BK BIRLA CENTRE FOR EDUCATION
SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARYCO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL
PRE-BOARD EXAMINATION 1

B K BIRLA CENTRE FOR EDUCATION
(Sarala Birla Group of Schools)

INDIAN PUBLIC SCHOOLS' CONFERENCE

CLASS:X
MAX.MARKS:80

MATHEMATICS
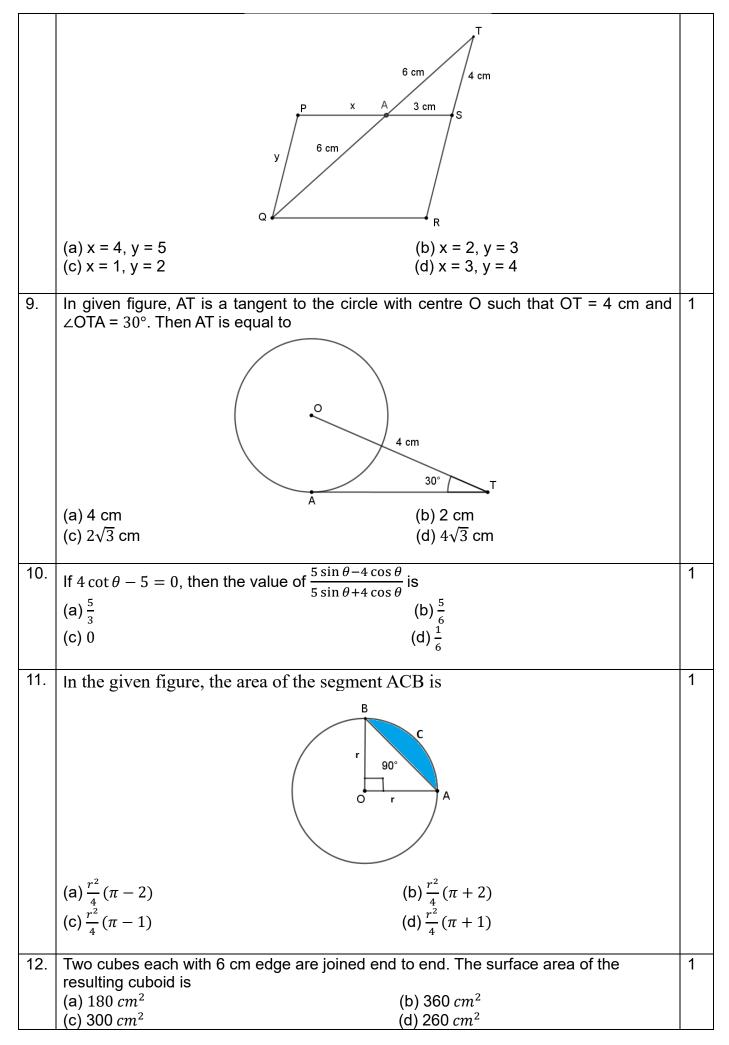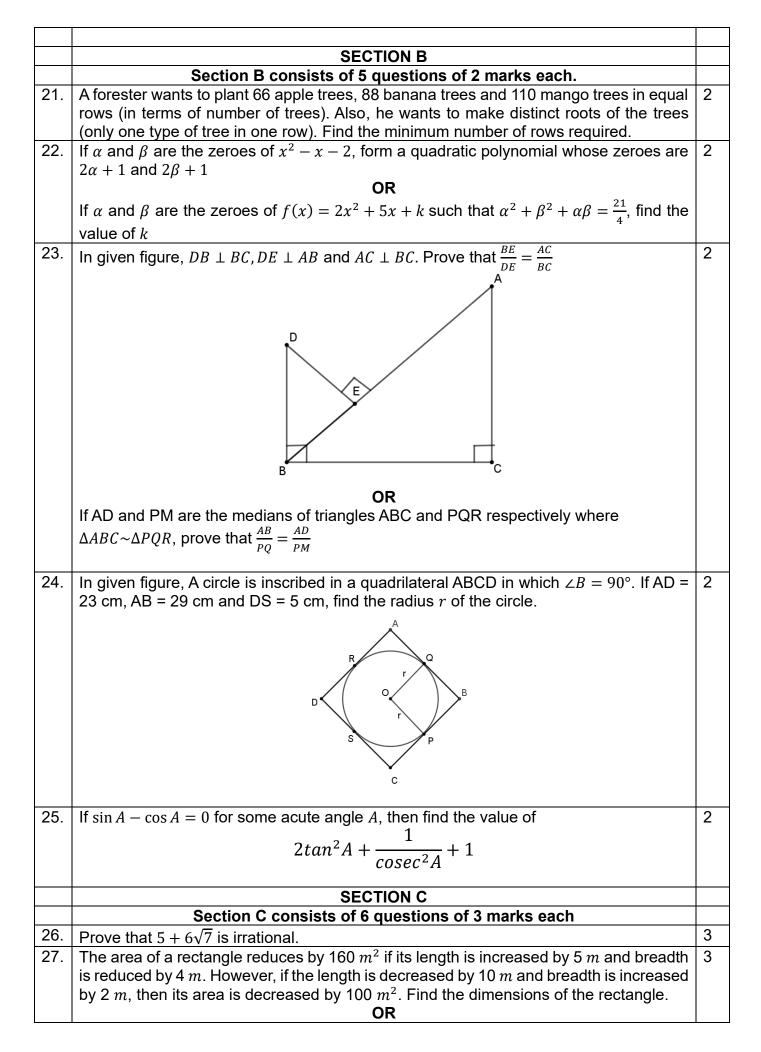
DATE:19-12-23
TIME:3HRS

General Instructions:
1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A
Section A consists of 20 questions of 1 mark each.

1.	A quadratic polynomial, the sum of whose zeroes is 0 and one zero is 4, is (a) $x^2 - 16$ (b) $x^2 + 16$ (c) $x^2 + 4$ (d) $x^2 - 4$	1
2.	In a formula racing competition, the time taken by two racing cars A and B to complete 1 round of the track is 30 minutes and **p** minutes respectively. If the cars meet again at the starting point for the first time after 90 minutes and the HCF (30, **p**) = 15, then the value of **p** is (a) 45 minutes (b) 60 minutes (c) 75 minutes (d) 180 minutes	1
3.	Graphically, the pair of equations $6x - 3y + 10 = 0$ and $2x - y + 9 = 0$ represents two lines which are (a) intersecting at exactly one point (b) intersecting at exactly two points (c) coincident (d) parallel	1
4.	If the quadratic equation $x^2 - 8x + k = 0$ has real roots, then (a) $k < 16$ (b) $k \le 16$ (c) $k > 16$ (d) $k \ge 16$	1
5.	If the sum of first n odd natural numbers is equal to k times the sum of first n even natural numbers, then k is equal to (a) $\dfrac{n+1}{2n}$ (b) $\dfrac{2n}{n+1}$ (c) $\dfrac{n+1}{n}$ (d) $\dfrac{n}{n+1}$	1
6.	Two APs have the same common difference. The first term of one of these is −1 and that of the other is − 8. Then the difference between their 4th terms is (a) -1 (b) -8 (c) 7 (d) -9	1
7.	If in two triangles, DEF and PQR, $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true? (a) $\dfrac{EF}{PR} = \dfrac{DF}{PQ}$ (b) $\dfrac{EF}{RP} = \dfrac{DE}{PQ}$ (c) $\dfrac{DE}{QR} = \dfrac{DF}{PQ}$ (d) $\dfrac{EF}{RP} = \dfrac{DE}{QR}$	1
8.	In given figure, PQRS is a parallelogram, if AT = AQ = 6 cm, AS = 3 cm and TS = 4 cm, then	1

(a) x = 4, y = 5   (b) x = 2, y = 3

(c) x = 1, y = 2   (d) x = 3, y = 4

9.	In given figure, AT is a tangent to the circle with centre O such that OT = 4 cm and ∠OTA = 30°. Then AT is equal to	1

(a) 4 cm   (b) 2 cm

(c) $2\sqrt{3}$ cm   (d) $4\sqrt{3}$ cm

10.	If $4\cot\theta - 5 = 0$, then the value of $\frac{5\sin\theta - 4\cos\theta}{5\sin\theta + 4\cos\theta}$ is	1

(a) $\frac{5}{3}$ (b) $\frac{5}{6}$

(c) 0   (d) $\frac{1}{6}$

11.	In the given figure, the area of the segment ACB is	1

(a) $\frac{r^2}{4}(\pi - 2)$ (b) $\frac{r^2}{4}(\pi + 2)$

(c) $\frac{r^2}{4}(\pi - 1)$ (d) $\frac{r^2}{4}(\pi + 1)$

12.	Two cubes each with 6 cm edge are joined end to end. The surface area of the resulting cuboid is (a) 180 cm^2 (b) 360 cm^2 (c) 300 cm^2 (d) 260 cm^2	1

13.	A sphere of maximum volume is cut out from a solid hemisphere of radius 7 cm. Then the ratio of the volume of the original hemisphere to that of the cut-out sphere is (a) $2:1$ (b) $16:1$ (c) $3:1$ (d) $4:1$	1
14.	The distance between two points A and B, on a graph is given as $\sqrt{10^2 + 7^2}$. The coordinates of A are $(-4,3)$. Given that the point B lies in the first quadrant, then all the possible x-coordinates of point B are (a) multiple of 2 (b) multiple of 3 (c) multiple of 5 (d) multiple of 6	1
15.	If $A(1,2)$, $B(4,3)$ and $C(6,6)$ are the three vertices of a parallelogram ABCD, then the coordinates of the fourth vertex D are (a) $\left(\frac{1}{2}, 4\right)$ (b) $\left(\frac{7}{2}, 5\right)$ (c) $(3,4)$ (d) $(3,5)$	1
16.	Two linear equations in variables x and y are given below: $a_1x + b_1y + c = 0$ $a_2x + b_2y + c = 0$ Which of the following pieces of information is independently sufficient to determine if a solution exists or not for this pair of linear equations? I. $\frac{a_1}{b_1} = \frac{a_2}{b_2} = 1$ II. $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ III. $\frac{a_1}{a_2} = \frac{a_1}{b_1} \neq 1$ IV. $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (a) IV only (b) I and IV (c) II and IV (d) I and III	1
17.	If mode of some data is 7 and their mean is also 7 then their median is (a) 10 (b) 9 (c) 8 (d) 7	1
18.	In an MCQ test, a student guesses the correct answer x out of y times. If the probability that the student guesses the answer to be wrong is $\frac{2}{3}$ then what is the relation between x and y (a) $y = 3x$ (b) $x = 3y$ (c) $3x = 2y$ (d) $2x = 3y$	1
	ASSERTION REASON BASED QUESTIONS: **In the question number 19 and 20, a statement of Assertion(A) is followed by a statement of Reason (R).** **Choose the correct answer out of the following choices** **(a) Both (A) and (R) are true and (R) is the correct explanation of (A).** **(b) Both A and (R) are true and (R) is not the correct explanation of (A).** **(c) (A) is true but (R) is false.** **(d) (A) is false but (R) is true.**	
19.	**Assertion(A):** Maximum value of $\frac{1}{\sec\theta} + \frac{1}{cosec\,\theta}$ is 1 **Reason(R):** Maximum value of both $\sin\theta$ and $\cos\theta$ is 1	1
20.	**Assertion(A):** The probability of getting a bad egg in a lot of 400 is 0.035. The number of good eggs in the lot is 386. **Reason(R):** If the probability of an event is p, the probability of its complementary event will be 1-p	1

		SECTION B	
		Section B consists of 5 questions of 2 marks each.	
21.	A forester wants to plant 66 apple trees, 88 banana trees and 110 mango trees in equal rows (in terms of number of trees). Also, he wants to make distinct roots of the trees (only one type of tree in one row). Find the minimum number of rows required.		2
22.	If α and β are the zeroes of $x^2 - x - 2$, form a quadratic polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$ **OR** If α and β are the zeroes of $f(x) = 2x^2 + 5x + k$ such that $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$, find the value of k		2
23.	In given figure, $DB \perp BC, DE \perp AB$ and $AC \perp BC$. Prove that $\frac{BE}{DE} = \frac{AC}{BC}$ **OR** If AD and PM are the medians of triangles ABC and PQR respectively where $\Delta ABC \sim \Delta PQR$, prove that $\frac{AB}{PQ} = \frac{AD}{PM}$		2
24.	In given figure, A circle is inscribed in a quadrilateral ABCD in which $\angle B = 90°$. If AD = 23 cm, AB = 29 cm and DS = 5 cm, find the radius r of the circle. 		2
25.	If $\sin A - \cos A = 0$ for some acute angle A, then find the value of $$2tan^2A + \frac{1}{cosec^2A} + 1$$		2
		SECTION C	
		Section C consists of 6 questions of 3 marks each	
26.	Prove that $5 + 6\sqrt{7}$ is irrational.		3
27.	The area of a rectangle reduces by 160 m^2 if its length is increased by 5 m and breadth is reduced by 4 m. However, if the length is decreased by 10 m and breadth is increased by 2 m, then its area is decreased by 100 m^2. Find the dimensions of the rectangle. **OR**		3

	If 16 is subtracted from twice the greater of two positive numbers, the result is half the other number. If 1 is subtracted from half the greater number, the result is still half the other number. Find the two numbers.	5
28.	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$.	3
29.	Prove that: $(sin^4\theta - cos^4\theta + 1)cosec^2\theta = 2$ **OR** If $\sin x + cosec\ x = 2$, then find the value of $sin^{19}x + cosec^{20}x$	3
30.	A right circular cylinder and a cone have equal bases and equal heights. If their curved surface areas are in the ratio $8:5$, then find the ratio between the radius of their bases to their heights.	3
31.	One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting (i) a face card or a black card (ii) neither an ace nor a king (iii) a jack and a black card	3

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SECTION D

Section D consists of 4 questions of 5 marks each

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32.	The marks obtained by 80 students of Class X in a mock test of Mathematics are given below in the table: <table><tr><td>Marks</td><td>Number of students</td></tr><tr><td>0 and above</td><td>80</td></tr><tr><td>10 and above</td><td>77</td></tr><tr><td>20 and above</td><td>72</td></tr><tr><td>30 and above</td><td>65</td></tr><tr><td>40 and above</td><td>55</td></tr><tr><td>50 and above</td><td>43</td></tr><tr><td>60 and above</td><td>28</td></tr><tr><td>70 and above</td><td>16</td></tr><tr><td>80 and above</td><td>10</td></tr><tr><td>90 and above</td><td>8</td></tr><tr><td>100 and above</td><td>0</td></tr></table> Find the median and the mode of the data **OR** If the mean of the following frequency distribution is 91, find the missing frequencies x and y <table><tr><td>Classes</td><td>Frequencies</td></tr><tr><td>0-30</td><td>12</td></tr><tr><td>30-60</td><td>21</td></tr><tr><td>60-90</td><td>x</td></tr><tr><td>90-120</td><td>52</td></tr><tr><td>120-150</td><td>y</td></tr><tr><td>150-180</td><td>11</td></tr><tr><td>Total</td><td>150</td></tr></table>	5
33.	State and prove Basic proportionality theorem. In $\triangle ABC$, if DE ∥ BC, AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then using the above result, find the value of x	5
34.	A man on the top of a vertical tower observes a car moving at a uniform speed coming directly towards it. If it takes 12 minutes for the angle of depression to change form $30°$ to $45°$, how soon after this, will the car reach the tower? Give your answer to nearest minutes. (Use $\sqrt{3} = 1.73$)	5

	OR	
	If the angle of elevation of a cloud from a point 10 metres above a lake is 30° and the angle of depression of its reflection in the lake is 60°, find the height of the cloud from the surface of the lake	
35.	A flight left 30 minutes later than the scheduled time and in order to reach its destination 1500 km away in time it has to increase its speed by 250 km/hr from its usual speed. Find its usual speed.	5

	SECTION E	
	Section E consists of 3 Case Studies of 4 marks each	
36.	Shown below is the trophy shield Akshi received on winning an international Table tennis tournament. The trophy is made of a glass sector DOC supported by identical wooden right triangles Δ DAO and Δ COB. Also, AO = 7 cm and AO : DA = 1 : $\sqrt{3}$ (Use $\sqrt{3} = 1.73$) Based on the given information, answer the following questions:	
	(i) Find ∠DOC	1
	(ii) Find the area of the wooden triangles	1
	(iii) Find the area of the shape formed by the glass portion **OR** If Akshi wants to decorate the boundary of the glass portion with glitter tape, then find the length of the tape she needs.	2
37.	A school auditorium has to be constructed with a capacity of 2000 people. The chairs in the auditorium are arranged in a concave shape facing towards the stage in such a way that each succeeding row has 5 seats more than the previous one. 	

	(i) If the first row has 15 seats, then how many seats will be there in 12th row?		1
	(ii) If there are 15 rows in the auditorium, then how many seats will be there in the middle row?		1
	(iii) If total 1875 guests were there in the auditorium for a particular event, then how many rows will be needed to make all of them sit? **OR** If total 1250 guests were there in the auditorium for a particular event, then how many rows will be left blank out of total 30 rows?		2
38.	The students of Class X of a secondary school have been allotted a rectangular plot of land for their gardening activity. Saplings are being planted on the boundary at a distance of 1 m from each other. There is a triangular grassy lawn in the plot as shown in the figure. The students are to row seeds of the flowering plant on the remaining area of the plot 		
	(i) If a tree is to be planted exactly in the middle of the triangle PQR ie. at the centroid of ΔPQR to give shed to the people sitting in the lawn, then find the coordinates of the point where the tree should be planted		1
	(ii) What type of triangle is formed by the grassy lawn?		1
	(iii) Find the area of the plot in which the students have to row the seeds. **OR** If a special flowering plant has to be planted at a point which divides the line joining the points C and Q in the ratio 2:3, then find the coordinates of the point where this plant will be planted		2

********END OF QUESTION PAPER**********