 13th term of the A. P. is .....

(1) $\frac{3}{2}$

(2) 0

(3) $12a_1$

(4) $14a_1$

43. If a, b, c are in A. P. then $\frac{a-b}{b-c}$ is

(1) $\frac{a}{b}$

(2) $\frac{b}{c}$

(3) $\frac{a}{c}$

(4) 1

44. If $A = \begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix}$ then $-A$ = ?

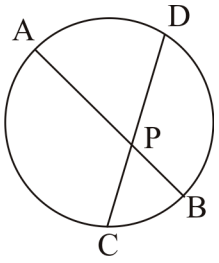
(1) $\begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix}$

(2) $\begin{pmatrix} -1 & 2 \\ 3 & -4 \end{pmatrix}$

(3) $\begin{pmatrix} -1 & -2 \\ -3 & -4 \end{pmatrix}$

(4) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

45. In the figure, chords AB and CD intersect at P. If AB = 16 cm, PD = 8 cm, PC = 6 and AP > PB, then AP = ...



(1) 2 cm

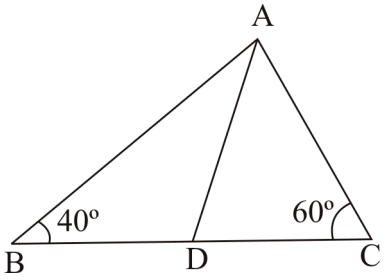
(2) 4 cm

(3) 12 cm

(4) 6 cm

46. In figure, if

$\frac{AB}{AC} = \frac{BD}{DC}$, $\angle B = 40^o$, and $\angle C = 60^o$, then $\angle BAD$ = ...



(1) 30°

(2) 50°

(3) 80°

(4) 40°

47. If cosecA – cot A = 3 then cosec A + cot A = ...

(1) $\frac{-1}{3}$

(2) $\frac{1}{3}$

(3) –3

(4) 1

48. If $\tan\theta = \frac{a}{b}$, then $\frac{a\sin\theta + b\cos\theta}{a\sin\theta - b\cos\theta}$ is equal to

(1) $\frac{a^2+b^2}{a^2-b^2}$

(2) $\frac{a^2-b^2}{a^2+b^2}$

(3) $\frac{a+b}{a-b}$

(4) $\frac{a-b}{a+b}$

49. If 16 cot x = 12, then $\frac{\sin x - \cos x}{\sin x + \cos x}$

(1) $\frac{1}{7}$

(2) $\frac{3}{7}$

(3) $\frac{2}{7}$

(4) 1

50. The value of $\frac{\cos^3 20^o - \cos^3 70^o}{\sin^3 70^o - \sin^3 20^o}$

(1) $\frac{1}{2}$

(2) $\frac{1}{\sqrt{2}}$

(3) 1

(4) 2

INTERACTIVE SECTION

Student have to solve either left hand side (LHS) questions OR right hand side (RHS) questions. RHS section is for Harvard-MIT Mathematics Tournament (HMMT) enthusiasts. EHF will be conducting math camp (LEVEL-3) to help students prepare for online HMMT participation. The camp will be conducted by retired IIT-Delhi Maths Professors. All expenses will be borne by EHF. Equal preference will be given to students solving either of these sections. More details of online HMMT is available on EHF Website www.eduhealfoundation.org

LHS SECTION

51. If A, B and C are interior angles of a triangle ABC, then $\sin\left(\frac{B+C}{2}\right) =$

(1) $\sin\frac{A}{2}$ (2) $\cos\frac{A}{2}$

(3) $-\sin\frac{A}{2}$ (4) $-\cos\frac{A}{2}$

52. $\frac{\sin\theta}{1+\cos\theta}$ is equal to

(1) $\frac{1+\cos\theta}{\sin\theta}$ (2) $\frac{1-\cos\theta}{\cos\theta}$

(3) $\frac{1-\cos\theta}{\sin\theta}$ (4) $\frac{1-\sin\theta}{\cos\theta}$

53. If α, β are the zeros of the polynomial $f(x) = x^2 + x + 1$, then $\frac{1}{\alpha}+\frac{1}{\beta} =$

(1) 1 (2) –1

(3) 0 (4) None of these

54. If α, β are zeros of the polynomial $p(x) = 4x^2 + 3x + 7$, then $\frac{1}{\alpha}+\frac{1}{\beta} =$

(1) $\frac{7}{3}$ (2) $-\frac{7}{3}$

(3) $\frac{3}{7}$ (4) $-\frac{3}{7}$

RHS SECTION HMMT

51. Let, ABCD be rectangle and let E and F be points on segment AB such that AE = EF = FB. If CE intersects the line AD at P, and PF intersects BC at Q, determine the ratio of BQ to CQ.

(1) 2/4 (2) 1/3

(3) 2/6 (4) 2/8

52. Danielle picks a positive $1 \le n \le 2016$ uniformly at random. What is the probability that gcd (n, 2015) = 1 ?

(1) $\frac{1440}{2015}$ (2) $\frac{1440}{2016}$

(3) $\frac{1441}{2016}$ (4) none of these

53. Michael is playing basketball. He makes 10% of his shots, and gets the ball back after 90% of his missed shots. If he does not get the ball back he stops playing. What is the probability that Michael eventually makes a shot ?

(1) 12/18 (2) 10/19

(3) 12/16 (4) none of these

54. If five fair coins are flipped simultaneously, what is the probability that at least three of them show heads?

(1) $\frac{1}{5}$ (2) $\frac{1}{4}$

(3) $\frac{1}{7}$ (4) $\frac{1}{2}$

LHS SECTION

55. If one zero of the polynomial $f(x) = (k^2 + 4)x^2 + 13x + 4k$ is reciprocal of the others. Then k =

(1) 2 (2) –2

(3) 1 (4) –1

56. If the sum of the zeros of the polynomial $f(x) = 2x^3 – 3kx^2 + 4x + 5$ is 6, then the value of k is

(1) 2

(2) 4

(3) –2

(4) –4

57. If α and β are the zeros of the polynomial $f(x) = x^2 + px + q$, then a polynomial having $1/\alpha$ and $1/\beta$ is its zeros is

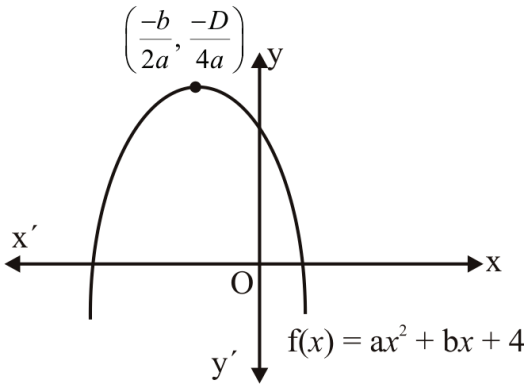
(1) $x^2 + qx + p$

(2) $x^2 – px + q$

(3) $qx^2 + px + 1$

(4) $px^2 + qx + 1$

58. Figure shows the graph of the polynomial $f(x) = ax^2 + bx + c$ for which



(1) $a < 0, b > 0$ and $c > 0$

(2) $a < 0, b < 0$ and $c > 0$

(3) $a < 0, b < 0$ and $c < 0$

(4) $a > 0, b > 0$ and $c < 0$

RHS SECTION

55. Two circles centred at O_1 and O_2 have radii 2 and 3 and are externally tangent at P. The common external tangent of the two circles intersects the line $O_2 O_2$ at Q. What the length of PQ?

(1) 12

(2) 10

(3) 16

(4) 14

56. A positive integer is written on each corner of a square such that numbers on opposite vertices are relatively prime while numbers on adjacent vertices are not relatively prime. What is the smallest possible value of the sum of these 4 numbers ?

(1) 40

(2) 60

(3) 50

(4) 30

57. The three points A, B, C from a triangle. AB = 4, BC = 5 AC = 6. Let the angle bisector of $\angle A$ intersect side BC at D. Let the foot of the perpendicular from B to the angle bisector of $\angle A$ be E. Let the line through E parallel to AC meet BC at F. Compute DF.

(1) 2/5

(2) 1/3

(3) 1/2

(4) 1/4

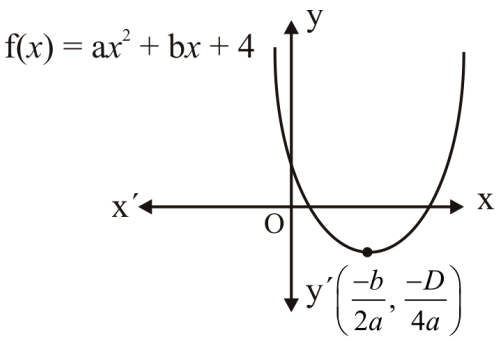
58. Let V be a rectangular prism with integer side lengths. The largest face has area 240 and the smallest face has area 48. A third face has area x, where x is not equal to 48 or 240. What is the sum of all possible values of x ?

(1) 220 (2) 260

(3) 240 (4) 210

LHS SECTION

59. In the diagram, shows the graph of the polynomial $f(x) = ax^2 + bx + c$, then



(1) $a < 0, b > 0$ and $c < 0$

(2) $a < 0, b < 0$ and $c < 0$

(3) $a < 0, b > 0$ and $c > 0$

(4) $a > 0, b < 0$ and $c > 0$

60. If zeros of the polynomial $f(x) = x^3 - 3px^2 + qr - r$ are in A.P., then

(1) $2p^3 = pq - r$

(2) $2p^3 = pq + r$

(3) $p^3 = pq - r$

(4) None of these

RHS SECTION

HMMT

59. A rectangular pool table has vertices at (0, 0), (12, 0), (0, 10), and (12, 10). There are pockets only in the four corners. A ball is hit from (0, 0) along the line y = x and bounces off several walls before eventually entering a pocket. Find the number of walls that the ball bounces off before entering a pocket.

(1) 9

(2) 12

(3) 8

(4) 15

60. Let ABC be a triangle with AB = 13, BC = 14, CA = 15. The altitude from A intersects BC at D. Let ω_1 and ω_2 be the incircles of ABD and ACD, and let the common external tangent of ω_1 and ω_2 (other than BC) intersect AD at E. Compute the length of AE.

(1) 14

(2) 9

(3) 11

(4) 7

END OF THE EXAM