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A
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- Please check that this questionnaire contains **15** printed pages.
- Code A, B or C given on the right hand top corner of the questionnaire should be written on the answer sheet in the space provided.
- Please check that this questionnaire contains **60** questions.

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## 40<sup>TH</sup> ARYABHATTA INTER-SCHOOL MATHEMATICS COMPETITION – 2023

### CLASS - VIII

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Time Allowed: **2 Hours**

Max. Marks: **100**

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#### GENERAL INSTRUCTIONS:

1. Do not write your name on the questionnaire.
  2. Write your roll no. on the questionnaire and the Answer Sheet in the space provided.
  3. All the questions are compulsory.
  4. Read questions carefully; think twice before you write the answer. **No overwriting or cutting is allowed on the Answer Sheet.** Another copy of the questionnaire or answer sheet will not be provided.
  5. Do your rough work in the space provided in the questionnaire.
  6. The questionnaire contains four sections. Section A contains **10** questions on Logical Reasoning of 1 mark each, Section B contains **20** Multiple Choice Questions of 1 mark each, Section C contains **20** Free Response Type Questions of 2 marks each and Section D contains **10** Free Response Type Questions of 3 marks each
  7. No working or descriptive answers of any question is to be given. Only the Answers are to be written on the Separate Answer sheet provided to you.
  8. Use Blue or Black pens to write the answer on the Answer Sheet.
  9. Answers should be written clearly in the space provided on the Answer sheet.
  10. Use of calculator is not allowed.
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## SECTION-A

Write the correct option (A, B, C or D) in the Answer sheet.

1. In the given figure, numbers follow a certain pattern. The value of  $X + Y$  is:

3	4	5	3
6	2	X	5
8	1	Y	3
2	6	3	6

2. A) 11                      B) 4                      C) 7                      D) None of these  
Given below is a magic square in which the numbers in each row, column or diagonal add up to 2022. The value of  $a + b + c$  is :

5		
a		4
c	b	

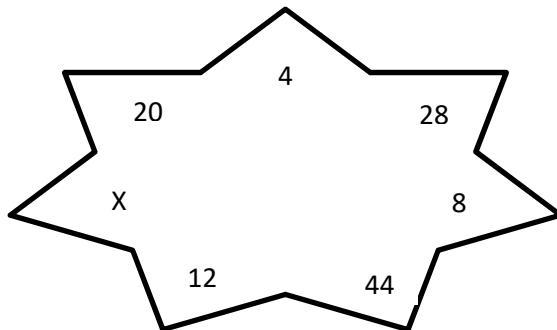
- A) 2022                      B) 2023                      C) 2020                      D) None of these
3. In a kinder garden, four girls aged one, two, three and four have one, two, three and four dolls, although not necessarily in that order. A has more dolls than her age. B is older than C. Curiously only one girl has the same number of dolls as her age. D has fewer dolls than B and the girl aged three has two dolls. D is the youngest. How old (in years) is B and how many dolls does D has?
- A) 1, 1                      B) 1, 4                      C) 4, 1                      D) None of these

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**SPACE FOR THE ROUGH WORK**

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4. Seven corners of a star are numbered using a pattern as shown in the figure. The value of X is:



- A) 10                      B) 25                      C) 52                      D) None of these

5. There are 8 black socks and 8 white socks mixed up in a bag. You are required to take out the socks one at a time, without looking into the bag. What is the smallest number of socks you need to take out to make sure that you have a matching pair?

- A) 4                      B) 3                      C) 9                      D) None of these

6. If the number of days in different months is as given below, then following the same rules, how many days January has?

MARCH	514
JUNE	422
JULY	413
AUGUST	633
OCTOBER	734

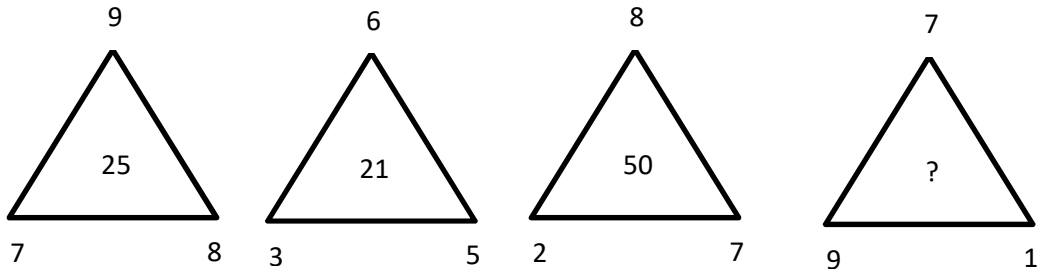
- A) 734                      B) 413                      C) 527                      D) None of these

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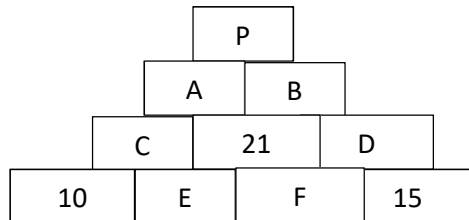
**SPACE FOR THE ROUGH WORK**

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7. Weeds often grow rapidly in gardens. Suppose the weeds double every day, if you start with a single weed, the garden is full of weeds on the 40<sup>th</sup> day. How many days will it take to fill the garden if there were 4 weeds to begin with?
- A) 40                      B) 39                      C) 38                      D) None of these
8. Meena's granny had as many sisters as she had brothers. Each of her brothers had twice as many sisters as brothers. How many siblings were there?
- A) 1                      B) 4                      C) 7                      D) None of these
9. Find the missing number:



- A) 70                      B) 40                      C) 50                      D) None of these
10. The numbers are arranged in the diagram as shown below. The number in any box is equal to the sum of the numbers in the boxes immediately below it, then the value of P is:



- A) 77                      B) 88                      C) 55                      D) None of these

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## SECTION-B

Write the correct option (A, B, C or D) in the Answer sheet

11. The number 45 is divided into four parts so that if 2 is added to the first part or 2 is subtracted from the second part or third part is multiplied by 2 or fourth part is divided by 2, the result is same. The sum of the first and the third part is:
- A) 12                      B) 31                      C) 13                      D) None of these
12. For the first quarter of his life, a man played no sports at all. After that, he played only one sport at a time. After the first quarter, he played only cricket for 9 years and then switched to badminton for 11 years and then he switched to running. He has been running only for the past 10 years. His present age ( in years ) is :
- A) 40                      B) 30                      C) 50                      D) None of these
13. Manya thinks of two consecutive whole numbers whose product is '  $\alpha$  '. The difference of the squares of the larger number and the smaller number is:
- A)  $\sqrt{2\alpha+1}$               B)  $\sqrt{4\alpha+1}$               C)  $\pm\sqrt{4\alpha+1}$               D) None of these
14. The value of the expression  $1 \div \left[ \left\{ \left( \frac{2}{3} \right)^2 \right\}^3 \times \left( \frac{1}{3} \right)^{-4} \times 3^{-1} \times 6^{-1} \right] + \left[ \left( \frac{1}{3} \right)^{-3} - \left( \frac{1}{2} \right)^{-3} \right] \div \left( \frac{1}{4} \right)^{-3}$  is:
- A)  $\frac{181}{64}$               B)  $\frac{151}{64}$                       C)  $\frac{172}{21}$                       D) None of these
15. The sum of digits of a three digit number is 17 and the first two digits are same. The third digit (at one's place), when subtracted from the digit at hundred's place, equals a positive even number. The number is:
- A) 881                      B) 773                      C) 557                      D) None of these

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**SPACE FOR THE ROUGH WORK**

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16. A cage at the local zoo contains both macaws and rabbits. If there are a total of 32 eyes and 52 feet, how many macaws and rabbits are there?
- A) 7,4                      B) 4,3                      C) 6,10                      D) None of these
17. Find the value of 'y' such that:  $\sqrt{188 + \sqrt{53 + \sqrt[3]{y}}} = 14$
- A) 1331                      B) 14641                      C) 121                      D) None of these
18. 'x' chocolates were distributed among 'y' children. If one chocolate is given to each child, two chocolate are left behind and if two chocolates are given to each child, two children do not get any chocolate. Then, the value of  $(3x - 4y)$  is:
- A) 1                      B) 0                      C) 2                      D) None of these
19. If the height of a right circular cylinder is increased by 10%, while radius of the base is decreased by 10%, then curved surface area of the cylinder:
- A) Remains same                      B) decreases by 1%                      C) increases by 1%                      D) None of these
20. Riya chooses six numbers a, b, c, d, e, f such that the average of a, b, c, d is 10 and the average of b, c, d, e, f is 14. If f is twice 'a', then the average of a and e is
- A) 15                      B) 17                      C) 16                      D) None of these

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**SPACE FOR THE ROUGH WORK**

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21. The solution of the equation  $3^{7x+9}2^{7x+6} = 27$  is :

- A)  $\frac{5}{6}$                       B)  $\frac{-5}{6}$                       C)  $\frac{-6}{7}$                       D) None of these

22. From the pattern given below, find the value of 'y'

$$\begin{aligned}6^2 + 8^2 &= 10^2 \\8^2 + 15^2 &= 17^2 \\10^2 + 24^2 &= 26^2 \\18^2 + n^2 &= y^2\end{aligned}$$

A) 42                      B) 82                      C) 52                      D) None of these

23. At a school picnic, every student was asked to take a bowl of soup, share a bowl of noodles with another classmate and share a bowl of fruit salad with two classmates. The cook was asked to fill 88 bowls of the same size and capacity with equal portions. How many students went for the picnic?

- A) 24                      B) 25                      C) 48                      D) None of these

24. If  $2^{x-1} + 2^{x+1} = 320$ , then the value of  $11^{x-3}$  is:

- A) 1331                      B) 14641                      C) 121                      D) None of these

25.  $\left\{ \sqrt{\left[ \left( \frac{a^{-2}}{b^2} \right)^{-3} \left( \frac{a^{-3}}{b^5} \right)^2 \right]} \times \left( \frac{1}{ab^3} \right)^{-2} \right\}^{2023} \times \left\{ \left( \frac{1}{b} \right)^{-20} \div \left( \frac{1}{b} \right)^{-21} \right\}^{2023}$  is equal to :

- A)  $a^{2023}$                       B)  $b^{2023}$                       C) 1                      D) None of these

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**SPACE FOR THE ROUGH WORK**

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26. Mary was counting down from 34. At the same time, Thomas was counting upwards, the number starting from 1 but calling out only the odd numbers. The common number which they will call out at the same time (they were calling numbers at the same speed) is :
- A) 19                      B) 23                      C) 25                      D) None of these
27. Choose the smallest among the given numbers.
- A)  $10 - 3\sqrt{11}$               B)  $3\sqrt{11} - 10$               C)  $51 - 10\sqrt{26}$               D)  $18 - 5\sqrt{13}$
28. If  $1^3 + 2^3 + 3^3 + \dots + 9^3 = 2025$ , then  $(0.11)^3 + (0.22)^3 + (0.33)^3 + \dots + (0.99)^3$  will be :
- A) 0.2695                      B) 0.02695                      C) 2.695                      D) None of these
29. In  $\triangle PSR$ ,  $\angle PRS = 120^\circ$ . A point Q is taken on PR such that  $PQ = QS$  and  $QR = RS$ .  $\angle PQS - 10\angle QPS$  is equal to :
- A)  $15^\circ$                       B)  $0^\circ$                       C)  $10^\circ$                       D) None of these
30. If  $x = \frac{a-b}{a+b}$ ,  $y = \frac{b-c}{b+c}$ ,  $z = \frac{c-a}{c+a}$ , then  $\frac{(1+x)(1+y)(1+z)}{(1-x)(1-y)(1-z)}$  is :
- A) 1                      B) 0                      C) 11                      D) None of these

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**SPACE FOR THE ROUGH WORK**

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## SECTION-C

**Write the Answers only in the space provided on the Answer sheet.**

31. Karan takes his pet dog for a morning walk every day. He walks briskly up and down on a 3 km long footpath before returning home. His dog walks at half the speed at which he walks and follows him. When Karan reaches far end of the footpath, he turns around and walks back to meet his dog on the way. He continues walking to the starting point, maintaining his speed. His dog follows him from the point where they meet, to return back at the starting point. How many kilometers does the dog walk every day?
32. Evaluate:  $\left(\frac{-8640}{13720}\right)^{\frac{2}{3}} \times \left(\frac{12288}{27648}\right)^{\frac{1}{2}} - \left(\frac{5103}{2401}\right)^{\frac{2}{3}}$
33. Solve the equation for z (correct to two decimal places):  $\frac{0.5(z-0.4)}{3.5} - \frac{0.6(z-2.7)}{4.2} = z+6.1$
34. Four friends A, B, C and D work in the same company. A's salary is 10% less than B, B gets 25% less than C and C gets 20% less than D. If A's salary is Rs. 27000, then find the difference in the salaries of C and A (in Rs.).
35. If  $\left(x + \frac{1}{x}\right) = 5$ , then find the value of  $x^3 - 5x^2 + 2x + \frac{1}{x^3} - \frac{5}{x^2} + \frac{2}{x}$ .

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**SPACE FOR THE ROUGH WORK**

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36. Two even numbers  $(6x-10)(3x+4)$  and  $(6x+2)(3x-4)$  are such that if they are represented on the number line, there is one even number in between them. If the first number is greater than the second one, then find the sum of the two numbers.
37. In a rectangle ABCD, E is the mid-point of DC and GE  $\parallel$  BC intersects BD at G.  
Find  $ar(\square BEG) : ar(\square ABCD)$ .
38. Find the value of  $m-n$  so that  $x^4 + nx^3 + 13x^2 + mx + 4$  is completely divisible by  $(x^2 + 3x + 2)$ .
39. When a natural number X is divided by 5, the remainder is 2. When a natural number Y is divided by 5, the remainder is 4. The remainder is Z, when  $(X+Y)$  is divided by 5. What is the value of  $\frac{2Z-5}{3}$ .
40. If  $a, b, m$  and  $n$  are constants, and  $\frac{m}{x} + \frac{n}{y} = a$ ;  $\frac{n}{x} + \frac{m}{y} = b$ , then find  $x$ .
41. A chord of a circle of radius 7 cm subtends an angle of  $90^\circ$  at the centre. Find the ratio of the area of the smaller segment to the area of the larger segment.  $\left(\text{use } \pi = \frac{22}{7}\right)$

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**SPACE FOR THE ROUGH WORK**

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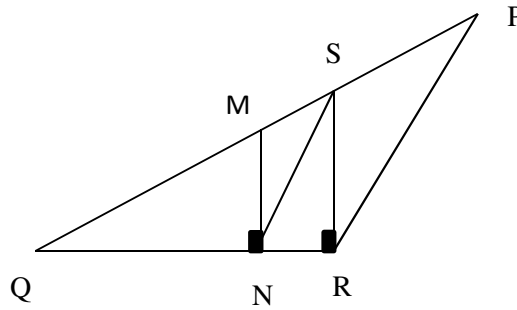
42. The surface area of a cylindrical pipe, open at both ends is 628 sq. m. The difference between the radius and length is 15m, the length being larger. If the pipe was closed at one end, find the amount of water it can hold (in cu m) (use  $\pi = 3.14$ ).
43. If  $\alpha + \beta + \gamma = 0$  and  $\alpha^2 + \beta^2 + \gamma^2 = x(\alpha^2 - \beta\gamma)$ , then find  $x$ .
44. If  $5A9 + 3B7 + 2C8 = 1114$ , where A, B and C are non-zero digits, then what is the maximum value C can have ?
45.  $\triangle ABC$  is a right triangle with  $\angle B = 90^\circ$ . M is the mid-point of the side AC and  $BM = \sqrt{117}$  cm. Sum of the lengths of the sides AB and BC is 30cm. Find area of  $\triangle ABC$  ( in sq. cm) .
46. If  $\alpha^x \cdot \beta^y = 7889$ , where  $\alpha$  and  $\beta$  are prime numbers and  $\alpha > \beta$ , then what is the value of  $\frac{\alpha + \beta}{y - x}$  .
47. If  $a$  and  $b$  are solutions of the equation :  $x^{\frac{2}{3}} + x^{\frac{1}{3}} - 2 = 0$ ,  $a > b$ , then evaluate :  $\sqrt[3]{a} - \sqrt[3]{b}$  .

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**SPACE FOR THE ROUGH WORK**

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48. If mean of 5, 10, 15, x, 20, 35 and 40 is 21 and y is the median of first 10 prime numbers, then find the value of  $\frac{x-y}{10}$ .
49. Rahul works in a factory for 40 hours a week. The wage for overtime is  $\frac{3}{2}$  times the usual rate of his wage. In a particular week he works for 10 hours as overtime and received Rs. 4730 as total wage of that week. What will be his weekly salary (in Rs.) for the week in which he worked for 12 hours as overtime?
50. In obtuse  $\triangle PQR$ ,  $PM = MQ$ ,  $MN \perp QR$ ,  $SR \perp QR$ ,  $ar(\triangle PRQ) = 2022mm^2$ , find  $ar(\triangle QNS)$ (in  $cm^2$ ).




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**SPACE FOR THE ROUGH WORK**

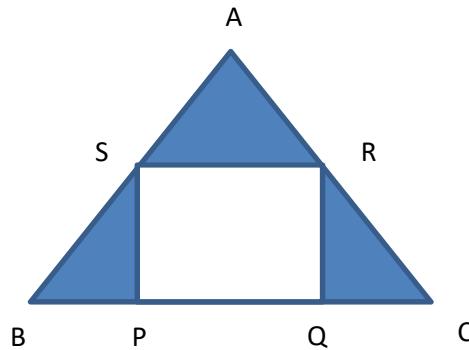
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## SECTION-D

Write the Answers only in the space provided on the Answer sheet.

51. Find the value of  $\sqrt[3]{\left(\frac{1}{x} + x^5 - 1\right)^{\frac{-2}{7}}}$ , if  $\sqrt{1 + \sqrt{1 - \frac{2176}{2401}}} = 1 + \frac{x}{7}$

52. ABC is an isosceles triangle with AB=AC=13 cm and BC= 10 cm. PQRS is a square inscribed in the triangle. Find the area of the remaining region of the triangle (in sq. cm correct to two places of decimals).



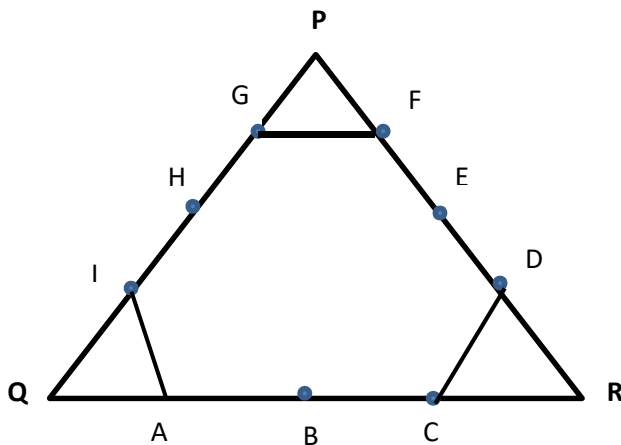
53. A conical vessel of radius 6cm and height 8cm is completely filled with water. A sphere is lowered into the water and its size is such that when it touches the base of the cone, it is just immersed. Find the fraction of water that overflows.

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**SPACE FOR THE ROUGH WORK**

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54. In the figure given below  $PQR$  is an equilateral triangle.  $A, B$  and  $C$  divide  $QR$ , and  $D, E$  and  $F$  divide  $PR$ , and  $G, H$  and  $I$  divide  $PQ$  in quarters respectively. If the side of  $\Delta PQR$  is 5 cm, then find the area of the hexagon  $ACDFGI$  (in sq. cm, correct to one decimal place) (use  $\sqrt{3} = 1.73$ ).



55. If  $\frac{4^{2022} + 4^{2022} + 4^{2022} + 4^{2022}}{2^{2022} + 2^{2022}} \times \frac{3^{2019} + 3^{2019} + 3^{2019}}{2^{2018} \times 32} = 3^{20n}$ , then find  $n$ .

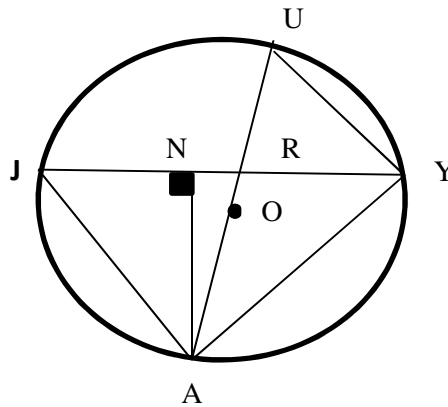
56. The average weight of all students in a class equals the number of students in the class. The increase in the average weight when a child of 21 kg is included equals the decrease in the average weight when a child of 19 kg is excluded. Find the number of students in the class.

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**SPACE FOR THE ROUGH WORK**

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57. In the given figure,  $JA = 18\text{cm}$ ,  $AY = 10\text{cm}$ , then find the value of  $AO \times AN$  .



58. Find the value of the expression:  $\frac{1}{\sqrt{11-2\sqrt{30}}} - \frac{3}{\sqrt{7-2\sqrt{10}}} - \frac{4}{\sqrt{8+4\sqrt{3}}}$  .

59. If a and b are roots of the quadratic equation  $x^2 - 7x - 2 = 0$  and if  $t_n = a^n - b^n$ , then what is the value of  $\frac{t_{10} - 2t_8}{2t_9}$  .

60. A right circular cylinder having height equal to two times its radius is carved out from a right circular cone having diameter 10 cm and height 12 cm. The axes of both the solids coincide. Find the surface area of the remaining solid correct to two decimal places (in sq. cm, in terms of  $\pi$ ).

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**SPACE FOR THE ROUGH WORK**

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