



38th ARYABHATTA INTER-SCHOOL MATHEMATICS COMPETITION: 2021

CLASS - VIII

Instructions:

1. The duration of the Competition is 2 hours (10:30 am – 12:30 pm).
 2. The Question Paper contains 75 questions. There are 50 questions of 1 mark each (including 10 questions based on logical reasoning) and 25 questions of 2 marks each. The marks are indicated as points (1 or 2) with each question.
 3. All the questions are Multiple Choice Questions. You have to select the correct option.
 4. You have to submit the Paper by clicking the ‘Submit’ button at the end of the question paper.
 5. You have to submit the Paper by 12:30 pm.
 6. You can submit the paper only once. No second chance will be provided.
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1. The next term in the number series 1,6,21,52,105 is :
A) 186 B) 188 C) 137 D) 159
2. The missing term in the given sequence : 1,2,3,6,9,18,____,54 is:
A) 18 B) 27 C)36 D)81
3. The wrong term in the letter-number series : G4T,J9R,M22P,P43N is:
A) G4T B) J9R C) M22P D) P43N
4. In a certain code ‘COVID’ is written as ‘HKYGE’. How is ‘STRAIN’ coded in that code?
A) XYNDGO B) MYNDGO C) MXNEGO D) XONXGM
5. There are six children playing football namely A, B, C, D, E and F. A and E are brothers. F is sister of E. C is the only son of A’s uncle. B and D are the daughters of the only brother of A’s father. How is D related to C.
A) Uncle B) Sister C) Niece D) Cousin

6. A man is facing west. He turns 45° in the clockwise direction and then another 180° in the same direction and then 270° in the anticlockwise direction and then 60° in the same direction. Which direction is he facing now?

- A) South-west B) North-west C) South-east D) North-east

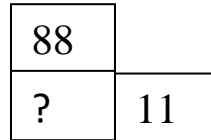
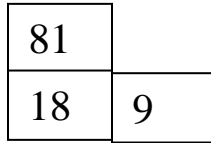
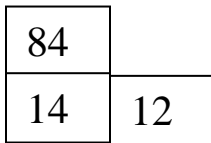
7. In the following sum, \otimes stands for which digit?

$$\otimes + 1\otimes + 2\otimes + \otimes 3 + \otimes 1 = 21\otimes$$

- A) 4 B) 8 C) 6 D) 5

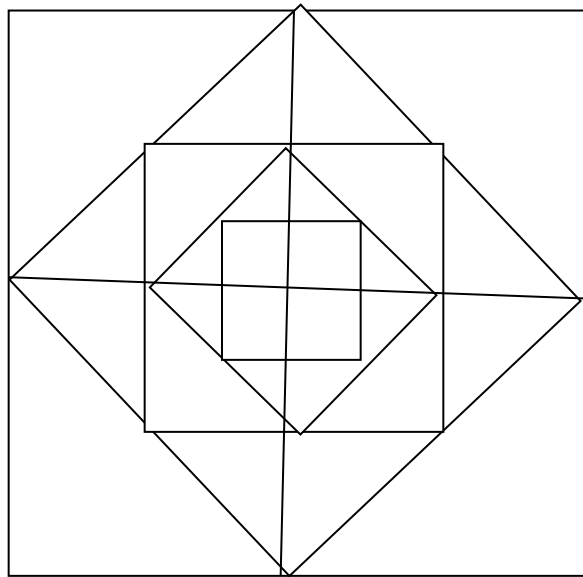
8. Find the missing number to replace ‘?’

- A) 21 B) 61 C) 16 D) 81



9. In the following figure, how many minimum colours are required if the figure is to be coloured such that no two adjacent shapes have the same colour?

- A) 2 B) 3 C) 4 D) 5



10. Numbers in the given figure exhibit a pattern. Which number should replace #?

- A) 6 B) 12 C) 18 D) 8

3	2	2
6	20	4
12	25	64
6	10	#

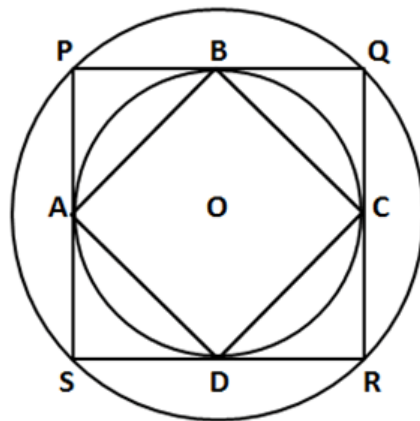
11. The remainder, when 7^{2021} is divided by 5 is:
 A) 1 B) 2 C) 3 D) 4
12. A number being successively divided by 3, 5 and 8 leaves remainder 1, 2 and 4 respectively. If the order of divisors is reversed, the remainders are a, b and c respectively. Then the value of $a+b+c$ is :
 A) 7 B) 5 C) 9 D) None of these
13. What should be the maximum value of β in the following equation, where α, β and γ represent a non-zero digit, $5\alpha 9 - 7\beta 2 + 9\gamma 6 = 823$?
 A) 5 B) 6 C) 7 D) 9
14. A boy multiplies 987 by a certain number and obtained 559981 as his answer. If in the answer both 9's are wrong but the other digits are correct, then the correct answer will be :
 A) 553681 B) 555181 C) 555681 D) 556581
15. When a certain number is multiplied by 13, each digit in the product obtained is five. The smallest such number when increased by 15 gives :
 A) 41625 B) 42135 C) 42750 D) 42515
16. The sum of all possible three-digit numbers, formed from three different non-zero digits, when divided by the sum of these digits is equal to:
 A) 222 B) 111 C) 555 D) 275

17. The sum of three prime numbers is 100. If one of them exceeds another by 36, then one of the number is :
 A) 7 B) 67 C) 29 D) 41
18. If $5x^2 - 13xy + 6y^2 = 0$, then $x : y$ is :
 A) (2:1) only B) (5:3) or (1:2) C) (3:5) only D) (3:5) or (2:1)
19. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, then $\frac{a+5b+4c}{17a}$ is:
 A) 0 B) 1 C) $\frac{14}{17}$ D) $\frac{13}{17}$
20. If $(a+b):(b+c):(c+a) = 6:7:8$ and $(a+b+c) = 42$, then the value of $c-b$ is:
 A) 0 B) 10 C) 8 D) 18
21. A sum of money is distributed among three states A, B and C in the ratio 5:7:8. There is a proposal to increase these amounts by 40%, 50% and 75% respectively. What will be the ratio of the new amounts?
 A) 2:3:4 B) 6:7:8 C) 6:8:9 D) 4:3:2
22. The third proportional to $(x^2 - y^2)$ and $(x - y)$ is:
 A) $x + y$ B) $x - y$ C) $\frac{x+y}{x-y}$ D) $\frac{x-y}{x+y}$
23. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water?
 A) 1:1 B) 2:3 C) 1:2 D) 3:2
24. Three containers have their volumes in the ratio 3:4:5. They are full of mixtures of milk and water. The containers contain milk and water in the ratios of (4:1), (3:1) and (5:2) respectively. The contents of all these three containers are poured in the fourth container. The ratio of water and milk in the fourth container is :
 A) 48:151 B) 157:53 C) 53:157 D) 151:48

25. X varies inversely as square of y. Given that $y = 2$ for $x = 1$. The value of x for $y = 6$ will be equal to:
 A) $1/3$ B) 9 C) $1/9$ D) None of these
26. A, B and C start a business each investing Rs. 20,000. After 5 months A withdrew Rs. 5000, B withdrew Rs. 4000 and C invests Rs. 6000. At the end of the year, a total profit of Rs. 69900 was earned. The difference in the profits of A and B (in Rs) is :
 A) 660 B) 700 C) 770 D) None of these
27. A room is half as long again as it is broad. The cost of carpeting the room at Rs.5 per sq. m is Rs.270 and the cost of papering the four walls at Rs.10 per sq. m. is Rs. 1720. If a door and a window occupy a total of 8sq. m , height of the room (in m) is :
 A) 6 B) 5 C) 7 D) None of these
28. The ratio of the areas of the incircle and the circumcircle of a square is:
 A) 2:1 B) 1:2 C) 1:3 D) None of these
29. A took 15 seconds to cross a rectangular field diagonally walking at the rate of 52 m/min and B took the same time to cross the same field along its sides, walking at the rate of 68m/min. The area of the field (in sq. m) is :
 A) 30 B) 40 C) 60 D) None of these
30. A square and a rectangle have equal areas. If the perimeters are P and Q respectively, then :
 A) $P < Q$ B) $P = Q$ C) $P > Q$ D) None of these
31. If the perimeters of a square and a rectangle are same, then the areas enclosed by them A and B respectively would satisfy the condition:
 A) $A < B$ B) $A \leq B$ C) $A > B$ D) None of these

32. The sides of a triangle are in the ratio of $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. If its perimeter is 52 cm, then its area (correct to two decimal places in sq. cm.) is:
 A) 85.33 B) 85.32 C) 84.32 D) None of these
33. If the perimeter of an isosceles right triangle is $(6+3\sqrt{2})$ m, then its area is:
 A) 5.4 B) 4.5 C) 6.5 D) None of these
34. From a point in the interior of an equilateral triangle, the perpendicular distances of the sides are $(7+6\sqrt{3})$ cm, $(4-\sqrt{3})$ cm and $(3\sqrt{3}-11)$ cm. The perimeter (in cm) of the triangle is :
 A) 48 B) 24 C) 32 D) None of these
35. The cross section of a canal is trapezium in the shape through which water is flowing with a speed of 3 km./min. The canal is 12m wide at the top and 8m wide at the bottom. If the depth of the canal is sum of ten times the bottom width and one-third of the top width, how many litres of water will flow through it in 2 seconds?
 A) 42 B) 63 C) 84 D) None of these
36. If a parallelogram with area P, a rectangle with area R and a triangle with area T are all constructed on the same base and all have the same altitude, then which of the following statement is false?
 A) $T = \frac{1}{2}R$ B) $P+T = 2R$ C) $P = 2T$ D) None of these
37. ABC is a right-angled triangle, with right angle at B. If the semi-circle on AB as diameter encloses an area of 81 sq cm and the semi-circle on BC as diameter encloses an area of 36 sq cm, then area of the semi-circle on AC, with AC as radius (in sq cm) will be :
 A) 936 B) 468 C) 117 D) None of these

38. A salesperson earns 900 dollars per month plus a 10% commission on all sales over 1000 dollars. One month she sells r dollars worth merchandise. How many dollars does she earn that month?
 A) $800+0.1r$ B) $800-0.1r$ C) $900+0.1r$ D) None of these
39. Ram owns a garden. In the garden, the number of mango trees is equal to number of mangoes per tree and the cost price per mango is the same as the number of mango trees in the garden. The maintenance cost is Rs. 935 per tree. If Ram sells one mango at Rs. 61, the overall loss in the business is Rs. 875. The number of mangoes in the garden, if no mangoes were wasted and the number of trees was more than 30 were:
 A) 625 B) 1225 C) 900 D) None of these
40. Triangle ABC right angled at B with the sides making right angle as 9 cm and 40 cm. Find the radius of the circle inscribed in the triangle.
 A) 3 cm B) 5 cm C) 6 cm D) 4 cm
41. The figure below shows two concentric circles with centre O. PQRS is a square inscribed in the outer circle. It also circumscribes the inner circle, touching it at point B, C, D and A. What is the ratio of the perimeter of the outer circle to that of polygon ABCD?



- A) $\pi/4$ B) $3\pi/2$ C) $\pi/2$ D) π
42. A light-pole has to be erected at a point on the boundary of a circular park of diameter 13 m in such a way that the differences of its distance from two

diametrically opposite fixed gates P and Q on the boundary is 7 m. At what distance from the two gates should the light pole be erected.

- A) 5 m, 12 m B) 6 m, 13 m C) 7 m, 14 m D) 9 m, 16 m

43. Chakradhar and Dhruva have two spools of 'manjha' to fly their kites. Each of the manjhas has tiny knots at regular intervals, which helps in keeping track of the length of the manjha that is used. Each of the persons has the same length of manjha. While Chakradhar's manjha has knots at intervals of 10 feet, Dhruva's has knots at intervals of 12 feet and it has 10 knots less than that of Chakradhar. Each of the manjhas has knots at only one of the extreme ends. Then the length of the manjha with either of those (in feet) is:

- A) 610 B) 590 C) 600 D) 1190

44. If the cost price of a pen is increased by Rs. 10, a person can buy 10 less pens for Rs. 1200. Find the original cost price of the pen.

- A) Rs. 40 B) Rs. 30 C) Rs. 50 D) Rs. 20

45. 39 workers can repair a road in 12 days working 5 hours a day. In how many days will 30 workers working 6 hours a day complete the work?

- A) 10 B) 13 C) 14 D) 15

46. There's a lot of work in preparing a birthday dinner. Even after the turkey is in the oven, there're still the potatoes and gravy, yams, salad, and cranberries, not to mention setting the table. Three friends Ashit, Arnold, and Afzal, work together to get all of these chores done. The time it takes them to do the work together is six hours less than Ashit would have taken working alone, one hour less than Arnold would have taken alone, and half the time Afzal would have taken working alone. How long did it take them to do these chores working together?

- A) 20 minutes B) 30 minutes C) 40 minutes D) 50 minutes

47. Let $N = 55^3 + 17^3 - 72^3$. N is divisible by:

- A) both 7 and 13 B) both 3 and 13 C) both 17 and 7 D) both 3 and 17

48. A large pump and three small pumps are filling a tank. Each small pump works at $\frac{2}{3}$ rd the rate of the large pump. If all four work at the same time, they should fill

the tank in what fraction of the time it would have taken the large pump alone?

- A) $\frac{4}{7}$ B) $\frac{1}{3}$ C) $\frac{2}{3}$ D) $\frac{3}{4}$

49. When you reverse the digits of the number 13, the number increases by 18. How many other two digit numbers increase by 18 when their digits are reversed?

- A) 7 B) 5 C) 6 D) 8

50. A rectangular floor is fully covered with square tiles of identical size. The tiles on the edges are white and the tiles in the interior are red. The number of white tiles is the same as the number of red tiles. A possible value of the number of tiles along one edge of the floor is :

- A) 10 B) 12 C) 14 D) 16

TWO MARKERS ($25 \times 2 = 50$)

51. The owner of a local jewelry store hired 3 watchmen to guard his diamonds, but a thief still got in and stole some diamonds. On the way out, the thief met each watchman, one at a time. To each he gave $\frac{1}{2}$ of the diamonds he had then, and 2 more besides. He escaped with one diamond. How many did he steal originally?

- A) 40 B) 36 C) 25 D) None of these

52. Rahul and Rohit contested for Gram Panchayat Elections. $\frac{2}{5}$ th of the voters promise to vote for Rahul and the rest promised to vote for Rohit. Of these, on the last day 15% of the voters went back of their promise to vote for Rahul and 25% of voters went back of their promise to vote for Rohit, and Rahul lost by 200 votes.

Then, the total number of voters is:

- A) 10000 B) 11000 C) 9000 D) 9500

53. The shopkeeper offers a cash discount of 20% and still makes a profit of 20%, when he further allows 16 articles to a dozen to a particularly sticky bargainer. How much

per cent above the cost price were his wares listed?

- A) 100% B) 80% C) 75% D) 66%

54. A table clock loses 5 min per hour. A wall clock loses 5 min per hour of the table clock. A wrist watch gains 5 min per hour of the wall clock. All the watches or clocks are set right at 12:00. What will be the time shown by the wrist watch when it is 2:00 for the first time after 12:00?

- A) 1: 49 : 14 B) 1 : 49 : 57 C). 1 : 40 : 11 D) 1 : 41 : 57

55. A train of 100 m long is approaching an unmanned railway crossing. The train is travelling at a uniform speed of 90 km/hr and is 1 km away from the crossing. At the same time, a bus, also approaching the crossing, is 700 m away from it. Assuming the bus is also travelling at a uniform speed of B, at what range of B (rounded to whole number) will the bus collide with the train?

- A. 59 km/hr < B < 61 km/hr B. 57 km/hr < B < 63 km/hr
C. 55 km/hr < B < 65 km/hr D. None of these

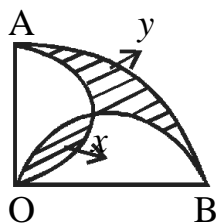
56. The external length, breadth and height of a closed box are 10 cm, 9 cm and 7 cm respectively. The total inner surface area of the box is 262 sq. cm. If the walls of the box are of uniform thickness t cm, then t equals:

- A) 1 cm B) $2\frac{2}{3}$ cm C) 1 cm or $2\frac{2}{3}$ cm D) None of these

57. Neha wants to visit Nitin's place and hence calls up Nitin at his residence to ask him to come and pick her up. Nitin asks her to leave immediately and start walking towards his house and at the same time he also leaves immediately by car, meets Neha on the way, picks her up and drives back to his place. Had Nitin driven all the way to Neha to pick her up, he would have taken 20 min to reach Neha. But since he asked Neha to walk towards his house, he ended driving only for a total of 30 min. What is the ratio of speed at which Neha walks to the speed at which Nitin drives the car?

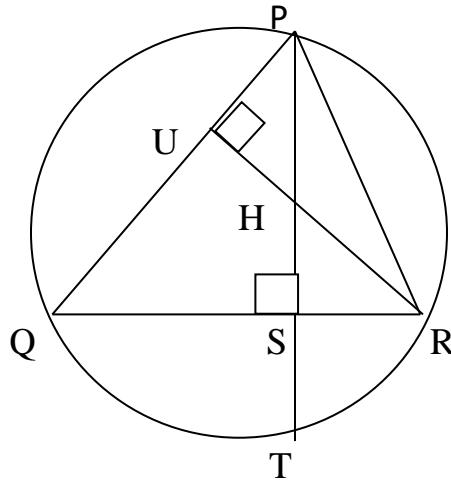
- A) 1 : 4 B) 1 : 5 C) 1 : 3 D) Cannot be determined

58. A ball of diameter 15 cm is floating so that the top of the ball is 5 cm above the smooth surface (water) of the pond. What is the circumference in centimetres of the circle formed by the contact of the water surface with the ball?
- A) $10\sqrt{2} \pi$ B) 50π C) 10π D) $5\sqrt{2} \pi$
59. A parallelogram is inscribed in a circle. If the area of the circle is $42\frac{1}{4}\pi \text{ cm}^2$ and one of sides of the parallelogram is 12 cm, what is the area of the parallelogram (in cm^2)?
- A) 60 B) 40 C) 80 D) Cannot be determined
60. PQR is a right-angled triangle with right angle at Q. S is the mid-point of PR and $QS = \sqrt{117}$ cm. Sum of the lengths of the sides PQ and QR is 30 cm. Area of the triangle PQR (in cm^2) is:
- A) 216 B) 108 C) 54 D) 162
61. AOB is a quarter of a circle, and semicircles are drawn on OA and OB. What is the relation between the shaded areas x and y ?
- A) $x = 2y$ B) $x = y$ C) $2x = y$ D) $2x = 3y$



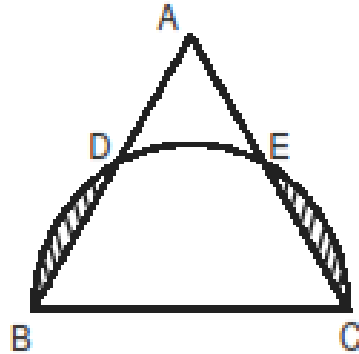
62. In ΔPQR , the incircle touches the sides QR, RP and PQ at T, U and S respectively. If the radius of the incircle is 4 units and QT, RU and PS are consecutive integers, area of the triangle (in sq. units) is
- A) 42 B) 84 C) 21 D) 48
63. If p, q and r are distinct real numbers such that $p^2 - q = q^2 - r = r^2 - p$, then $(p + q)(q + r)(r + p)$ equals
- A) 2 B) 3 C) 1 D) 0

64. If altitude PS meets the circumcircle of $\triangle PQR$ at T, and H is the orthocentre, then what is the length of the line segment HT (in cm)? (Given $ST = 3$ cm)



- A) 4.5 B) 5 C) 6 D) 4
65. If $3^p = 4^q = 12^r$, then $(p + q)r$ is equal to :
- A) pq B) qr C) pr D) None of these
66. The perimeter of an isosceles triangle is A cm and each of the two equal sides is B cm longer than the third unequal side. Which of the following is the length of the equal sides?
- A) $\frac{A-B}{3}$ B) $A + \frac{A}{B}$ C) $\frac{A+B}{3}$ D) $\frac{A}{3} + B$
67. ABCDEF is a regular hexagon of side 'a'. P is a point inside the hexagon. If PG, PH, PI, PJ, PK, PL are drawn perpendicular to the sides AB, BC, CD, DE, EF, FA, respectively, then the value of $PG + PH + PI + PJ + PK + PL$ is equal to :
- A) $6\sqrt{3}a$ B) $3\sqrt{3}a$ C) $3a$ D) None of these
68. $\triangle ABC$ is an equilateral triangle of side 14 cm. A semi-circle on BC as diameter is drawn to meet AB at D, and AC at E. Find the area of the shaded region.

- A) $49\left(\frac{\pi}{2}-\sqrt{3}\right)$ B) $49\left(\frac{\pi}{3}-\frac{\sqrt{3}}{2}\right)$ C) 49 D) None of these

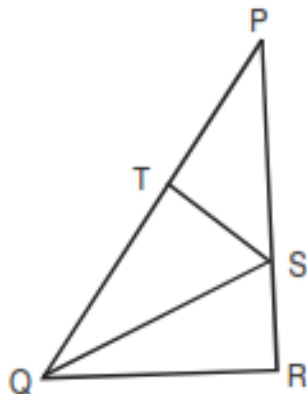


69. If p,q,r and are distinct integers in the range 10 to 15 (both inclusive) , the greatest value of $(p + q) (r + s)$ is :

- A) 750 B) 731 C) 729 D) 700

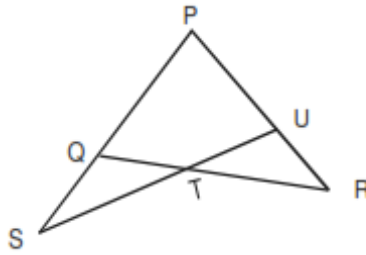
70. In the adjoining figure, In ΔPQR , $PQ = PR$, S and T are the points on PR and PQ respectively such that $RQ=QS=ST=TP$. The measure of angle PTS is :

- A) $\frac{180^\circ}{7}$ B) $\frac{540^\circ}{7}$ C) $\frac{900^\circ}{7}$ D) $\frac{1080^\circ}{7}$



71. Through T, the mid-point of the side QR of a ΔPQR , a straight line is drawn to meet PQ produced to S and PR at U, so that $PU=PS$. If length of $UR=2$ cm, then the length of QS is :

- A) $2\sqrt{2}$ B) $\sqrt{2}$ C) 2 D) cannot be determined



72. Barrack likes to jog in a park. While jogging he calculates his speed and the number of steps taken by him. He also observes that the steps taken by him per minute are 5 times his speed in km/hr. What is the distance, in metres, he covers per step if he jogs at a uniform speed?
- A) $\frac{5}{3}$ B) $\frac{10}{3}$ C) $\frac{100}{3}$ D) Data Insufficient
73. PQR is an acute angled triangle and PS be the altitude through P. If QR = 16 cm and PS = 12 cm, then the distance between the mid-points of QS and PR (in cm) is :
- A) 14 B)12 C)10 D)8
74. 5 men start painting a wall. On day 2 three more men join then and on day 3 two of them leaves the group. Again on the next day 3 more men join them and 2 leave on the very next day and this process of joining by 3 men and 2 men leaving the group continues. If the wall is completed in exactly 15 days, find the number of days required to paint the wall by 5 men working together?
- A) 29 B) 27 C) 25 D) None of these
75. A swimmer started swimming from Ghat X towards Ghat Y against the stream. At Ghat Y he saw a floating log. He continued swimming till Ghat Z and after reaching there, he immediately turned and started swimming back. Coincidentally the log and the swimmer both reached Ghat A at the same time. If Ghat Z is 20 km away from Ghat Y and the swimmer take triple the time for one trip than the other, then what is the distance between Ghat X and Ghat Y(in km) ?
- A) 60 B) 20 C) 10 D) 40