केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

Kendriya Vidyalaya Sangathan Regional Office Raipur

तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

MATHEMATICS

Class - X

Question Bank Term- II 2021-22

केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

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MESSAGE FROM DUPUTY COMMISSIONER

It is a matter of great pleasure for me to publish study material for different subjects of classes X and XII for Raipur Region. Getting acquainted and familiarized with the recent changes in curriculum and assessment process made by CBSE vide Circular No. 51 and 53 issued in the month of July 2021 will help students to prepare themselves better for the examination. Sound and deeper knowledge of the Units and Chapters is must for grasping the concepts, understanding the questions. Study materials help in making suitable and effective notes for quick revision just before the examination.

Due to the unprecedented circumstances of COVID-19 pandemic the students and the teachers are getting very limited opportunity to interact face to face in the classes. In such a situation the supervised and especially prepared value points will help the students to develop their understanding and analytical skills together. The students will be benefitted immensely after going through the question bank and practice papers. The study materials will build a special bond and act as connecting link between the teachers and the students as both can undertake a guided and experiential learning simultaneously. It will help the students develop the habit of exploring and analyzing the ***Creative & Critical Thinking Skills***. The new concepts introduced in the question pattern related to case study, reasoning and ascertain will empower the students to take independent decision on different situational problems. The different study materials are designed in such a manner to help the students in their self-learning pace. It emphasizes the great pedagogical dictum that *'everything can be learnt but nothing can be taught'*. The self-motivated learning as well as supervised classes will together help them achieve the new academic heights.

I would like to extend my sincere gratitude to all the principals and the teachers who have relentlessly striven for completion of the project of preparing study materials for all the subjects. Their enormous contribution in making this project successful is praiseworthy.

Happy learning and best of luck!

Vinod Kumar
(Deputy Commissioner)

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Kendriya Vidyalaya Sangathan Regional Office Raipur

Our Patorn

Vinod Kumar
Deputy Commissioner
KVS RO Raipur

Smt.Biraja Mishra
Assistant Commissioner
KVS RO Raipur

Sh.A.K. Mishra
Assistant Commissioner
KVS RO Raipur

SH.V.ARORA
PRINCIPAL, KV BMY BHILAI

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COMPILED BY: 1. Dr. Mridula Chaturvedi (KV DURG)

2. Mrs. Bindu Shivrajan (KV DURG)

1. TOPIC "QUADRATIC EQUATIONS "

KEY POINTS:

1. The polynomial of degree two is called quadratic polynomial and equation corresponding to a Quadratic polynomial P(x) is called a quadratic equation in variable x.

Thus $p(x) = ax^2 + bx + c = 0$, $a \neq 0$, $a, b, c \in R$.

2. Zero of a quadratic polynomial:

The value of x for which the polynomial becomes zero is called zero of a polynomial.

Ex. 1 is zero of a polynomial $x^2 - 2x + 1$, because it became zero at x = 1.

3. Solution of a quadratic equation by factorisation method:

Roots of a quadratic equation $ax^2 + bx + c = 0$ can be found by factorization method or middle term split.

4. Discriminant method: The expression $b^2 - 4ac$ is called discriminant of the equation

$ax^2 + bx + c = 0$ and it is usually denoted by "D". $D = b^2 - 4ac$

5. Nature of roots of $ax^2 + bx + c = 0$

i) If D >0, then roots are real and unequal.

ii) D =0, Then the equation has real and equal roots.

Iii) D< 0, then the equation has no real roots.

iv) If D>0, and D is a perfect square, then roots are rational and unequal.

v) If D>0 and D is not a perfect square, then roots are irrational.

6. Roots of quadratic Equation:

Let the quadratic equation be $ax^2 + bx + c = 0$, $a \neq 0$ and α and β are roots

$\alpha = \frac{-b-\sqrt{b2-4ac}}{2a}$, $\beta = \frac{-b+\sqrt{b2-4ac}}{2a}$

7. Sum of Roots : $\alpha + \beta = \frac{-b}{a}$ Product of Roots : $\alpha \times \beta = \frac{c}{a}$

8. Forming quadratic equation ,when the roots α and β are given by :

$X^2 - (\alpha + \beta)\, x + \alpha.\beta = 0$

9. Method of solving Word Problems:

10. Form the word problems into quadratic equations and solve them

(2 Marks Questions)

Q.1 If ½ is a root of the equation $x^2 + px - 5/4 = 0$, then find the value of p.

Q.2 Check whether x= -1 is a solution of equation $4x^2 - 3x - 1 = 0$.

Q.3 If D >0, Then write the roots of a quadratic equation $ax^2 + bx + c = 0$

Q.4 Find the Discriminant of $x^2 + 5x + 5 = 0$.

Q.5 Find the sum of roots of a quadratic equation $x^2 + 4x - 32 = 0$

Q.6 Find the product of the roots of the quadratic equation $2x^2 + 7x - 4 = 0$

Q.7 Find the value of K for which the equation $9x^2 + 2Kx + 1 = 0$ have real roots.

Q.8 Find the value of K if the equation $x^2 - 2(K+1)x + K^2 = 0$ has equal roots.

Q.9 Represent the situation in the form of Quadratic equation:

"The product of Rohan's age (in years) 5 years ago with his age 9 years later is 15.

Q.10 Find the roots of $x^2 - 3x - 10 = 0$

(3 Marks each)

Q.11 What is the nature of roots of the quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$?

Q.12 Find the numerical difference of the roots of equation $x^2 - 7x - 18 = 0$

Q.13 If the discriminant of the equation $6x^2 - bx + 2 = 0$ is 1, then find the value of b.

Q.14 The product of two consecutive odd numbers is 483.Find the numbers.

Q.15 Solve : $x - \frac{1}{x} = 3 \quad (x \neq 0)$

Q.16 The hypotenuse of right angled triangle is 6 meters. more than twice the shortest side.

If the third side is 2 meters. less than the hypotenuse, then find all the sides of the triangle.

Q.17 The sum of the reciprocals of Anjali's age 3 years ago and 5 years from now is 1/3.

Find the present age of Anjali.

Q.18 Check whether: $(x+2)^3 = 2x(x^2 - 1)$ is a quadratic equation or not.

Q.19 Solve for x : $\sqrt{2x+9} + x = 13$.

Q.20 Find the roots of quadratic equation $16x^2 - 24x - 1 = 0$ by using the quadratic formula

(4 Marks each)

Q.21 A passenger train takes 3 Hour less for a journey of 360 km. If its speed is increased by 10km/ h from its usual speed. Find its usual speed.

Q.22 The speed of boat in still water is 15 km/h. It can go 30 km upstream and return downstream to the original point in 4 hour and 30 minutes. Find the speed of stream.

Q.23 Two pipes running together can fill a small tank in $3\frac{1}{3}$ minutes. If one pipe takes 3 minutes more than the other to fill it, then find the time in which each pipe would fill the tank.

Q.24 Solve for:

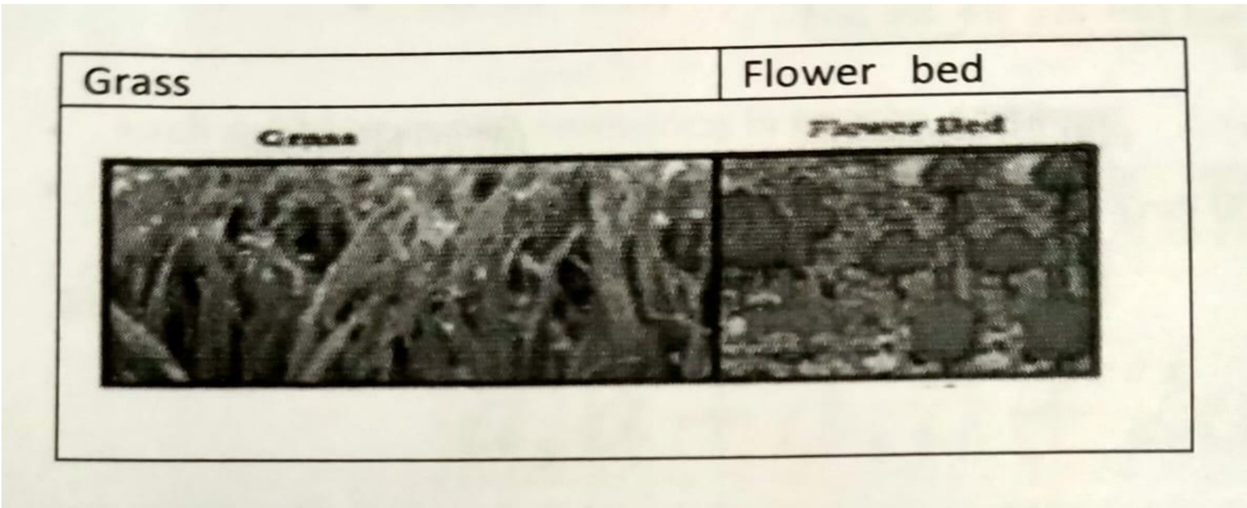
$$\frac{1}{(x-1)(x-2)} + \frac{1}{(x-2)(x-3)} = \frac{2}{3} \quad \text{,where } x \neq 1,2,3$$

Q.25 If the equation $(1+m^2)\,x^2 + (2mc)\,x + (c^2 - a^2) = 0$ has equal roots, then prove that

$c^2 = a^2\,(1+m^2)$

CASE –STUDY QUESTIONS (4 MARKS)

Q.26 Riya has a field with a flowerbed and grass land. The grassland is in the shape of rectangle while flowerbed is in the shape of square. The length of the grassland is found to be 3 meters more than twice the length of the flowerbed. Total area of the whole land is 1260 m^2.



(i) If the length of the flowerbed is x meters, then what is the total length of the field? (2 Marks)

(ii) What is the area of grassland? (2 Marks)

Q. 27 Nidhi and Riya are very close friends. Nidhi's parents have a Maruti Alto. Riya 's parents have a Toyota. Both the families decided to go for a picnic to Somnath Temple in Gujarat by their own car. Nidhi's car travels x km/h, while Riya's car travels 5km/h more than Nidhi's car. Nidhi's car took 4 hours more than Riya's car in covering 400 km.

(i) What will be the distance covered by Riya's car in two hours? How much time took Riya to travel 400 km? (2 Marks)

(ii) Write the quadratic equation describe the speed of Nidhi's car. What is the speed of Nidhi's car? (2 Marks)

VALUE BASED QUESTIONS (4-MARKS EACH)

Q.28 If the price of petrol is increased by Rs.7 per litre, a person has to buy 1 litre less petrol for Rs. 1740.Find the original price of the petrol at that time.

a) Why do you think the price of petrol is increasing day by day?

b) What should we do to save petrol?

Q.29 Ramesh wants to design a rectangular park of perimeter 80 meters and area 400 m^2.for jogging and walk for the people of colony. Is it possible to design the park? If so, find the length and breadth of the park. Which value of Ramesh is depicted here?

SOLUTIONS/ANSWER

(2 marks each)

1. PUT the value of x=1/2 in the given equation

$(\frac{1}{2})^2 + \frac{1}{2}$ p - $\frac{5}{4}$ =0

P=2

2. Check,if x= -1 ,then put the value in the given equation

$4(-1)^2$ -3(-1) -1=0,

4+3 -1$\neq$ 0 , NO

3. IF D>0 , THEN , $\alpha = \frac{-b-\sqrt{b2-4ac}}{2a}$, $\beta = \frac{-b+\sqrt{b2-4ac}}{2a}$

4. compare the given equation to ax^2 +bx+c =0 a=1, b =5, c =5

D = b^2 -4ac, D = 5

5 Sum of roots = -4

6. Product of roots = -2

7. real roots , D $\geq$0 ,K$\geq$3 OR K≤ -3

8. Compare the given equation from ax^2 +bx +c =0 a=1, b= -2(k+1), c = k^2

D = 0, then k = -1/2

9. Let the Rahman's age be x years.

5 years ago = (x- 5), 9 years later = (x+9)

product of his age = (x-5) (x+9) =15, x^2 +4x -60 =0

10 x = (-2, 5)

(3 marks each)

11. Compare to ax^2 +bx +c =0 ,a=2 b= - $\sqrt{5}$,c = 1

D = b^2 -4ac , D = (- $\sqrt{5}$) ^{2} -4 X2X1 , D = 25-8=17 , D>0 Real and distinct(unequal)

12. Solve the equation x= 9 and -2

Numerical difference = 9 – (-2) = 9+2 = 11

13. Compare to $ax^2 + bx + c = 0$ a =6, b = -b, c = 2

$D = b^2 - 4ac = 1$

$D = (-b)^2 - 4 \times 6 \times 2 = 1,$

$b^2 - 48 = 1$, b= 7,-7

14. Let the first odd number be x and consecutive odd number be (x+2)

$x.(x+2) = 483$, $x^2 + 2x - 483 = 0$

x = 21 ,23

15. $x - \frac{1}{x} = 3$, $\frac{x2-1}{x} = 3$, $x^2 - 1 = 3x$, $x^2 - 3x - 1 = 0$, $x = (\frac{3-\sqrt{13}}{2}, \frac{3+\sqrt{13}}{2})$

16. Let the length of the shortest side be x meters.

According to question hypotenuse = (2x+6)

Third side = (2x +6-2) =2x +4

By the Pythagoras theorem $(\text{Hypo})^{2} = B^2 + P^2$

$$(2x+6)^2 = x^2 + (2x+4)^2$$

Then equation: $x^2 - 8x - 20 = 0$

x = 10, -2, but the length cannot be negative.

So x= 10 m.

Hypo =26, B =10, P=24

17. Let the Anjali's age be x years

Anjali's age 3 years ago = x-3

Anjali's age 5 years from now = x+5

According to question $\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$

x = 7, -3. but age cannot be negative. so x=7 years

18. After solution we get $-x^3 + 6x^2 + 14x + 8 = 0$.

It is not in the form of $ax^2 + bx + c = 0$

So it is not a quadratic equation.

19. $\sqrt{2x+9} + x = 13$.

$\sqrt{2x+9} = 13 - x$. squiring both sides

$(2x + 9) = (13 - x)^2$

$x^2 - 28x + 160 = 0$

x= 20, 8 but x=20 does not satisfy the equation.

So x = 8

20. $x = \frac{3+\sqrt{10}}{4}$, $\frac{3-\sqrt{10}}{4}$

(4 marks each)

21. Let the usual speed of the train = x km/h

Total distance =360 km.

Time = Distance /speed.

So the time taken by the train $= \frac{300}{x}$ h

If the speed is increased by 10 km/h, then the new speed of the train = (x+10) km/h

Time taken by the train $= \frac{300}{x+10}$

According to the question $\frac{300}{x} = \frac{300}{x+10} + 3$

$$\frac{300}{x} - \frac{300}{x+10} = 3$$

After solution x = - 40 km and 30 km, but speed cannot be negative.

x = 30 km.

22. Let speed of the stream = x km/h

Given, speed of boat in still water = 15 km/h

Speed of boat upstream = (15-x) km/h

Speed of boat downstream = (15+x) km/h

According to the question

$$\frac{30}{15-x} + \frac{30}{15+x} = 4\frac{1}{2} \quad \text{(TIME = DISTANCE / SPEED)}$$

$X^2 - 225x + 200 = 0$, x = 5, -5

But speed cannot be negative. So x = 5 km/h.

23 Let faster pipe takes x minutes to fill the tank.

Then. Slower pipe will take (x+3) minutes to fill the tank.

Since, portion of the tank filled by the faster pipe in 1 minute = 1/x

And portion of the tank filled by the slower pipe in 1 minute = $\frac{1}{x+3}$

IN $3\frac{1}{13}$ minutes =($\frac{40}{13}$ minutes)

Both pipe will fill to tank together

$\frac{40}{13}\left(\frac{1}{x}+\frac{1}{x+3}\right)=1$

After calculation we get $13x^2 - 41x - 120 = 0$

x = 5 or x = $\frac{-24}{13}$, but time cannot be negative.

So, x = 5 minutes.

Faster pipe takes 5 minutes and slower pipe takes (x+3) =8 minutes to fill the tank.

24. Solution of the given equation

$\frac{x-3+x-1}{(x-1)(x-2)(x-3)} = \frac{2}{3}$

(x-1) (x-3) = 3

solution of x = 0 or x = 4

25. Compare the given equation to A x^2 +Bx +C =0

A $(1+m^2)$, B =2mc and C= $(c^2 - a^2)$

Since the given equation has equal roots.

So, D = b^2-4ac =0, then prove it.

CASE –STUDY SOLUTIONS)

26. (i) (3x+3) m.

(ii) 860m^2.

27. (i) 2(x+5)km , 16 hours

(ii) (c) $x^2 + 5x - 500 = 0$, 20 km /h

SOLUTIONS OF VALUE BASED QUESTIONS

28 . Let the original price of the petrol be Rs. x per litre.

The amount of petrol that can be purchased = $\frac{1740}{x}$

According to question

$$\frac{1740}{x} - \frac{1740}{x+2} = 1 \ ,$$

$1740\ (x+2 – x) = x(x+2)$

$x^2 +2x – 3480 =0$

x = 58, (-60)-rejected

Original cost of petrol was Rs.58 per litres.

a) Petrol is a natural resource which is depleting day by day. So due to more demand and less supply, its price is increasing.

b) We should use more of public transport and substitute petrol with CNG or other renewable resources.

29. Let the Length = L and Breadth = B of the Park.

So, Area = L X B = 400 m^2, So L = 400/B

PERIMETER= 2 (L + B) = 80 m.

So, L +B =40, put the value of L = 400/B

We get B^2 -40B +400 = 0

B=20 m, L=20 m.

VALUE –Jogging and Morning walk are beneficial or our mental and physical health.

2. TOPIC – ARITHMETIC PROGRESSION

(2 MARKS QUESTIONS)

Q1 The fee charged from a student every month by a school for the whole session, when the monthly fee is Rs 400, Is in the given situation do the list of numbers involved form an AP? If yes then find total fee for the year.

Q 2. Given a=5, d=3, a_n=50, find S_n

Q 3 Find 21st term of an AP whose first two terms are -3 and 4.

Q 4 Which terms of an AP 21,42,63 … is 210, Solve.

Q 5 Find 4th term from the end of the AP: -11, $-$,8,-5 ,… 49.

Q 6 Verify whether the given series 2, 2^2 ,2^3,2^4 form an AP. If yes Find common difference.

Q 7 If the first term of an AP is -5 and d=2, then find the sum of first six term.

Q 8 Find $a_{30} - a_{20}$ in the given series $-3, -7, -11, \ldots$

Q 9 Is the given series $\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}$,…form an AP. If yes find common difference.

Q 10 In an AP a=3.5, d=0, n=101 find a_n.

Q 11 Find the total number of terms the series $7 + 10\frac{1}{2} + 14 + \cdots + 84$.

Q 12 Verify that $a + b, \{(a + 1) + b\}, \{(a + 1) + (b + 1)\}$,…is an AP.
Find Common difference in case of AP.

Q 13 If 18, a, b, -3 are in AP, then find $a +$ b

Q 14 Write down the first four terms of an AP when a=-5, d -3

Q 15 Is 0 a term of the AP: 31, 28, 25, ….? Justify your answer.

(3 MARKS QUESTIONS)

Q 16 How many two-digits numbers are divisible by 3.

Q 17 Given a_n =28, S_n =144 and there are total 9 terms. Find a

Q 18 **Two APs have the same common difference. The difference between their 100th term is 100, Find the difference between their 1000th terms.**

Q 19 Find the 31st term of an A.P. whose 11th term is 38 and 16th term is 73.

Q 20 How many terms of the AP 9,17,25 … must be taken to give a sum of 636?

Q 21 Find the sum of the first 15 multiples of 8.

Q 22 Find the sum of the first 40 positive integers divisible by 6.

Q 23 Find the sum of the odd numbers between 0 and 50.

Q 24 If the 9th term of an AP is zero, prove that its 29th term is twice its 19th term.

Q25 Determine the AP whose 5^{th} term is 19 and the difference of the 8^{th} term from the 13^{th} term is 20.

(4 MARKS QUESTIONS)

Q 26 In a potato race a bucket is placed at the starting point, which is 5m from the first potato and the other potatoes are placed 3m apart in a straight line. There are ten potatoes in the line. A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in and she continues in the same way until all the potatoes are in the bucket, what is the total distance the competitor has to run?

Q 27 Ramkali saves Rs 5 in the first week, of a year and increased her weekly savings by Rs 1.75. If in the n^{th} week her weekly savings became Rs 20.75, find n.

Q 28 In an AP, if $S_5 + S_7 = 167$ and $S_{10} = 235$, then find the AP, where s, denotes the sum of its first n terms

Q.29. The digits of a positive number of three digits are in A.P. and their sum is 15. The number obtained by reversing the digits is 594 less than the original number. Find the number.

Q 30 Find the sum of all multiples of 7 lying between 500 and 900.

Q 31 A thief runs with a uniform speed of 100 m/minute. After one minute a policeman runs after the thief to catch him. He goes with a speed of 100 m/minute in the first minute and increases his speed by 10 m/minute every succeeding minute. After how many minutes the policeman will catch the thief.

Q 32 Divide 56 in four parts in A.P. such that the ratio of the product of their extremes (1st and 4th) to the product of means (2nd and 3rd) is 5: 6.

Q 33 In a school, students decided to plant trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be double of the class in which they are studying. If there are 1 to 12 classes in the school and each class has two sections, find how many trees were planted by the students.

Q 34 A sum of Rs 1600 is to be used to give ten cash prizes to students of a school for their overall academic performance. If each prize is Rs 20 less than its preceding prize, find the value of each of the prizes.

Q 35 If the sum of the first n terms of an AP is $4n - n^2$, what is the first term (that is S_1)? What is the sum of first two terms? What is the second term? Similarly find the 3rd, the 10th and the nth terms.

CASE STUDY QUESTIONS

Q 36 A road roller (sometimes called a roller-compactor, or just roller) is a compactor-type engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of roads and foundations. Similar rollers are used also at landfills or in agriculture. Road rollers are frequently referred to as steamrollers, regardless of their method of propulsion. RCB Machine Pvt Ltd started making road roller 10 year ago. Company increased its production uniformly by fixed number every year. The company produces 800 rollers in the 6th year and 1130 rollers in the 9th year.

On the basis of the above information, answer any four of the following questions:

(i) Find the company's production in first year.

(ii) In which year the company's production was 1350 rollers?

(a) 5th (b) 6th (c) 11th (d) 9

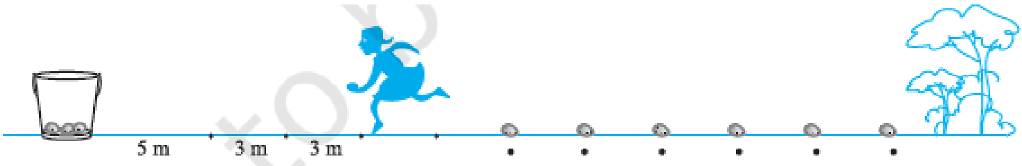
Q 37 Aditya is celebrating his birthday. He invited his friends. He bought a packet of toffees/candies which contains 120 candies. He arranges the candies such that in the first row there are 3 candies, in second there are 5 candies, in third there are 7 candies and so on.

On the basis of the above information, answer any four of the following questions:

(i) Find the total number of rows of candies.

(ii) Find the difference in number of candies placed in 7^{th} and 3^{rd} rows.

Q 38 In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are 12 potatoes in the line (see Fig.).



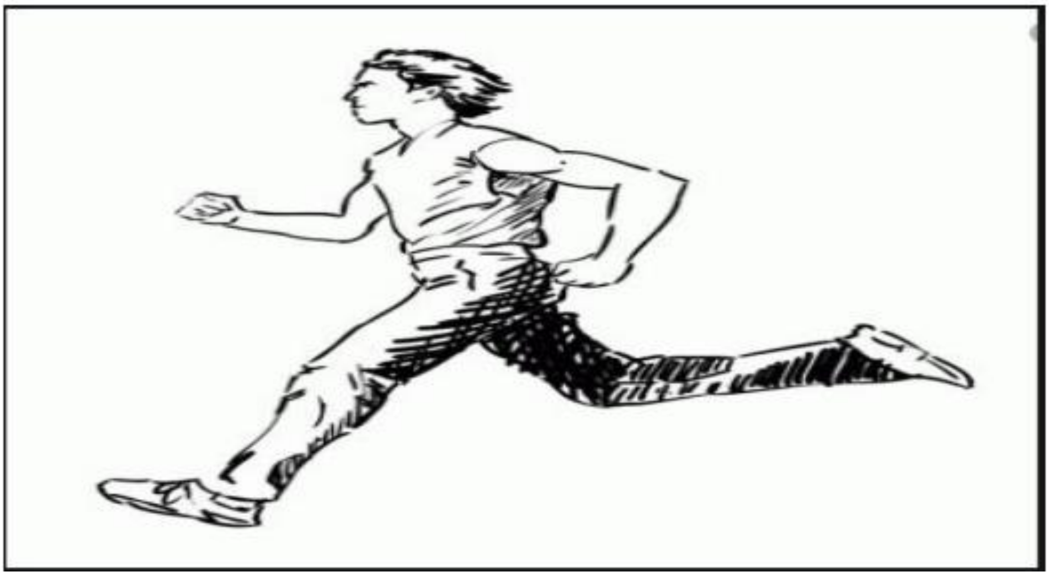
A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket.

(i) Find the total distance covered by the competitor after placed the second potato in the bucket?

(ii) Calculate the total distance covered by the competitor?

Q 39.

Your friend Veer wants to participate in a 200m race. He can currently run that distance in 51 seconds and with each day of practice it takes him 2 seconds less.He wants to do in 31 seconds .



(i) Find the minimum number of days he needs to practice till his goal is achieved

(ii) If nth term of an AP is given by an = 2n + 3 then find common difference of AP

Q 40

Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of Rs 1,18,000 by paying every month starting with the first instalment of Rs 1000. If he increases the instalment by Rs 100 every month , answer the following:

(i). Find the amount paid by him in the 30^{th} installment.

(ii). Find the total installments paid by him.

ANSWERS AND HINTS OF ARITHMETIC PROGRESSION

(1) yes, Rs.4800

(2) 440 [find n=16 by last term = a+(n-1)d, 50 = 5+(n-1)3, then apply $S_n = \frac{n}{2}\{a + l\}$]

(3) 137 [a=-3 and d = 4-(-3) = 7 then find 21^{st} term = -3+(21-1)7]

(4) 10 [a=21, d=21 then use formula of last term 210 = 21+(n-1)21 & div.by 21]

(5) 40 [rewrite AP in reverse order a = 49, d = -11+8 = -3

then 4^{th} term from the end = 49+(4-1)(-3) = 40

(6) No because common difference is not same

(7) 0 [a=-5, d=2 n=6 then use $s_6 = \frac{6}{2}\{2(-5) + (6-1)2\} = 3(0)$

(8) -40, [a=-3, d=-4

then $a_{30} - a_{20} = \{-3 + 29 \times (-4)\} - \{-3 + 19 \times (-4)\} = \{10\} \times (-4)$]

(9) yes, [because common difference is same $= \sqrt{3} = 2\sqrt{3} - \sqrt{3} = 3\sqrt{3} - 2\sqrt{3} = \cdots$]

(10) 3.5 [a=3.5 and because common difference is zero so AP will not increase or decrease i.e. nth term=0]

(11) 23 [a=7 d= $\frac{7}{2}$use last term l=a+(n-1)d, 84=7+(n-1)$\frac{7}{2}$]

(12) Yes, [because common difference is same=1]

(13) 15, [common difference= a-18 = b-a = -3-b now take a-18 = -3-b gives a+b =15]

(14) $-5, -8, -11, -14$ [use a, a+d, a+2d, a+3d where a=-5 & d=-3]

(15) No, [∴a=31, d=-3, Let nth term=0, then 31+(n-1)×(-3)=0

gives n=34/3 which is not a Positive Integer.]

(16) 30, [because $\mathrm{a} = 12$ $\mathrm{d} = 3$ and $\mathrm{l} = 99$ then use formula of last term $\mathrm{l} = \mathrm{a} + (\mathrm{n} - 1)\mathrm{d}$]

(17) 4, [use $S_n = \frac{n}{2}\{a + (a + (n-1)d)\}, 144 = \frac{9}{2}\{a + 28\}$]

(18) 100, [for first AP: $a_{100} = a_1+99d$ & $a_{1000} = a_1+999d$ and for Second AP: $a_{100} = a_2+99d$ & $a_{1000} = a_2+999d$ then $(a_1+999d) - (a_2+999d) = a_1-a_2$ & then $(a_1+99d) - (a_2+99d) = 100$ hence $a_1-a_2 = 100$]

(19) 178, [a+10d=38 & a+15d=73, then a=-32 & d=7 so 31st term = -32+30(7)]

(20) 12, [$S_n = \frac{n}{2}\{2a + (n-1)d\}, 636 = \frac{n}{2}\{2(9) + (n-1)(8)\},$

$$636 = n\{5 + 4n\} \text{ gives } n = 12]$$

(21) 960, [8×{sum of 15 natural Nos,}, 8×$\left\{\frac{n(n+1)}{2}\right\}$, 8×$\left\{\frac{15(15+1)}{2}\right\}$,8{120}]

(22) 4920, [Sum of first 40 positive integers which are divisible by 6 = 6,12,18,24,…. 40 terms = 6× $\{sum\ of\ first\ 40\ natural\ Nos.\}$ = 6 × $\left\{\frac{40(40+1)}{2}\right\}$ =4920]

(23) 625, [$use\ Sum\ of\ odd\ numbers = n^2$],

(24) do yourself

(25) 3,7,11,15 [a+4d=19 & {(a+12d)-(a+7d)}=20, d=4 & a= 3 then use a, a+d, a+2d, a+3d]

(26) 370 m [s = 2{5+8+11+…up to 10 terms} = 2× $\frac{10}{2}\{2 \times 5 + (10-1) \times 3\}$ = 370 m]

(27) 10 [nth term = a+(n-1)d, 20.75=5+(n-1)X1.75, n = 10]

(28) A.P. is 1, 6, 11…[$s_5 + s_7 = 167$ $means$ $12a + 31d = 167$

$$\& \; s_{10} = 235 \; means \; 2a + 9d = 47 \; then \; a = 1 \; \& \; d = 5$$

(29) 852,

Soln: Let hundred's place digit = (a – d), ten's place digit = a, and unit's place digit = a + d

ATQ, a – d + a + a + d = 15 ⇒ 3a = 15 ⇒ a = 5

Original number = 100(a – d) + 10(a) + 1(a + d) = 100a – 100d + 10a + a + d = 111a – 99d

Reversed number = 1(a – d) + 10a + 100(a + d) = a – d + 10a + 100a + 100d = 111a + 99d

Now, Original no. – Reversed no. = 594

111a – 99d – (111a + 99d) = 594; -198d = 594 ⇒ d = -3

∴ The Original no. = 111a – 99d = 111(5) – 99(-3) = 555 + 297 = 852

(30) 39900 [AP: 504, 511, 518, …,896, apply last term=a+(n-1)d, 896=504+(n-1)X7 we get n = 57 then sum of 57 terms = $\frac{57}{2}\{504 + 896\}$ = 39900]

(31) 5 minutes, Let the police catch the thief in n min

As the thief ran 1 min before the police

Time taken by the thief before being caught =(n+1) min

Distance travelled by the thief in (n+1) min =100(n+1) m

Speed of police in 1st min =100m/min

Speed of police in 2nd min=110m/min Speed of police in3rd min =120m/min. and so on

∴100, 110, 120, ... this forms an AP

Total distance travelled by the police in n min $=\frac{n}{2}(2\times100+(n-1)10)$

On catching the thief by police, distance travelled by thief= distance travelled by the police

$\Rightarrow 100(n+1)=\frac{n}{2}(2\times100+(n-1)10)$

$\Rightarrow 100n+100=100n+n(n-1)5 \Rightarrow 100=n(n-1)5 \Rightarrow n2-n-20=0 \Rightarrow (n-5)(n+4)=0$

$\Rightarrow n-5=0, n+4=0 \Rightarrow n=5$ OR $n=-4$(but this is not possible) so, n=5

Time taken by the policeman to catch the thief=5min

(32) 8,12,16,20

Hint: Take four parts of an AP as a-3d, a-d, a+d, a+3d and their sum is 56

Then find a= 14 and d= ±2

(33) 312, $[2\times\{2\times(1+2+3+\cdots+12)\}]$

(34) 250,230,210,190,170,150,130,110,90,70

(35) **The second term is 1,** The 3rd, 10th, and nth terms are −1, −15 and (5 − 2n) respectively

(36) (i) Production in 6^{th} year = 800 9^{th} year = 1130, means $a_6=800$ & $a_9=1130$

Means a+5d=800 & a+8d=1130 we get a=250 and d=110 First year production = 250

(ii) 11^{th} year, [apply nth term= a+(n-1)d, 1350=250+(n-1)110 we get n=11]

(37) (i) There is an AP: 3,5,7, … a=3 & d=2 so apply let there are n rows

sum of n terms$=\frac{n}{2}\{2a+(n-1)d\}$, $120=\frac{n}{2}\{2\times3+(n-1)2\}$

we get $n^2+2n-120=0 \; then \; n=10 \,\&-12$ So there are 10 rows

(ii) 7^{th} row=3+(7-1)X2=3+12=15 and 3^{rd} row=3+(3-1)X2=7 their diff.= 8

(38) (i) 26 m [s = 2{5+8+11+…up to 2 terms} = $2\{\frac{2}{2}\{2\times5+(2-1)\times3\}$ = 26 m]

(ii) 516 m [s = 2{5+8+11+…up to 12 terms} = $2\times\frac{12}{2}\{2\times5+(12-1)\times3\}$ = 516 m]

(39) (i) a=51 & d=(-2) so nth term=a+(n-1)Xd, since goal is 31 minutes

so 31=51+(n-1)X(-2) hence n =11^{th} day

(ii) common difference= $a_n-a_{n-1}=(2n+3)-\{2(n-1)+3\}=3-1=2$

(40) (i) AP: 1000, 1100, 1200, … so a=1000, d=100 so 30^{th} instalment = 1000+29X100=3900

(ii) Total Amount paid=118000

$S_n=\frac{n}{2}\{2a+(n-1)d\}, 118000=\frac{n}{2}\{2\times1000+(n-1)\times100\}=\frac{n}{2}\{1900+100n\}$

We get $100n^2+1900n-236000=0 \; means \; n^2+19n-2360=0$

$n^2+59n-40n-2360=0 \; means \; (n+59(n-40)=0 \; so \; n=40$

3. TOPIC – Tangents To A Circle

VERY SHORT ANSWER TYPE QUESTIONS(2marks)

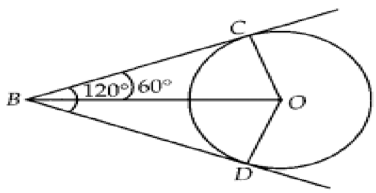
Q1. O is the Centre of a circle of radius 8 cm. The tangent at a point A on the circle cuts a line through O at B such that AB= 15cm. Find the radius of the circle.

Q2. If PT is a tangent at T to a circle whose center is O and OP= 17cm, OT= 8cm, Find the length of the tangent segment PT.

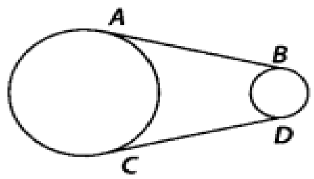
Q3. If TP and TQ are two tangents to a circle with center O so that ∠POQ = 110°, then, what is the value of ∠PTQ?

Q4. ***F***rom a point Q, the length of the tangent to a circle is 24cm and the distance of Q from the Centre is 26cm.Find the radius of the circle.

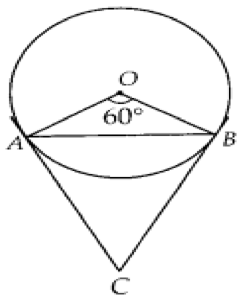
Q5. If from an external point B of a circle with Centre O, two tangents BC and BD are drawn such that ∠DBC = 120°, prove that BC + BD = BO.



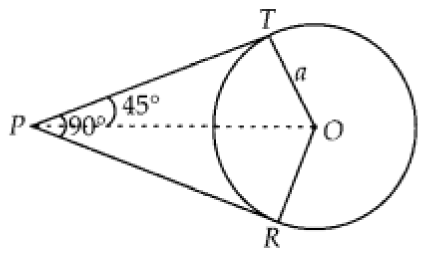
Q6. In figure, AB and CD are common tangents to two circles of unequal radii. Prove that AB = CD.



Q7. If a chord AB subtends an angle of 60°at the Centre of a circle, then find angle between the tangents at A and B.

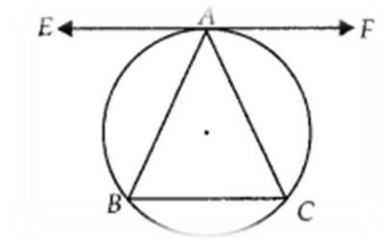


Q8. If angle between two tangents drawn from a point 'P' to a circle of radius 'a' and Centre O is 90◦, then find OP.

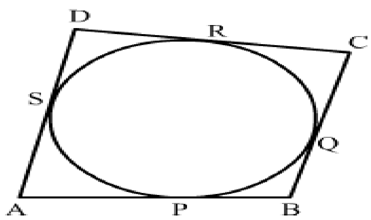


Q9. Show that the tangent to the circumcircle of an isosceles triangle ABC at A, in which

AB = AC, is parallel to BC.

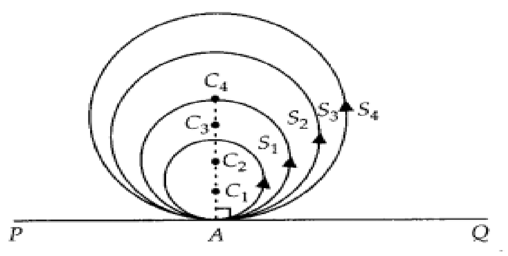


Q10. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC

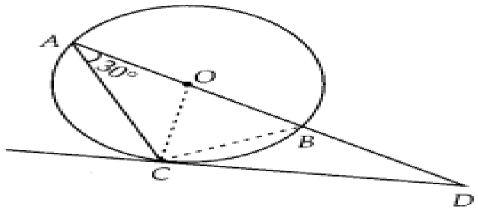


SHORT ANSWER TYPE QUESTION- (3marks)

Q1. If a number of circles touch a given line segment PQ at a point A, then where will the centers of all circle lie?

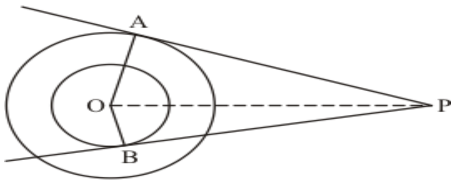


Q2. AB is a diameter of a circle and AC is its chord such that<BAC = 30°. If the tangent at C intersect AB extended at D, then show that BC = BD.

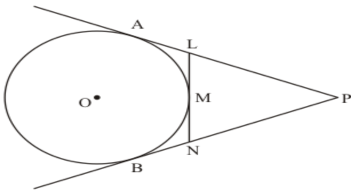


Q3. What is the length of the tangent PQ at a point P of a circle of radius 12cm meets a line through the Centre O at a point Q so that OQ =20 cm.?

Q4. There are two concentric circle with center O of radii 5cm and 3cm. From an external point P, tangent PA and PB are drawn to these circles. If AP= 12cm, Find the length of BP.

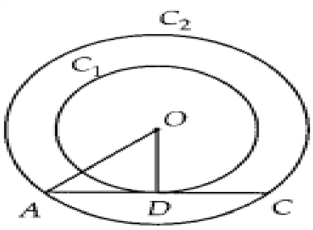


Q5. If PA and PB are tangents from an external point P to a circle with center O. LN touches the circle at M. Prove that PL + LM = PN + MN.

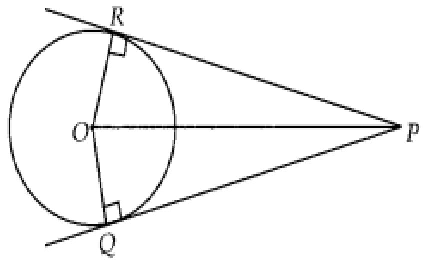


Q6. From an external point P, tangents PA = PB are drawn to a circle with Centre O. If ∠PAB = 50°, then find ∠AOB.

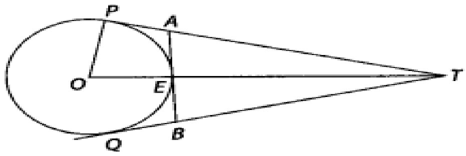
Q7. Out of the two concentric circles, the radius of the outer circle is 10 cm and the chord AC of length 16 cm is a tangent to the inner circle. Find the radius of the inner circle.



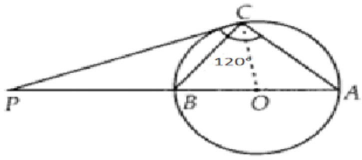
Q8. Two tangents PQ and PR are drawn from an external point to a circle with Centre O. Prove that QORP is a cyclic quadrilateral.



Q9. In figure, O is the Centre of a circle of radius 8 cm, T is a point such that 0T= 17 cm and 0T intersects the circle at E. If AB is the tangent to the circle at E, find the length of AB.

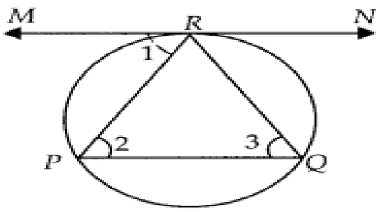


Q10. The tangent at a point C of a circle and a diameter AB when extended intersect at P. If ∠PCA = 120°, Find ∠CBA.

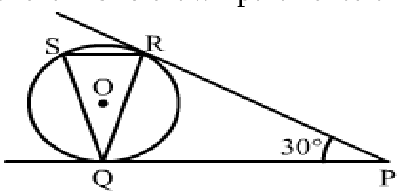


<u>LONG ANSWER TYPE QUESTIONS :</u>(4marks)

Q1. A chord PQ of a circle is parallel to the tangent drawn at a point R of the circle. Prove that R bisects the arc PRQ.

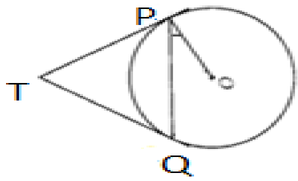


Q2. If tangent PQ and PR are drawn from an external point P to a circle with Centre O, such that ∠RPQ =30°. A chord RS is drawn parallel to the tangent PQ. Find ∠RQS.



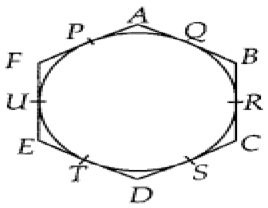
Q3. If tangents PA and PB from a point P to a circle with Centre O are inclined to each other at an angle of 60°, then find < POA.

Q4. Two tangents TP and TQ are drawn to a circle with Centre O from an external point T. Prove that ∠ PTQ = 2 ∠ OPQ.

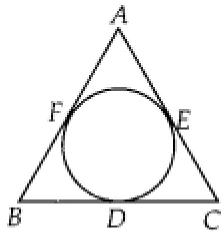


Q5Prove that the parallelogram circumscribing a circle is a rhombus.

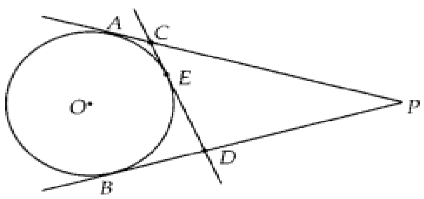
Q6. If a hexagon ABCDEF circumscribes a circle, prove that
AB + CD + EF = BC + DE + FA.



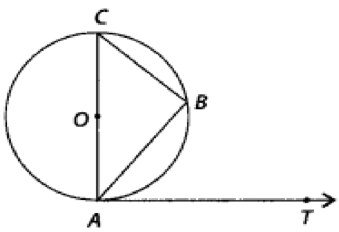
Q7. Let s denote the semi-perimeter of a triangle ABC in which BC = a, CA = b, AB = c. If a circle touches the sides BC, CA, AB at D, E, F respectively, prove that BD = s – b.



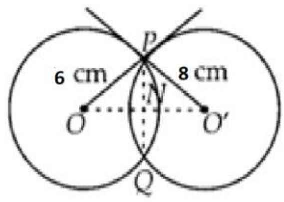
Q8. From an external point P, two tangents, PA and PB are drawn to a circle with Centre O. At one-point E on the circle tangent is drawn which intersects PA and PB at C and D, respectively. If PA = 20 cm, find the perimeter of the triangle PCD.



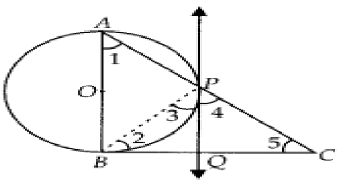
Q9. If AB is a chord of a circle with Centre O, AOC is a diameter and AT is the tangent at A as shown in figure. Prove that ∠BAT = ∠ACB



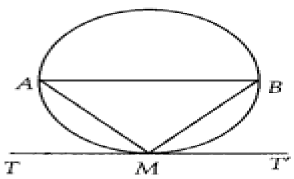
Q10. Two circles with centers O and O' of radii 6cm and 8 cm, respectively intersect at two points P and Q such that OP and O'P are tangents to the two circles. Find the length of the common chord PQ.



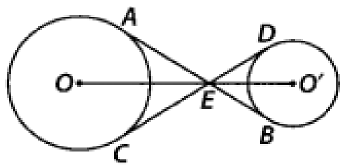
Q11. In a right triangle ABC in which ∠B = 90°, a circle is drawn with AB as diameter intersecting the hypotenuse AC at P. Prove that the tangent to the circle at P bisects BC.



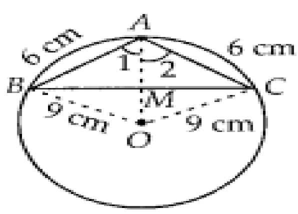
Q12. Prove that the tangent drawn at the mid-point of an arc of a circle is parallel to the chord joining the end points of the arc.



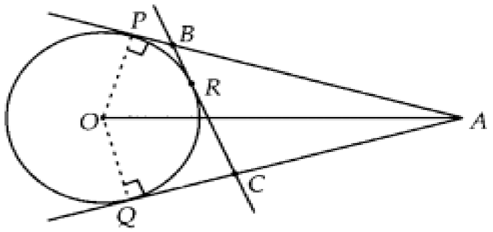
Q13. In figure, the common tangent, AB and CD to two circles with centers O and O' intersect at E. Prove that the points O, E, O' are collinear.



Q14. If an isosceles triangle ABC, in which AB = AC = 6 cm, is inscribed in a circle of radius 9 cm, find the area of the triangle.



Q15 A is a point at a distance 13 cm from the Centre 0 of a circle of radius 5 cm. AP and AQ are the tangents to the circle at P and Q. If a tangent BC is drawn at a point R lying on the minor arc PQ to intersect AP at B and AQ at C, find the perimeter of the ΔABC.

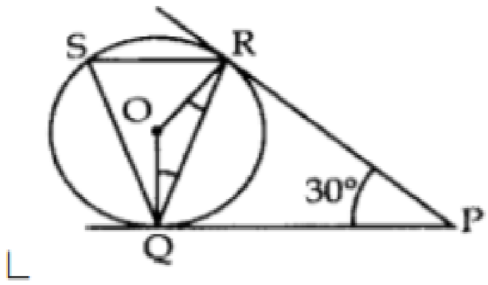


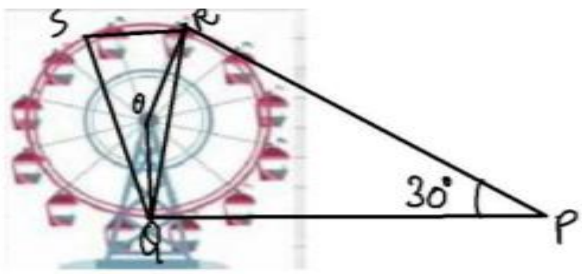
CASE STUDY BASED QUESTIONS

CASE STUDY 1:

A Ferris wheel (or a big wheel in the United Kingdom) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubs, capsules, gondolas, or pods) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity.

After taking a ride in Ferris wheel, Aarti came out from the crowd and was observing her friends who were enjoying the ride. She was curious about the different angles and measures that the wheel will form. She forms the figure as given below.





1. In the given figure find ∠ROQ

a) 60°

b) 100 °

c) 150°

d) 90°

2. Find ∠RQP

a) 75°

b) 60°

c) 30°

d) 90°

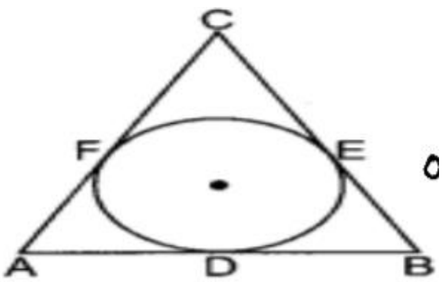
3. Find ∠RSQ

a) 60°
b) 75°
c) 100 °
d) 30°

4. Find ∠ORP
a) 90°
b) 70°
c) 100°
d) 60°

CASE STUDY 2:

Varun has been selected by his School to design logo for Sports Day T-shirts for students and staff . The logo design is as given in the figure and he is working on the fonts and different colours according to the theme. In given figure, a circle with center O is inscribed in a ΔABC, such that it touches the sides AB, BC and CA at points D, E and F respectively. The lengths of sides AB, BC and CA are 12 cm, 8 cm and 10 cm respectively.



1. Find the length of AD
a) 7
b) 8
c) 5
d) 9

2. Find the Length of BE
a) 8
b) 5
c) 2
d) 9

3. Find the length of CF
a) 9
b) 5
c) 2
d) 3

4. If radius of the circle is 4cm, Find the area of ΔOAB

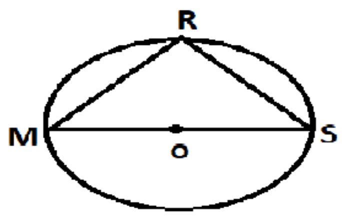
a) 20
b) 36
c) 24
d) 48

5. Find area of ΔABC

a) 50
b) 60
c) 100
d) 90

CASE STUDY 3:

There girls Reshma, Salma, Mandeep are playing a game by standing on a circle. Reshma throws a ball to Salma, Salma to Mandeep, Mandeep to Reshma. The distance between Reshma and Mandeep is 6m, and between Reshma and Salma is 8m if O is the center of the circle, then



1. Find diameter of the circle
   a) 6m b) 8m c) 10m d) 12m

2. Measure of ∠MRS
   a)180° b)90° c)100° d) 80°

3. Area of the ΔRMS is

   a) 10 m^2 b)20cm^2 c)24 cm^2d)40 cm^2

4. length of the longest chord of the circle.

   a)6m b) 8m c)10m d)12m

5. The radius of the circle is

   a)6m b) 3m c)4m d)5m

…………………………………………………………………………………………………….

Circles (Answer key)

SHORT ANSWER TYPE QUESTIONS(2marks)

1. 17cm
2. 15cm
3. 70°
4. 7cm

7.120°

8. a$\sqrt{2}$

SHORT ANSWERTYPE QUESTIONS (3 marks)

1. Perpendicular line of PQ True
3. 16cm
4. $4\sqrt{10}\ cm$

6. 100°

7. DO=6cm

9. 48/5cm

10. 60°

LONG ANSWER TYPE QUESTION (4 marks)

2. ∠RQS=75°
3. ∠POA =60°
8. 40cm
10. pq= 9.6cm
14. $8\sqrt{2}\ cm^2$
15. 24cm

CASE BASED QUESTIONS

CASE STUDY 1:

1. c) 150°
2. a) 75°

3. b) 75°

4. a) 90°

CASE STUDY 2:

1. a) 7

2. b) 5

3. d) 3

4. c) 24

5. b) 60

CASE STUDY 3:

1: - c) 10m

2: -b) 90°

3: -c) 24 cm^2

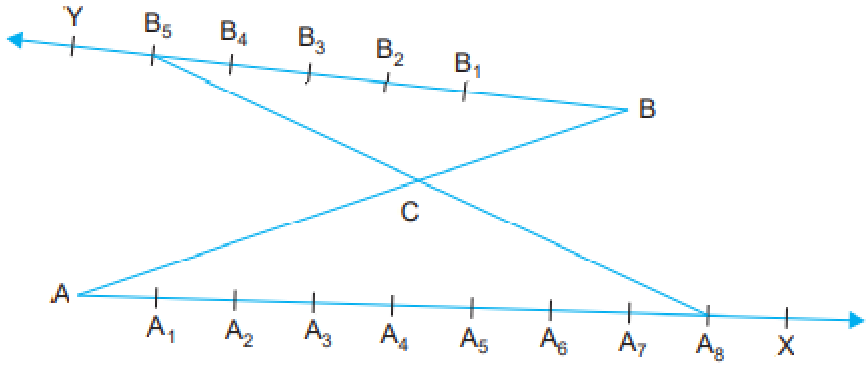
4: -d) 10m

5: - 5m

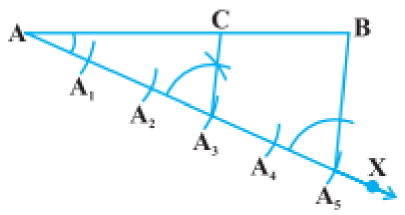
4.TOPIC- CONSTRUCTIONS

SHORT ANSWER TYPE QUESTION (2 MARKS)

Q.1. In the given figure, A1, A2, A3 --- and B1, B2, B3 ,----- are marked at equal distances. Answer the following questions.



(i) In what ratio point C divides AB ? [Ans: 8:5]
(ii) If AB = 13cm then find the length of AC. [Ans: 8cm]
Q.2, In the given figure, A1, A2, A3, A4, A5 are marked at equal distances. Answer the following questions.

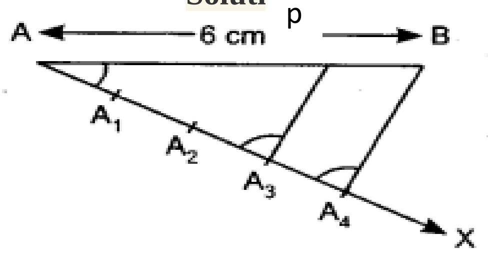


(i) In what ratio point C divides AB? [Ans: 3:2]
(ii) If AB = 5cm then find the length of AC. [Ans: 3cm]

LONG ANSWER TYPE QUESTION (3 MARKS)

Q.1. Draw a line segment of length 6 cm. Using compasses and ruler, find a point P on it which divides it in the ratio 3:1.

Soluti

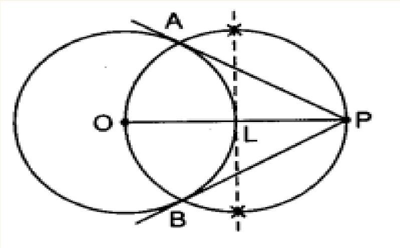


Steps of Construction : 1. Draw AB = 6 cm with the help of scale.
2. Draw any ray AX, making an acute angle with AB.
3. Locate 4 (= 3 + 1) points A1, A2, A3 and A4 on AX so that AA1 = A1 A2 = A2 A3 = A3 A4 .
4. Join BA4 .
5. Through the point A3 (m = 3), draw a line parallel to A3 P (by making an angle equal to ∠ AA4B) at
A3 intersecting AB at the point P. Then, AP:PB = 3 : 1
Q.2. Draw a line segment of length 8 cm and divide it in the ratio 3 :5.Measure the two parts.
Q.3. Draw a line segment of length 5 cm and divide it in the ratio 2:3. Measure the two parts.

Q.4. Draw a pair of tangents to a circle of radius 3 cm, which are inclined to each other at an angle of 60°.

Q.5. Draw a circle of radius 4 cm. From a point P, 9 cm away from the centre of the circle, draw two tangents to the circle. Also, measure the angle between two radii through point of contacts of two tangents.

Solution:



Steps of construction:

1. A circle, with centre O and radius 4 cm is drawn.
2. A point P is taken, outside the circle at a distance of 9 cm from O.
3. Perpendicular bisector of OP is drawn, meeting OP at L.
4. With L as centre and OL as radius a circle is drawn meeting the given circle at A and B.
5. PA and PB are joined.
6. Then PA and PB are the required tangents to the circle and PA = PB = 6.7 cm (approx.)

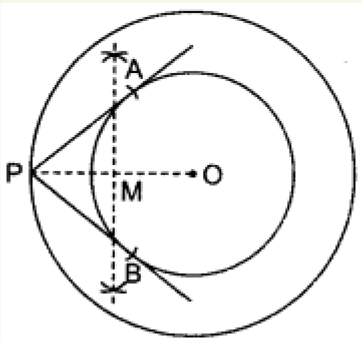
Q.6. Draw a circle of radius 3 cm. From a point P, 7 cm away from the centre of the circle, draw two tangents to the circle. Also, measure the lengths of the tangents.

Q.7. Draw two concentric circles of radii 3 cm and 5 cm.Construct a tangent to smaller circle from a point on the larger circle. Also measure its length.

Q.8. Draw a pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 60°. Measure the length of the two tangents also.

Q.9. Draw a circle of radius 4cm. Mark a point P on it .Draw a tangents passing through it. Measure the angle between two tangents at P.

Solution:



Now after measuring, PA and PB comes out to be 4 cm.

Steps of construction of tangents:

1. Take point O. Draw 2 concentric circles of radii 3 cm and 5 cm respectively.
2. Locate point P on the circumference of larger circle.
3. Join OP and bisect it. Let M be mid-point of OP.
4. Taking M as centre and MP as radius, draw an arc intersecting smaller circle at A and B.
5. Join PA and PB. Thus, PA, PB are required tangents

LONG ANSWER TYPE QUESTION (4-MARKS)

Q.1. Draw two tangents to a circle of radius 4 cm from a point P at a distance of 6 cm from its centre. Measure the angle between two tangents.

Q.2. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

Q.3. Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm and measure its length. Also verify the measurement by actual calculation.

Q.4. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.

Q.5. Draw a pair of tangents to a circle of radius 6cm which are inclined to each other at an angle of 60^0. Also find the length of the tangent.

Q.6. Construct two concentric circles of radii 3cm and 7cm. Draw two tangents to the smaller circle from a point P which lies on the bigger circle.

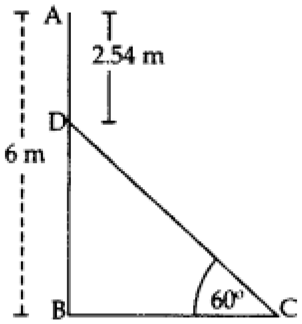
Q7. Let ABC be a right triangle in which AB = 6 cm, BC = 8 cm and $\angle B = 90°$. BD is the perpendicular from B on AC. The circle through B, C, D is drawn. Construct the tangents from A to this circle.

Q8. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 45°. Measure the angle between two radii through point of contact at centre of the circle.

5. TOPIC: SOME APPLICATIONS OF TRIGONOMETRY

(3 MARKS QUESTIONS)

1. In the figure, AB is a 6 m high pole and CD is a ladder inclined at an angle of 60° to the horizontal and reaches up to a point D of pole. If AD = 2.54 m. Find the length of the ladder. (Use √3 = 1.73



2. The tops of two towers of height x and y, standing on level ground, subtend angles of 30° and 60° respectively at the centre of the line joining their feet, then find x : y.

3. The angles of depression of two ships from the top of a light house and on the same side of it are found to be 45° and 30°. If the ships are 200 m apart, find the height of the light house.

4. The angle of elevation of the top of the tower from two points at the distance of 4m and 9m from the base of the tower and in the same straight line with it are complementary. Find height of tower?

5. An observer 1.5m tall is 28.5m away from a chimney . The angle of elevation of the top of the chimney from her eyes is 45^0. What is the height of the chimney. ?

6. If a tower 30 m high, casts a shadow 10√3 m long on the ground, then what is the angle of elevation of the sun?

7. A tree is break due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30^0 with it . The distance between the foot of the tree to the point where the top touches the ground is 8m. Find the height of the tree.
8. As observed from the top of a 60 m high light house from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light-house, find the distance between the two ships. (Use √3 = 1.732]

9. The shadow of a tower standing on level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60°. Find the height of the tower.

10. The angle of elevation of the top of a tower from two points distant a and b from its foot are complementary. Prove that the height of the tower is $\sqrt{ab}$

11. The angle of elevation of the top of a hill at the foot of a tower is 60° and the angle of elevation of the top of the tower from the foot of the hill is 30°. If the tower is 50 m high, what is the height of the hill?

12. Two men on either side of a 75 m high building and in line with base of building observe the angles of elevation of the top of the building as 30° and 60°. Find the distance between the two men

13. A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string, assuming that there is no slack in the string.

14. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 3 m from the banks, find the width of the river.

15. A man standing on the deck of a ship, which is 10 m above the water level, observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill as 30°. Calculate the height of the hill.

Long answer question (4 marks)

1 . The angles of elevation and depression of the top and bottom of a lighthouse from the top of a building, 60 m high, are 30° and 60° respectively. Find
(i) the difference between the heights of the lighthouse and the building.
(ii) distance between the lighthouse and the building.

2. A vertical tower stands on a horizontal plane and is surmounted by a flagstaff of height 5 m. From a point on the ground the angles of elevation of the top and bottom of the flagstaff are 60° and 30° respectively. Find

(1). The height of the tower .

(2) The distance of the point from the tower. (Take $\sqrt{3} = 1.732$)

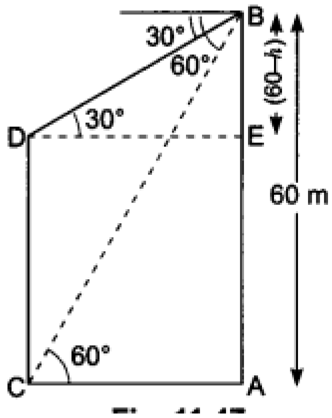
3. The angles of depression of the top and the bottom of a 8 m tall building from the top of a multi-storied building are 30° and 45°, respectively. Find

(1)The height of the multi-storied building

(2) The distance between the two buildings.

4. In Figure , from the top of a building AB, 60 meters high, the angles of depression of the top and bottom of a vertical lamp post CD height h meter are observed to be 30° and 60°, respectively. Find

(i) the horizontal distance between AB and CD.
(ii) the height of the lamp post.



5. The angle of elevation of an aeroplane from a point on the ground is 60°. After a flight of 30 seconds the angle of elevation becomes 30°. If the aeroplane is flying at a constant height of 3000 √3 m, find the speed of the aeroplane.

6. A TV tower stands vertically on bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of tower is 60^0. From another point 20m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the tower is 30^0. Find

1. The height of the tower
2. The width of the canal.

7. A vertical tower stands on a horizontal plane and is surmounted by a vertical flagstaff of height h. At a point on the plane, the angles of elevation of the bottom and top of the flagstaff are α and β respectively. Prove that the height of the tower is $\frac{h\tan\alpha}{\tan\beta-\tan\alpha}$

8. A spherical balloon of radius r subtends an angle α at the eye of an observer. If the angle of elevation of its center is β find the height of centre of the balloon.

9. A man on the deck of a ship, which is 10 m above water level, observes the angle of elevation of the top of a cliff as 60^0 and the angle of depression of the base of the cliff as 30^0. Calculate

1. The distance of the cliff from the ship
2. The height of the cliff.

10. At a point, the angle of elevation of a tower is such that its tangent is 5/12 On walking 240 m to the tower, the tangent of the angle of elevation becomes 3/4. Find the height of the tower.

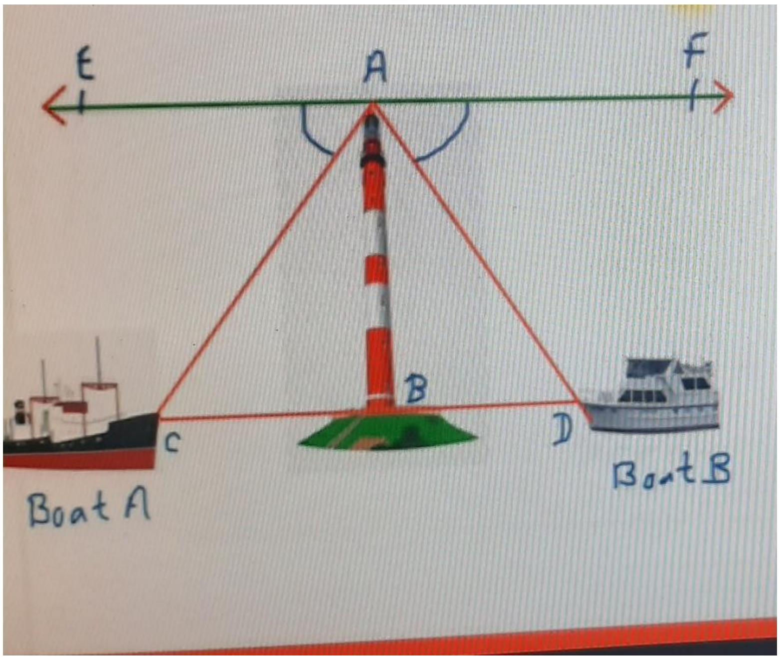
11. A group of students of class X visited India gate on an education trip the teacher and students had interested in history as well. the narrate the India gate. Official name Delhi Memorial originally called All- India War Memorial, monumental sand stone arch in new Delhi dedicated to the troops of British India who died in wars fought between 1914 and 1919. The teacher also said that india gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway) is about 138 feet (42 metres) in height.

(i) if the altitude of the sun is at 60^0. then the height of the vertical tower that will cast a shadow of length 20 m is?

(ii) The ratio of the length of a Rod and its shadow is 1:1. The angle of elevation of the sun is?

12. Mr. Ram observing from the top of light house finds that Boat A and Boat B are approaching to light house from opposite direction he finds that the angle of depression of boat A is 45^0 and angle

of depression of Boat B is 30^0.He also is aware of the height of the light house is 100m

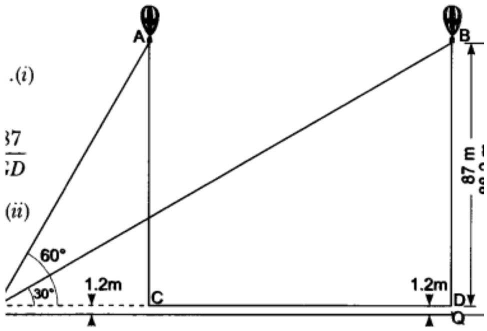


Answer the following question.

1 find length of BC

2 Find length BD

Q 13. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60°. After some time, the angle of elevation reduces to 30° (given fFig.). Find the distance travelled by the balloon during the interval.



Q 14. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, find the height of the building.

Q. 15. If the angle of elevation of a cloud from a point h metres above a lake is a and the angle of depression of its reflection in the lake is B, prove that the height of the cloud is h(tanß–tanα)/tanß–tanα

Answers

(3 MARKS)

Que (1.) 4m, Que (2.) 1:3, Que (3.) 273m, Que (4) 6m ,
Que (5) 30m , Que (6) 60^0 Que (8) 8√3 m Que (9) 30√3 ,
Que (10) √ab , Que (11)150m , Que (12) 155.7m Que (13) 40√3m
Que (14) 3(√3+1)m , Que (15) 40m

(4 MARKS)

Ans1. (i) difference between two light house = 20m

(ii) distance between light house and building = 34.64 m

Ans 2. (i) Height of the tower = 2.5 m

(ii) Distance of point of the point of the tower = 4.33 m

Ans 3. (i) The height of the building = 4(3+ √3) m

(ii) Distance between two building 4√3(3+√3)

Ans 4. (i) Horizontal between AB and CD = 20√3 m = 34.64m

(ii) Height of lamppost = 40m

Ans 5. 200m/s OR 720km/h

Ans 6. (i) Height of the tower = 10√3m

(ii) width of the river = 10m

Ans 7. H = $\frac{h \tan\alpha}{\tan\beta - \tan\alpha}$

Ans 8 height h = r sinβ. cosec α/2

Ans 9. (i) Distance of the cliff from the ship = 17.32 m

Ans 10 Height of the tower = 225 m

Ans 11. (i) 20√3m (ii) 45^0

Ans 12. (i) 100m (ii) 100√3m

Ans 13. Balloon travel 58√3 m

Ans 14. Height of the building = 50/3 m

Ans 15 Height of the cloud is h(tanß−tanα)/tanß–tanα

6.TOPIC: SURFACE AREA AND VOLUME

SHORT ANSWER QUESTIONS

2 MARKS

Q1. A toy is in the shape of a right circular cylinder with hemisphere at one end and a cone at the other. The radius and height of the cylindrical part are 5 cm and 13 cm respectively. The radii of the hemispherical and conical parts are the same as that of the cylindrical part.If the total height of the toy is 30 cm, find the total surface area of the toy.

Q2. Three cubes of a metal whose edges are in the ratio 3:4:5 are melted and converted into a single cube whose diagonal is $12\sqrt{3}$ cm.Find the edges of the cubes.

Q3. A cone of maximum size is carved out from a cube of edge 14 cm. Find the surface area of the cone and the remaining solid left after the cone carved out.

Q4. A vessel is in the form of a hemispherical bowl mounted by a hollow cylinder.The diameter of the hemisphere is 14 cm and the total height of the vessel is 13cm. Find the capacity of the vessel.

Q5.Two identical cubes each of volume 64 cm^3 are joined together end to end.What is the surface area of the resulting cuboid?

Q6.From a solid cube of side 7cm, a conical cavity of height 7cm and radius 3cm is hollowed out. Find the volume of the remaining solid.

Q7. Marbles of diameter 1.4 cm are dropped into a cylindrical beaker of diameter 7cm containing some water. Find the numberof marbles that should be dropped into the beaker so that the water level rises by 5.6 cm.

Q8.Two cones with same base radius 8 cm and height 15 cm are joined together along their bases. Find the surface area of the shape so formed.

Q9. A hemispherical bowl of internal diameter 36 cm. contains liquid. This liquid is to be filledin the cylindrical bottles of radius 3cm and height 6 cm. Find the number of bottles required to empty the bowl.

Q10. An ice cream cone of radius 5 cm and height 10cm is full of ice cream. Calculate the volume of ice cream , provided that 1/6 part is left unfilled with ice cream.

3 MARK QUESTIONS

Q 1. A sphere of diameter 18 cm is dropped into a cylindrical vessel of diameter 36 cm, partly filled with water. If the sphere is completely submerged, then calculate the rise of water level in cm

Q 2. Find the number of solid spheres, each of diameter 6 cm that can be made by melting a solid metal cylinder of height 45 cm and diameter 4 cm.

Q 3. A solid right circular cone is cut into two parts at the middle of its height by a plane parallel to its base. Find the ratio of the volume of the smaller cone to the whole cone.

Q 4. Volume and surface area of a solid hemisphere are numerically equal. What is the diameter of hemisphere?

Q 5. Two cubes each of side 4 cm are joined end to end. Find the surface area of the resulting cuboid.

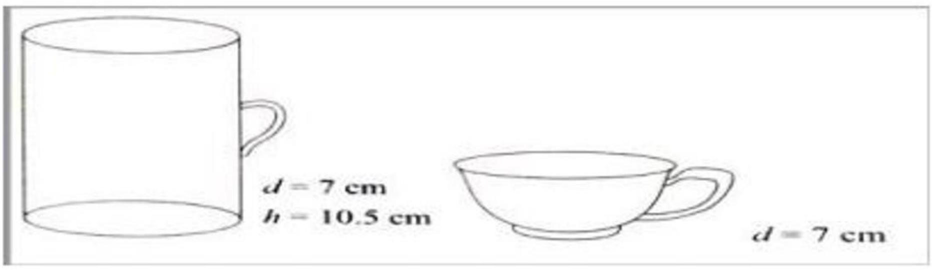
Q 6. If the total surface area of a solid hemisphere is 462 cm^2. Find its volume.

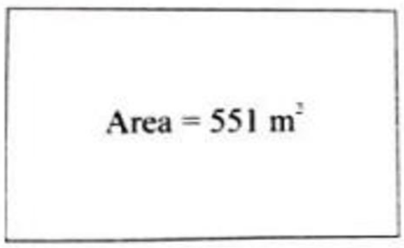
LONG ANSWER QUESTIONS

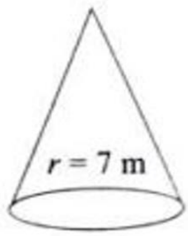
4 MARKS

CASE STUDY 1:

Q1. Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area $551 m^2$. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to $1 m^2$, the students put the tents. The radius of the tent is 7m.







(i) The volume of cylindrical cup is
a) 295.75 cm^3 b) 7415.5 cm^3 c) 384.88 cm^3 d) 404.25 cm^3

(ii) The volume of hemispherical cup is
a) 179.67 cm^3 b) 89.83 cm^3 c) 172.25 cm^3 d) 210.60 cm^3

iii) Which container had more juice and by how much?
a) Hemispherical cup, 195 cm^3 b) Cylindrical glass, 207 cm^3
c) Hemispherical cup, 280.85 cm^3 d) Cylindrical glass, 314.42 cm^3

iv) The height of the conical tent prepared to accommodate four students is
a) 18m b) 10m c) 24m d) 14m

v) How much space on the ground is occupied by each student in the conical tent
a) 54 m^2 b) 38.5 m^2 c) 86 m^2 d) 24 m^2

CASE STUDY 2:

Q2. The Great Stupa at Sanchi is one of the oldest stone structures in India, and an important monument of Indian Architecture. It was originally commissioned by the emperor Ashoka in the 3rd century BCE. Its nucleus was a simple hemispherical brick structure built over the relics of the Buddha. It is a perfect example of combination of solid figures.

A big hemispherical dome with a cuboidal structure mounted on it. (Take $\pi = 22/7$)

(i) Calculate the volume of the hemispherical dome if the height of the dome is 21 m –
a) 19404 cu. m b) 2000 cu .m c) 15000 cu. m d) 19000 cu. m

(ii) The formula to find the Volume of Sphere is -
a) $2/3\ \pi r^3$ b) $4/3\ \pi r^3$ c) $4\ \pi r^2$ d) $2\ \pi r^2$

(iii) The cloth require to cover the hemispherical dome if the radius of its base is 14m is
a) 1222 sq.m b) 1232 sq.m c) 1200 sq.m d) 1400 sq.

(iv) The total surface area of the combined figure i.e. hemispherical dome with radius 14m and cuboidal shaped top with dimensions 8m, 6m and 4m is

a)1200 sq.m b) 1232 sq.m c) 1392 sq.m d) 1932 sq.m

(v) The volume of the cuboidal shaped top is with dimensions mentioned in question (iv)

a) 182.45 m^3 b) 282.45 m^3 c) 292 m^3 d) 192 m^3

CASE STUDY 3:

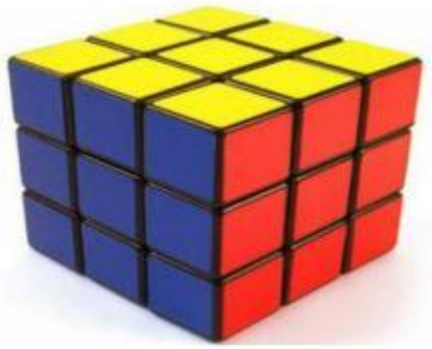
Q3. On a Sunday, your parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIC's cube and strawberry ice-cream for you. Observe the figures and answer the questions: -

(i) The length of the diagonal if each edge measures 6cm is

a) $3\sqrt{3}$ b) $3\sqrt{6}$ c) $\sqrt{12}$ d) $6\sqrt{3}$

(ii) Volume of the solid figure if the length of the edge is 7cm is

a)256 cm^3 b) 196 cm^3 c) 343 cm^3 d) 434 cm^3



3. What is the curved surface area of hemisphere (ice cream) if the base radius is 7cm?

a) 309 cm^2 b) 308 cm^2 c) 803 cm^2 d) 903 cm^2

4. Slant height of a cone if the radius is 7cm and the height is 24 cm___

a) 26cm b) 25 cm c) 52 cm d) 62cm

5. The total surface area of cone with hemispherical ice cream is

a) 858 cm^2 b) 885 cm^2 c) 588 cm^2 d) 855 cm^2

Q4.The surface area of a solid metallic sphere is 616 cm^2 . It is melted and recast into a cone of height 28 cm. Find the diameter of the base of the cone so formed

Q5. Water in a canal 6m wide and 1.5 m deep , is flowing with a speed of 10 km/hr. How much area will it irrigate in 30 minutes if 8cm of standing water is needed?

Q6.A building is in the form of a cylinder surmounted by a hemispherical dome.The base of the dome is equal to 2/3 of the total height of the building .Find the height of the building if it contains $67\frac{1}{21}m^3$ of air.

Q7.A toy is in the form of a hemisphere surrmounted by a right circular cone of the same base radius as that of the hemisphere. If the radius of the base of the cone is 21cm and its volume is 2/3 of the volume of the hemisphere , calculate the height of the cone and the surface area of the toy.

Q8. A cylindrical vessel with internal diameter 10 cm and height 10.5 cm is full of water. A solid cone of base diameter 7cm and height 6cm is completely immersed in water .Find the volume(in litres)of

(i) water displaced out of the cylindrical vessel
(ii) water left in the cylindrical vessel.

Q9. A solid is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 4cm and the diameter of the base is 8cm. Determine the volume of the toy. If a cube circumscribes the toy, then the difference of the volumes of cube and toy. Also, find the total surface area of the toy.

Q10. A juice seller serves his customers using a glass with bottom(base) as hemispherical portion raised which reduces the capacity of the glass. If the inner diameter of cylindrical glass is 5cm amd height is 10cm, find the apparent capacity of the glass and its actual capacity.(Use π =3.14)

ANSWER KEY

SHORT ANSWER QUESTIONS

Q1.770 cm^2 **Q2.** 6cm,8cm,10cm **Q3.** $154(1+\sqrt{5})cm^2, (1022+154\sqrt{5})cm^2$

Q4. 1642.66cm^3 **Q5.** 160 cm^2 **Q6.** 277.60 cm^3 **Q7.** 150

Q8. 855 cm^2 **Q9.** 72 bottles **Q10.** 327.375 cm^3

LONG ANSWER QUESTIONS

CASE STUDY 1:
Q1. (i)d) 404.25 cm^3 (ii) b) 89.83 cm^3 (iii)d) Cylindrical glass, 314.42 cm^3
(iv) c) 24m (v) b) 38.5 m^2

CASE STUDY 2:

Q2. (i) a) 19404 cu.m (ii) b) $4/3\ \pi r^3$ (iii) b) 1232 sq.m (iv) c) 1392 sq.m (v) d) 192 m^3

CASE STUDY 3:
Q3.(i) d) $6\sqrt{3}$ (ii) c) 343 cm^3 (iii) b) 308 cm^2 (iv) b) 25 cm
(v) a) 858 cm^2

Q4. 14 cm **Q5. 562500 m^2** **Q6.** Height = 6 m **Q7. 5082 cm^2**

Q8. 0.77 litre , 0.748 litre **Q9. 1408/7 cm^3, 310.86 cm^3, 171.68 cm^2**

Q10. 32.71cm^3, 163.54 cm^3

7.TOPIC: STATISTICS

IMPORTANT FORMULAS AND CONCEPTS

We will learn the three measures of central tendency namely, mean, median and mode of grouped data.

1. Mean or Average: - It is the sum of the values of all the observations divided by the total number of observations.

(a) Direct Method: - Mean of grouped data

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

(b) Assumed Mean Method: - Mean of grouped data

$$\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$$

2. Mode of grouped data: - Mode is that values among the observations which occurs most often or the value of the observation having the maximum frequency.

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

Where l = lower limit of the modal class
h = size of the class interval
f_1 = frequency of the modal class
f_0 = frequency of the class preceding the modal class
f_2 = frequency of the class succeeding the modal class

3. Median of grouped data: - median is the measure of central tendency which gives the value of the middle-most observation in the data.

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

Where l = lower limit of median class
n = number of observations
cf = cumulative frequency of class preceding the median class
f = frequency of median class
h = class size

The empirical relationship between the three measures of central tendency is: -

3 Median = Mode + 2 Mean

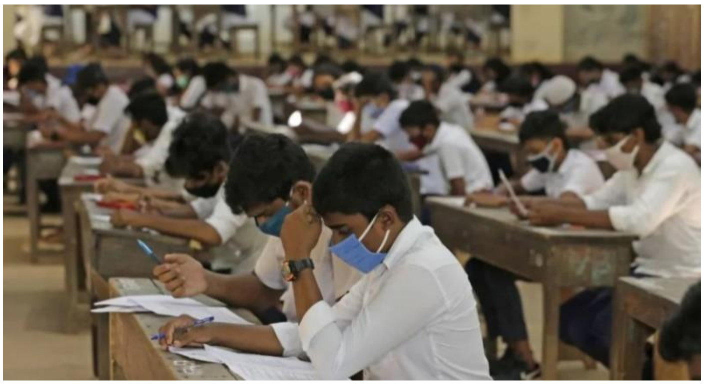
I. Case Study and Situation Based Questions: -

1. Under the physical and health education a medical checkup program was conducted in a Vidyalaya to improve the health and fitness conditions of the students. Reading of the heights of 50 students was obtained as given in the table below:

Hight (in cm)	Number of students
135 – 140	2
140 – 145	8
145 – 150	10
150 – 155	15
155 – 160	6
160 – 165	5
165 – 170	4

(i) Identify the lower-class limit of the modal class and find the mode of the given data.
(ii) Calculate the mean and median of the above data.

2. In a Vidyalaya there are two sections A and B. 39 students are there in section A and in section B there are 41 students. A periodic test was conducted to assess the performance of students thereafter analyze and plan the teaching learning process accordingly. The marks obtained out of 40 are given below in the table.



Marks obtained by the students	Number of students
Less than 5	3
Less than 10	12
Less than 15	22
Less than 20	35
Less than 25	42
Less than 30	60
Less than 35	71
Less than or equal to 40	80

(i) How many students have obtained more than or equal to 35 marks?

(iii) Arrange the given data in class interval and find the median of the marks obtained.

3. An international cricket tournament was organized. Ten teams participated in the tournament. All the players got opportunity to bat in their first match. The lowest and highest runs scored by an individual player in their first match are 0 and 99 respectively. Runs scored by the players in their first match are given below in the table: -

Runs scored in their first match	Number of players
More than or equal to 0	110
More than or equal to 10	105
More than or equal to 20	95
More than or equal to 30	81
More than or equal to 40	69
More than or equal to 50	51
More than or equal to 60	45
More than or equal to 70	30
More than or equal to 80	20
More than or equal to 90	8

(i) How many players scored more than or equal to 50 runs and how many players scored less than 10 runs?

(iii) Find the range of the runs scored by individual players.

<u>II. Very Short Answer Type Questions: -</u>

1. Find the mean of first ten whole numbers.

2. If the mode of a distribution is 9 and its mean is 6, then find its median.

3. Write the modal class for the following frequency distribution.

Class Interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	7	4	10	4

4. Write the empirical relationship between the three measures of central tendency.

5. A data has 9 observations arranged in descending order. Which observation represents the median of the data?

6. Find the class size of the given class intervals.

Class Interval	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30	30 – 46
Frequency	3	5	7	4	9	2

7. Find the cumulative frequency of the class interval 20 – 25 in the given frequency distribution.

Class Interval	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
Frequency	4	12	8	3	3	2

8. Find the class mark of the class interval 30 – 40 in a frequency distribution.

III. Short Answer Type Questions: -

1. Find the mean of 20 numbers, such that if the mean of 8 of them is 10 and the mean of 10 of them is 12. The last two numbers are 8 and 12.

2. Find the mean of first 15 natural numbers.

3. The number of pages read by a student during a week are as under: -

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
14	14	12	18	13	15	12

Find the mean number of pages.

4. The observation 15, 24, 32, a + 5, b, 46, 50 is arranged in ascending order. The median is 36. Find the value of a.

5. From the following frequency distribution, find the median class.

Monthly wages	Number of workers
18000 – 24000	18
24000 – 30000	25
30000 – 36000	30
36000 – 42000	28
42000 – 48000	35
48000 – 54000	32
54000 – 60000	32

6. Find the mode of the following frequency distribution.

Class Interval	Frequency
0 – 10	10
10 – 20	14
20 – 30	12
30 – 40	8
40 – 50	9

7. While finding the mean of 18 observations, an observation 43 was wrongly noted as 34 and then the mean was 30. Find the correct mean.

8. In the following frequency distribution, find the lower limit of the median class.

Age group (in years)	Number of Students
5 – 8	45
8 – 11	50
11 – 14	35
14 – 17	60
17 – 20	110

9. The mean of the following frequency distribution is 4.84. Find the value of f.

Class Interval	Frequency
0 – 2	5
2 – 4	f
4 – 6	25
6 – 8	4
8 – 10	6

10. Find the missing frequency from the following data, when mode is 27.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	x	15	12	7

IV.Long Answer Type Questions: -

1. A survey was conducted to find the monthly earnings of 500 people in a city. Their monthly earnings are given by the following frequency distribution table. Find the mean earnings and modal monthly earnings.

Monthly earnings (in Rs.)	Number of people
20000 – 30000	58
30000 – 40000	56
40000 – 50000	60
50000 – 60000	85
60000 – 70000	37
70000 – 80000	70
80000 – 90000	77
90000 – 100000	57

2. In a Vidyalaya, students were asked to find out the number of people of different ages those who have been recovered from Covid-19 pandemic. The students asked 100 people and represented the data as given:

Age (in years)	Number of people
Below 10	2
Below 20	6
Below 30	22
Below 40	40
Below 50	75
Below 60	84
Below 70	90
Below 80	96
Below 90	99
Below 100	100

Calculate the median age and mean age of the people.

3. The percentage of marks scored by 40 students of class X in their board examination is given below in the table. Find the mean and modal percentage of their marks.

Percentage of marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Number of students	6	14	20	25	15	12	8

4. Apples are supplied to a retail market from a garden. Different number of apples are packed in the boxes as per their size. The following are the distribution of apples according to the number of boxes:

Number of apples	100 - 105	105 – 110	110 – 115	115 – 120	120 – 125
Number of boxes	25	100	130	125	20

Find the average number of apples kept in a packing box. Also find the mode of the given distribution.

5. The class teacher of class X A has the following attendance record of 40 students for 200 days. The minimum number of days any student present is 80. Find the mean, median and modal attendance of the students.

Number of days	Number of students present
More than or equal to 80	40
More than or equal to 100	36
More than or equal to 120	30
More than or equal to 140	20
More than or equal to 160	15
More than or equal to 180	8

6. It is good news that the number of covid-19 cases are decreasing day by day. 30 cities of our country is surveyed and the number of positive cases in a day are recorded as under.

Number of cases	Number of cities
Less than 15	3
Less than 30	4
Less than 45	5
Less than 60	7
Less than 75	10
Less than 90	12
Less than 105	15
Less than 120	23
Less than 135	26
Less than 150	30

Find the median and modal number of cases.

7. The distribution below gives the weight of 50 students of class X. Find the median and modal weight of the students.

Weight (in kg)	35 – 45	45 –55	55 – 65	65 – 75	75 – 85
Number of students	5	10	20	12	3

8. Data of average annual rainfall (incm)of different states and union territories of our country is recorded by the students of class X B. It is represented by the following table.

Average annual rainfall (incm)	Number of states or union territories
50 – 74	3
75 – 99	5
100 –124	4
125 – 149	10
150 – 174	8
175 – 199	4
200 – 225	1

Find the median and mean rainfall of the cities.

Answer Key

I. Case Study and Situation Based Questions:

1. (i) Lower class limit of modal is (150 – 155) is 150. Mode of the observation is 151.79

   (ii) Mean of the data is 190.13 and median is 150

2. Hint: Convert the less than type data into class intervals.

(i) 80 – 71 = 9

(ii) Median of the marks obtained is 21.92

3. Hint: Convert the more than type data into class intervals and find cumulative frequency.

(i) more than or equal to 50 is 51 and less 10 is 5.
(ii) Range of the runs scored by individual player = 99 – 0 = 99.

II. VSA

1. 2   2. 7   3. 30 – 40   4. 3 Median = Mode + 2 Mean   5. 5 th   6. 6   7. 30   8. 35

III. SA

1. 11   2. 8   3. 14   4. 31(Hint: When data is arranged in ascending or descending order, the middle value is its median.)

5. 36000 – 42000   6. 16.67   7. 30.5   8. 14   9. f = 10   10. x = 8

IV. Long Answer Type Questions

1. The mean earnings is Rs. 58190 and modal earnings is Rs.53203.

2.(Hint: Convert the 'below type' into class intervals as 0 – 10, 10 – 20, 20 – 30 etc.

   Median age is 43 years and mean age is 41.05 years.

3.Mean percentage of marks is 64. 70 and modal percentage of marks is 63.33.

4.The average number of apples is 113 (112.69) and mode of the given distribution is 114.29

5.Mean = 144.5, Median = 140 and mode = 128.89

6.Median = 105 and mode = 112.5

7.Median = 60 and mode = 60.56

8. (Hint: convert the data to continuous classes, as 49.5 – 74.5, 74.5 – 99.5, 99.5 – 124.5 and so on) Median rainfall is138.25 cm and mean rainfall is 134.14 cm.

MODEL PAPER 1
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION
CLASS-X

TIME: 2 HRS. **SUBJECT – BASIC MATHEMATICS** **M.M.:40**

Instructions: 1. Write Serial Number of the question before attempting it.
2. The Question Paper divided into 3 sections – A, B, & C.
3. There are some optional questions you have to attempt any one (a) or (b)

SECTION – A

Q.NO.		MARKS
1	(a) Find the roots of the quadratic equation: $x^2 -3x - 10 = 0$ **OR** (b) Find the nature of the roots of the quadratic equation. If the real roots exist, find them: $3x^2 - 4\sqrt{3}x + 4 = 0$	**2**
2	Which of the following is an AP? If they form an AP, find the common difference d and write two more terms. $\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32} \ldots \ldots$	**2**
3	(a) If tangents PA and PB from a point P to a circle with centre O are inclined to Each other at angle of 80°, then find ∠POA. **OR** (b) The length of a tangent from a point A at distance 5 cm from the centre of The circle is 4 cm. Find the radius of the circle.	**2**
4	Metallic spheres of radii 6 cm, 8 cm and 10 cm, respectively, are melted to form a single solid sphere. Find the radius of the resulting sphere.	**2**

5	The given distribution shows the number of runs scored by some top batsmen of the world in one-day international cricket matches. *(table below)* Find the mode of the data.	**2**
6	100 surnames were randomly picked up from a local telephone directory and the frequency distribution of the number of letters in the English alphabet in the surnames was obtained as follows: *(table below)* Determine the median number of letters in the surnames.	**2**

Runs scored	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000-9000	9000-10000	10000-11000
Number of batsmen	4	18	9	7	6	3	1	1

Number of letters	1-4	4-7	7-10	10-13	13-16	16-19
Number of surnames	6	30	40	16	4	4

SECTION – B

7	Is the following situation possible? If so, determine their present ages. "The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48".	**3**
8	The first term of an AP is 5, the last term is 45 and the sum is 400. Find the number of terms and the common difference.	**3**

9	(a) A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree. **OR** (b) A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string, assuming that there is no slack in the string.	**3**
10	Prove that "The lengths of tangents drawn from an external point to a circle are equal".	**3**

SECTION – C

11	(a) Draw a line segment of length 7.6 cm and divide it in the ratio 5:8. Measure the two parts. Write the steps of constructions and give the proper justification also. **OR**	

	(b) Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths. Write steps of construction and give proper justification	**4**
12	A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.	**4**

Number of plants	0-2	2-4	4-6	6-8	8-10	10-12	12-14
Number of houses	1	2	1	5	6	2	3

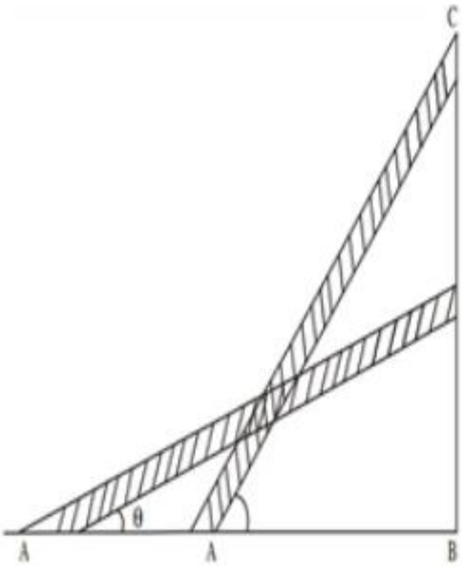
Which method did you use for finding the mean, and why?

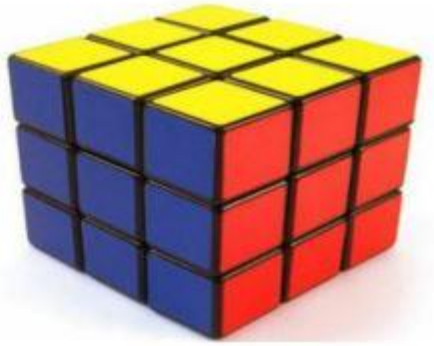
13

CASE STUDY-1

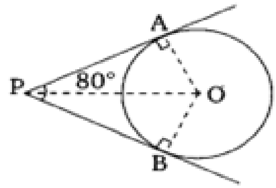
Painting on wall

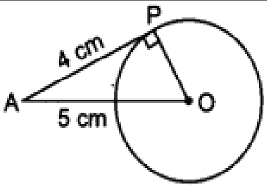
A person is white washing a wall with the help of a ladder which is kept as shown in the following figure



	When he wants to paint at higher or lower points he should change the position of ladder and angle θ. Now answer the following questions: - i) If ladder is inclined at 60° angle and distance of the foot of the ladder to the foot of the wall AB = 2 metres then find length of ladder. ii) If length of ladder is 10 metres and BC = $5\sqrt{2}$ metres then find angle θ	**2** **2**
14	**CASE STUDY-2** On a Sunday, your Parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. Observe the figures and answer the questions: -   (a) Find the volume of Rubik's if edge is 7 cm and find **the length of the diagonal also.** (b) **Find the curved surface area of hemisphere (ice cream) if the base radius is 7cm?**	**2** **2**

Marking Scheme of Class-X- BASIC MATHS-2021-22

Q.NO.	EXPECTED SOLUTIONS/ANSWERS	MARKS GIVEN
1	(a) $x^2-5x+2x-10=0 \Rightarrow (x-5)(x+2)=0$ $x = 5\ or\ -2$ **OR** (b) Discriminant (D) = $b^2-4ac=\left(-4\sqrt{3}\right)^2-4\times3\times4$ $D=48-48=0$ Since D>0 so roots are real and equal. $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-(-4\sqrt{3})\pm\sqrt{0}}{2\times3}=\frac{4\sqrt{3}}{6}=\frac{2}{\sqrt{3}}$	**1½** ½ ½ ½ **1**
2	$\sqrt{2},\sqrt{8},\sqrt{18},\sqrt{32}$ … … $=\sqrt{2},2\sqrt{2},3\sqrt{2},4\sqrt{2}$…… Common difference(d) = $2\sqrt{2-}\sqrt{2}=4\sqrt{2}-3\sqrt{2}$ = $\sqrt{2}$ Since there exit common difference so it is an AP and d=$\sqrt{2}$, $\sqrt{50}$,$\sqrt{72}$	½ **1** ½
3	(a)  Justification: In ΔPOA and ΔPOB, $\angle$PAO = $\angle$PBO [Each of 90°] OA = OB [Radii of the circle] PA = PB [Both are tangents] $\therefore$ ΔPOA $\cong$ ΔPOB [By SAS congruence] $\Rightarrow$ $\angle$APO = $\angle$BPO [CPCT] $\Rightarrow$ $\angle APO=\frac{1}{2}\angle APB=\frac{1}{2}\times80^\circ=40^\circ$ In ΔPAO, $\angle$APO + $\angle$POA + $\angle$OAP = 180° $\Rightarrow$ 40° + $\angle$POA + 90° = 180° $\Rightarrow$ $\angle$POA = **50°**. **OR** (b)	 **1**



OA = 5 cm, AP = 4 cm

OP = Radius of the circle **1**

∠OPA = 90° [Radius and tangent are perpendicular]

$$OA^2 = AP^2 + OP^2 \qquad \text{[By Pythagoras theorem]}$$

$$5^2 = 4^2 + OP^2 \Rightarrow 25 = 16 + OP^2$$

$$\Rightarrow 25 - 16 = OP^2 \Rightarrow 9 = OP^2 \Rightarrow \sqrt{9} = OP$$

$$\Rightarrow OP = 3 \text{ cm}$$

$$\therefore \text{Radius} = 3 \text{ cm}$$

1

1

4	Radius of 1^{st} metallic sphere = 6 cm $\therefore$ Volume of 1^{st} metallic sphere = $\frac{4}{3}\pi(6)^3$ cm^3 Radius of 2^{nd} metallic sphere = 8 cm $\therefore$ Volume of 2^{nd} metallic sphere = $\frac{4}{3}\pi(8)^3$ cm^3 Radius of 3^{rd} metallic sphere = 10 cm $\therefore$ Volume of 3^{rd} metallic sphere = $\frac{4}{3}\pi(10)^3$ cm^3 Volume of all three metallic spheres = $\frac{4}{3}\pi(6^3+8^3+10^3)$ cm^3 $\because$ 3 spheres are melted and recast into a new metallic sphere of radius r. $\therefore$ Volume of new metallic sphere = $\frac{4}{3}\pi r^3$ According to question, $\frac{4}{3}\pi(6^3+8^3+10^3) = \frac{4}{3}\pi r^3 \Rightarrow 6^3+8^3+10^3 = r^3$ $\Rightarrow$ $216+512+1000 = r^3 \Rightarrow 1728 = r^3 \Rightarrow r = 12$ cm	½ ½ ½ ½
5		

Runs scored	Number of batsmen (f_i)
3000 – 4000	4
4000 – 5000	18
5000 – 6000	9
6000 – 7000	7
7000 – 8000	6
8000 – 9000	3
9000 – 10000	1
10000 – 11000	1

Maximum frequency = 18,

$\therefore$ Modal class = 4000 – 5000; Here, $l = 4000, f_0 = 4, f_1 = 18, f_2 = 9$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 4000 + \left(\frac{18-4}{36-4-9}\right) \times 1000$$

$$= 4000 + \frac{14000}{23} = 4000 + 608.7 = 4608.7 \text{ runs}$$

½

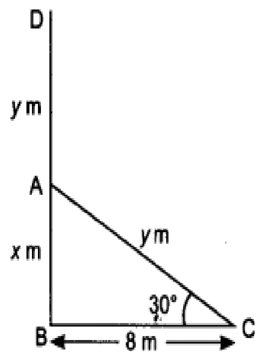
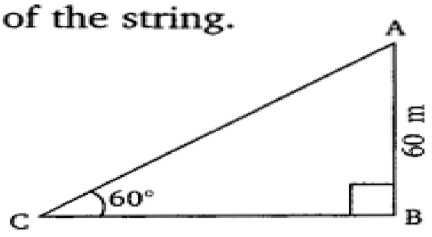
½

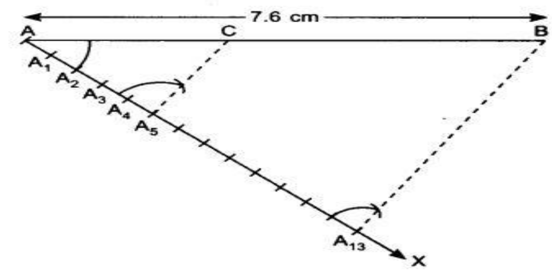
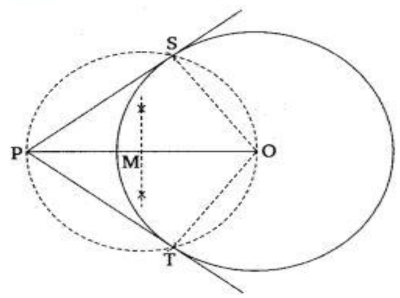
1

6

	$\because \quad n = 100$ $\therefore \quad \frac{n}{2} = \frac{100}{2} = 50$ Since 40 is the maximum frequency, so the median class is $(7 - 10)$. Here, $l = 7, f_m = 40, cf = 36$ and $h = 3$. $\therefore$ **Median** $= l + \left(\frac{\frac{n}{2} - cf}{f_m}\right) \times h$ $= 7 + \left(\frac{50-36}{40}\right) \times 3 = 7 + \frac{14}{40} \times 3$ $= 7 + \frac{21}{20} = 7 + \frac{10.5}{10}$ $= 7 + 1.05 = \mathbf{8.05}$	½ ½ **1**
7	Let present ages be x and $(20 - x)$ years respectively then 4 years ago $(x-4)$ and $(20 - x - 4 = 16 - x)$ years respectively. $(x-4)(16-x) = 48 \Rightarrow x^2 - 20x + 112 = 0$ *then* $D = b^2 - 4ac$ $D = 400 - 448 = -48 < 0$ since no real roots exit, so the given situation is not possible.	**1** **1** **1**

8	Given: $a = 5$, $l = t_n = 45$(last term) and $S_n = 400$ $\therefore \quad \frac{n}{2}[a + l] = 400$ $\Rightarrow \frac{n}{2}[5 + 45] = 400$ $\Rightarrow \quad n = \frac{400}{25} = 16$ Now, $t_{16} = 45$ $\Rightarrow \quad 5 + 15d = 45$ $\Rightarrow \quad d = \frac{40}{15} = \frac{8}{3}$ Thus, $n = \mathbf{16}$ and $d = \mathbf{\frac{8}{3}}$.	½ ½ 1 ½ ½
9	(a)	

	Let DB is a tree and AD is the broken part of it which touches the ground at C. Given: $\angle ACB = 30^\circ$ and $BC = 8$ m Let $AB = x$ m and $AD = y$ m $\therefore$ Now, length of the tree $= (x + y)$ m  In ΔABC, $\frac{AB}{BC} = \tan 30^\circ \Rightarrow \frac{x}{8} = \frac{1}{\sqrt{3}} \Rightarrow x = \frac{8}{\sqrt{3}}$ ... (*i*) and $\frac{AB}{AC} = \sin 30^\circ \Rightarrow \frac{x}{y} = \frac{1}{2}$ $\Rightarrow y = 2x \Rightarrow y = 2 \times \frac{8}{\sqrt{3}} = \frac{16}{\sqrt{3}}$ [From equation (*i*)] Hence, total height of the tree $x + y = \frac{8}{\sqrt{3}} + \frac{16}{\sqrt{3}} = \frac{24}{\sqrt{3}} = \frac{24}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{24\sqrt{3}}{3} = 8 \times 1.732 = 13.856$ m OR (b) Given: $AB = 60$ m and $\angle ACB = 60^\circ$ Let AC be the length of the string. Then in right ΔABC,  $\sin 60^\circ = \frac{AB}{AC}$ $\Rightarrow \frac{\sqrt{3}}{2} = \frac{60}{AC}$ $\Rightarrow AC = \frac{60 \times 2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{120 \times \sqrt{3}}{3} = 40\sqrt{3}$ m. Hence, the length of the string is $\mathbf{40\sqrt{3}}$ **m**.	**2** **1** **1** **2**
10	Correct Figure, Correct Proof	**1** **2**
11	(a)	

	Steps of Construction: 1. Draw a line segment AB = 7.6 cm. 2. Draw an acute angle BAX on base AB. Mark the ray as AX. 3. Locate 13 points $A_1, A_2, A_3, \ldots\ldots, A_{13}$ on the ray AX so that $AA_1 = A_1A_2 = \ldots\ldots = A_{12}A_{13}$ 4. Join A_{13} with B and at A_5 draw a line ∥ to BA_{13}, i.e. A_5C. The line intersects AB at C. 5. On measure AC = 2.9 cm and BC = 4.7 cm.	**1**
		
	Justification: In ΔAA_5C and $\Delta AA_{13}B$, $A_5C \parallel A_{13}B$ $\frac{AC}{BC} = \frac{AA_5}{A_5A_{13}}$ **(By the Basic Proportionality Theorem)** $\frac{AC}{BC} = \frac{5}{8}$ $\left[\because \frac{AA_5}{A_5A_{13}} = \frac{5}{8}\right]$ $\therefore$ AC : BC = 5 : 8	**2**
	(b) **Steps of Construction:** 1. Draw a circle with centre and radices = 6 cm. 2. Take a point P such that OP = 10 cm. 3. Draw the perpendicular bisector of OP. Let M is the mid-point of OP. 4. With centre M and radius PM = MO, draw a circle which cuts the given circle at S and T. 5. Join PS and PT. Thus, PS and PT are the required tangents. The length of tangents Ps= PT = 8 cm.	**1**
		
	Justification: Join OS. Now in triangle PSO, $\angle PSO = 90°$ $\therefore PS = \sqrt{OP^2 - OS^2}$ [By Pythagoras' Theorem] $= \sqrt{(10)^2 - (6)^2} = \sqrt{100 - 36} = \sqrt{64}$ $= 8$ cm.	

		1 **2** **1**
12	See below	

Number of plants	Class mark (x_i)	Number of houses (f_i)	$f_i x_i$
0 – 2	1	1	01
2 – 4	3	2	06
4 – 6	5	1	05
6 – 8	7	5	35
8 – 10	9	6	54
10 – 12	11	2	22
12 – 14	13	3	39
Total		$\Sigma f_i = 20$	$\Sigma f_i x_i = 162$

We have, Mean $(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{162}{20} = 8.1$ plants. The mean of the data is 8.1.

Since the values of x_i and f_i are small, so we have used direct method to find the mean.

		2 **1** **1**
13	(a) (i) $cos60° = \frac{2}{l} \Rightarrow \frac{1}{2} = \frac{2}{l} \Rightarrow l = 4\ metres$ (ii) $sin\theta = \frac{BC}{l} \Rightarrow sin\theta = \frac{5\sqrt{2}}{10} = \frac{1}{\sqrt{2}} \Rightarrow sin\theta = sin45° \Rightarrow \theta = 45°$	**2** **2**
14	(a) Volume of Rubik's = $7 \times 7 \times 7 = 343\ cubic\ cm$ and length of diagonal = $7\sqrt{3}\ cm$ (b) Curved Surface Area of Hemisphere =$2\pi r^2 = 2 \times \frac{22}{7} \times 7^2 =$ $308\ square\ cm.$	**1** **1** **2**

MODEL PAPER 2

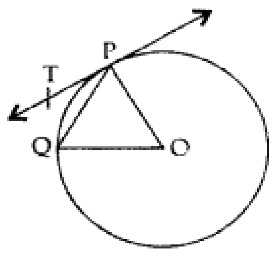
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION

CLASS-X

TIME: 2 HRS. SUBJECT – STANDARD MATHEMATICS M.M.:40

Instructions: 1. Write Serial Number of the question before attempting it.
2. The Question Paper divided into 3 sections – A, B, & C with 14 questions.
3. Where internal choices have been provided as (a) and (b) you have to attempt only one (a) or (b)

SECTION – A

Q.NO.		MARKS
1	Represent the following situation in the form of quadratic equations: "The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice its breadth. We need to find the length and breadth of the plot."	**2**
2	**(a)** Find the roots of quadratic equation by factorisation: $\sqrt{2}\,x^2 + 7x + 5\sqrt{2} = 0$ **<u>OR</u>** **(b)** Find the values of ***k*** for quadratic equation, so that they have two equal roots. $2x^2 + kx + 3 = 0$	**2**
3	The following data gives the information on the observed lifetimes (in hours) of 225 electrical components: Lifetimes (in hours): 0-20, 20-40, 40-60, 60-80, 80-100, 100-120 Frequency: 10, 35, 52, 61, 38, 29 Determine the modal lifetimes of the components.	**2**
4	A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel.	**2**
5	In the given figure, O is the centre of a circle, PQ is a chord and PT is the tangent at P. If ∠POQ = 70°, then calculate ∠TPQ 	

Lifetimes (in hours)	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	10	35	52	61	38	29

		2
6	(a) Find the common difference of the A.P.: $\frac{1}{2b}, \frac{1-6b}{2b}, \frac{1-12b}{2b}$ ……… **OR** (b) The angles of a triangle are in A.P., the least being half the greatest. Find the angles.	**2**

SECTION – B

7	(a) From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower. **OR** (b) From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60∘ and the angle of depression of its foot is 45∘. Determine the height of the tower.	**3**
8	The median of the following data is 525. Find the values of x and y, if the total frequency is 100.	**3**
9	Q.9. Find the mean of the following data:	**3**

Table for Q.8:

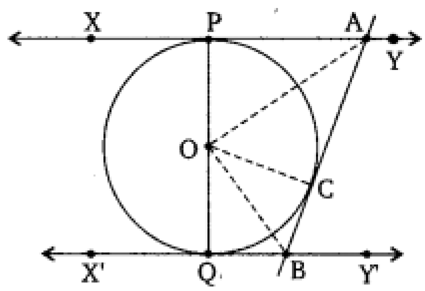
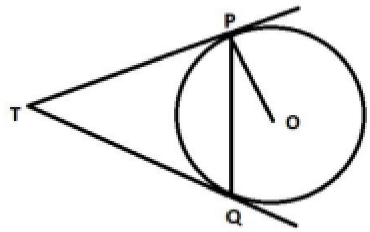
Class interval	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency	2	5	x	12	17	20	y	9	7	4

Table for Q.9:

Percentage of female teachers	15-25	25-35	35-45	45-55	55-65	65-75	75-85
Number of state/UT	6	11	7	4	4	2	1

10	Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths. Give a proper justification of the construction.	**3**

SECTION – C

11	(a) In figure, XY and X'Y' are two parallel tangents to a circle, x with centre O and Another tangent AB with point of contact C intersecting XY at A and X'Y' at B. Prove that ∠AOB = 90°.  **<u>OR</u>** (b) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$ 	**4**
12	A container shaped like a right circular cylinder having diameter 12 cm and height 15 cm is full of ice cream. The ice cream is to be filled into cones of height 12 cm and diameter 6 cm, having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream.	**4**
13	**CASE STUDY-1** Read the following content then solve the given questions: - Raman is a contractor; he is constructing a building of many floors. The building has interesting design on each floor it has open space thus number of room's decreases as we go up. If number of bricks for construction of a room is 1500. The number of bricks required for ground floor is 30,000 on 1st floor it is 27,000 on 2nd floor It is 24,000 ...... and so on. (i) Find the total number of rooms on ground floor. (ii) Find the number of rooms on 5th floor.	**2** **2**

14 **CASE STUDY-2**

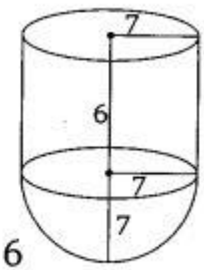
See the following picture and read the content then solve the given questions below of this case study: -

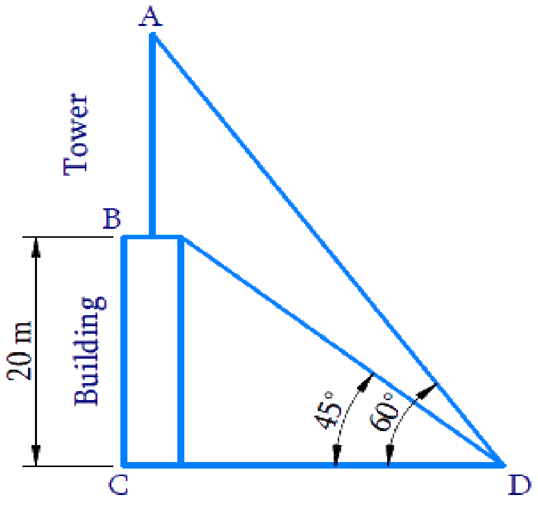
A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that **India Gate**, official name **Delhi Memorial**, originally called **All-India War Memorial**, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919.The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway), is about 138 feet (42 metres) in height.

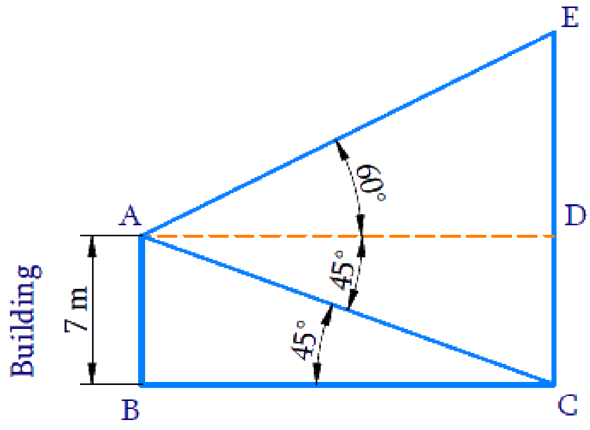
(i) Find the angle of elevation if they are standing at a distance of 42 m away from the monument? **2**

(ii) If the altitude of the Sun is at 60°, then find the height of the vertical tower that will cast a shadow of length 20 m. **2**

Marking Scheme of Class-X-STANDARD MATHS -2021-22

Q.NO.	EXPECTED SOLUTIONS/ANSWERS	MARKS GIVEN
1	Breadth of the rectangular plot = x m Thus, the length of the plot = (2x + 1) m $2x^2 + x - 528 = 0$	 ½ **1½**
2	(a) $\sqrt{2}\,x^2 + 5x + 2x + 5\sqrt{2}$ => $x(\sqrt{2}x + 5) + \sqrt{2}(\sqrt{2}x + 5) = (\sqrt{2}x + 5)(x + \sqrt{2})$ => $x = \frac{-5}{\sqrt{2}}$ or $x = -\sqrt{2}$ **<u>OR</u>** (b) Discriminant = $b^2 - 4ac = (k)^2 - 4(2)(3) = 0$ $k = \pm\sqrt{24} = \pm 2\sqrt{6}$	½ **1** ½ **1** **1**
3	Modal class: 60-80 $Mode = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 60 + \left(\frac{61 - 52}{2 \times 61 - 52 - 38}\right) \times 20$ $= 60 + \frac{9}{32} \times 20 = 60 + 5.625 = 65.625$	½ **1** ½
4	Radius of hemisphere, $r = \frac{14}{2} = 7$ cm Height of cylinder, $h = 13 - 7 = 6$ cm  ∴ Total inner surface area of vessel = Inner surface area of hemisphere + Inner surface area of cylinder = $2\pi r^2 + 2\pi rh$ $= 2\pi \times (7)^2 + 2\pi \times 7 \times 6$ $= 98\pi + 84\pi = 182\pi$ $= 182 \times \frac{22}{7}$ = **572 cm²**.	½ ½ ½ ½
5	By ASP of triangle, ∠P+∠Q = 180°-70° = 110° But ∠P=∠Q (Opposite sides of equal radii) ⇒∠P=∠Q=55° Tangent ⊥ Radius so ∠TPO=90° hence ∠TPQ = 35°	½ ½ **1**

6	(a) d = $a_2 - a_1 = a_3 - a_2$ $means\ d = \frac{1-6b}{2b} - \frac{1}{2b} = \frac{1-12b}{2b} - \frac{1-6b}{2b} = -3$ **OR** (b) Let the angles be , (a-d) , (a) , (a+d) Sum of the angles of a triangle is 180°. So, (a-d)+(a)+(a+d)=180°-----(1) a=60° Also, from the given condition, a-d=1/2 (a+d) d=20Thus, angles are 40°, 60°, 80°.	**½** **1½** **½** **½** **½** **½**
7	 In ΔBCD, tan 45° = BC/CD, 1 = 20/CD⇒ CD = 20 m In ΔACD, tan 60° = AC/CD, √3 = AC/20, AC = 20√3 m Height of the tower, AB = AC – BC, AB = 20√3 - 20 m = 20 (√3 - 1) m **OR**	 **1** **1**

	 Draw AD || BC. Then, ∠DAC = ∠ACB = 45° (alternate interior angles) In ΔABC, tan 45° = AB / BC, 1 = 7/BC, BC = 7 ABCD is a rectangle, Therefore, BC = AD = 7 and AB = CD = 7 In ΔADE, tan 60° = ED/AD, √3 = ED/7, ED = 7√3 Height of tower = CE = ED + CD= 7√3 + 7 = 7 (√3 + 1) m	**1**
8	Median class: 500-600 $x + y = 24$ Median = $l + \left(\frac{\frac{n}{2} - cf}{f}\right)h \Rightarrow 525 = 500 + \left(\frac{\frac{100}{2} - (36+x)}{20}\right) \times 100$ 25 = 70-5x ⇒ x = 9 then y = 15	½ ½ **1** ½ ½

9

Percentage of female teachers	Number of States/U.T. (f_i)	Class mark (x_i)	$x_i - a$	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
15 – 25	6	20	20 – 50 = –30	$\frac{-30}{10} = -3$	6 × –3 = –18
25 – 35	11	30	30 – 50 = –20	$\frac{-20}{10} = -2$	11 × -2 = –22
35 – 45	7	40	40 – 50 = –10	$\frac{-10}{10} = -1$	7 × –1 = –7
45 - 55	4	50	50 – 50 = 0	$\frac{0}{10} = 0$	4 × 0 = 0
55 - 65	4	60	60 – 50 = 10	$\frac{10}{10} = 1$	4 × 1 = 4
65 - 75	2	70	70 – 50 = 20	$\frac{20}{10} = 2$	2 × 2 = 4
75 – 85	1	80	80 – 50 = 30	$\frac{30}{10} = 3$	1 × 3 = 3
	$\sum f_i = 35$				$\sum f_i u_i = -36$

$$\text{Mean}(\bar{x}) = a + h \times \frac{\sum f_i u_i}{\sum f_i}$$

$$\bar{x} = 50 + 10 \times \frac{-36}{35}$$

2

$$\bar{x} = 50 - 10.29$$

$= 39.71$

1

If using Direct method mean=1390/35=39.71

10 Correct diagram **2**

Correct justification **1**

11 (a)

In ΔAOP and ΔAOC, **1**

$AP = AC$ [Tangents from the point]

$OP = OC$ [Radii of the same circle]

$OA = OA$ [Common]

$\therefore \Delta AOP \cong \Delta AOC$ [By SSS congruence]

$\Rightarrow \angle PAO = \angle CAO$ [CPCT]

$\Rightarrow \angle PAC = 2\angle PAO = 2\angle CAO$ **1**

$\Rightarrow \angle PAC = 2\angle OAC$ ...(i)

Similarly, $\angle QBC = 2\angle OBC$ ...(ii)

Adding equations (i) and (ii), we get:

$\angle PAC + \angle QBC = 2(\angle OAC + \angle OBC)$

$\Rightarrow 180^\circ = 2(\angle OAC + \angle OBC)$

$\Rightarrow \angle OAC + \angle OBC = 90^\circ$

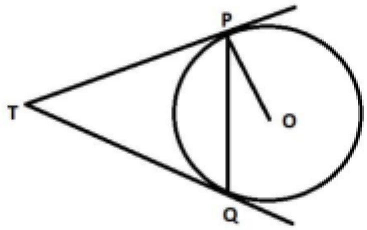
Then, in triangle AOB, we have

$\angle AOB + \angle OAC + \angle OBC = 180^\circ$ **1**

$\Rightarrow \angle AOB + 90^\circ = 180^\circ$

$\Rightarrow \angle AOB = 90^\circ$. Hence, **proved**.

OR (b)



1

Let $\angle PTQ = \theta$

TPQ is an isosceles triangle.

$\angle TPQ = \angle TQP = \frac{1}{2}(180^o - \theta) = 90^\circ - \frac{\theta}{2}$

$\angle OPT = 90^o$

$\angle OPQ = \angle OPT - \angle TPQ = 90^o - \left(90^o - \frac{\theta}{2}\right) = \frac{\theta}{2}$

$\angle OPQ = \frac{1}{2}\angle PTQ$

$2\angle OPQ = \angle PTQ$

12	Radius of cylinder, $R = \frac{12}{2} = 6$ cm Height of cylinder, $H = 15$ cm Volume of cylinder $= \pi R^2 H$ $= [\pi(6)^2 \times 15]$ cm^3 $= 540\pi$ cm^3. Volume of one ice cream cone = Volume of cone + Volume of hemisphere $= \frac{1}{3}\pi (3)^2 \times 12 + \frac{2}{3}\pi (3)^3$ $= 36\pi + 18\pi = 54\pi$ cm^3 $\therefore$ Number of cones filled with ice cream $= \frac{540\pi}{54\pi}$ $=$ **10**.	**1** **1** **1** **1**
13	(i) Number of rooms in the ground floor=30000/1500=20 (ii) 30000, 27000, 24000 form an AP where a = 30000, d = (-3000) So bricks required for 5th floor = 30000+4X(-3000) =18000 Hence number of rooms in 5th floor = 18000/1500 =15	**2** **½** **1½**
14	$\tan\theta = 42/42 = 1$ so $\theta = 45°$ $\tan 60° = h/20 \Rightarrow \sqrt{3} = h/20 \Rightarrow h = 20\sqrt{3} = 34.64$ m	**2** **2**

MODEL PAPER 3
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION
CLASS-X

TIME: 2 HRS. SUBJECT – STANDARD MATHEMATICS M.M.:40

General Instructions :

1. The question paper consists of 14 question divided into three section A,B,C.
2. Section A comprises of 6 questions of 2 marks each . Internal choice has been provided in 2 questions.
3. Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice questions has been provided in one question. It contains two case study based questions.

SECTION A

1. Check whether the following is quadratic equation .

$$(x+1)^2 = 2(x-3)$$

2. Write first four terms of the AP, when the first term a and the common difference d are given as follows:

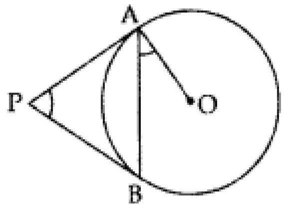
$$a = -1,\ d = 1/2$$

3. A statue 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal.

4. From a point Q, the length of the tangent to a circle is 24 cm and the distance of Q from the centre is 25 cm. The radius of the circle is.

OR

In the given figure, PA and PB are tangents to the circle with centre O. If ∠APB = 60°, then calculate ∠OAB.



5. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel.

OR

Find the number of solid spheres, each of diameter 6 cm that can be made by melting a solid metal cylinder of height 45 cm and diameter 4 cm.

6. From the following frequency distribution, find the median class.

Cost of living index	*No. of weeks*
1400-1550	8
1550-1700	15
1700-1850	21
1850-2000	8

SECTION B

7. Find the roots of the quadratic equations by applying the quadratic formula.

$$4x^2 - 4\sqrt{3}x + 3 = 0$$

8. If they form an AP, find the common difference d and write three more terms.

$$2, \frac{5}{2}, 3, \frac{7}{2}$$

9. . Prove that the lengths of tangents drawn from an external point to a circle are equal.
10. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

OR

Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q.

SECTION C

11. A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that India Gate, official name Delhi Memorial, originally called All-India War Memorial, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919.The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway), is about 138 feet (42 metres) in height.

1. What is the angle of elevation if they are standing at a distance of 42m away from the monument?
2. If the altitude of the Sun is at 60° , then the height of the vertical tower that will cast a shadow of length 20 m is .

12. COVID-19 Pandemic The COVID-19 pandemic, also known as coronavirus pandemic, is an ongoing pandemic of coronavirus disease caused by the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among humans.

The following tables shows the age distribution of case admitted during a day in two different hospitals

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
No. of cases	6	11	21	23	14	5

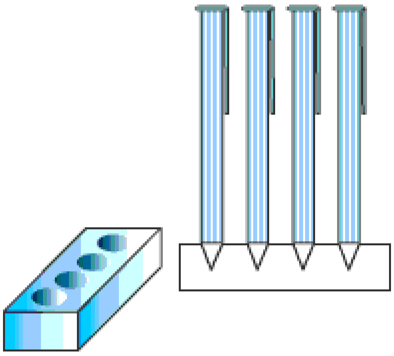
Refer to table

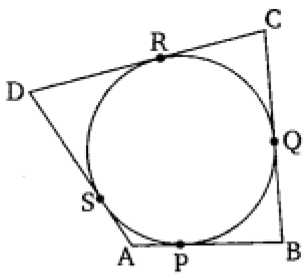
1. The average age for which maximum cases occurred is.
2. The mean of the given data is.

13. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and inner dimensions of the model to be nearly the same.)

OR

A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand.





14. A quadrilateral ABCD is drawn to circumscribe a circle (see figure).

Prove that AB + CD = AD + BC.

SUB: MATHEMATICS (STANDARD)
CLASS: X SESSION: 2021-22
ANSWER KEY

1.

$(x+1)^2 = 2(x-3)$

$\boxed{\text{Using } (a+b)^2 = a^2 + b^2 + 2ab}$

$x^2 + 1^2 + 2 \times x \times 1 = 2(x-3)$

$x^2 + 1 + 2x = 2x - 6$

$x^2 + 1 + 2x - 2x + 6 = 0$

$x^2 + 1 + 6 = 0$

$x^2 + 7 = 0$

$x^2 + 0x + 7 = 0$

Since , it is of the form $ax^2 + bx + c = 0$

Where $a = 1,\ b = 0,\ c = 7$

Hence, it is a quadratic equation

2.

$$a_1 = -1, d = \frac{1}{2}$$

$$a_2 = a_1 + d = \frac{-1}{1} + \frac{1}{2} = \frac{-1}{2}$$

$$a_3 = a_2 + d = \frac{-1}{2} + \frac{1}{2} = 0$$

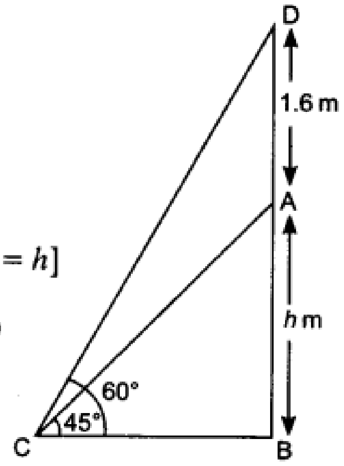
$$a_4 = a_3 + d = 0 + \frac{1}{2} = \frac{1}{2}$$

∴, the first four terms of the AP are $-1, -\frac{1}{2}, 0, \frac{1}{2}$.

3.

Let the height of the pedestal AB = h m

Given: height of the statue = 1.6 m, ∠ACB = 45° and ∠DCB = 60°



In ΔABC, $\quad \dfrac{AB}{BC} = \tan 45^\circ \Rightarrow \dfrac{h}{BC} = 1 \Rightarrow BC = h$

In ΔDBC, $\quad \dfrac{DB}{BC} = \tan 60^\circ$

$$\Rightarrow \quad \frac{1.6+h}{h} = \sqrt{3} \qquad [\because BC = h]$$

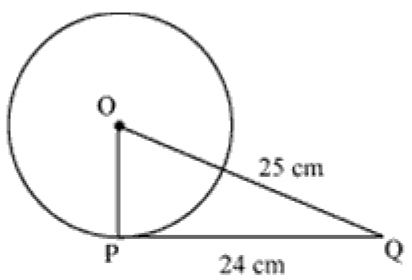
$$\Rightarrow \quad 1.6 + h = \sqrt{3}h \Rightarrow 1.6 = \sqrt{3}h - h \Rightarrow 1.6 = h(\sqrt{3} - 1)$$

$$\Rightarrow \quad \frac{1.6}{\sqrt{3}-1} = h \Rightarrow \frac{1.6}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = h$$

$$\Rightarrow \quad \frac{1.6(\sqrt{3}+1)}{3-1} = h \Rightarrow \frac{1.6(\sqrt{3}+1)}{2} = h \Rightarrow h = 0.8(\sqrt{3} + 1)$$

Hence, height of the pedestal $= 0.8(\sqrt{3} + 1)$m

4.



Let O be the center of the circle

OQ = 25cm and PQ=24 cm

Since, radius is perpendicular to tangent at the point of contact, $OP \perp PQ$.

Applying Pythagoras theorem in Δ OPQ,

$OP^2 + PQ^2 = OQ^2$

$OP^2 + 24^2 = 25^2$

$OP^2 = 625 - 576$

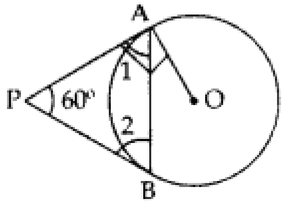
$OP^2 = 49$

$OP = 7$

Thus, the radius of the circle is 7 cm.

OR

Solution:



$\angle 1 = \angle 2$

$\angle 1 + \angle 2 + \angle APB = 180°$

$\angle 1 + \angle 1 + 60° = 180°$

$2\angle 1 = 180° – 60° = 120°$

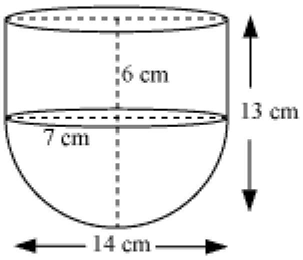
$\angle 1 = 120/2 = 60°$

$\angle 1 + \angle OAB = 90°$

$60° + \angle OAB = 90°$

$\angle OAB = 90° – 60° = 30°$

5.



radius (r) of cylindrical part and hemispherical part = 7 cm
Height of hemispherical part = radius = 7 cm.
Height of cylindrical part (h) = 13 − 7 = 6 cm
Inner surface area of the vessel = CSA of cylindrical part + CSA of hemispherical part

$$= 2\pi rh + 2\pi r^2$$

$$\text{Inner surface area of vessel} = 2 \times \frac{22}{7} \times 7 \times 6 + 2 \times \frac{22}{7} \times 7 \times 7$$

$$= 44(6+7) = 44 \times 13$$

$$= 572 \text{ cm}^2$$

OR

Number of solid spheres

$$= \frac{\text{Volume of cylinder}}{\text{Volume of one solid sphere}}$$

$$= \left(\frac{\pi(2)^2(45)}{\frac{4}{3}\pi(3)^3}\right) \quad \ldots\left[\begin{array}{l}\because \text{Volume of Cylinder} = \pi r^2 h \\ \text{Volume of Sphere} = \frac{4}{3}\pi r^3\end{array}\right.$$

$$= \frac{2 \times 2 \times 45}{\frac{4}{3} \times 3 \times 3 \times 3} = 5$$

6. Solution:

Cost of living index	No. of weeks (f)	c.f.
1400–1550	8	8
1550–1700	15	23
1700–1850	21	44
1850–2000	8	52
	52	

Here, $n = 52$; $\frac{n}{2} = \frac{52}{2} = 26$

∴ Median class 1700 – 1850.

7.

i) $4x^2 - 4\sqrt{3}x + 3 = 0$

This is of the form $ax^2 + bx + c = 0$,

where $a = 4, b = 4\sqrt{3}$ and $c = 3$.

Discriminant, $D = b^2 - 4ac$

$= (4\sqrt{3})^2 - 4 \times 4 \times 3 = 48 - 48 = 0$

Since, $D = 0$

Roots are

$$\alpha = \frac{-b+\sqrt{D}}{2a} = \frac{-4\sqrt{3}+0}{8} = \frac{-4\sqrt{3}}{8} = \frac{-\sqrt{3}}{2}$$

$$\beta = \frac{-b-\sqrt{D}}{2a} = \frac{-4\sqrt{3}-0}{8} = \frac{-4\sqrt{3}}{8} = \frac{-\sqrt{3}}{2}$$

Hence, the roots are $\frac{-\sqrt{3}}{2}, \frac{-\sqrt{3}}{2}$.

8.

$2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$

$$a_2 - a_1 = \frac{5}{2} - \frac{2}{1} = \frac{1}{2}$$

$$a_3 - a_2 = \frac{3}{1} - \frac{5}{2} = \frac{1}{2}$$

$$a_2 - a_1 = a_3 - a_2$$

Thus, the given sequence is an AP.

$$a_1 = 2, d = \frac{1}{2}$$

Next three terms are $a_5 = a_4 + d = \frac{7}{2} + \frac{1}{2} = 4$,

$$a_6 = a_5 + d = 4 + \frac{1}{2} = \frac{9}{2}, a_7 = a_6 + d = \frac{9}{2} + \frac{1}{2} = 5$$

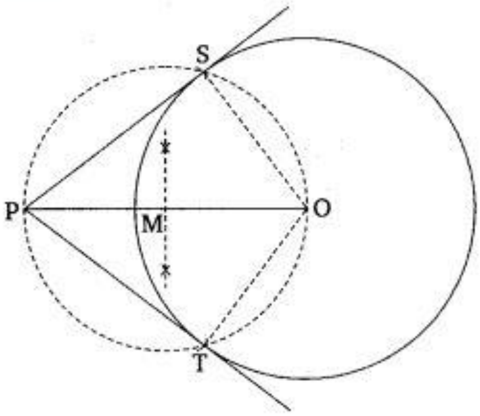
9. Refer to ncert class 10 pg 211.

Steps of Construction:

1. Draw a circle with centre and radices = 6 cm.
2. Take a point P such that OP = 10 cm.
3. Draw the perpendicular bisector of OP. Let M is the mid-point of OP.
4. With centre M and radius PM = MO, draw a circle which cuts the given circle at S and T.
5. Join PS and PT.

Thus, PS and PT are the required tangents.

The length of tangents Ps= PT = 8 cm.



Justification:

Join OS.

Now in triangle PSO,

$\angle PSO = 90°$

$\therefore PS = \sqrt{OP^2 - OS^2}$ [By Pythagoras' Theorem]

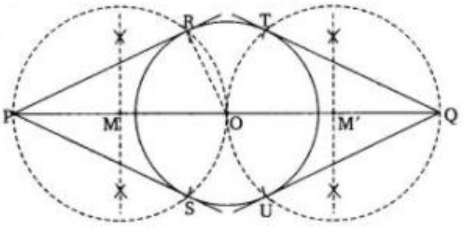
$= \sqrt{(10)^2 - (6)^2} = \sqrt{100 - 36} = \sqrt{64}$

10. $= 8$ cm.

OR

Steps of Construction:

1. With centre and radius 3 cm, draw a circle.
2. Produce the diameter of circle to both the ends up to P and such that OP = OQ = 7 cm
3. Mark the mid-points M and M' of OP and OQ respectively
4. With centres M and M' and radii MP and MO respectively, draw two circles.



5. Circle with centre M intersects the given circle at Rand S. The circle with centre M intersects the given circle at T and U.
6. Join PR, PS, QT and QU.

Thus, we have PR and PS as a pair of tangents from P and OT and QU as another pair of tangents from Q drawn to the given circle.

11. (1). 45 °

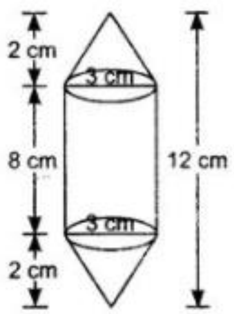
(2) 20√ 3 m

12. (1.) 36.82

(2.) 35.4

13. Solution:

Solution:



$$\begin{aligned}
\text{Volume of air contained in the model} &= \text{Total volume of the solid} \\
\text{Diameter of base of each cone} &= 3 \text{ cm} \\
\therefore \quad \text{Radius of base of each cone} &= \frac{3}{2} \text{ cm} \\
\text{Height of each cone} &= 2 \text{ cm} \\
\text{Volume of one cone} &= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\left(\frac{3}{2}\right)^2 \times 2 \text{ cm}^3 \\
&= \frac{1}{3}\pi\left(\frac{9 \times 2}{4}\right) = \frac{3}{2}\pi \text{ cm}^3 \\
\therefore \quad \text{Volume of both cones} &= 2 \times \frac{3}{2}\pi \text{ cm}^3 = 3\pi \text{ cm}^3 \\
\text{Volume of the cylindrical portion} &= \pi r^2 h = \pi\left(\frac{3}{2}\right)^2 \times 8 \text{ cm}^3 = \frac{\pi \times 9 \times 8}{4} \text{ cm}^3 = 18\pi \text{ cm}^3 \\
\text{Volume of air contained in the model} &= \text{Total volume of the solid} \\
&= 3\pi \text{ cm}^3 + 18\pi \text{ cm}^3 = 21\pi \text{ cm}^3 \\
&= \frac{21 \times 22}{7} \text{ cm}^3 = 66 \text{ cm}^3
\end{aligned}$$

OR

Solution:

Radius of one conical depression = 0.5 cm

Depth of one conical depression = 1.4 cm

Volume of one conical depression $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (0.5)^2 \times 1.4\, cm^3$

$= \frac{1}{3} \times \frac{22}{7} \times 0.5 \times 0.5 \times 1.4\ cm^3 = 0.366\ cm^3$

$\therefore$ Volume of four conical depressions

$= 4 \times 0.366\ cm^3 = 1.464\ cm^3$

Volume of cuboidal box $= l \times b \times h$

$= 15 \times 10 \times 3.5\ cm^3 = 525\ cm^3$

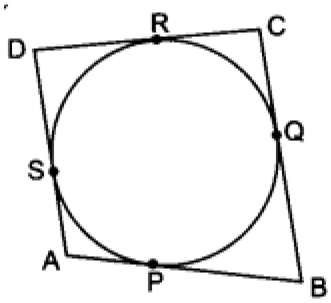
Remaining volume of box = Volume of cubical box – Volume of four conical depressions

$= 525\ cm^3 - 1.464\ cm^3 = 523.5\ cm^3$

14.

AP = AS ...(i)

[Lengths of tangents from an external point are equal]



BP = BQ ...(ii)

CR = CQ ...(iii)

DR = DS ...(iv)

Adding equations (i), (ii), (iii) and (iv), we get

AP + BP + CR + DR = AS + BQ + CQ + DS

⇒ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)

⇒ AB + CD = AD + BC

Hence proved.

MODEL PAPER 4
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION
CLASS-X
TIME: 2 HRS. SUBJECT – BASIC MATHEMATICS M.M.:40

General Instructions:

1. The question paper consists of 14 question divided into three section A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in 2 questions.
3. Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice questions has been provided in one question. It contains two case study based questions.

SECTION A

1.If one root of the quadratic equation $2x^2 + kx - 6 = 0$ is 2, the value of k is.

OR

Find the roots of the following quadratic equation by factorisation:

$$x^2 - 3x - 10 = 0$$

2. 2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting cuboid.

3. Weekly household expenditure of families living in a housing society are shown below:

Weekly expenditure (in ₹)	*No. of families (f)*
Up to 3000	4
3000–6000	25
6000–9000	31
9000–12000	48
12000–15000	10

Find the upper limit of the modal class.

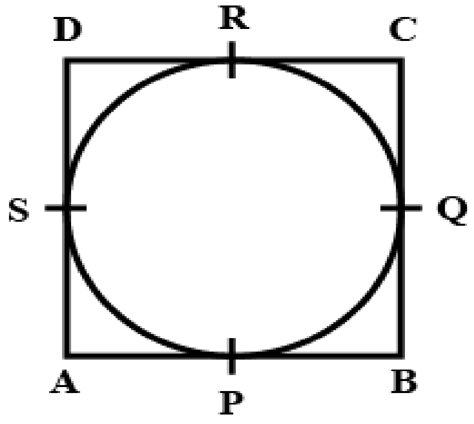
4. Which term of the AP: 3, 8, 13, 18, …, is 78?

5. Find the median of the data using an empirical formula, when it is given that mode = 35.3 and mean = 30.5.

6. If tangents PA and PB from a point P to a circle with centre O are inclined to each other at angle of 80°, then ∠POA is equal to.

OR

In figure, a circle touches all the four sides of a quadrilateral ABCD, whose sides AB=6cm, BC=7cm, and CD=4cm. Length of AD is.



SECTION B

7. An AP 5, 8, 11…has 40 terms. Find the last term. Also find the sum of the last 10 terms.

8. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree.

OR

A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string, assuming that there is no slack in the string.

9. Prove that the parallelogram circumscribing a circle is a rhombus.

10. The altitude of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm, find the other two sides.

SECTION C

11. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60° and also justify it.

OR

Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

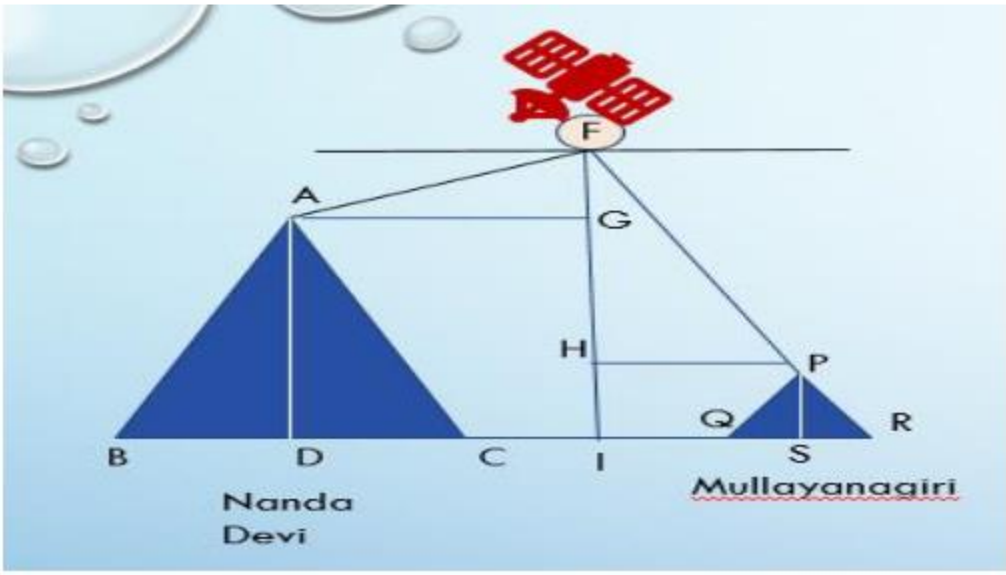
12. The table below shows the daily expenditure on food of 25 households in a locality.

Daily expenditure (in ₹)	No. of households
100 – 150	4
150 – 200	5
200 – 250	12
250 – 300	2
300 – 350	2

Find the mean daily expenditure on food by a suitable method.

13. A Satellite flying at height h is watching the top of the two tallest mountains in Uttarakhand and Karnataka ,them being Nanda Devi(height 7,816m) and Mullayanagiri (height 1,930 m). The angles of depression from the satellite , to the top of Nanda Devi and Mullayanagiri are 30° and 60° respectively.

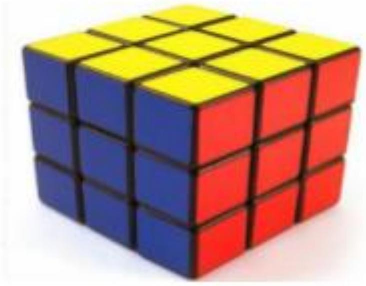
If the distance between the peaks of two mountains is 1937 km , and the satellite is vertically above the midpoint of the distance between the two mountains.



1. The distance of the satellite from the top of Nanda Devi is .

2.. The distance of the satellite from the top of Mullayanagiri is.

14. On a Sunday, your Parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. Observe the figures and answer the questions-:



(1). Volume of the solid figure if the length of the edge is 7cm is.

(2). What is the curved surface area of hemisphere (ice cream) if the base radius is 7cm?

SUB: MATHEMATICS (BASIC)
CLASS: X SESSION : 2021-22
ANSWER KEY

1. $x = 2$ is a root of the equation $2x^2 + kx - 6 = 0$

$\therefore 2(2)^2 + k(2) - 6 = 0$

$\Rightarrow 8 + 2k - 6 = 0$

$\Rightarrow 2k = -2$

$\therefore k = -1$

OR

Given: $x^2 - 3x - 10 = 0$

$\Rightarrow \quad x^2 - 5x + 2x - 10 = 0$

$\Rightarrow \quad x(x-5) + 2(x-5) = 0$

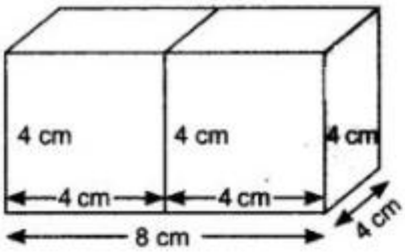
$\Rightarrow \quad (x-5)(x+2) = 0$

Either $x - 5 = 0$ or $x + 2 = 0$

$\Rightarrow \quad x = 5$ or $x = -2$

Hence, the roots are **5** and **–2**.

2. Solution:



Solution:

Volume of one cube = 64 cm^3

Let edge of one cube = a

Volume of the cube = $(edge)^3$

$a^3 = 64 \Rightarrow a = 4$ cm

Similarly, edge of the another cube = 4 cm.

Now, both cubes are joined together and a cuboid is formed as shown in the figure.

Now, length of the cuboid (l) = 8 cm

breadth of the cuboid (b) = 4 cm

height of the cuboid (h) = 4 cm

Surface area of the cuboid so formed = 2 (lb + bh + hl)

= 2(8 x 4 + 4 x 4 + 4 x 8)

= 2(32 + 16 + 32) = 160 cm^2

3. Solution:

Maximum frequency = 48

∴ Modal class = 9,000 – 12,000

Upper limit of the modal class = 12,000

4. Solution:

Given: 3, 8, 13, 18, ………,

a = 3, d = 8 − 3 = 5

Let nth term is 78

$a_n = 78$

a + (n − 1) d = 78

⇒ 3 + (n − 1) 5 = 78

⇒ (n − 1) 5 = 78 − 3

⇒ (n − 1) 5 = 75

⇒ n − 1 = 15

⇒ n = 15 + 1

⇒ n = 16

Hence, $a_{16} = 78$

5. Solution:

Mode = 3(Median) – 2(Mean)

35.3 = 3(Median) – 2(30.5)

35.3 = 3(Median) – 61

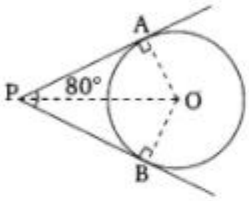
96.3 = 3 Median

Median = 96.3/3 = 32.1

6.

The correct option is (A).

Justification:



In ΔPOA and ΔPOB,

$\angle PAO = \angle PBO$ [Each of 90°]

$OA = OB$ [Radii of the circle]

$PA = PB$ [Both are tangents]

∴ $\Delta POA \cong \Delta POB$ [By SAS congruence]

⇒ $\angle APO = \angle BPO$ [CPCT]

⇒ $\angle APO = \frac{1}{2}\angle APB = \frac{1}{2} \times 80^\circ = 40^\circ$

In ΔPAO, $\angle APO + \angle POA + \angle OAP = 180^\circ$

⇒ $40^\circ + \angle POA + 90^\circ = 180^\circ$

⇒ $\angle POA = \mathbf{50^\circ}$.

OR

Let the circle touch the sides AB,BC,CD,DA, at P,Q,R and S, respectively.

AP=AS

BP=BQ

DR=DS

CR=CQ {Lengths of two tangents drawn from an external point of circle, are equal}

Adding all these, we get

(AP+BP)+(CR+RD)=(BQ+QC)+(DS+SA)

AB+CD=BC+DA

$\Rightarrow 6+4=7+AD$

$\Rightarrow AD=10-7=3$cm.

7.

First Term of the AP (a) = 5

Common difference (d) = 8 - 5 = 3

Last term = $a_{40} = a + (40 - 1)\ d$

$= 5 + 39 \times 3 = 122$

Also $a_{31} = a + 30d = 5 + 30 \times 3 = 95$

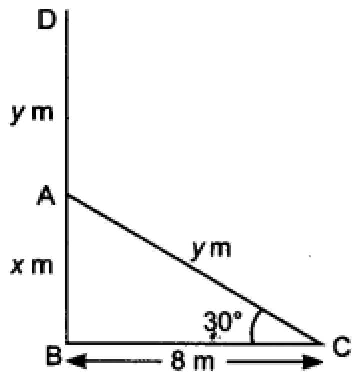
Sum of last 10 terms = $\frac{n}{2}(a_{31} + a_{40})$

$= \frac{10}{2}(95 + 122)$

$= 5 \times 217 = 1085$

8. Solution:

Let DB is a tree and AD is the broken part of it which touches the ground at C.



Given: $\angle ACB = 30°$ and $BC = 8$ m

Let $AB = x$ m and $AD = y$ m

$\therefore$ **Now,** length of the tree $= (x + y)$ m

In ΔABC,

$$\frac{AB}{BC} = \tan 30° \Rightarrow \frac{x}{8} = \frac{1}{\sqrt{3}} \Rightarrow x = \frac{8}{\sqrt{3}} \quad \ldots (i)$$

and $$\frac{AB}{AC} = \sin 30° \Rightarrow \frac{x}{y} = \frac{1}{2}$$

$$\Rightarrow \quad y = 2x \Rightarrow y = 2 \times \frac{8}{\sqrt{3}} = \frac{16}{\sqrt{3}}$$ [From equation (*i*)]

Hence, total height of the tree

$$x + y = \frac{8}{\sqrt{3}} + \frac{16}{\sqrt{3}} = \frac{24}{\sqrt{3}} = \frac{24}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{24\sqrt{3}}{3} = 8 \times 1.732 = 13.856 \text{ m}$$

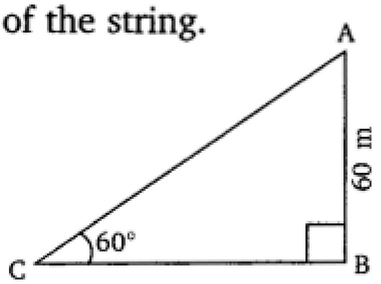
OR

Solution:

Given: $AB = 60$ m and $\angle ACB = 60°$

Let AC be the length of the string.

Then in right ΔABC,



$$\sin 60° = \frac{AB}{AC}$$

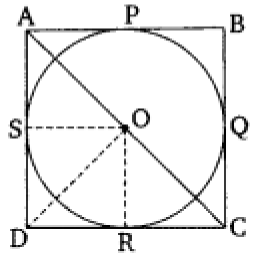
$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{60}{AC}$$

$$\Rightarrow AC = \frac{60 \times 2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{120 \times \sqrt{3}}{3} = 40\sqrt{3} \text{ m.}$$

Hence, the length of the string is $\mathbf{40\sqrt{3}}$ **m.**

9. Solution:

We have a parallelogram ABCD which circumscribes a circle with centre O. P, Q, R and S are the poi
of contact of sides AB, BC, CD and DA respectively.



In ΔORC and ΔOSA,

$\angle ORC = \angle OSA$ [Each of 90°]

$OC = OA$ [O is the midpoint of AC]

$OR = OS$ [Radii of the same circle]

$\therefore\ \Delta ORC \cong \Delta OSA$ [By RHS congruence]

$\Rightarrow\ RC = AS$ ... (i) [By CPCT]

$\Rightarrow\ DR = DS$ ... (ii) [Tangents from the point]

Adding equations (i) and (ii), we get:

$RC + DR = AS + DS$

$\Rightarrow\ DC = AD$

$\Rightarrow\ AB = DC, AD = BC$

[ABCD is a parallelogram]

$\Rightarrow$ ABCD is a rhombus.

Hence, **proved**.

10. Solution:

Let the base of right triangle be x cm.

Then, altitude of right triangle will be (x – 7) cm

Hypotenuse = 13cm **[Given]**

By Pythagoras' theorem, we have:

$$(13)^2 = x^2 + (x-7)^2$$

$$\Rightarrow \quad 169 = x^2 + x^2 - 14x + 49$$

$$\Rightarrow \quad 2x^2 - 14x - 120 = 0$$

$$\Rightarrow \quad x^2 - 7x - 60 = 0$$

$$\Rightarrow \quad x^2 - 12x + 5x - 60 = 0$$

$$\Rightarrow \quad (x-12)(x+5) = 0$$

$$\Rightarrow \quad x = 12 \quad \text{or} \quad x = -5.$$

Hence, the base of the right triangle is **12 cm** and its altitude is 12 – 7 = **5 cm**.

11.

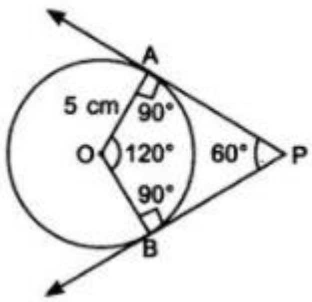
Solution:

Steps of Construction:

1. Draw a circle of radius 5 cm.
2. As tangents are inclined to each other at an angle of 60°.

∴ Angle between the radii of circle is 120°. (Use quadrilateral property)

3. Draw radii OA and OB inclined to each other at an angle 120°.
4. At points A and B, draw 90° angles. The arms of these angles intersect at point P.
5. PA and PB are the required tangents.

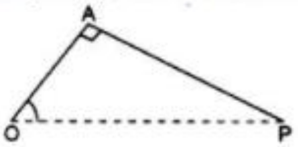


Justification: In quadrilateral AOBP,

AP and BP are the tangents to the circle.

Join OP.

In right angled ΔOAP, $OA \perp PA$ [Radius is $\perp$ to tangent]



OAPB forms a quadrilateral

$$\therefore \quad \angle AOB = 120^\circ$$

$$\angle AOP = 60^\circ$$

OP bisects $\angle AOB$

$$OA = 5 \text{ cm}$$

$$\therefore \quad \tan 60^\circ = \frac{AP}{OA} = \frac{AP}{5}$$

$$\Rightarrow \quad \sqrt{3} = \frac{AP}{5} \Rightarrow AP = 5\sqrt{3} \text{ cm.}$$

Similarly, $BP = 5\sqrt{3}$ cm.

A pair of tangents can be drawn to a circle from an external point outside the circle. These two tangents are equal in lengths.

$\therefore$ PA = PB.

OR

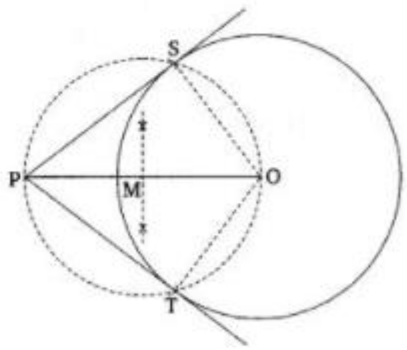
Solution:

Steps of Construction:

1. Draw a circle with centre and radices = 6 cm.
2. Take a point P such that OP = 10 cm.
3. Draw the perpendicular bisector of OP. Let M is the mid-point of OP.
4. With centre M and radius PM = MO, draw a circle which cuts the given circle at S and T.
5. Join PS and PT.

Thus, PS and PT are the required tangents.

The length of tangents Ps= PT = 8 cm.



Justification:

Join OS.

Now in triangle PSO,

$\angle PSO = 90°$

$\therefore PS = \sqrt{OP^2 - OS^2}$ [By Pythagoras' Theorem]

$= \sqrt{(10)^2 - (6)^2} = \sqrt{100-36} = \sqrt{64}$

$= 8$ cm.

12.

Solution:

Here, a = 225 and h = 50

Class interval	Frequency (f_i)	Class marks(x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100–150	4	125	–2	–8
150–200	5	175	–1	–5
200–250	12	$225 = a$	0	0
250–300	2	275	1	2
300–350	2	325	2	4
	$\Sigma f_i = 25$			$\Sigma f_i u_i = -7$

$$\therefore \text{Mean, } \bar{x} = a + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) = 225 + 50\left(\frac{-7}{25}\right)$$

$$= 225 - 14 = 211.$$

Hence, the mean daily ecpenditure on food is ₹ 211.

14. (1) 1139.4 km

(2) 1937 km

15. (1) 343 cm3

(2) 308 cm2

MODEL PAPER 5
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION
CLASS-X

TIME: 2 HRS. **SUBJECT – STANDARD MATHEMATICS** **M.M.:40**

Instructions: 1. Write correct serial number of the question before attempting it.
2. The Question Paper is divided into 3 sections – A, B, & C with 14 questions.
3. Where internal choices have been provided as (a) and (b) you have to attempt only one (a) or (b)

SECTION – A

Q.NO.		MARKS
1	(a)Find the roots of the following quadratic equations, if they exist, using the quadratic formula: $3x^2 - 5x + 2 = 0$ Or, (b) Find the discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$, and hence discuss the nature of its roots	**2**
2	For which value of 'k', quadratic equation $k.x.(x - 2) + 6 = 0$ exist in the set of real number and have equal roots.	**2**
3	How many two-digit numbers are divisible by 3?	**2**
4	AB is a chord of length 9.6cm of a circle with centre O and radius 6cm.If the tangents at A and B intersect at point P then find the length PA.	**2**
5	A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The total height of the toy is 15.5 cm. Find the total surface area of the toy. Or, A metallic sphere of radius 4.2 cm is melted and recast into the shape of a cylinder of radius 6 cm. Find the height of the cylinder.	**2**
6	Find the mode of the following data.	**2**

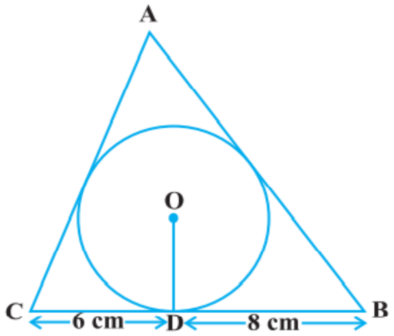
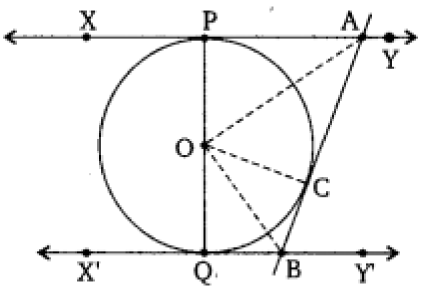
Wages(in Rs)	100-120	120-140	140-160	160-180	180-200
No of workers	12	14	8	6	10

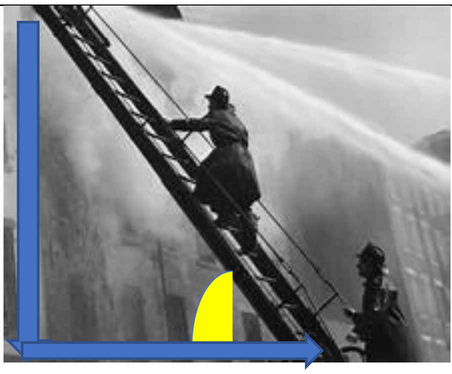
SECTION – B

7	Draw a circle of radius 5 cm. construct the pair of tangents to the circle such that angle between them is 45^0 and measure their lengths also.	

		3
8	Find the missing frequencies when the mean of the following data is 53. | Age (in years) | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | TOTAL | | No. Of People | 15 | F1 | 21 | F2 | 17 | 100 |	**3**
9	The median of the following frequency distribution is 35. Find the value of x. | C.I. | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | | Frequency | 2 | 3 | X | 6 | 5 | 3 | 2 |	**3**
10	(a)The angles of depression of the top and the bottom of an 8 m tall building from the top of a multi-storeyed building are 30° and 45°, respectively. Find the height of the multi-storeyed building and the distance between the two buildings. OR, (b)The angles of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary. Prove that the height of the tower is 6 m.	**3**

SECTION – C

11	(a) A triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 8 cm and 6 cm respectively (see figure). Find tlic sides AB and AC. Hence find the perimeter of ΔABC also.  **<u>OR</u>** (b)) In figure, XY and X'Y' are two parallel tangents to a circle, x with centre O and Another tangent AB with point of contact C intersecting XY at A and X'Y' at B. Prove that ∠AOB = 90°.  	**4**
12	**CASE STUDY -1** A circus artist is climbing through a 15 m long ladder which is inclined with the top of a vertical wall to the ground as shown below. Based on the above information, answer the following questions.	**1x4 =4**



(i) Find the height of the wall, if angle made by ladder to the ground level is 45°.

(ii) If the angle made by the ladder to the ground level is 60°, then find the distance between foot of the ladder and foot of the wall.

(iii) Find the height of the wall if the angle made by the ladder to the ground level is 30°.

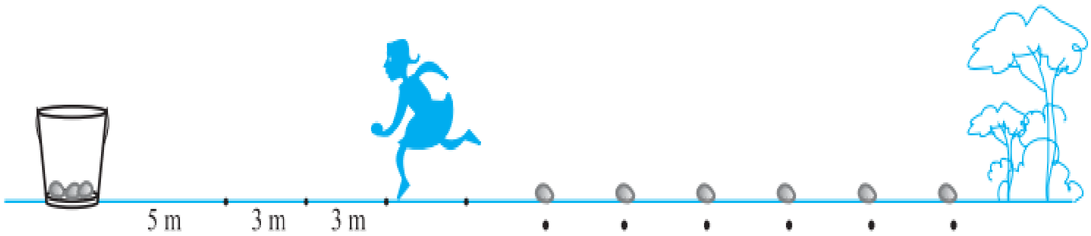
(iv) Which mathematical concept is used here?

13

CASE STUDY-2

Read the following content then solve the given questions: -

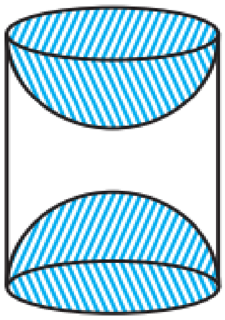
In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line (see Fig below).



A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. Answer the following questions:

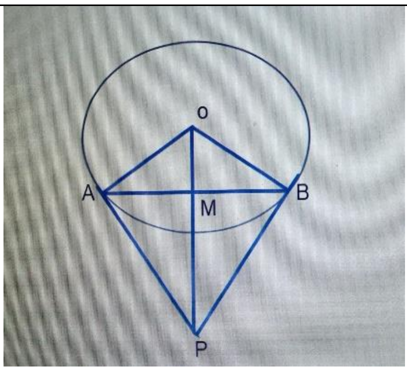
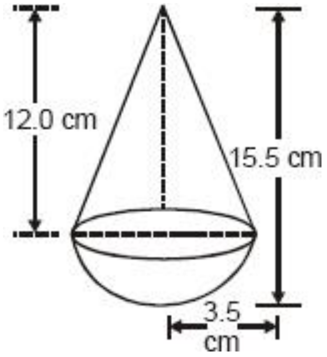
(a) What is the total distance the competitor has to run together to pick up and drop 5^{th} potato in the bucket?

(b) What is the total distance the competitor has to run together to pick up and drop all potatoes in the bucket?

		2 2
14	A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in Fig. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, (a) find the total surface area and Volume of the article. (b) Find the weight of the wooden article if $1cm^3$ of wood weigh 1.5gm. 	**4**

Marking Scheme of Model Paper 5
Class-X-STANDARD MATHS -2021-22

Q.NO.	EXPECTED SOLUTIONS/ANSWERS	MARKS GIVEN
1 (a)	$3x^2 - 5x + 2 = 0$. Here, $a = 3$, $b = -5$, $c = 2$. So, $b^2 - 4ac = 25 - 24 = 1 > 0$. Therefore, $x = \frac{5 \pm \sqrt{1}}{6} = \frac{5 \pm 1}{6}$, i.e., $x = 1$ or $x = \frac{2}{3}$ So, the roots are $\frac{2}{3}$ and 1.	1 1
1(b)	The given equation is of the form $ax^2 + bx + c = 0$, Where a = 2, b = – 4 and c = 3. Therefore, the discriminant= $b^2 - 4ac = (-4)2 - (4 \times 2 \times 3) = 16 - 24 = -8 < 0$ So, the given equation has no real roots	1 1
2	kx(x – 2) + 6 = 0 Comparing kx (x – 2) + 6 = 0 i.e., $kx^2 - 2kx + 6 = 0$ with $ax^2 + bx + c = 0$, we get a = k , b = – a , c = 6 $\therefore D = b^2 - 4ac = (-2k)^2 - 4(k)(6)$ $= 4k^2 - 24k$ Since, the roots are real and equal, $\therefore b^2 - 4ac = 0$ $\Rightarrow 4k^2 - 24k = 0$ $\Rightarrow 4k(K - 6) = 0$ $\Rightarrow 4k = 0$ or $k - 6 = 0$ $\Rightarrow k = 0$ or $k = 6$ But k cannot be 0, otherwise, the given equation is no more quadratic. Thus, the required value of k = 6.	1 1

3	The list of two-digit numbers divisible by 3 is : 12, 15, 18, . . . , 99 Here, $a = 12,\ d = 3,\ a_n = 99.$ $a_n = a + (n-1)\,d,$ $99 = 12 + (n-1) \times 3$ $87 = (n-1) \times 3$ $n - 1 = \frac{87}{3} = 29$ $n = 29 + 1 = 30$ So There are 30 two digits number are divisible by 3.	½ ½ **1**
4	Given OA = 6cm , AB = 9.6 cm AM = 9.6/2 = 4.8 cm OM = 3.6 cm by Pythagoros theorem) Here $\Delta PAO \sim \Delta AMO$ so by CPST we get PA/OA = AM/OM Hence PA = 8cm.  	½ ½ ½ ½
5	(a)Here, r = 3.5 cm ∴ h = (15.5 – 3.5) cm = 12.0 cm  	½

	Surface area of the conical part $= \pi rl$ Surface area of the hemispherical part $= 2\pi r^2$ $\therefore$ Total surface area of the toy $= \pi rl + 2\pi r^2 = \pi r(l + 2r)\ cm^2$ $\because l^2 = (12)^2 + (3.5)^2$ $= \frac{22}{7} \times \frac{35}{10}(12.5 + 2 \times 3.5)cm^2$ $l^2 = 144 + 12.25 = 156.25$ $\Rightarrow l = 12.5$ cm $= 11 \times (12.5 + 7)\ cm^2$ $= 11 \times 19.5\ cm^2 = 214.5\ cm^2$.	½ ½
	Or, (b) Radius of the sphere (r^1) = 4.2 cm $\therefore$ Volume of the sphere $\left(\frac{4}{3}\pi r_1^{\ 3}\right) = \frac{4}{3} \times \frac{22}{7} \times \frac{42}{10} \times \frac{42}{10} \times \frac{42}{10} cm^3$ Radius of the cylinder (r_2) = 6 cm Let 'h' be the height of the cylinder $\therefore$ Volume of the cylinder $= \pi r^2 h = \frac{22}{7} \times 6 \times 6 \times h\ cm^3$ Since, Volume of the metallic sphere = Volume of the cylinder. $\Rightarrow \frac{4}{3} \times \frac{22}{7} \times \frac{42}{10} \times \frac{42}{10} \times \frac{42}{10} = \frac{22}{7} \times 6 \times 6 \times h$ $\Rightarrow h = \frac{4}{3} \times \frac{22}{7} \times \frac{42}{10} \times \frac{42}{10} \times \frac{42}{10} \times \frac{7}{22} \times \frac{1}{6} \times \frac{1}{6} cm$ $= \frac{4 \times 7 \times 7 \times 4}{10 \times 10 \times 10} cm = \frac{2744}{1000} cm = 2.744\ cm.$	½ ½ ½

		1
6	Modal class: 120- 140 $Mode = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$ $= 120 + \frac{(14-12)}{2x14-12-8} X\ 20$ = 120 + 5 = 125	**½** **½** **1**
7	For Correct diagrams For correct measurements of tangents	**2** **1**
8	(see below)	

8

Age (in years)	0-20	20-40	40-60	60-80	80-100	TOTAL
No. Of People	15	F1	21	F2	17	100
x	10	30	50	70	90	
x.f	150	30f1	1050	70f2	1530	2730+30f1 +70f2

½

½

Given Mean = 53

$\frac{\sum x\ x\ f}{\sum f}$ = 53 ⟹2730+30f1+70f2 = 100x53 **1**

⟹ 30f1+70f2= 5300-2730 = 2570

⟹ 3f1+ 7f2 = 257 --------- (i)

A/Q 53 + f1+f2 =100 ⟹ f1 + f2 = 47

3f1 + 3f2 = 141 --------- (ii)

Solving (i) and (ii) 4f2 = 116

f2 = 29 , f1 = 24 **2x ½**

9

Given median = 35. To Find the value of x.

C.I.	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	2	3	X	6	5	3	2
CF	2	5	5+x	11+x	16 + x	19+x	21+x

½

Median Class = 30-40 l = 30

N = 21 + x , N/2 = (21+ x)/2 , f = 6 , cf = 5+x , h = 20

1

Median = l + $\left(\frac{\frac{N}{2}-cf}{f}\right) x\ h$

½

X = 5

1

10

Solution : In Fig. 9.9, PC denotes the multistoried building and AB denotes the 8 m tall building. We are interested to determine the height of the multistoried building, i.e., PC and the distance between the two buildings, i.e., AC

1

So ∠ PBD = 30°. Similarly, ∠ PAC = 45°

In right Δ PBD, we have

$$\frac{PD}{BD} = \tan 30° = \frac{1}{\sqrt{3}} \text{ or } BD = PD\sqrt{3}$$

In right Δ PAC, we have

$$\frac{PC}{AC} = \tan 45° = 1$$

i.e., PC = AC

Also, PC = PD + DC, therefore, PD + DC = AC.

1/2

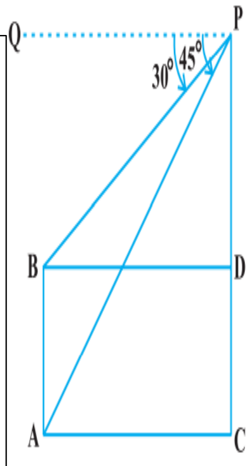
Since, AC = BD and DC = AB = 8 m, we get PD + 8 = BD = $PD\sqrt{3}$ (Why?)

1/2

This gives $PD = \frac{8}{\sqrt{3}-1} = \frac{8(\sqrt{3}+1)}{(\sqrt{3}+1)(\sqrt{3}-1)} = 4(\sqrt{3}+1)$m.

So, the height of the multi-storeyed building is $\{4(\sqrt{3}+1)+8\}$ m = $4(3+\sqrt{3})$ m

and the distance between the two buildings is also $4(3+\sqrt{3})$ m.

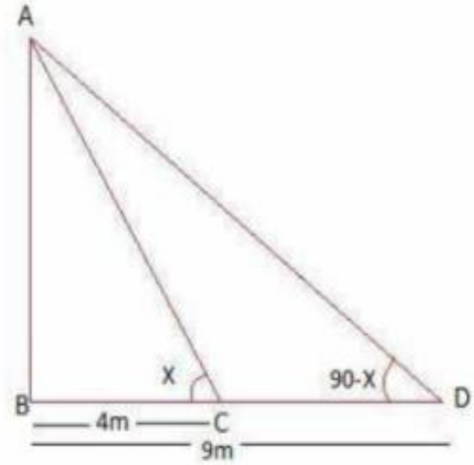


1/2

1/2

Or,

(b) Correct Figure with explanation



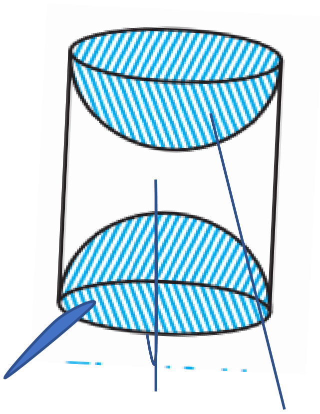
1

In right ΔABC,
$\tan x = AB/BC$
$\tan x = AB/4$
$AB = 4 \tan x$ ... (i)
Again, from right ΔABD,
$\tan (90^\circ - x) = AB/BD$
$\cot x = AB/9$
$AB = 9 \cot x$ ... (ii)
Multiplying equation (i) and (ii)
$AB^2 = 9 \cot x \times 4 \tan x$
$\Rightarrow AB^2 = 36$ (because $\cot x = 1/\tan x$
$\Rightarrow AB = \pm 6$
Since height cannot be negative. Therefore, the height of the tower is 6 m.

		½ ½ **1**
11	(a) Here Δ ABC subscribe the circle with centre O. Also, radius = 4 cm ∵ The sides BC, CA and AB touch the circle at D, E and F respectively. ∴ BF = BD = 8 cm CE = CD = 6 cm AF = AE = x cm (say) ⇒ The sides of the triangle are 14 cm, (x + 6) cm and (x + 8) cm Perimeter of Δ ABC = [14 + (x + 6) + (x + 8)] cm	 **1**

	$= [14 + 6 + 8 + 2x]$ cm	
	$= 28 + 2x$ cm	
	$\Rightarrow$ Semi perimeter of Δ ABC $= 14+x$	**1**
	$\therefore S - AB = (14 + x) - (8 + x) = 6$	
	$S - BC = (14 + x) - (14) = x$	
	$S - AC = (14 + x) - (16 + x) = 8$	
	$\therefore$ ar (ΔABC) = ar (Δ OBC) + ar (Δ OCA) + ar (Δ OAB)	**1**
	$= 28\text{ cm}^2 + (2x + 12)\text{ cm}^2 + (2x + 16)\text{ cm}^2$	
	$= (28 + 12 + 16) + 4x\text{ cm}^2$	
	$= (56 + 4x)\text{ cm}^2$	
	From (1) and (2), we have:	
	Squaring both sides	
	$(14 + x)^2 = (14 + x)\ 3x$	
	$\Rightarrow 196 + x^2 + 28x = 45x + 3x^2$	
	$\Rightarrow 2x^2 + 14x - 196 = 0 \Rightarrow x^2 + 7x - 98 = 0$	
	$\Rightarrow (x - 7)(x + 14) = 0$	
	$\Rightarrow$ Either $x - 7 = 0 \Rightarrow x = 7$	
	or $x + 14 = 0 \Rightarrow x = (-14)$	
	But $x = (-14)$ is rejected.	**1**
	$\therefore x = 7$ cm	
	Thus, AB = 8 + 7 = 15 cm , BC = 8 + 6 = 14 cm & CA = 6 + 7 = 13 cm	
	(b)	
		1
		1

	In ΔAOP and ΔAOC, $AP = AC$ [Tangents from the point] $OP = OC$ [Radii of the same circle] $OA = OA$ [Common] $\therefore\ \Delta AOP \cong \Delta AOC$ [By SSS congruence] $\Rightarrow\ \angle PAO = \angle CAO$ [CPCT] $\Rightarrow\ \angle PAC = 2\angle PAO = 2\angle CAO$ $\Rightarrow\ \angle PAC = 2\angle OAC$ ...(i) Similarly, $\angle QBC = 2\angle OBC$ ...(ii) Adding equations (i) and (ii), we get: $\angle PAC + \angle QBC = 2(\angle OAC + \angle OBC)$ $\Rightarrow\ 180^\circ = 2(\angle OAC + \angle OBC)$ $\Rightarrow\ \angle OAC + \angle OBC = 90^\circ$ Then, in triangle AOB, we have $\angle AOB + \angle OAC + \angle OBC = 180^\circ$ $\Rightarrow\ \angle AOB + 90^\circ = 180^\circ$ $\Rightarrow\ \angle AOB = 90^\circ$. Hence, **proved**.	**1** **1**
12	(i) For correct Answer Required height of wall = $\frac{15}{2}\sqrt{2}$ m (ii) For correct Answer Required Distance = 7.5 m (iii) For correct answer Required height = 7.5 m (iv) Application of trigonometric ratios.	**1** **1** **1** **1**
13	(i) To pick up and drop the 5th potato, the total distance (in metres) run by a competitor = 2(5+3+3+3+3) = 34m (b) Here, number of potatoes = 10 The up–down distance of the bucket: From the 1st potato = [5 m] × 2 = 10 m From the 2nd potato = [(5 + 3) m] × 2 = 16 m From the 3rd potato [(5 + 3 + 3) m] × 2 = 22 m From the 4th potato = [(5 + 3 + 3 + 3) m] × 2 = 28 m	**1** **1** **1**

	∵ 10, 16, 22, 28, ... are in A.P. such that a = 10 and d = 16 – 10 = 6 ∴ Using $S_n = \frac{n}{2}[2a + (n-1)d]$, we have: $S_{10} = \frac{10}{2}[2(10) + (10-1) \times 6]$ $= 5[20 + 9 \times 6]$ $= 5[20 + 54]$ $= 5[74]$ $= 5 \times 74 = 370$ Thus, the sum of above distances = 370 m. The competitor has to run a total distance of 370 m.	1
14	Given , r = 3.5cm h = 10 cm A/Q TSA of Article = CSA(Fig-1)+ CSA(Fig-2) + CSA(Fig-3) $= 2\Pi r^2 + 2\Pi r\,h + 2\Pi r^2$ $= 4\Pi r^2 + 2\Pi rh$ $= 2\Pi r\,(2r + h)$ = 2x22/7(2x3.5+10) = $374cm^2$  Fig-1 Fig-2 Fig-3 A/Q Volume of Article = volume (cylinder) - Volume of (2 hemisphere) $= \Pi\ r^2h - 2x\ 2/3\Pi r^3$ $= \Pi\ r^2\ (h - 4/3\ .r)$ = 22/7 x 35/10x35/10(10 - 4/3 x35/10) = 616/3 cm^3 (b) Weight = 616/3 x 1.5 = 308.0 gm	1/2 1 1/2

		1
		1

MODEL PAPER 6
KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION
CLASS-X

TIME: 2 HRS. SUBJECT – BASIC MATHEMATICS M.M.:40

General Instructions:

1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
3. Section B comprises of 4questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one question. It contains two case study based questions.

SECTION – A

1. Check whether the quadratic equation $8x^2 + 2x - 3 = 0$ has real roots. If real roots exist, find them.

OR

Find the value of **k** for which the quadratic equation$(3k + 1)x^2 + 2(k + 1)x + 1 = 0$ has equal roots.

2. From a solid cube of side 7 cm, a conical cavity of height 7 cm and radius 3 cm is hollowed out. Find the volume of the remaining solid.
3. The marks obtained by 30 students of class X of a School in a mathematics paper of 100 marks are presented in the table given below:

Class Intervals	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100
Number of Students	2	3	7	6	6	6

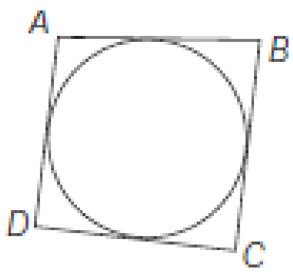
Find the median marks obtained by the students.

4. The 8th term of an AP is 17 and its 14th term is 29. Find its common difference of the AP.

OR

If 7 times the 7th term of an AP is equal to 11 times its 11th term, then show that the 18th term of the AP is zero.

5. For a grouped data, if Σf i = 20, $\Sigma \boldsymbol{f_i x_i}$ = 2p + 20 and mean of distribution is 12, then find the value of p.
6. In the given figure, a circle is inscribed in the quadrilateral ABCD. Given AB = 6cm, BC = 7cm and CD = 4cm. Find AD.



SECTION - B

7. Find the sum of first 17 terms of an AP whose 4^{th} and 9th terms are − 15 and − 30, respectively
8. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60°. Find the height of the tower.

OR

A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground. Find the height of the pole, if the angle made by the rope with the ground level is 30°.

9. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

10. The diagonal of a rectangular field is 16 m more than the shorter side. If the longer side is 14 m more than the shorter side, then find the length of the sides of the field.

SECTION – C

11. Draw a circle of radius 3 cm. From a point 5 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

OR

Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.

12. The following data gives the information on the observed lifetimes (in hours) of 225 electrical components:

Lifetime (in hrs)	0 – 20	20 – 40	40 – 60	60 - 80	80 - 100	100 - 120
Number of Components	10	35	52	61	38	29

Determine the modal lifetimes of the components.

13. A group of students of class X visited India Gate on an educational trip. The teacher and students had interest in history as well. The teacher narrated that India Gate, official name Delhi Memorial, originally called All-India War Memorial, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919.The teacher also said that India Gate, which is located at the eastern end of the Rajpath, is about 42 m in height.

(i) What is the angle of elevation if the students are standing at a distance of 42 m away from the monument?

(ii) The students want to see the top of the monument at an angle of 60˚. At what distance they should stand from the monument?

14.	The Great Stupa at Sanchi is one of the oldest stone structures in India, and an important monument of Indian Architecture. It was originally commissioned by the emperor Ashoka in the 3rd century **BCE**. Its nucleus was a simple hemispherical brick structure built over the relics of the Buddha. It is a perfect example of combination of solid figures. A big hemispherical dome with a cuboidal structure mounted on it. (i) How much cloth will require to cover the hemispherical dome if the radius of its base is 14 m? (ii) Find the volume of the cuboidal shaped top with dimensions 8m × 6m × 4m.	

Mathematics- Basic (241)
Class- X, Session: 2021-22
TERM II
Marking Scheme

Qu No	Answer(s)	Mark(s)
	SECTION - A	
1	D (100)>0, real roots exist For finding the roots ½ and -3/4 **OR** For real and equal roots $b^2 - 4ac$ = 0 For finding the values k = 0, 1	1 1 ½ 1 ½
2	Vol of cube = 343 cm^3 Vol of conical cavity = 66 cm^3 Vol of remaining solid = 277 cm^3	½ 1 ½
3	Using appropriate formula and finding the median = 62.5	2
4	$a + 7d = 17$, $a + 13d = 29$ Solving the equations and finding d=2. **OR** $7a_7$ = $11a_{11}$ 7 $(a + 6d)$ = 11 $(a + 10d)$ Solving the equation and getting the expression $a + 17d$= 0	1 1 ½ ½ 1
5	$\frac{(2p+20)}{20} = 12$ $p = 110$	1 1
6	AB + CD = AD + BC (with property) AD = 3 cm	1 1
	SECTION – B	
7	$a + 3d = -15$, $a + 8d = -30$	½

	Finding $a = -6, d = -3$ Finding the sum of 17 terms using formula = - 510	1 1 ½
8	For appropriate fig: For using appropriate Trigonometric ratios and finding the height of the tower $20\sqrt{3}$ m. **OR** For appropriate fig: For using appropriate Trigonometric ratios and finding the height of the pole 10 m.	½ 2 ½ ½ 2 ½
9	Length of chord = 8 cm, Using properties of tangents and Pythagoras property	3
10	Shorter side = x, longer side = $(x + 14)$, diagonal = $(x + 16)$ Using Pythagoras Theorem and getting the equation $x^2 - 4x - 60 = 0$ Solving the equation and getting the sides 10m, 24m and 26m.	1 1 1
	SECTION – C	
11	For neat and correct construction.	4
12	L = 60, $f_0 = 52, f_1 = 61, f_2 = 38,\ h = 20$ Using correct formula and finding Mode = 65.63	1 3
13	(i) Using appropriate trigonometric ratio and finding angle of elevation = 45˚ (ii) Using appropriate trigonometric ratio and finding the distance from the monument = $14\sqrt{3}$ m.	2 2
14	(i) Using curved surface area of hemisphere, cloth required = 1232 m^2 (ii) Volume of cuboidal top = (8 × 6 × 4) = 192 m^3	2 2