IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2018-19

CLASS 9

QUESTION PAPER SET B
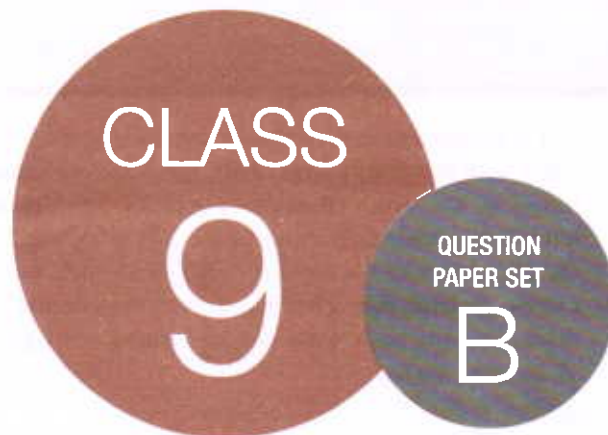
Name:..

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 with you your marks / result 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. ● ⑧ © ⑩`

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.

SCIENCE OLYMPIAD FOUNDATION
Inspiring Young Minds Through Knowledge Olympiads

1. If it is possible to make only one meaningful English word with the first, fourth, fifth, ninth and eleventh letters of the word TRANSLOCATION(using each letter only once), then which of the following will be the third letter of the word formed? If no such word can be formed, then give 'X' as your answer and if more than one such word can be formed, then give 'Z' as your answer.

   A.   X
   B.   T
   C.   Z
   D.   I

2. Starting from a point, Rohit walked 15 m South. Then, he turned left and walked 10 m. Again, he turned left and walked 15 m. After that he turned right and walked 5 m. At last he turned left and walked another 20 m. How far is he now and in which direction from the starting point?

   A.   25 m, South-East
   B.   20 m, North-East
   C.   15 m, South-West
   D.   25 m, North-East

3. Given question consists of a set of three figures X, Y and Z showing a sequence of folding of a piece of paper. Fig. (Z) shows the manner in which the folded paper has been cut. Select a figure from the options that would most closely resembles the unfolded form of Fig. (Z).
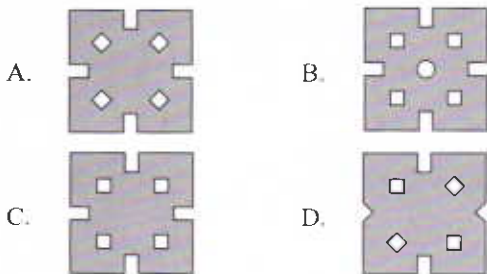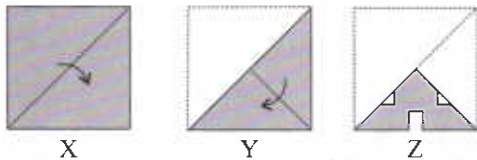
4. Which of the following figures is exactly embedded in the given figure as one of its parts?
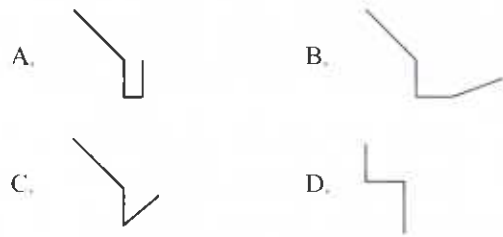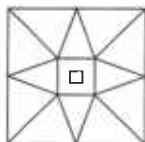
5. If '−' stands for 'multiplication', '+' stands for 'division', '×' stands for 'addition' and '÷' stands for 'subtraction', then find the value of $142 + 2 \div 31 \times 10 - \frac{1}{2}$.

   A.   7/3
   B.   45
   C.   39
   D.   5/2

6. Select the correct water image of the given combination of numbers and letters.

   OP73ER29ATI4ON
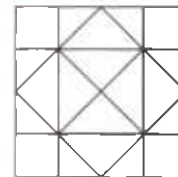
   A.   ΟႦϽƎᴚᲨᲔＶⱢI₹ΟИ
   B.   ИΟᎦIＴＡᲔᲨᴚƎϽƎᏔႦΟ
   C.   ΟႦϽƎᴚᲨᲔＶⱢI₹ΟИ
   D.   ΝΟᎦIＴＡᲔᲨᴚƎᏃƎႦᏐΟ

7. Group the given figures into three classes on the basis of their identical properties by using each figure only once.

A 1	L 2	W 3
E 4	V 5	N 6
T 7	M 8	Z 9

   A.   1,3,8; 2,5,7; 4,6,9
   B.   1,6,9; 2,5,7; 3,4,8
   C.   1,5,7; 2,3,4; 6,8,9
   D.   1,2,3; 4,6,8; 5,7,9

8. Find the number of squares formed in the given figure.


   A.   15
   B.   11
   C.   12
   D.   None of these

9. In a row of boys, Vishal is 16th from the left end and Ashish is 18th from the right end. Aryan is 11th from Vishal towards the right end and 3rd from Ashish towards the right end. How many boys are there in the row?

A. 38
B. 36
C. 41
D. Can't be determined

10. There is a certain relationship between figures (1) and (2). Establish a similar relationship between figures (3) and (4) by selecting a suitable figure from the given options that would replace the (?) in figure (4).

(1)   (2)   (3)   (4)
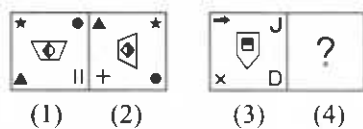
A.

B.

C.

D.

11. Find the missing number, if same rule is followed in all the three figures.
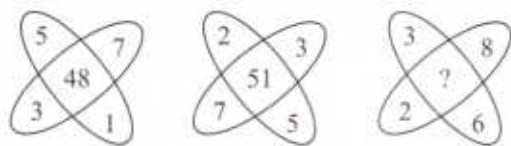
A. 120
B. 60
C. 57
D. 75

12. Two rows of numbers are given. The resultant number in each row is to be worked out separately based on the following rules and the question below the rows of numbers is to be answered. The operations on numbers progress from left to right.

Rules:

(i) If a two digit odd number is followed by another two digit odd number, then they are to be added.

(ii) If a two digit even number is followed by a two digit odd number which is a perfect square, then the even number is to be subtracted from the odd number.

(iii) If a three digit number is followed by a two digit number, then the first number is to be divided by the second number.

(iv) If a prime number is followed by an even number, then the two numbers are to be added.

(v) If an even number is followed by another even number, then the two numbers are to be multiplied.

255	17	11
X	4	13

If X is the resultant of the first row, then what will be the resultant of the second row?

A. 7
B. 8
C. 10
D. 12

13. Three positions of a dice are shown below. Find the number on the face opposite to the face showing number 5.
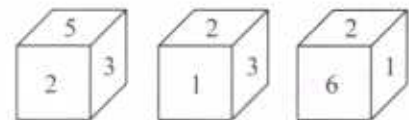
A. 4
B. 1
C. 3
D. 6

14. If 'P × Q' means 'P is the daughter of Q', 'P + Q' means 'P is the father of Q', 'P ÷ Q' means 'P is the mother of Q' and 'P – Q' means 'P is the brother of Q', then in the expression 'M ÷ N + R – T × K', how is M related to K?

A. Mother-in-law
B. Sister-in-law
C. Aunt
D. Mother

15. Find the missing term in the given series.

CMP, ENN, HOK, LPG, _?_

A. PRC
B. OQA
C. RPC
D. QQB

16. Temperature of a body can be measured in Celsius unit as X°C or in Fahrenheit unit as Y°F. The relation between the two scales of temperature is given by the linear equation $Y = \frac{9}{5} X + 32°$.

    (i) Find the temperature of a body in Fahrenheit, if the temperature of the body is 60°C.
    (ii) If the temperature of a body is 77°F, then find the temperature in Celsius.

	(i)	(ii)
A.	140°F	35°C
B.	80°F	60°C
C.	140°F	25°C
D.	70°F	75°C

17. A hemispherical bowl is filled to the brim with a beverage. The contents of the bowl are transferred into a cylindrical vessel whose radius is 50% more than its height. If the diameter is same for both the bowl and the vessel, then what percent of the beverage can be poured from the bowl into the cylindrical vessel?

    A. $66\frac{2}{3}\%$

    B. $78\frac{1}{2}\%$

    C. 100%

    D. None of these

18. If $\dfrac{\left(8+3\sqrt{2}\right)+\left(7-\sqrt{2}\right)-\left(3-4\sqrt{2}\right)}{6-2\sqrt{2}} = a+b\sqrt{2},$ then find the value of a and b respectively.

    A. $\dfrac{24}{7}, \dfrac{15\sqrt{2}}{7}$

    B. $\dfrac{-24}{7}, \dfrac{-15}{7}$

    C. $\dfrac{24}{7}, \dfrac{15}{6}$

    D. $\dfrac{24}{7}, \dfrac{15}{7}$

19. PQRS is a parallelogram. M and N are the mid-points of sides PQ and RS respectively. If XY is any line intersecting PS, MN and QR at X, O and Y respectively such that XY || PQ, then find the ratio in which O divides the line XY.

    A. 1 : 3
    B. 1 : 1

C. 1 : 4
D. 2 : 1

20. Find the quotient, when $x^{3/2} - xy^{1/2} + x^{1/2} y - y^{3/2}$ is divided by $(x^{1/2} - y^{1/2})$.

    A. $x + y$
    B. $x - y$
    C. $x^{1/2} + y^{1/2}$
    D. $x^2 - y^2$

21. A money lender borrows money at 4% p.a. on simple interest and pays interest at the end of the year. He lends it at 6% p.a. compound interest compounded half-yearly and receives the interest at the end of the year. Thus, he gains ₹104.50 per year. Find the amount of money he borrows.

    A. ₹ 5500
    B. ₹ 4500
    C. ₹ 5000
    D. ₹ 6000

22. In the given figure, if AB || CD, then the value of x is _____.
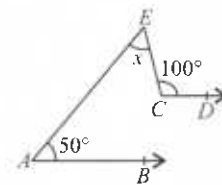
    A. 25°
    B. 30°
    C. 45°
    D. 50°

23. If the base radius and the height of a right circular cone are increased by 20%, then the percentage increase in volume is _____ (approximately).
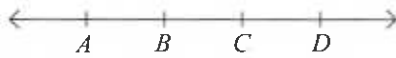
    A. 60 %
    B. 68 %
    C. 73 %
    D. 78 %

24. In the given figure (not drawn to scale), L, M and N are the mid-points of the sides QR, RP and PQ respectively of a ΔPQR. QM intersects the line LN at U and RN intersects the line LM at V, then UV = kQR. Find the value of k.
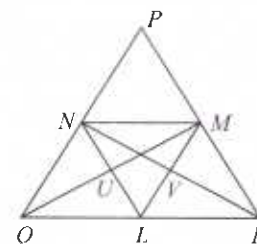
    A. 4

    B. 1/4

    C. 2

    D. 1/2

25. In the given figure (not drawn to scale), $AC = BD$ and if BC is subtracted from AC and BD, then $AB = CD$.

Which of the following Euclid's axioms explains the above result?

A. If equals are added to equals, the wholes are equal.

B. If equals are subtracted from equals, the remainders are equal.

C. Things which coincide with one another are equal to one another.

D. Things which are equal to the same thing are equal to one another.

26. Study the given graph carefully.
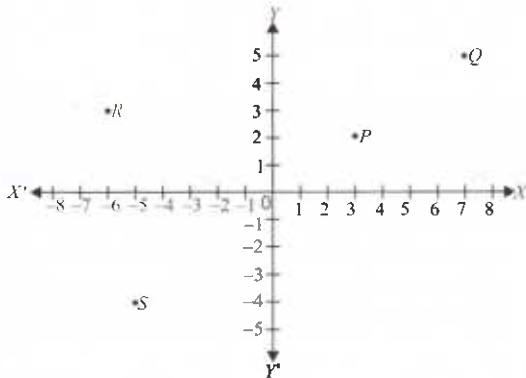
Sum of abscissae of points P and R is _____.

A. 5

B. 6

C. 9

D. −3

27. Simplify:

(i) If $\dfrac{4^{n+3} \times 8^{3-n}}{\left(64^{\frac{-n}{2}}\right)^2} = 2^{9n} \times 4^{3n}$, then find the value of $2n$.

(ii) If $\sqrt{x} + \sqrt{x - \sqrt{1-x}} = 1$, then find the value of x.

	(i)	(ii)
A.	3/2	4/5
B.	2	3/5
C.	3	16/25
D.	3	9/25

28. The mean of 150 observations was found to be 45. If at the time of calculation, two items were wrongly taken as 42 and 28 instead of 35 and 25, then find the correct mean.

A. 46

B. 44.9

C. 45.9

D. 43.5

29. Which of the following is incorrect?

A. If three angles of a quadrilateral are equal, then it is always a parallelogram.

B. The line segments joining the mid points of the sides of an equilateral triangle divides it into four congruent triangles.

C. $PQRS$ is a parallelogram in which diagonal SQ bisects $\angle PQR$. If $\angle PQS = 42°$, then $\angle SPQ = 96°$.

D. None of these

30. In the given figure (not drawn to scale), MN is the diameter of circle with centre O. If $\angle MNR = 55°$, $\angle RMT = 30°$ and $\angle MNS = 60°$, then find the value of $\angle NMR$ and $\angle MRT$ respectively.
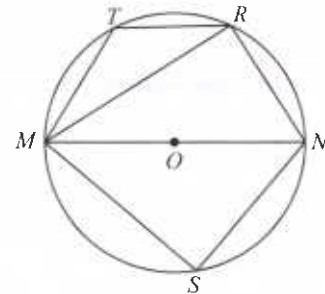
A. 35°, 25°

B. 25°, 15°

C. 45°, 65°

D. 30°, 20°

31. The three vertices of a square $ABCD$ are $A(4, 3)$, $B(-3, 3)$ and $C(-3, -4)$. Find:

(i) The coordinates of D.

(ii) The area of square $ABCD$.

	(i)	(ii)
A.	$(-4, -4)$	49 sq. units
B.	$(3, -4)$	25 sq. units
C.	$(2, -4)$	36 sq. units
D.	$(4, -4)$	49 sq. units

32. In $\triangle DEF$ and $\triangle PQR$, $DE = DF$, $\angle F = \angle P$ and $\angle E = \angle Q$. The two triangles are

A. Isosceles but not necessarily congruent.

B. Isosceles and congruent.

C. Congruent but not isosceles.

D. Neither congruent nor isosceles.

33. An open rectangular cistern when measured from outside is 1.15 m long, 0.94 m broad and 70 cm deep. It is made up of iron, which is 5 cm thick. Find

    (i)   The capacity of cistern.
    (ii) Volume of iron used.

 | | (i) | (ii) |
    | --- | ------------------------ | ------------------------ |
    | A. | 756700 cm^3 | 573300 cm^3 |
    | B. | 756700 cm^3 | 529200 cm^3 |
    | C. | 529200 cm^3 | 227500 cm^3 |
    | D. | 573300 cm^3 | 183400 cm^3 |

34. A tyre manufacturing company kept a record of the distance covered before a tyre needed to be replaced. The table shows the results of 1000 cases.

Distance (in km)	< 4000	4000-9000	9000-14000	> 14000
Frequency	20	210	325	445

    If you buy a tyre of this company, then what is the probability that it will last more than 9000 km?

    A.   0.02
    B.   0.77
    C.   0.445
    D.   0.325

35. In the given figure (not drawn to scale), $\angle DAB$ and $\angle BAC$ are in the ratio 2 : 3 respectively and $AB = DB$. Find the value of x.
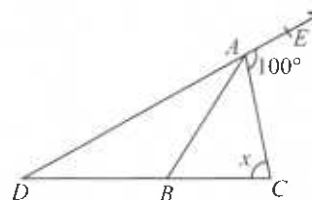
    A.   72°
    B.   68°
    C.   56°
    D.   None of these

EVERYDAY MATHEMATICS

36. A piece of rectangular cardboard sheet measuring 40 inch × 25 inch is made into an open chocolate box by cutting out squares of side 'p' from each corner. Which of the following expressions is equivalent to the volume of the box?

    A. $4p^3 - 120p^2 + 950p$
    B. $4p^3 + 130p^2 + 1000p$
    C. $4p^3 - 130p^2 + 1000p$
    D.   None of these

37. There are some marbles of two colours black and golden in a jar. If the ratio of the number of black marbles to the golden marbles is 5:3 and the total number of marbles in the jar is 120, then how many black marbles are there in the jar?

    A.   45
    B.   75
    C.   60
    D.   80

38. The king, queen and jack of heart cards are removed from the deck of 52 cards and then the remaining cards are well shuffled. One card is selected at random from the remaining cards. What is the probability of getting an ace card?

    A. $\dfrac{3}{49}$ B. $\dfrac{4}{49}$

    C. $\dfrac{12}{52}$ D. $\dfrac{3}{52}$

39. Anya's piggy bank is full of ₹ 10 and ₹ 5 coins. It contains three times as many ₹ 5 coins as ₹ 10 coins. The total amount of money in piggy bank is ₹ 300. How many coins of ₹ 10 are there in the piggy bank?

    A.   12
    B.   36
    C.   18
    D.   16

40. A tank can be filled by two taps P and Q in 15 hours and 20 hours respectively. The full tank can be emptied by a third tap R in 10 hours. If all the three taps are turned on at the same time, then in how much time will the empty tank be filled up completely?

    A.   30 hours
    B.   45 hours
    C.   40 hours
    D.   60 hours

41. A school provides milk to students daily in cylindrical glasses of diameter 7 cm each. If the glass is filled with milk up to a height of 12 cm, then how many litres of milk is needed to serve 1600 students?

    A.   739.2 litres
    B.   538 litres
    C.   740 litres
    D.   400 litres

42. One year ago, Sugandha was four times as old as her son Ritik. Six years hence, Sugandha's age will exceed her son's age by 9 years. What is the ratio of present ages of Sugandha and her son?

A. 9 : 2
B. 11 : 3
C. 12 : 5
D. 13 : 4

43. A company bought 45 laptops and 15 printers to modernize billing operations. If the price of each laptop was $\frac{5}{3}$ times the price of each printer, then what percent of the total cost of the purchase was the total cost of laptops?

A. 72.5 %
B. 78 %
C. 90 %
D. None of these

44. A cycle was sold at a loss of 8%. If it was sold for ₹ 121 more, then there would have been a gain of 3%. What was the cost price and selling price of the cycle respectively?

A. ₹ 1012, ₹ 1000
B. ₹ 1000, ₹ 1300
C. ₹ 1100, ₹ 1012
D. ₹ 1002, ₹ 1100

45. A person has to completely put each of three types of juices, 210 litres of orange juice, 220 litres of guava juice and 260 litres of litchi juice in bottles of equal size without mixing any of the above three types of juices such that each bottle is completely filled. What is the least possible number of bottles required?

A. 45
B. 69
C. 72
D. 55

ACHIEVERS SECTION

46. Match the linear equations given in Column-I with their solutions given in Column-II and select the correct option.

Column-I	Column-II
(P) $5x = -2y + 7$	(a) (0, 0)
(Q) $4x - 6y = 0$	(b) (2, 0)
(R) $3y = \frac{5}{3}x + 7$	(c) (3, -4)
(S) $2x - y = 4$	(d) (3, 4)

A. (P) → (b) ; (Q) → (c); (R) → (a); (S) → (d)
B. (P) → (c) ; (Q) → (b); (R) → (d); (S) → (a)
C. (P) → (c) ; (Q) → (a); (R) → (d); (S) → (b)
D. (P) → (d) ; (Q) → (b); (R) → (a); (S) → (c)

47. Read the statements carefully and select the correct option.

Statement-I : If two circles with centres A and B intersect each other at points M and N, then the line joining the centres AB bisects the common chord MN at right angle.

Statement-II : Two circles of radii 10 cm and 8 cm intersect each other and the length of common chord is 12 cm. Then the distance between their centres is 8 cm.

A. Both Statement-I and Statement-II are true.
B. Both Statement-I and Statement-II are false.
C. Statement-I is false but Statement-II is true.
D. Statement-I is true but Statement-II is false.

48. Let ABC be a triangle in which $AB = 5.8$ cm, $BC + CA = 8.4$ cm and $\angle B = 60°$. Given below are the steps of constructing the triangle ABC. Which of the following options is correct while arranging the steps in correct order?

(P) Join AD.
(Q) From ray BX, cut off line segment $BD = BC + CA = 8.4$ cm.
(R) Draw a line segment AB of length 5.8 cm.
(S) Draw a perpendicular bisector of AD meeting BD at point C. Join AC, ABC is the required triangle.
(T) Draw $\angle ABX = 60°$ at point B of line segment AB.

A. (T) → (R) → (S) → (P) → (Q)
B. (R) → (P) → (T) → (S) → (Q)
C. (R) → (T) → (Q) → (P) → (S)
D. (P) → (R) → (S) → (T) → (Q)

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

(i) The sum of any two sides of a triangle is greater than __P__ the median drawn to the third side.

(ii) The perimeter of a triangle is __Q__ than the sum of its three medians.

(iii) If the altitude from the vertex of a triangle bisects the base, the triangle is __R__.

	P	Q	R
A.	Twice	less	isosceles
B.	Twice	greater	isosceles
C.	Half	less	equilateral
D.	Half	greater	equilateral

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

(i) If the number of observations is odd, then the median is $\left(\dfrac{n}{2}+1\right)^{th}$ observation.

(ii) The mean of 25 observations is 18. Out of these observations, the mean of first 13 observations is 16 and that of the last 13 observations is 20. Then, the 13th observation is 18.

(iii) Mode of the data 17, 21, 11, 48, 35, 11, 19, 17, 12, 13, 11, 15 is 11.

(iv) The mean of first 15 prime natural numbers is 27.5.

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

SPACE FOR ROUGH WORK