I M O

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2018-19
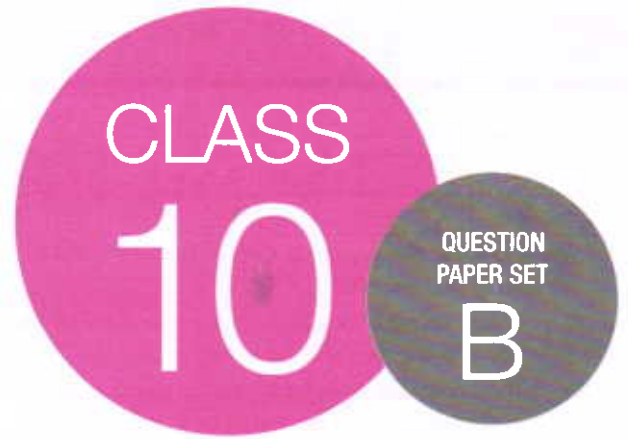
CLASS 10

QUESTION PAPER SET B

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. ● Ⓑ Ⓒ Ⓓ

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.

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1. Some digits are coded as shown below:

Digits	1	2	3	4	5	6	7	8	9
Codes	×	*	?	÷	S	●	+	!	D

While coding the given number following conditions are also to be observed.

   I.   If any number begins with an odd number, then the odd number will be coded as @.
   II. If any number ends with an even number, then the even number will be coded as ©.

   Which of the following will be the code of 236475?
   A.   ?*●÷×@
   B.   *?●÷+@
   C.   ©?●÷+S
   D.   *?●÷+S

2. Three positions of a cube are given below. Which letter will be at the bottom, if letter A is at the top?

   A.   H
   B.   P
   C.   B
   D.   M
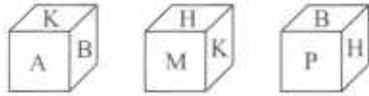
3. If all the symbols are dropped from the given arrangement, then which of the following will be 14th from the left end?
   F 4 © J 2 E % M P 5 W 9 @ I Q R 6 U H 3 Z 7 * A T B 8 V # G $ Y D
   A.   R
   B.   Q
   C.   U
   D.   6

4. Find the missing number, if a certain rule is followed either row-wise or column-wise.

5	7	7
6	3	4
3	8	3
90	168	?

   A.   84
   B.   78
   C.   92
   D.   None of these

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

   PLE37AS91URE

   A.   ЬꞀE37AS191URE
   B.   ЭꞀUI92AS7EꞀ9
   C.   ЬꞀE37AS9IURE
   D.   PLE37AS9IURE

6. Vikas left his home to go to his friend's home. He drove straight for 5 km and then he took a right turn to go another 5 km and again he took a right turn to go another 5 km, then he turned 45° left to travel another 5 km. When he reached his friend's home he realised, North is on his left at 90°. In which direction is his friend's home from his house?
   A.   West
   B.   North-West
   C.   South
   D.   North-East

7. 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 options which will replace the (?) in figure (4).
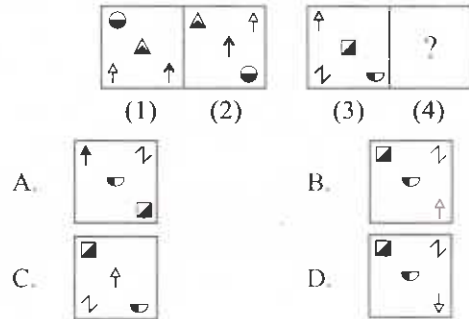

8. If the first and second digits of each of the following numbers are interchanged and then numbers are arranged in ascending order, then which of the following is the middle digit of the middle number in the new arrangement formed?

   518   645   251   273   723

   A.   2
   B.   6
   C.   1
   D.   3

9. Select a figure from the options which satisfies the same conditions of placement of the dots as in the given figure.
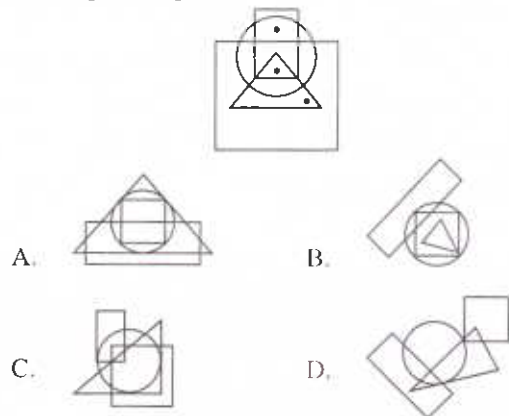
10. If 'A $ B' means 'A is brother of B', 'A @ B' means 'A is wife of B', 'A # B' means 'A is daughter of B' and 'A* B' means 'A is father of B', then which of the following expressions indicates the relationship 'U is father-in-law of P'?

A. P@Q$W*T#U
B. P@W$Q*T#U
C. P@Q$T#U*W
D. P@Q$T#W*U

11. A word arrangement machine when given an input line of words, rearranges them by following a particular rule in each step. The following is an illustration of input and steps of rearrangement.

Input : window open shut door house full of goods
Step I : of window open shut door house full goods
Step II : of door window open shut house full goods
Step III : of door full window open shut house goods
Step IV : of door full open window shut house goods
Step V : of door full open shut window house goods
Step VI : of door full open shut goods window house
Step VII: of door full open shut goods house window
And step VII is the last step of the given input.

As per the rule followed in the above steps, which of the following will be the third step for the given below input?

Input : he was getting ready to start for office

A. he to for was ready getting office start
B. he to was for getting ready start office
C. he to for was ready getting start office
D. Can't be determined

12. In which of the following figures, the given figure is exactly embedded as one of its parts?

A.   B.

13. Given question consists of 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 which would most closely resembles the unfolded form of Fig. (Z).

A.   B.

C.   D.

14. Which of the following figures will complete the given figure matrix?

O	C	S
T	B	?
K	N	Z

A. W   B. P

C. V   D. Q

15. How many pairs of letters are there in the word COMMUNICATION, which have as many letters between them in the word as in the English alphabet?

A. Five
B. Two
C. Three
D. More than five

MATHEMATICAL REASONING

16. Heights of students of class X are given in the following distribution:

Heights (in cm)	150-155	155-160	160-165	165-170	170-175
Number of students	13	10	20	10	7

Find the modal height.

A. 150 cm   B. 170 cm
C. 162.5 cm   D. None of these

17. If α, β and γ are the zeroes of the polynomial $f(x) = ax^3 + bx^2 + cx + d$, then $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} =$

A. $-\frac{b}{d}$ B. $\frac{c}{d}$

C. $-\frac{c}{d}$ D. $\frac{c}{a}$

18. Which of the following is INCORRECT?

    A. If x is a rational number, such that the prime factorisation of denominator is not in the form $2^n 5^m$, (where m and n are non-negative integers), then it has a decimal expansion which is non-terminating and repeating.

    B. $5 + \sqrt{2}$ is an irrational number.

    C. Every composite number can be expressed as a product of primes.

    D. None of these

19. Which of the following graphs has more than three distinct real roots?

    A.

    B.

    C.

    D.
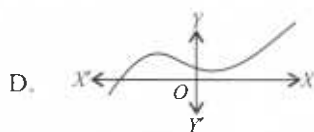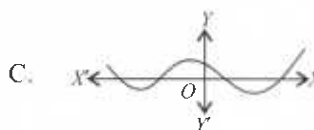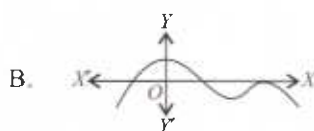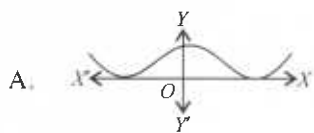
20. If $2x - 3y = 7$ and $(a + b)x - (a + b - 3)y = 4a + b$ represent coincident lines, then a and b satisfy the equation

    A. $a + 5b = 0$
    B. $5a + b = 0$
    C. $a - 5b = 0$
    D. $5a - b = 0$

21. ABC is an isosceles triangle right-angled at B. Similar triangles ACD and ABE are constructed on sides AC and AB. Find the ratio between the areas of $\triangle ABE$ and $\triangle ACD$.

    A. $3 : 2$
    B. $2 : 3$
    C. $\sqrt{2} : 1$
    D. $1 : 2$

22. The points (x, y), (x_1, y_1) and $(x - x_1, y - y_1)$ are collinear, if

    A. $xy_1 = x_1 y$
    B. $xy = x_1 y_1$
    C. $xx_1 = yy_1$
   D. $x + x_1 = y + y_1$

23. If $x \neq y$ and the sequences x, a_1, a_2, y and x, b_1, b_2, y each are in A.P., then $\left(\dfrac{a_2 - a_1}{b_2 - b_1} \right)$ is _____.

    A. $\dfrac{2}{3}$

    B. $\dfrac{3}{2}$

    C. 1

    D. $\dfrac{3}{4}$

24. A hand fan is made by stitching 10 equal sized triangular strips of two different coloured papers as shown. The dimensions of equal strips are 13 cm, 13 cm and 24 cm. Find the area of white coloured paper needed to make the hand fan.

    A. 220 cm^2
    B. 150 cm^2
    C. 600 cm^2
    D. 300 cm^2

25. In the given figure, arcs are drawn by taking vertices, A, B and C of an equilateral triangle side 10 cm to intersect the sides BC, CA and AB at their respective mid-points D, E and F. Find the area of the shaded region. (Use $\pi = 3.14$)
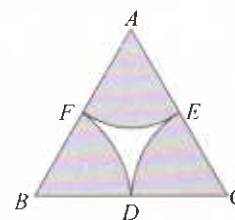
    A. 39.25 cm^2
    B. 82.52 cm^2
    C. 42.20 cm^2
    D. None of these

26. A jar contains 54 marbles of blue, green and white colours. The probability of selecting a blue marble at random from the jar is $\dfrac{1}{3}$, and the probability of selecting a green marble at random is $\dfrac{4}{9}$. How many white marbles does the jar contain?

A. 12
B. 6
C. 9
D. 11

27. Evaluate: $\dfrac{\sec 39°}{\csc 51°} + \dfrac{2}{\sqrt{3}}\tan 17°\tan 38°\tan 60°\tan 52°$
$\tan 73° - 3(\sin^2 31° + \sin^2 59°)$

A. 0
B. 1
C. $\sin 45°$
D. $\cos 30°$

28. A reservoir which is in the form of a frustum of a right circular cone, contains (44×10^7) litres of water which fills it completely. The radii of the bottom and top of the reservoir are 50 metres and 100 metres respectively. Find the lateral surface area of the reservoir. (Take $\pi = 22/7$)

A. 32150.2 m^2
B. 17264.2 m^2
C. 26146.23 m^2
D. None of these

29. 2 is a root of the equation $x^2 + bx + 12 = 0$. If equation $x^2 + bx + q = 0$ has equal roots, then $q =$

A. 8
B. -8
C. 16
D. -16

30. Five coins were simultaneously tossed 1000 times and at each toss the number of heads were observed. The number of tosses during which 0, 1, 2, 3, 4 and 5 heads were obtained are shown in the table below. Find the mean number of heads per toss.

No. of heads per toss	No. of tosses
0	38
1	144
2	342
3	287
4	164
5	25
Total	1000

A. 5.92
B. 1.28
C. 2.47
D. 4.23

31. The coordinates of the third vertex of an equilateral triangle whose two vertices are at (3, 4), (−2, 3) are

A. (1, 7)
B. (5, 1)
C. $\left(\dfrac{1+\sqrt{3}}{2}, \dfrac{7-5\sqrt{3}}{2}\right)$ or $\left(\dfrac{1-\sqrt{3}}{2}, \dfrac{7+5\sqrt{3}}{2}\right)$
D. (−5, 5)

32. Find the height of a mountain, if the elevation of its top at an unknown distance from the base is 30° and at a distance 10 km further off from the mountain, along the same line, the angle of elevation is 15°. (Use : $\tan 15° = 0.27$)

A. 9.76 km
B. 5.07 km
C. 4.90 km
D. 8.02 km

33. Find the value of k, for which the polynomial $p(x) = x^{100} + 2x^{99} + k$ is exactly divisible by $(x + 1)$.

A. 1
B. 0
C. −1
D. −3

34. In the given figure (not drawn to scale), O is the centre of the circle, $\angle OAB = 30°$ and $\angle OCB = 55°$. Find $\angle BOC$ and $\angle AOC$ respectively.
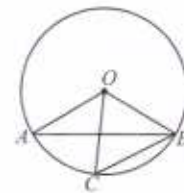
A. 50°, 30°
B. 70°, 50°
C. 120°, 50°
D. 70°, 30°

35. The following table shows the life time of 300 lamps.

Life time (in hours)	100-200	200-300	300-400	400-500	500-600	600-700	700-800
Number of lamps	38	12	48	42	43	65	52

A lamp is selected at random. Find the probability that the life time of the selected lamp is

(i) less than 300 hours   (ii) atleast 200 hours.

	(i)	(ii)
A.	19/75	131/150
B.	131/150	15/6
C.	49/150	131/150
D.	1/6	131/150

36. A can build a wall in 25 days and B can demolish the same wall in 80 days and C can build the same wall in 60 days. If they work on consecutive days one after another starting from A on the first day. Then, in how many days will the work be completed?

   A.   67 days

   B. $67\dfrac{17}{24}$ days

   C. $66\dfrac{17}{24}$ days

   D. $68\dfrac{17}{24}$ days

37. Price of a chair is greater than the price of a table by ₹ 400. If the price of 6 chairs and 6 tables is ₹ 4800, then by how much percent the price of a table is less than the price of a chair?

   A. $\dfrac{200}{3}\%$

   B.   25%

   C. $37\dfrac{1}{2}\%$

   D. $\dfrac{2}{3}\%$

38. A student on his birthday distributed on an average 5 chocolates per student. If on the arrival of the teacher and the headmaster to whom the student gives 10 and 15 chocolates respectively, the average chocolate distributed per head increases to 5.5, then what is the number of students in the class?

   A.   28
   B.   30
   C.   32
   D.   36

39. Priyansh wants to plant 42 mango trees, 49 apple trees and 63 banana trees in equal rows. Also, he wants to make distinct rows of trees, i.e., only one type of tree in one row. Find the minimum of number rows required.

   A.   22
   B.   7
   C.   17
   D.   15

40. A group consists of 15 males and 12 females. Write a quadratic polynomial whose roots are equal to the number of males and females.

   A. $x^2 - 27x + 180$
   B. $x^2 + 27x - 180$
   C. $x^2 + 3x - 27$
   D.   None of these

41. A square water tank has its sides equal to 40 m. There are four semicircular grassy plots all around it. Find the cost of turfing the plots at ₹ 1.25 per sq. m. (Take $\pi = 3.14$)

   A.   ₹ 2671
   B.   ₹ 4401
   C.   ₹ 2512
   D.   ₹ 3140

42. A school decided to award prizes to the most punctual and disciplined students. The sum of two prizes is ₹ 95 and their product is ₹ 2250. Calculate the prize money of the two prizes.

   A.   ₹ 50, ₹ 45
   B.   ₹ 60, ₹ 35
   C.   ₹ 70, ₹ 25
   D.   None of these

43. A steamer goes downstream from one port to another in 4 hours. It covers the same distance upstream in 5 hours. If the speed of the stream is 2 km/h, then find the distance between the two ports.

   A.   50 km
   B.   60 km
   C.   70 km
   D.   80 km

44. A girl calculates that the probability of her winning the first prize in a lottery is 1/30. If 9000 tickets are sold, then how many tickets has she bought?

   A.   300
   B.   450
   C.   900
   D.   350

45. The internal radius and thickness of a hollow metallic pipe are 24 cm and 1 cm respectively. If it is melted and recast into a solid cylinder of equal length, then find the diameter of the solid cylinder.

   A.   7 cm
   B.   14 cm
   C.   96 cm
   D.   98 cm

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

    Statement-I : The sum of first n terms of an A.P. whose first term is A, the second term is B and the last term is L, is equal to $\dfrac{(B+L-2A)(A+L)}{2(B-A)}$.

    Statement-II : If the sum of p terms of an A.P. is equal to the sum of its q terms, then the sum of its $(p+q)$ terms is $p + q$.

    A.   Both Statement-I and Statement-II are false.

    B.   Both Statement-I and Statement-II are true.

    C.   Statement-I is true but Statement-II is false.

    D.   Statement-I is false but Statement-II is true.

47. An iron pillar has some part in the form of a right circular cylinder and remaining in the form of a right circular cone. The radius of base of each of cone and cylinder is 8 cm. The cylindrical part is 240 cm high and the conical part is 36 cm high. Find

    (i)   The volume of iron used

    (ii) The weight of pillar, if 1 cm^3 of iron weighs 10 g.

	(i)	(ii)
A.	50688 cm^3	826.65 kg
B.	42652 cm^3	705.23 kg
C.	50688 cm^3	506.88 kg
D.	None of these	

48. Which of the following options is incorrect?

    A.   If the points are collinear, then the area of the triangle formed by the points is zero.

    B.   If the vertices of a ΔABC are (x, y), $(x_1, 0)$ and $(0, y_1)$, such that $\dfrac{x}{x_1}+\dfrac{y}{y_1}=1$, then the three points are collinear.

    C.   The distance between the points (6 cos 45°, 0) and (0, 6 sin 45°) is 1.

    D.   The coordinates of the centroid of triangle formed by the points (x, y), $(0, y_1)$ and $(x_1, 0)$ is $\left(\dfrac{x+x_1}{3}, \dfrac{y+y_1}{3}\right)$.

49. If each of a, b and c is a positive acute angle such that sin $(a + b - c) = 1/2$, cos $(b + c - a) = 1/2$ and tan $(c + a - b) = 1$, then find the values of a, b and c respectively.

    A.   30°, 60°, 90°

    B.   45°, 45°, 90°

    C.   30°, 45°, 60°

    D. $\left(37\dfrac{1}{2}\right)^{\circ}, 45°, \left(52\dfrac{1}{2}\right)^{\circ}$

50. Match the following and select the correct option.

	Column-I		Column-II
(i)	Probability that a leap year has 53 sundays is	(p)	$\dfrac{1}{7}$
(ii)	If $P(A) = \dfrac{6}{7}$, then $P(\text{not } A) =$	(q)	$\dfrac{2}{7}$
(iii)	Probability of getting at most 2 heads in a throw of two coins is	(r)	$\dfrac{1}{2}$
(iv)	Probability of getting a red card from a pack of 52 playing cards is	(s)	1

    A.   (i)→(q); (ii)→(r); (iii)→(p); (iv)→(s)

    B.   (i)→(q); (ii)→(p); (iii)→(s); (iv)→(r)

    C.   (i)→(s); (ii)→(q); (iii)→(p); (iv)→(r)

    D.   (i)→(p); (ii)→(q); (iii)→(s); (iv)→(r)

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