IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2019-20

CLASS 9

QUESTION PAPER SET B

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Name:.....

Section:..... SOF Olympiad Roll No.:..... Contact No.:.....

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises four sections:

   Logical Reasoning (15 Questions), **Mathematical Reasoning** (20 Questions), **Everyday Mathematics** (10 Questions) and **Achievers Section** (5 Questions)

   Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only ONE correct answer. Choose only ONE option for an answer.
6. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.

   Q.16: Rahul bought 4 kg 90 g of apples, 2 kg 60 g of grapes and 5 kg 300 g of mangoes. The total weight of all the fruits he bought is_____.

   A. 11.450 kg B. 11.000 kg C. 11.350 kg D. 11.250 kg

   As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet. 16. ● Ⓑ Ⓒ Ⓓ
7. Rough work should be done in the blank space provided in the booklet.
8. Return the OMR Sheet to the invigilator at the end of the exam.
9. Please fill in your personal details in the space provided on this page before attempting the paper.

SOF

SCIENCE OLYMPIAD FOUNDATION

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LOGICAL REASONING

1. Pointing towards Shruti, Vishal said, "She is the daughter of the woman who is the mother of the husband of my mother". How is the Vishal related to Shruti?

   A. Nephew
   B. Grandfather
   C. Father
   D. Brother

2. Select the correct mirror image of the given combination of letters, symbols and numbers, if the mirror is placed vertically to the left.

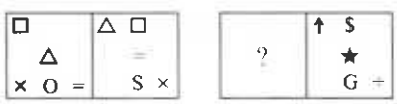
   CR01$A34T@70N

   A. N07@T4ƐA$10RƆ
   B. N07@T4ƐA$10ЯƆ
   C. N07@T4ƐA$10ЯƆ
   D. N07@T4ƐA$10ЯC

3. In a row of girls facing North, Reena is 10th to the left of Pallavi, who is 21st from the right end. If Malini, who is 17th from the left end, is fourth to the right of Reena, then how many girls are there in the row?

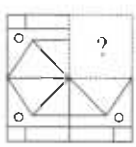
   A. 37 B. 43
   C. 44 D. Data inadequate

4. There is a certain relationship between figures (1) and (2). Establish the similar relationship between figures (3) and (4) by selecting a suitable figure from the options which will replace the '?' in figure (3).



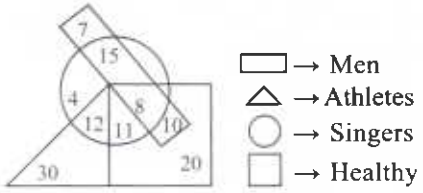
   A.
   B.
   C.
   D.

5. Select a figure from the options which when placed in the blank space of the given figure would complete the pattern.



   A.
   B.
   C.
   D.

6. Study the given Venn diagram carefully and answer the following question.



   How many healthy men are there who are singers but not athletes?

   A. 15
   B. 8
   C. 20
   D. 12

7. In a certain code language, '125' means 'water is life', '146' means 'give me water', '785' means 'life must healthy' and '8541' means 'water give healthy life'. What is the code for 'me' in that language?

   A. 6
   B. 2
   C. 4
   D. 1

8. A number arrangement machine when given an input line of numbers rearranges them by following a particular rule in each step. The following is an illustration of input and rearrangement.

   Input : 62 15 87 115 20 240 7 40
   Step I : 240 62 15 87 115 20 7 40
   Step II : 240 7 62 15 87 115 20 40
   Step III : 240 7 115 62 15 87 20 40
   Step IV : 240 7 115 15 62 87 20 40
   Step V : 240 7 115 15 87 62 20 40
   Step VI : 240 7 115 15 87 20 62 40

   Step VI is the last step of the above input. As per the rules followed in the above steps, answer the following question.

   If Step III of an input is : 135 5 110 13 75 95 42 105, then which of the following is definitely the input?

   A. 5 75 110 135 95 13 42 105
   B. 5 110 135 75 13 95 42 105
   C. 13 95 5 110 135 75 42 105
   D. Can't be determined

9. Study the given information carefully and answer the question that follows:

On a playing ground, Dinesh, Kunal, Nitin, Atul and Prashant are standing facing the North.

(i) Kunal is 40 metres to the right of Atul.

(ii) Dinesh is 60 metres to the South of Kunal.

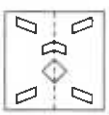
(iii) Nitin is 25 metres to the West of Atul.

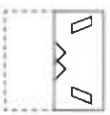
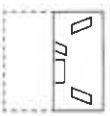
(iv) Prashant is 90 metres to the North of Dinesh.

Who is to the North-East of the person, who is to the immediate left of Kunal?

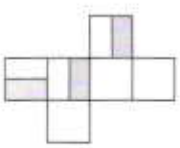
A. Dinesh
B. Nitin
C. Prashant
D. None of these

10. A square transparent sheet with a pattern and a dotted line on it is given. Select a figure from the options as to how the pattern would appear when the transparent sheet is folded along the dotted line.



A.
B.
C. 
D. 

11. When the given figure is folded to form a cube, which of the following cubes is similar to the cube so formed?

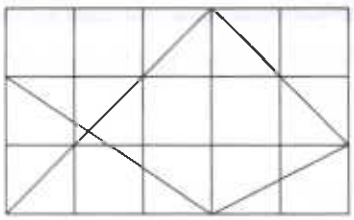


A.
B.
C.
D.

12. If A is written as '+', B is written as '–', C is written as '×' and D is written as '÷', then what is the value of 18 C 14 A 6 B 16 D 4 ?

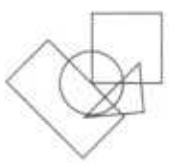
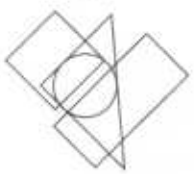
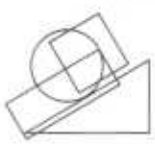
A. 254
B. 238
C. 188
D. 258

13. How many squares are there in the given figure?

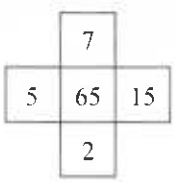


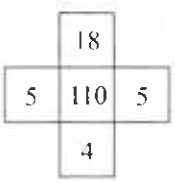
A. 24
B. 25
C. 26
D. None of these

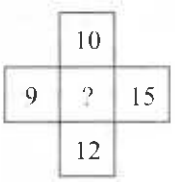
14. Select a figure from the options which satisfies the same conditions of placement of the dots as in the given figure.

A.
B. 
C. 
D. 

15. Find the missing number, if same rule is followed in all the three figures.





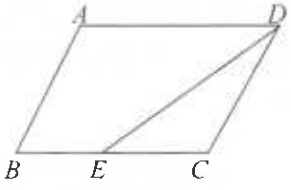


A. 270
B. 85
C. 195
D. 54

16. If $a + b + c = 3x$, then find the value of $(x - a)^3 + (x - b)^3 + (x - c)^3$.

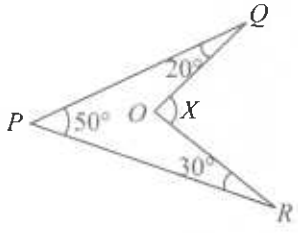
A. 0
B. $3(x - a)(x - b)(x - c)$
C. 1
D. $(x - a)(x - b)(x - c)$

17. In the given figure, if $ABCD$ is a parallelogram and E is the mid-point of BC, then ar(ΔDEC) = k ar($ABCD$). Find the value of k.



A. 2
B. $\frac{1}{4}$
C. $\frac{1}{2}$
D. $\frac{2}{3}$

18. Find the value of X in the given figure (not drawn to scale).



A. 130°
B. 100°
C. 90°
D. 145°

19. The construction of a ΔLMN in which LM = 8 cm, $\angle L = 45°$ is possible when ($MN + LN$) is _____ .

A. 6 cm
B. 7 cm
C. 9 cm
D. 5 cm

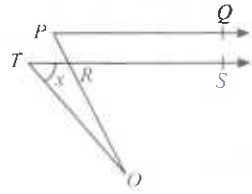
20. If the sum of the interior angles of a polygon is two times the sum of its exterior angles, then the number of sides of the polygon is

A. 5
B. 6
C. 7
D. 8

21. If the perpendicular distance of a point S from the y-axis is 8 units in the negative direction of the x-axis, and the perpendicular distance of S from the x-axis is 6 units in the positive direction of y-axis, then the coordinates of S are _____ .

A. (–6, –8)
B. (8, –6)
C. (–8, 6)
D. (–8, –6)

22. In the given figure (not drawn to scale), $PQ \parallel RS$. If $\angle QPR = 70°$ and $\angle ROT = 20°$, then find the value of x.

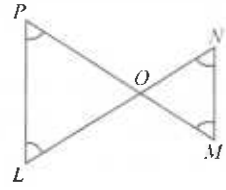


A. 110°
B. 80°
C. 50°
D. 60°

23. The graph of the linear equation $2y = 4x - 5$ passes through the point

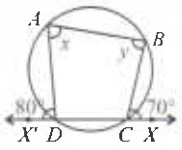
A. $\left(3, \frac{7}{2}\right)$
B. (0, 2)
C. (2, 1)
D. $\left(-\frac{3}{2}, \frac{7}{2}\right)$

24. In the given figure, if $\angle P < \angle L$ and $\angle M < \angle N$, then which of the following statements is true regarding the relationship between LN and PM?



A. $LN = PM$
B. $LN < PM$
C. $LN > PM$
D. Can't be determined

25. $ABCD$ is a cyclic quadrilateral. If $\angle BCX = 70°$ and $\angle ADX' = 80°$, then find the values of x and y respectively.



A. 70°, 80°
B. 70°, 70°
C. 80°, 70°
D. None of these

26. The following data shows the number of families and number of children they have.

Number of children in a family	3	4	5	0	1	2
Number of families	3	6	10	12	7	15

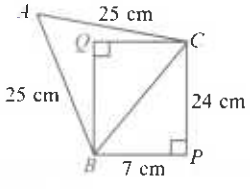
What is the probability that a family chosen at random has at least two children?

A. $\frac{33}{53}$ B. $\frac{35}{53}$
C. $\frac{34}{53}$ D. $\frac{19}{53}$

27. What value must be subtracted from the polynomial $4y^4 + 12y^3 + 6y^2 + 50y + 26$, so that the resultant polynomial is exactly divisible by $y^2 + 4y + 2$?

A. y
B. $4y + 5$
C. $2y - 2$
D. $2y + 3$

28. In the given figure (not drawn to scale), find the ratio of the area of ΔABC to the area of the rectangle $BPCQ$.



A. $(572+\sqrt{6}):\sqrt{6}$
B. $625:(672+\sqrt{6})$
C. $625\sqrt{3}:672$
D. $\sqrt{3}:672$

29. In a cylinder, if radius of the base is halved and height is twiced, then the curved surface area will be _____ the curved surface area of the original cylinder.

A. Two times
B. Three times
C. Same as
D. Four times

30. Simplify :

(i) $\frac{\sqrt[5]{a^3b^{-2}c^{-4}}}{\sqrt[5]{a^8b^3c^{-9}}}$ (ii) $(125)^{\frac{1}{4}}\left(8^{\frac{1}{3}}+27^{\frac{1}{3}}\right)^{\frac{1}{4}}$

	(i)	(ii)
A.	$\frac{ab}{c}$	$\frac{1}{5}$
B.	$\frac{c}{ab}$	5
C.	$\frac{a}{bc}$	25
D.	abc	30

31. Which of the following options is incorrect?

A. In a ΔPQR, if PM bisects QR, then $QM = MR$.
B. If the altitudes PM, QN and RO of ΔPQR are equal, then ΔPQR is equilateral.
C. The line joining the mid points of any two sides of a triangle is parallel to the third side.
D. None of these

32. Which of the following is/are Euclid's postulate?

(i) A terminated line can be produced indefinitely.
(ii) Things which coincide with one another are equal to one another.

A. Only (i)
B. Only (ii)
C. Both (i) and (ii)
D. Neither (i) nor (ii)

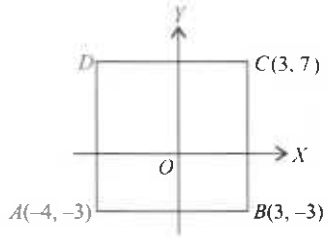
33. The adjacent sides of a parallelogram $PQRS$ measure 34 cm and 20 cm and the diagonal PR measures 42 cm. Find the area of the parallelogram.

A. 724 cm^2
B. 342 cm^2
C. 562 cm^2
D. 672 cm^2

34. A bank offers 8% compound interest calculated on half-yearly basis. A customer deposits ₹ 2000 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained as interest, is _____.

A. ₹ 220.20
B. ₹ 221.60
C. ₹ 122.50
D. ₹ 243.20

35. The given diagram is drawn on a cartesian plane.



If $ABCD$ is a rectangle, then find

(i) the coordinates of point D.

(ii) the area of rectangle $ABCD$ (in square units).

	(i)	(ii)
A.	(4, 7)	42
B.	(4, – 7)	60
C.	(– 3, –7)	70
D.	(– 4, 7)	70

EVERYDAY MATHEMATICS

36. 20 children are to be divided into two groups A and B of 12 and 8 children respectively. The average marks obtained by the children of group A is 85 and the average marks of all the 20 children is 80. What is the average marks of children of group B?

A. 72.5
B. 74
C. 78.3
D. 79

37. Puneet bought x caps at ₹ 80 each and y notebooks at ₹ 12 each. If the cost of caps is ₹ 60 more than the cost of notebooks, then the given condition is represented by the equation

A. $20x = 5 + 3y$
B. $20x = 15 - 3y$
C. $80x = 60 + 4y$
D. $80x = 60 + 12y$

38. Ginni went to the stationery shop and bought things worth ₹ 50, out of which 60 paise went on sales tax on taxable purchases. If the tax rate was 12%, then what was the cost of the tax free items?

A. ₹ 40
B. ₹ 42.50
C. ₹ 44.40
D. ₹ 28

39. The paint in a certain container is sufficient to paint an area equal to 10.865 m^2. How many bricks of dimensions 31.5 cm × 10 cm × 5.5 cm can be painted from that paint?

A. 150
B. 200
C. 100
D. 250

40. Vikas has ₹$(x^3 + 2ax + b)$, with this money he can buy exactly $(x - 1)$ jeans or $(x + 1)$ shirts with no money left. How much money does Vikas have, if $x = 4$?

A. ₹ 80
B. ₹ 120
C. ₹ 30
D. ₹ 60

41. Two trains A and B start running together from the same point in the same direction at 90 kmph and 60 kmph respectively. If the length of each train is 250 m, then how long will it take for the train B to cross train A?

A. 2 mins 15 secs
B. 1 min
C. 2 mins 05 secs
D. 1 min 30 secs

42. 76 ladies can do a job in 33 days. Due to some reason, some ladies did not join the work and therefore, it was completed in 44 days. The number of ladies who did not join the work is _____.

A. 22
B. 21
C. 20
D. 19

43. Two years ago, Kirti was four times as old as her daughter Sunidhi. Ten years hence, Kirti will be two times as old as her daughter. Find the ratio of the present ages of Kirti and her daughter.

A. 13 : 4
B. 12 : 7
C. 7 : 3
D. 7 : 4

44. An umbrella is made by stitching 12 triangular pieces of cloth of two different colours as shown in the figure, each piece measuring 40 cm, 40 cm and 10 cm. How much cloth of each colour is required for the umbrella?

A. 1500.23 cm^2, 1500.23 cm^2

B. 1190.58 cm^2, 1190.58 cm^2

C. 9000 cm^2, 9000 cm^2

D. 7500 cm^2, 7500 cm^2

45. The probability of selecting a male employee in a company is 0.75 and there are 500 employees in the company. Find the number of female employees in the company.

A. 125

B. 150

C. 275

D. 325

ACHIEVERS SECTION

46. Arrange the following steps of construction of a triangle PQR in which $PQ = 5$ cm, $QR + RP = 8$ cm and $\angle Q = 60°$ in correct sequence.

Steps of construction :

Step 1 : Draw $\angle PQX = 60°$.

Step 2 : Draw the perpendicular bisector of PY meeting QY at R.

Step 3 : Join PY.

Step 4 : Join PR.

Step 5 : Along $\overrightarrow{QX}$, cut off line segment $QY = QR + RP = 8$ cm.

Step 6 : Draw $PQ = 5$ cm.

Hence, ΔPQR is the required triangle.

A. 6, 1, 3, 2, 4, 5

B. 6, 5, 1, 3, 2, 4

C. 6, 1, 5, 3, 4, 2

D. 6, 1, 5, 3, 2, 4

47. Read the given statements carefully and state 'T' for true and 'F' for false.

(i) $ABCD$ is a parallelogram in which $\angle A = 60°$. If the bisectors of $\angle A$ and $\angle B$ meet CD at P, then $DC = 2AD$.

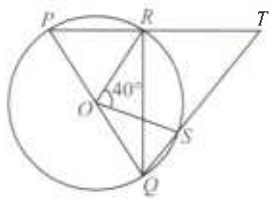
(ii) Diagonals of a rhombus are always equal and bisect each other at 90°.

(iii) The bisectors of angles of a parallelogram form a rectangle.

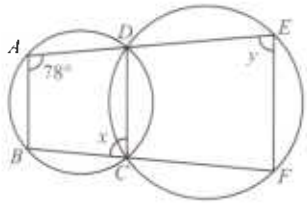
	(i)	(ii)	(iii)
A.	T	F	F
B.	F	T	T
C.	T	F	T
D.	F	F	T

48. Solve the following questions.

(i) In the given figure (not drawn to scale), O is the centre of a circle and PQ is the diameter. If $\angle ROS = 40°$, then find $\angle RTS$.



(ii) In the given figure (not drawn to scale), $\angle BAD = 78°$, $\angle DCB = x$ and $\angle DEF = y$. Find the sum of x and y.



	(i)	(ii)
A.	90°	102°
B.	20°	78°
C.	70°	204°
D.	60°	102°

49. A conical tent is 7 m high and the radius of its base is 24 m.

(i) What is the cost of the canvas required to make it, if a square metre canvas costs ₹ 20?

(ii) How many persons can be accommodated in the tent, if each person requires 5 square metre on the ground and 20 m^3 of space to breathe in?

	(i)	(ii)
A.	₹ 56521.30	190
B.	₹ 1456.20	292
C.	₹ 35625.48	362
D.	None of these	

50. Fill in the blanks and select the correct option.

(i) The mean of five numbers is 20. If 5 is subtracted from each number, then the new mean is __P__.

(ii) The median of the data 32, 44, 53, 47, 37, 54, 34, 36, 40, 50 is __Q__.

(iii) The mode of the data 15, 17, 15, 19, 14, 18, 15, 14, 16, 15, 14, 20, 19, 14, 15 is __R__.

	P	Q	R
A.	20	40	15
B.	15	42	15
C.	15	40	19
D.	18	42	19

SPACE FOR ROUGH WORK

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