केन्द्रीय विद्यालय संगठन, क्षेत्रीय कार्यालय एर्नाकुलम

Kendriya Vidyalaya Ernakulam Region

Student Support Material

Term –II

Class - X

Mathematics

Session : 2021-22

तत् त्वं पूषन् अपावृणु

केन्द्रीय विद्यालय संगठन

STUDENT SUPPORT MATERIAL

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Preface

This Study Material is an in-house academic exercise undertaken by the Maths teachers of KVS Ernakulam Region under the supervision of a subject expert, Shri K P Sudhakaran, Principal, KV Peringome, to provide the students a comprehensive, yet concise, support tool for consolidation of learning.

It consists of 7-chapters in capsule form with the gist of the lesson and questions in VSA, SA and LA forms. This material is developed keeping in mind the latest CBSE curriculum and pattern of the question paper. It will definitely provide the students a valuable window on precise information and it covers all essential components that are required for effective revision of the subject.

Hoping this material will prove to be a helpful tool for quick revision and will serve the purpose of enhancing students' confidence level to help them perform better.

Best of Luck.

आर सेन्दिल कुमार
उपायुक्त

R. Senthil Kumar
Deputy Commissioner

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Message

I feel immense pleasure to publish the study material for class X Maths. This support material is prepared incorporating all the recent changes in curriculum and assessment process made by CBSE. I am sure it will definitely be of great help to class X students of all Kendriya Vidyalayas.

Getting acquainted with the latest changes will help students to prepare well for the board examination and enable students to face case based and Multiple-Choice Questions with confidence. This support material has been prepared by a team of dedicated and veteran teachers with expertise in their respective subjects.

The Support material contains all the important aspects required by the students- the design of question paper, term wise split up syllabus, summary of all the chapters, important formulas, Sample question papers, problem solving and Case study questions.

I hope that this Support Material will be used by students and teachers as well and will prove to be a good tool for quick revision.

I would like to express my sincere gratitude to the In- charge principal and all the teachers who have relentlessly worked for the preparation of this study material. Their enormous contribution in making this project successful is praiseworthy.

Meticulous planning blended with hard work, effective time management and sincerity will help the students to reach the pinnacle of success.

Wish you all the best

(R Senthil Kumar)

Mr. K P SUDHAKARAN
Principal
Kendriya Vidyalaya
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KENDRIYA VIDYALAYA SANGATHAN

ERNAKULAM REGION

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3	Mrs SEENA P R KV NO 1 CALICUT	18	Mr MANOJ KUMAR KV ERNAKULAM
4	Mr AKHIL KV NO 2 CALICUT	19	Mrs KUNJUMOL P S KV ERNAKULAM
5	Mrs.JAYALALITHA KV THRISSUR	20	Mrs MINI SEKHAR KV 1 PALAKKAD
6	Mrs LISI MOOKEN KV THRISSUR	21	Mrs VALSAMMA THOMMAS KV 1 PALAKKAD
7	Mrs ROOPITHA KV THRISSUR	22	Mrs PRABHINA KV1 PALAKKAD
8	Mrs NAZEEMA KV THRISSUR	23	Mrs AJITHA L KV1 PALAKKAD
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13	Mr JOSEPH KV KANHANGAD	28	Mrs JYOTHI K KV KANJIKODE
14	Mrs ANIQUEEN KV CPCRI KASARGOD	29	Mrs MANJU S NAIR KV PANGODE
15	Mrs REMYA KV KANNUR	30	Mrs BINDU PV KV KELTRON

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RATIONALISED CURRICULUM (2021-22)

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3	TRIGONOMETRY • SOME APPLICATIONS OF TRIGONOMETRY	7
4	MENSURATION • SURFACE AREA AND VOLUME	6
8	STATISTICS & PROBABILITY • STATISTICS	8
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INTERNAL ASSESSMENT

INTERNAL ASSESSMENT	TERM 1	TOTAL MARKS
PERIODIC TESTS	3	10 MARKS FOR THE TERM
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PORTFOLIO	2	
ENRICHMENT ACTIVITIES	3	

ALGEBRA

QUADRATIC EQUATIONS

IMPORTANT FORMULAS & CONCEPTS

Quadratic Polynomial

A polynomial of the form $ax^2 + bx + c$, where a, b and c are real numbers and $a \neq 0$ is called a quadratic polynomial.

The standard form of a Quadratic Equation

The standard form of a quadratic equation is $ax^2 + bx + c = 0$, where a, b and c are real numbers and $a \neq 0$.'a' is the coefficient of x^2 . 'b' is the coefficient of x and 'c' is the constant term.

Roots of a Quadratic equation

The values of x for which a quadratic equation is satisfied are called the roots of the quadratic equation.

If α is a root of the quadratic equation $ax^2 + bx + c = 0$, then $a\alpha^2 + b\alpha + c = 0$.

A quadratic equation can have two distinct real roots, two equal roots or real roots may not exist.

Methods of solving a Quadratic Equation

1. **Factorization method**

   In this method, factorisation can be done using splitting the middle term

2. **Using Quadratic Formula**

   Quadratic Formula is used to obtain the roots of a quadratic equation directly from the standard form of the equation.

Quadratic formula: The roots of a quadratic equation $ax^2 + bx + c = 0$ are given

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ provided $b^2 - 4ac \geq 0$.

Here, the value $b^2 - 4ac$ is known as the **discriminant** and is generally denoted by **D**. The value of discriminant helps us to determine the nature of roots for a given quadratic equation. The rules are:

1. If $D = 0 \Rightarrow$ The roots are Real and Equal.
2. If $D > 0 \Rightarrow$ The two roots are Real and distinct.
3. If $D < 0 \Rightarrow$ No Real roots exist.

SHORT ANSWER TYPE QUESTIONS

SECTION - A (2 MARK QUESTIONS)

Q1. For what value of p for equation $2x^2 - 4x + p = 0$ will have real roots?

Q2. One year ago, a man was 8 times as old as his son. Now his age is equal to the square of his son's age. Then find their present ages

Q3. Find the sum of the roots of the quadratic equation $3x^2 - 9x + 5 = 0$?

Q4. If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$ then find the value of k?

Q5. A natural number, when increased by 12, equals 160 times its reciprocal. Find the number?

Q6. If the one root of the equation $4x^2 - 2x + p - 4 = 0$ be the reciprocal of other, find the value of p

Q7. Find the roots of the following quadratic equations by factorisation: $x^2-3x-10=0$

Q8. Find two numbers whose sum is 27 and product is 182.

Q9. The sum of the squares of two consecutive natural numbers is 313, then find the numbers

Q10. Write the quadratic equation whose one root is $3 + \sqrt{2}$

Q11. If -5 is a root of the quadratic equation $2x^2 + px - 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, find the value of k.

Q12. For what value of p, the equation $px^2 + 6x + 4p = 0$ has product of roots equal to sum of roots?

SHORT ANSWER TYPE QUESTIONS
Section B- 3 Mark questions

Q1. Find two consecutive positive integers, the sum of whose squares is 365.

Q2. If 2 is a root of the equation $x^2 + bx + 12 = 0$, find the value of 'b' and find the other root.

Q3. Find the nature of roots of equation $9x^2 + 12x + 4 = 0$

Q4. Determine the discriminant of the equation: $2x^2 - 7x + 3 = 0$

Q5. Find two numbers whose sum is 27 and product is 182.

Q6. Solve: $x + \frac{1}{x} = 3\ (x \neq 0)$

Q7. Solve by factorization: $9x^2 - 3x - 20 = 0$

Q8. Find k, if $2kx^2 + 6x + 5 = 0$ has equal roots

Q9. Find the roots of the quadratic equation: $3x^2 - 2\sqrt{6}\ x + 2 = 0$

Q10. The altitude of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm, find the other two sides.

Q11. Find the value of p, for which one root of the quadratic equation $px^2 – 14x + 8 = 0$ is 6 times the other

Q12. Find the value of k, for which the quadratic equation $(k- 12)\ x^2 + 2\ (k-12)\ x + 2 = 0$ has equal roots

Q13. The sum of a number and its reciprocal is $\frac{17}{4}$. Find the number.

Q14. Find the discriminant of the equation $3x^2 – 2x + \frac{1}{3} = 0$ and hence write the nature of its roots. Find them, if they are real.

Q15. Three consecutive natural numbers are such that the square of the middle number exceeds the difference of the squares of the other two by 60. Find the numbers

LONG ANSWER TYPE QUESTIONS)

SECTION - C (4 MARKS QUESTIONS)

Q1. If -5 is a root of the quadratic equation $2x^2 + px – 15 = 0$ and the quadratic equation $p\ (x^2 + x) + k = 0$ has equal roots, find the value of k.

Q2. Solve the following quadratic equation for x: $4x^2 + 4bx – (a^2 – b^2) = 0$

Q3. The sum of the areas of two squares is 468 m^2. If the difference of their perimeters is 24 m, find the sides of the two squares.

Q4. A train travels 180 km at a uniform speed. If the speed had been 9 km/ hour more, it would have taken 1 hour less for the same journey. Find the speed of the train.

Q5. In a flight of 600 km, an aircraft was slowed due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. Find the original duration of the flight.

Q6. The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers.

Q7. The sum of reciprocals of Rehman's ages (in years) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age.

Q8. A motor boat whose speed is 24 km/h in still water takes 1 hour more to go 32 km upstream than to return downstream to the same spot. Find the speed of the stream.

Q9. The diagonal of a rectangular field is 16 metres more than the shorter side. If the longer side is 14 metres more than the shorter side, then find the lengths of the sides of the field.

Q10. Solve the following quadratic equation for x: $9x^2 - 6b^2 x - (a^4 - b^4) = 0$

CASE STUDY QUESTIONS

CASE STUDY 1:

Nidhi and Ria are very close friends. Nidhi's parents own a Maruti Alto. Ria's parents own a Toyota Liva. Both the families decide to go for a picnic to Somnath temple in Gujrat by their own cars. Nidhi's car travels x km/hr while Ria's car travels 5 km/hr more than Nidhi's car. Nidhi's car took 4 hours more than Ria's car in covering 400km.

1. What will be the distance covered by Ria's car in two hours? What is the speed of Nidhi's car?
2. What is the speed of Ria's car? How much time Ria took to travel 400 km

CASE STUDY 2

An Auditorium was booked for School Annual Day Celebrations and the seats are arranged in a particular manner. The number of rows are equal to the number of seats in each row. When the number of rows was doubled and the number of seats in each row was reduced by 10, the total number of seats increased by 300.

Based on the above information answer the following questions

1. If x is taken as number of row in original arrangement which quadratic equation describe the situation? How many number of rows are there in the original arrangement?
2. How many seats are there in the auditorium in original arrangement? How many seats are there in the auditorium after re-arrangement?

CASE STUDY 3

Some students planned a picnic to Wayanad as a part of their Scout and guide activities. The total budget for picnic was Rs.2000 for each student. But 5 students failed to attend the picnic and thus the contribution for each student is increased by Rs.20.The details of other expenditures are given in the table below

Article	Entry ticket	Coffee	Food	Travelling Cost	Ice Cream
Cost per student	5	10	25	50	15

1. If x is the number of students planned for picnic, write the correct quadratic equation that describe the situation? What is the number of students planned for picnic?
2. What is the number of students who attended the picnic? What is the total expense for this picnic?

Answer Key

Short answer (2 Marks)

SECTION A

Question	Answer	Question	Answer
1	$P \leq 2$	7	x = 5 and 8
2	7 years, 49 years	8	Numbers are 14 and 13
3	3	9	12 & 13
4	K=2	10	$x^2 - 6x + 7 = 0$
5	8	11	$k = \frac{7}{4}$
6	P = 8	12	$p = \frac{-3}{2}$

Section – B Short Answer (3 Marks)

Question	Answer	Question	Answer
1	13 and 14	9	$x = \sqrt{\frac{2}{3}}, x = \sqrt{\frac{2}{3}}$
2	b=-8, other root 6	10	Other two sides are 5cm and 12cm
3	Two equal roots	11	p = 3
4	25	12	k = 14
5	13 and 14	13	The number is 4
6	$\frac{3+\sqrt{5}}{2}, \frac{3-\sqrt{5}}{2}$	14	D = 0, Equal roots - $They\ are\ \frac{1}{3}, \frac{1}{3}$
7	$x = \frac{5}{3}\ and\ -\frac{4}{3}$	15	The numbers 9, 10, 11
8	$\frac{9}{10}$		

SECTION C Long answer Type Questions			
1	P = 7 and k = $\frac{7}{4}$	6	18 & 12 OR 18 & -12
2	$\frac{-b+a}{2}, \frac{-b-a}{2}$	7	7 years
3	18m and 12m	8	8 km/hr
4	36 km/ hr	9	10 m and 24 m
5	1 hour	10	$\frac{b^2+a^2}{3}, \frac{b^2-a^2}{3}$

CASE STUDY BASED QUESTIONS

CASE STUDY 1	CASE STUDY 2	CASE STUDY 3
1. a) 2(x+5)km b) 20km/hr	1. a) $ax^2 - 20x - 300 = 0$ b) 30	1. a) $ax^2 - 5x - 500 = 0$ b) 25
2. a) 25 km/hr b) 16 hours	2. a) 900 b) 1200	2. a) 20 b) Rs 2100

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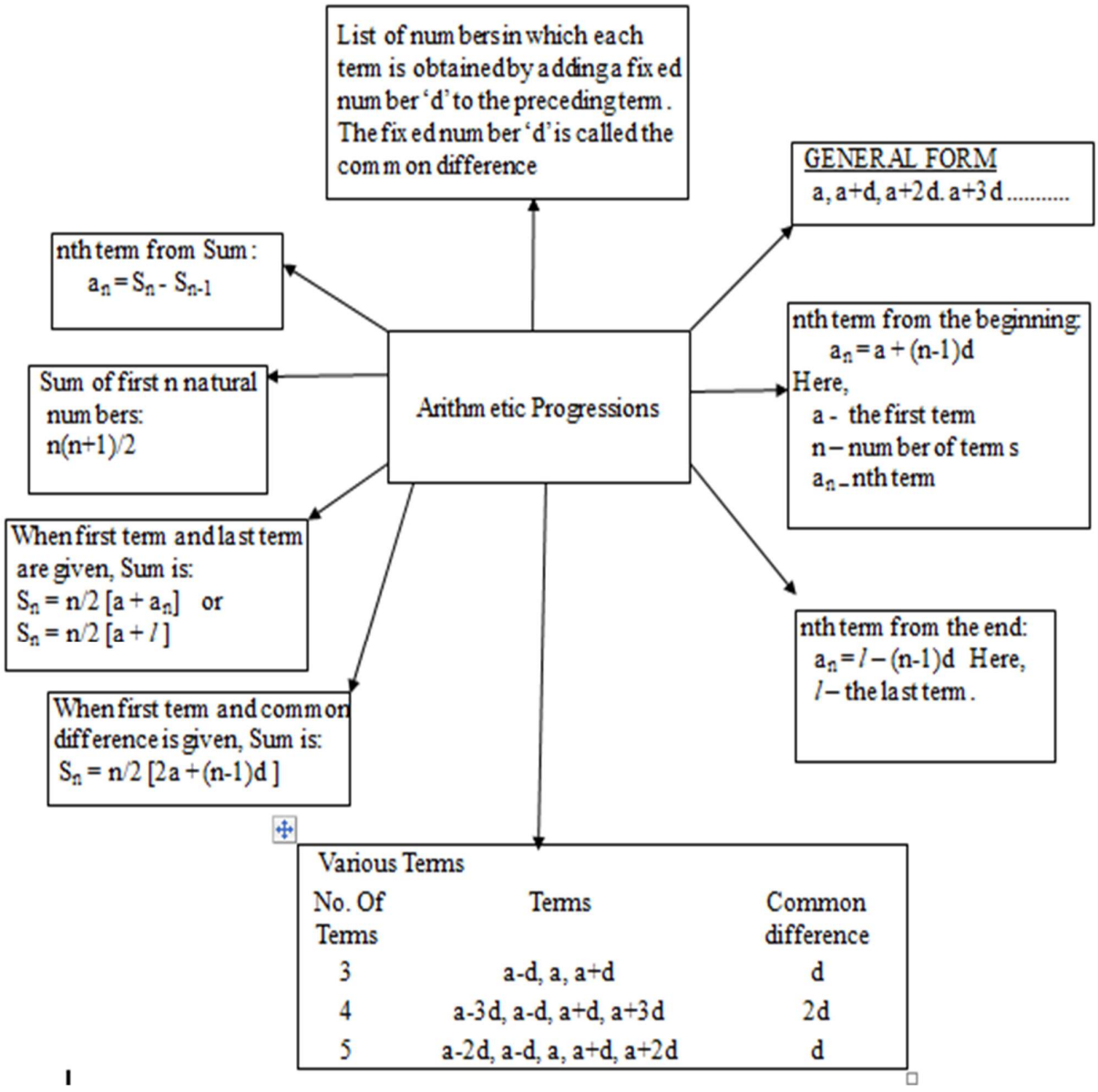
ARITHMETIC PROGRESSIONS

CONCEPT MAP:



SHORT ANSWER TYPE QUESTIONS

SECTION A (2 Mark Questions)

Q1. How many two digits numbers are divisible by 3?

Q2. In an AP, the common difference is -4, the seventh term is 4, and then find the first term?

Q3. Which term of AP 8,14,20,26.....will be 72 more than its 41st term?

Q4. Write the nth term of AP $\frac{1}{m}$, $\frac{1+m}{m}$, $\frac{1+2m}{m}$, ...?

Q5. Find the middle term of 6, 13, 20..... 216?

Q6. The 8th term of an AP is zero. Then find its 38th term?

Q7. Find the sum of all two-digit positive odd numbers?

Q8. Three numbers are in AP and their sum is 21, find the middle number?

Q9. If 7 times the 7th term of an AP is equal to 11times its 11th term. Then find its 18th term.

Q10. The consecutive terms of an AP are 2, x, 26, find the value of x?

Q11. For what value of p is 2p+1, 13, 5p-3, are 3 consecutive terms of an AP?

Q12. Which term of the AP: 3, 8, 13, 18 ... is 78?

Q13. Write the 5th term from the end of the AP 3,5,7,9 ..... 201?

Q14. From the given AP: 8, 10, 12... Find the sum of its last 10 terms if it has 60 terms?

Q15. Find the number of terms of an AP 5, 9, 13 ...185?

Q16. If an AP has 8 as the first term, -5 as the common difference and its first 3 terms are 8, A, B, then find (A+B)?

Q17. Find the 21st term of an AP whose first two terms are -3 and 4?

Q18. If a_n =5-11n, then find its common difference?

Q19. How many terms of AP 18, 16, 4, ...? should be taken, so that their sum is 0?

Q20. In an AP, if a=3.5, d=0, n=101, then find the value of a_n?

Q21. Which term of the following AP 27, 24, 21.....is zero?

Q22. Find the 10th term of the sequence$\sqrt{2}$, $\sqrt{8}$, $\sqrt{18}$, ... ?

Q23. Find the common difference of the AP $\frac{1}{p}, \frac{1-p}{p}$, $\frac{1-2p}{p}$

Q24. Which term of the AP 12, 7, 2, -3 is -98?

Q25. Find the value of $x\ for\ whch\ \ x+2\ , 2x\ , 2x+3$ are three consecutive terms of an AP?

SHORT ANSWER QUESTIONS

SECTION B (3 Mark Questions)

Q1. If the 3rd and 9th term of an AP are 4 and -8 respectively, then which term of this AP is zero?

Q2. Find the 25th term of an AP. -5, -5/2,0,5/2, ….

Q3. The first three terms of an A.P are 3y-1, 3y +5 and 5y +1 respectively then find y.

Q4. The fifth term of an A. P is 20 and the sum of its seventh and eleventh terms is 64. Find the common difference.

Q5. Find whether 100 is a term of the A P 20,28,36 …

Q6. How many two-digit numbers are divisible by 7?

Q7. If the ratio of the sums of first n terms of two A. P's is (7n+1): (4n+27), find the ratio of their $m^{th} terms$.

Q8. Find the sum of all odd numbers between 0 and 50.

Q9. If m^{th} term of an A.P is $\frac{1}{n}$ and n^{th} term is $\frac{1}{m}$, find the sum of first mn terms.

Q10. In an A.P if sum of its first n terms is $3n^2 + 5n \; and \; its \; k^{th} \; term \; is \; 164$,find the value of k.

Q11. Find the common difference of an AP, whose first term is ½ and the 8th term is 17/6.Also ,find the ratio of 4th term and 50th term.

Q12. How many terms of the AP 24, 21, 18, . . . must be taken so that their sum is 78?

Q13. Determine the A.P. whose 4th term is 18 and the difference of 9th term from the 15th term is 30.

Q14. The sum of the first 9 terms of an A.P. is 171 and the sum of its first 24 terms is 996. Find the first term and common difference of the A.P.

Q15. Find the number of natural numbers between 101 and 999 which are divisible by both 2 and 5

LONG ANSWER QUESTION

SECTION C (4 Mark Questions)

Q1. In an A. P. if $S_5 + S_7$=167 and S_{10}= 235, then find the A.P., where $S_n$denotes the sum of the first n terms.

Q2. The first and the last term of A.P. are 5 and 45 respectively. If the sum of all its terms is 400, find its common difference.

Q3. The sum of 3rd and 7th terms of an A.P. is 6 and their product is 8. Find the sum of the first 20 terms of the A.P

Q4. If 1 + 4 + 7 + 10 ……. + x = 287 find the value of x.

Q5. The ratio of the sums of first m and first n terms of an A.P.is $m^2 : n^2$.Show that the ratio of its m^{th} and the n^{th}terms is (2m-1): (2n - 1).

Q6. If the ratio of the 11th term of an A.P. to its 18th term is 2 :3, find the ratio of the sum of the first five term to the sum of the first 10 terms

Q7. If the p^{th} term of an A.P. is 1/q and the q^{th} term is 1/p, prove that sum of the first pq terms of the A.P. is $\left[\frac{pq+1}{2}\right]$.

Q8. The sum of first n terms of an A.P are S_1, S_2, S_3 $respectively. The$ $first$ $term$ of each A.P is 1 and common differences are 1,2 and 3 respectively .Prove that $S_1 + S_3 = 2S_2$

Q9. If pth, qth and rth terms of an A.P. are a, b, c respectively, then show that (a – b)r + (b – c)p+ (c – a)q = 0.

Q10. The first and the last terms of an AP are 8 and 350 respectively. If its common difference is 9, how many terms are there and what is their sum?

CASE STUDY QUESTIONS

CASE STUDY QUESTION I

Birthdays are important for each one of us. Smriti is celebrating her birthday. She invited her friends for a party. She arranged a number card game. In this game, number cards are distributed among her friends such that they are following an Arithmetic progression. Smriti made sure that each of her friends who stood in a row gets a card. The first three cards marked 2x, x+10 and 3x+2 is given to Rahul, Sonu and Sanjay respectively

Based on the above information answer the questions

1. Sonu is a curious child. She wants to find the sum of the number cards obtained by her, Rahul, and Sanjay. From the above given information, help her to do so.
2. Smriti has called only a few of her close friends as the Covid pandemic is spreading. Ratan is her friend who gets the last card with the number 56. If so, find how many of Smriti's friends are attending the birthday party.

CASE STUDY QUESTION II

As a part of this one-week long festival, students of Durgapura Higher Secondary School thought of planting trees in and around their school to reduce air pollution. It was decided that each section of each class would plant twice as many plants as class which they belong to. There were 4 sections of each standard from 1 to 12. So, if thereare four sections in class 1 say 1A, 1B , 1C and I D, then each section would plant 2 trees. Similarly, each section of class 2 would plant 4 trees and so on. Thus, the number of trees planted by classes 1 to 12 formed an AP given by 8, 16, 24, ,.... Ratan ,who is a student of Class 10 B decided to frame a set of questions and answers based on the above information . Help him to do so.

1. Find the total number of trees planted by class 10 students of all the sections together. Also find the total number of trees planted by students of Ratan's class alone.
2. The members of the Nature Club of the School decided to find the total number of trees planted by the students of the school altogether. Help them to do so.

CASE STUDY QUESTION III

Accumulation of plastics in the environment creates problems for wildlife and their habitats as well as for human. Plastics are a threat to the environment. The children of

Avantipur decided that they would contribute their service to put an end to the usage of plastics in their village. They fixed posters and hoisted placards which depicted the ill effects of plastics on human health and environment. They started their work on June $\mathbf{15^{th}}$ They started collecting the thrown off plastic bottles in their locality and started counting them.

To their astonishment, they found that the number of plastic bottles that they collected each day were in Arithmetic Progression which went like this: 417 ,404 ,391, ……

1. How many bottles did they collect on June 25^{th} ?
2. The children of Avantipur wanted to make their village a plastic free zone. Identify the day on which they got 1 bottle which was their dream day

ANSWER KEY

SECTION A

Qn no	ANS	Qn.no	ANS	Qn no	ANS	Qnno	ANS	Qn.no	ANS
1	$n = 30$	6	$30d$	11	$p = 4$	16	1	21	10th
2	$a = 28$	7	2475	12	$n = 16$	17	137	22	$\sqrt{200}$
3	$n = 53$	8	$a = 7$	13	193	18	-11	23	-1
4	$\frac{1 + (n-1)m}{m}$	9	zero	14	1170	19	$n = 19$	24	23rd
5	a_{16}=111	10	$x = 14$	15	$n = 46$	20	3.5	25	5

SECTION B

1)	$a + 2d = 4$ *and* $a + 8d = -8$. *subtracting them we get* $d = -2$. *Also we get* $a = 8$ Let $a_n = 0$; $a + (n-1)d = 0$; $8 + (n-1)(-2) = -8$; $n = 5$, *Hence 5th term of the AP is zero* ;
2)	55, use a_n=$a + (n-1)d$, where a=-5, d= 5/2

3)	Since it is an A.P $a_3 - a_2 = a_2 - a_1$ hence we get y= 5
4)	a+4d =20 a+6d+a+10d=64 d=3
5)	a = 20 and d= 8; 20+(n-1)×8=100 ; n=11
6)	Two digit numbers divisible by 7 are 14,21,28,……,98. Here a =14 ,d= 7 and $a_n = 98;\ a_n = a + (n-1)d\ ;n = 13$
7)	Let A and a be the first terms and D and d be the common difference of two A.P's $\frac{S_n}{S'_n} = \frac{\frac{n}{2}[2a+(n-1)d]}{\frac{n}{2}[2A+(n-1)D]} = \frac{7n+1}{4n+27}$ Simplify L.H.S $\frac{a+\frac{(n-1)d}{2}}{A+\frac{(n-1)d}{2}} = \frac{7n+1}{4n+27}$ putting $\frac{n-1}{2} = m-1\ or, n = 2m-1$ Hence, $\frac{a_m}{A_m} = \frac{14m-6}{8m+23}$
8)	Given ,1+3+5+7+….+…+49 has n terms $a_n = 1 + (n-1)2 = 49$ n =25 $S_{25} = \frac{25}{2}(1+49) = 25 \times 25 = 625$
9)	$a_m = a + (m-1)d = \frac{1}{n} : a_n = a + (n-1)d = \frac{1}{m}$ subtracting these we get d =$\frac{1}{mn}\ and\ a = \frac{1}{mn}$, now $S_n = \frac{mn}{2}\left(2\frac{1}{mn} + (mn-1)\frac{1}{mn}\right) = \frac{1}{2}[mn+1]$
10)	$s_n = 3n^2 + 5n$ $S_1 = 3 \times 1^2 + 5 \times 1 = 8 = a_1$ $S_2 = 3 \times 2^2 + 5 \times 2 = 22 = a_1 + a_2$ $a_2 = 22 - 8 = 14 \Longrightarrow d = 6$ $a_k = 164 \Longrightarrow 8 + (k-1)6 = 164$, k= 27
11)	$a_n = \frac{17}{6} = a + 7d, d = \frac{1}{3}\ a_4 = \frac{3}{2} and\ a_{50} = \frac{101}{6} hence\ required\ ratio\ is\ 9:101$

12)	Given AP: 24, 21, 18,… Here, a = 24, d = 21 – 24 = –3, S_n = 78. We need to find n. We know that; S_n = n/2[2a+(n-1)d] So, 78 = n/2 [48+(n-1)(-3)] 78 = n/2 [51 – 3n] 156 = 51n – $3n^2$ $3n^2$ – 51n +156 = 0 n^2 – 17n + 52 = 0 n^2 – 13n – 4n + 52 = 0 n(n – 13) – 4(n – 13) = 0 (n-4) (n-13) = 0 n = 4 or 13 Both values of n are admissible. So, the number of terms is either 4 or 13.
13)	a_4= 18 ...(1), $a_{15} - a_9$= 30 ...(2) equation (2) will give d = 5 Substitute d = 5 in (1) to get a = 3 A.P. 3, 8, 13, ...
14)	S_9 = 171, S_{24}= 996; a + 4d = 19, 2a + 23d = 83 Solve to get, d = 3, a = 7
15)	Numbers divisible by both 2 and 5 ⇒ Numbers divisible by 10. Numbers between 101 and 999 divisible by 2 and 5 both 110, 120, 130, 140, ..., 990. Use a_n = 990 to get n = 89.
	SECTION C - LONG ANSWERS
1)	$S_n = \frac{n}{2}[2a + (n-1)d]$;$S_5 + S_7 = 167$; 12a+31d=167….(1);(2a+9d)=47…(2) Solving 1 and 2 we get a=1 and d=5.Hence A.P =1,6,11,…
2)	a = 5,$S_n = 400$ and l = 45 45=5 + (n-1)d $S_n = \frac{n}{2}(a + l)$;n=16,d=8/3
3)	$a_3 + a_7 = 6\ and\ a_3 \times a_7 = 8$ $2a + 8d = 6\ and\ (a + 2d)(a + 6d) = 8\ \ ; a + 4d = 3\ or, a = 3 - 4d.$ $and\ (a + 2d)(a + 6d) = 8; we\ get\ d = \pm\frac{1}{2}$

	$case\ i, d = 1/2\ and\ , a = 1\ \ s_n = \frac{n}{2}[2a + (n-1)d]$; $S_{20} = \frac{20}{2}\left[2 + \frac{19}{2}\right]$ =115 Case ii) d=-1/2 and a=5; $S_{20} = \frac{20}{2}\left[2 \times 5 + 19 \times \frac{-1}{2}\right]$ =5
4)	Given a=1and d=3.let the number of terms in the series be n ; $s_n = \frac{n}{2}[2a + (n-1)d]$ $287 = \frac{n}{2}[2 \times 1 + (n-1)3]\ \ , 3n^2 - n = 574$ $n = 14\ or\ -\frac{41}{3}\ which\ is\ not\ possible\ .$ $Hence\ the\ 14th\ term\ is\ x,\ \ a + (n-1)d = x, x = 40.$
5)	$\frac{S_m}{S_n} = \frac{m^2}{n^2}$; $\frac{\frac{m}{2}[2a+(m-1)d]}{\frac{n}{2}[2a(n-1)d]} = \frac{m^2}{n^2}$; $\frac{[2a+(m-1)d]}{[2a(n-1)d]} = \frac{m^2}{n^2} \times \frac{n}{m} = \frac{m}{n}$ $m(2a + (n-1)d) = n[2a + (m-1)d]; d = 2a, now\ \frac{a_m}{a_n} = \frac{a + (m-1)d}{a + (n-1)d}$ $= \frac{a + (m-1)2a}{a + (n-1)2a} = \frac{a + 2ma - 2a}{a + 2na - 2a} = \frac{a(2m-1)}{a(2n-1)} = 2m - 1 : 2n - 1$
6)	$\frac{a_{11}}{a_{18}} = \frac{a+10d}{a+17d} = \frac{2}{3}$; a=4d $\frac{S_5}{S_{10}} = \frac{\frac{5}{2}(2a+4d)}{\frac{10}{2}(2a+9d)} = \frac{\frac{5}{2}(8d+4d)}{5(8d+9d)} = \frac{12d}{34d} = \frac{6}{17}$; 6: 17
7)	Let first term and common difference of given A.P be a and d respectively $a_p = a + (p-1)d = \frac{1}{q}$; $a_q = a + (q-1)d = \frac{1}{p}$ $solving\ these\ two\ equations\ we\ get\ , a = \frac{1}{pq}\ and\ d = \frac{1}{pq}$; $S_{pq} = \frac{pq}{2}\left[2 \times \frac{1}{pq} + (pq-1)\frac{1}{pq}\right] = \frac{pq+1}{2}$
8)	$let\ S_1 = 1 + 2 + 3 + 4 \ldots\ldots + n$ or n(n+1)/2 $S_2 = 1 + 3 + 5 + \cdots \ldots + upto\ n\ terms$ or $\frac{n}{2}(2n) = n^2$ $S_3 = 1 + 4 + 7 + \cdots \ldots\ldots + upto\ n\ terms$ or $\frac{n(3n-1)}{2}$ $S_1 + S_3 = \frac{n(4n)}{2} = 2n^2 = 2S_2$
9)	Let A be the first term and D be the common difference of the given A.P. p^{th} term = A + (p – 1)D = a …(i)

	q^{th} term = A + (q – 1)D = b …(ii) r^{th} term = A + (r – 1)D = c … (iii) L.H.S. = (a – b)r + (b – c)p + (c – a)q = [A + (p – 1)D – (A + (q – 1)D)]r + [A + (q – 1)D – (A + (r – 1)D)]p + [A + (r – 1)D – (A + (p – 1)D)]q = [(p – 1 – q + 1)D]r + [(q – 1 – r + 1)D]p + [(r – 1 – p + 1)D]q = D[(p – q)r + (q – r)p + (r – p)q] = D[pr – qr + qp – rp + rq – pq] = D[0] = 0 = R.H.S.
10)	$a_n = 350, a + (n-1)d = 350, n = 39$ $S_n = \frac{n}{2}(a + a_{n)} = 6981$

CASE STUDY QUESTIONS

Q NO:	HINTS/SOLUTION	MARKS
CASE STUDY :1	(i)To find the sum of the number on the cards,first find x. As the terms are in AP, (x+10)-2x = (3x+2)-(x+10) ⇒ x = 6 ∴ Sum of the number cards of Rahul, Sonu and Sanjay is 2x + x+10 + 3x+2=6x +12 =48 (ii) To find the number card ,find the first term(a) and common difference(d) ⇒ a = 12 and d= 4 Let Ratan occupy the n^{th} position. ⇒ a_n = a +(n-1)d ⇒ 56 = 12 +(n-1)4 ⇒n =12. Hence , Smriti's 12 friends attended the party.	1 1 1 1
CASE STUDY :2	(i) 8,16,24,…. To find the total number of trees planted by Class 10 students of all the 4 sections together, find a_{10} .Here a= 8 , d= 8 a_{10} = a +9d ⇒ a_{10} = 8 +(9 x 8) = 80 trees The total number of trees planted by students of Ratan's class(X B) =80 /4 =20 trees	1 1

	(ii) Sum of trees planted by the students of the school altogether= $S_n = \frac{n}{2}$ [2a +(n-1)d] $= \frac{12}{2}$ [(2 x8)+ (11 x 8)] =624 trees	1 1
CASE STUDY :3	(i) 417 ,404 ,391 ,..... As the children started collecting plastics on on June 15^{th} ,June 25^{th} falls on the 11^{th} day ⇒n = 11 ⇒ a_{11} = a +(11-1)d =287 bottles (ii)The AP is 417 ,404 ,391 ,…… a=417 ,d =(-13) Let the day on which they got 1 bottle be the n^{th} day ⇒ a_n = 1 ⇒ a +(n-1)d =1 ⇒ 417 +(n-1)(-13) =1 ⇒ n = 33 Their dream day was on the 33^{rd} day starting from June 15^{th}. Hence the day falls on July 17^{th}	1 1 1 1

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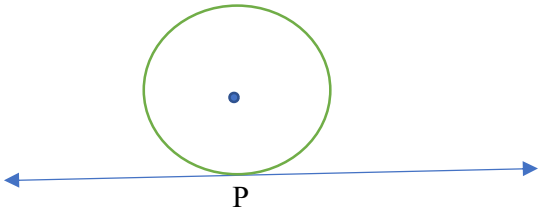
Circles

Important Concepts

Tangent to a circle

A tangent to a circle is a line that intersects the circle at only one point



* There is only one tangent at a point on a circle
* There are exactly two tangents to a circle through a point lying outside the circle.
* The tangent at any point of a circle is perpendicular to the radius through the point of contact.
* The length of tangents drawn from an external point to a circle are equal.

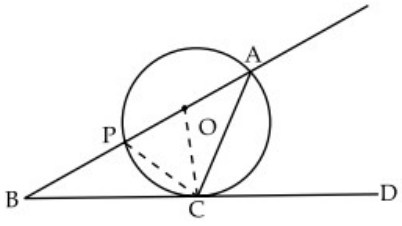
Short Answer Questions

SECTION A (2 MARK QUESTIONS)

Q1. Prove that the line segments joining the points of contact of two parallel tangents is a diameter of the circle.

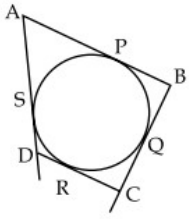
Q2. O is the centre of the circle and BCD is a tangent to it at C.

Prove that $< BAC + < ACD = 90^0$



Q3. In the figure quadrilateral ABCD is drawn to circumscribe a circle.

Prove that AD + BC = AB + CD

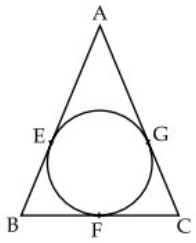


Q4. Prove that the tangents drawn at the end- points of the diameter of a circle are parallel.

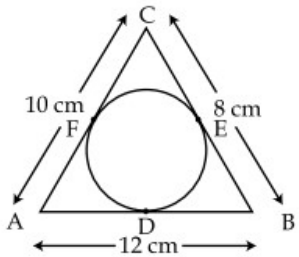
Q5. Two concentric circles have centre O, OP= 4cm, OB = 5cm. AB is a chord of the outer circle and tangent to the inner circle at P. Find the length of AB.

Q6. Two tangents PA and PB are drawn to a circle with centre O such that $< APB = 120^{0}$. Prove that OP=2AP

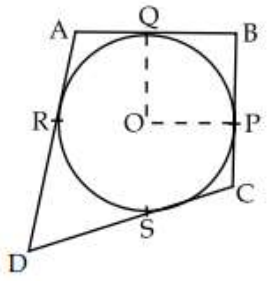
Q7. In the isosceles triangle ABC in fig. AB = AC, show that BF = FC



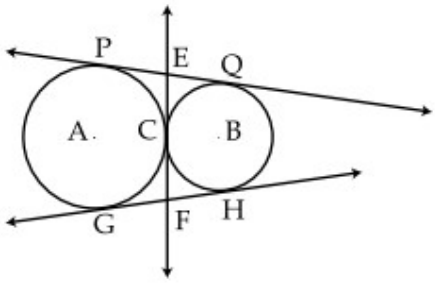
Q8. In the fig. a circle is inscribed in a ΔABC with sides AB = 12cm, BC = 8 cm and AC = 10cm. Find the lengths of AD, BE and CF



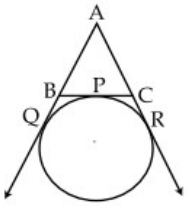
Q9. In fig. circle is inscribed in a quadrilateral ABCD in which $< B = 90^{0}$. If AD = 23cm, AB = 29cm, and DS = 5cm, find the radius 'r' of the circle



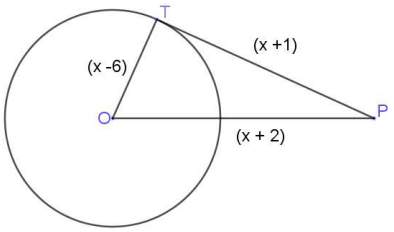
Q10. In fig. two circles touch each other externally at C. Prove that the common tangent at C bisects the other two tangents



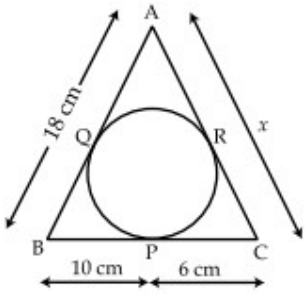
Q11. In fig. circle touches the side BC of a triangle ABC at the point P and AB and AC produced at Q and R. Show that AQ = $\frac{1}{2}(perimeter\ of\ \Delta ABC)$



Q12. Find the actual length of sides of ΔOTP



Q13. In fig. all three sides of the triangle touch the circle. Find the value of x.



Q14. Two tangents PR and PQ are drawn from external point P to a circle with centre O. Prove that PROQ is a cyclic quadrilateral.

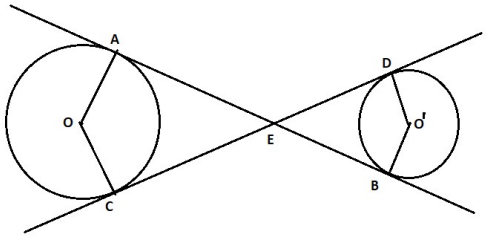
Q15. Prove that tangents drawn at the ends of a chord make equal angles with the chord

SHORT ANSWER QUESTIONS

SECTION B (3 MARK QUESTIONS)

Q1. If an angle between two tangents drawn from a point P to a circle of radius 'a' and centre O is 60°, then prove that AP = a$\sqrt{3}$.

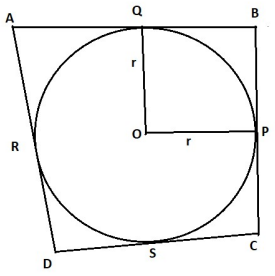
Q2. In the figure common tangents AB and CD to two circles with centre O and 'O^I intersects at E. Prove that AB = CD.



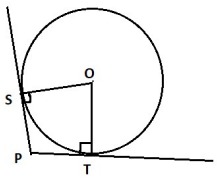
Q3. If all the sides of a parallelogram touch a circle, then prove that the parallelogram is a rhombus.

Q4. XY and X^{I}Y^I are two parallel tangents to a circle with centre O and another tangent AB with point of contact C, intersecting XY at A and X^{I}Y^I at B, is drawn. Prove that $\angle AOB = 90°$.

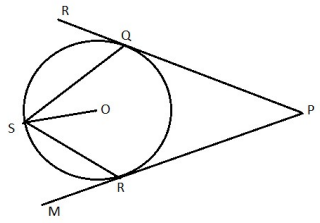
Q5. In the figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90°$. If AD = 23 cm , AB = 29 cm and DS = 5 cm, find the radius of the circle.



Q6. In figure tangent segments PS and PT are drawn to a circle with centre O such that $\angle SPT$ = 120°. Prove that OP = 2PS.

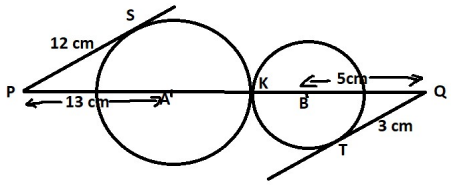


Q7. In fig. 3, PQ and PR are tangents to the circle with centre O and S is a point on the circle such that ∠SQR= 50° and ∠SRM = 60° . Find ∠QSR.



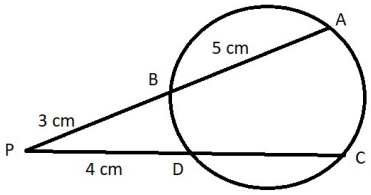
Q8. Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ=2∠OPQ.

Q9. In fig, two circles with centres A and B touch each other externally at K. find the length of segment PQ. (Given PA=13 cm , BQ=5 cm , PS=12 cm AND QT=3 cm)

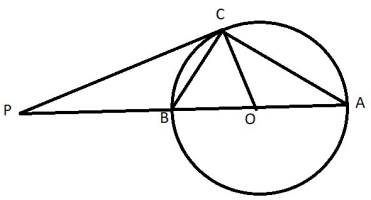


Q10. PA and PB are the two tangents to a circle with centre O in which OP is equal to the diameter of the circle. Prove that APB is an equilateral triangle.

Q11. 11. In fig. Chords AB and CD intersect at P. If AB = 5 cm, PB = 3 cm and PD = 4 cm. Find the length of CD.



Q12. The tangent at a point C of a circle and a diameter AB when extended intersect at P. If ∠PCA = 110°, find ∠CBA.

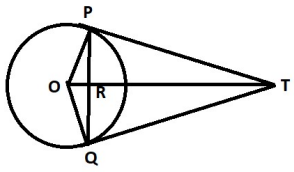


Q13. Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the centre

LONG ANSWER QUESTIONS

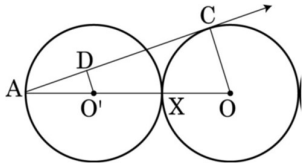
SECTION C (4 MARK QUESTIONS)

Q1. In fig PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents drawn at P and Q intersect at T. Find the length of TP.



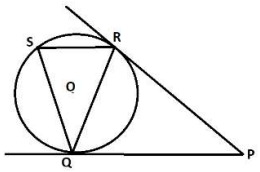
Q2. Prove that the lengths of tangents drawn from an external point to a circle are equal.

Q3. In fig, two equal circles with centres O and O^I, touch each other at X. OO^I produced meet the circle with centre O^I at A. AC is tangent to the circle with centre O, at the point C. O^ID is perpendicular to AC. Find the value of $\frac{DO^I}{CO}$.



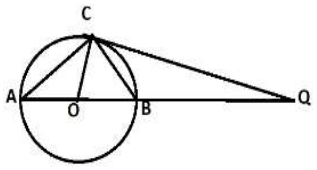
Q4. The radius of the in-circle of a triangle is 4 cm and the segments into which one side is divided by the point of contact are 6 cm and 8 cm. Determine the other two sides of the triangle.

Q5. In fig, tangents 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.



Q6. Prove that opposites sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

Q7. In fig AB is diameter of a circle with centre O and QC is a tangent to the circle at C. If ∠CAB=30°, find ∠CQA and ∠CBA.

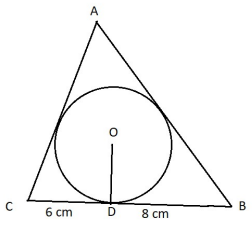


Q8. In fig, O is the centre of a circle of radius 5 cm. T is a point such that OT = 13cm and OT intersect circle at E. If AB is a tangent to the circle at E, find the length of AB, where TP and TQ are two tangents to the circle.

Q9. In ΔABC, AB= 8cm , BC=6cm and CA= 4 cm. With the vertices of triangle as centre, three circles are described, each touching the other two externally, find the radii of each circle.

Q10. 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 bisect BC.

Q11. 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. Find the sides AB and AC.

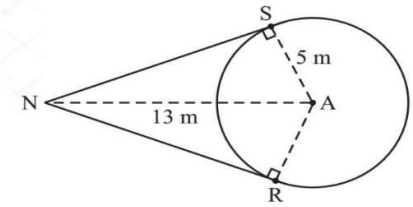


CASE STUDY QUESTIONS

Case Study 1

An international school in Hyderabad organised an Interschool Throwball Tournament for girls just after the pre-board exam. The throw ball team was very excited. The team captain Anjali directed the team to assemble in the ground for practices. Only three girls Priyanshi, Swetha and Aditi showed up. The rest did not come on the pretext of preparing for pre-board exam. Anjali drew a circle of radius 5 m on the ground. The centre A was the position of Priyanshi. Anjali marked a point N, 13 m away from centre A as her own position. From the point N, she drew two tangential lines NS and NR and gave positions S and R to Swetha and Aditi. Anjali

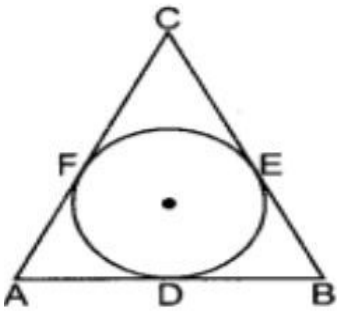
throws the ball to Priyanshi, Priyanshi throws it to Swetha, Swetha throws it to Anjali, Anjali throws it to Aditi, Aditi throws it to Priyanshi, Priyanshi throws it to Swetha and so on.



1. Find the distance between Swetha and Anjali. Which theorem is used and why is it used?
2. If ∠ SNR = θ, find ∠ NAS. Write the reason for your answer.

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 centre 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
3. If radius of the circle is 4cm, find area of ΔABC.

Answer Key

SECTION A (**Short answer Questions)**

Q1. Consider the circle with centre at O

PQ & RS are two parallel tangents to it touching at A and B respectively.

Join OA and OB

Now OA perpendicular to PQ (∴ radius is perpendicular to tangent)

and OB perpendicular to RS

∴OA||OB

But OA and OB pass through O

∴AB is straight line through centre

∴AB is a diameter

Q2. $<OCD = 90^0$ (∵ radius is perpendicular to tangent at the point of contact)

$<OCA + <ACD = 90^0$

$<OAC + < ACD = 90^0$ (∵ OC = OA , <OCA=<OAC)

$<BAC + < ACD = 90^0$

Q3. AS = AP ,,,,,,,,,,,,,,,,,,,,(i) (Length of tangents drawn from an external point to a circle are equal)

DS=DR……..(ii)

CQ=CR…….. (iii)

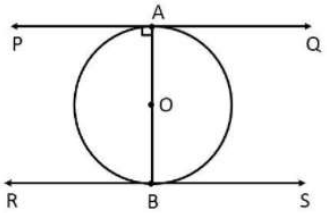
BQ=BP…….(iv)

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

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

AD +BC = AB + CD

Q4.



Let AB be a diameter of the circle. Two tangents PQ and RS are drawn at points A and B respectively.

Radius drawn to these tangents will be perpendicular to the tangents.

Thus, OA ⊥ PQ and OB ⊥ RS

∠OAP = 90°

∠OAQ = 90°

∠OBR = 90°

∠OBS = 90°

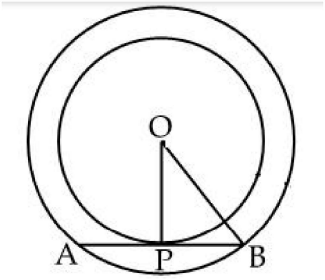
It can be observed that

∠OAP = ∠OBS (Alternate interior angles)

∠OAQ = ∠OBR (Alternate interior angles)

Since alternate interior angles are equal, lines PQ and RS will be parallel.

Q5.



OP = 4 cm, OB = 5 cm

We know that the radius is perpendicular to the tangent at the point of contact.

∴ ∠OPB = 90°

In right triangle OPB,

$OB^2 = OP^2 + PB^2$

$(5)^2 = (4)^2 + PB^2$

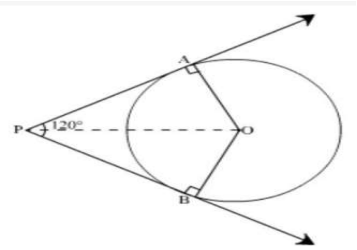
$PB^2 = 25 - 16 = 9$

PB = 3 cm

We know that perpendicular from the centre to the chord bisect the chord.

∴ AB = 2PB = 6 cm

Q6.



In ΔOAP and ΔOBP,

OP = OP (Common)

∠OAP = ∠OBP (90°) (Radius is perpendicular to the tangent at the point of contact)

OA = OB (Radius of the circle)

∴ ΔOAP is congruent to ΔOBP (RHS criterion)

∠OPA = ∠OPB = 120°/2 = 60° (CPCT)

In ΔOAP,

Cos ∠OPA = cos 60° = AP/OP

Therefore, 1/2 =AP/OP

Thus, OP = 2AP

Hence, proved.

Q7. AB= AC (given)

ie AE +BE = AG + GC

BE = GC (Length of tangents drawn from an external point to a circle are equal)

BF = CF (∵ BE = BF and GC = CF)

Q8. Let AD= x cm

BD = 12 – x

BE = 12 – x

CE = 8 – (12 – x)

CE = x – 4 …….. (i)

AF = x

CF = 10 – x --------(ii)

From (i) and (ii) , we get

x- 4 = 10-x

x = 7 cm

AD = 7 cm

BE = 5cm

CF = 3cm

Q9. OPBQ is a square

Let AQ = x

So BQ = 29 -x , BP = 29 – x

AQ = AR = x , DR = DS = 23-x

i.e. 23-x = 5 gives x = 18 units

Radius of the circle = 29-x = 29-18 = 11cm

Q10. PE = CE = EQ (lengths of tangents from an external point to a circle are equal)

GF= CF = FH

Therefore CF bisects PQ and GH

Q11. AQ = AB +BQ = AB + BP

AR = C R+ AC = CP + AC

AQ + AR = AB + BP + CP + AC

2AQ = AB + BC + AC

AQ = ½ (perimeter of triangle ABC)

Q12. $(x+2)^2 = (x + 1)^2 + (x -6)^2$

$x^2 – 14x +33 = 0$

$(x – 11)(x-3) = 0$

x= 11

so OT = 5 units ,TP = 12 units , OP = 13 units

Q13. BP=BQ= 10cm

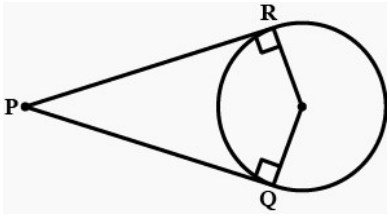
AQ = AQ = 8cm

CR = CP = x – 8 cm

x-8 = 6cm

there fore x = 14cm

Q14.



Given : Tangents PR and PQ from an external point P to a circle with centre O.

To prove : Quadrilateral QORP is cyclic.

Proof : RO and RP are the radius and tangent respectively at contact point R.

$\therefore \angle PRO=90^\circ$

Similarly $\angle PQO=90^\circ$

In quadrilateral OQPR, we have

$\angle P+\angle R+\angle O+\angle Q=360^0$

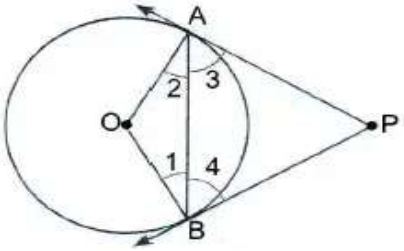
$\Rightarrow \angle P+\angle 90^0+\angle O+\angle 90^0=360^0$

$\Rightarrow \angle P+\angle O=360^0-180^0=180^0$

These are opposite angles of quadrilateral QORP and are supplementary.

∴ Quadrilateral QORP is cyclic, hence, proved.

15.



Given: - A circle with centre O, PA and PB are tangents drawn at ends A and B on chord AB.

To prove: - $\angle PAB=\angle PBA$

Construction: - Join OA and OB

Proof: - In $\triangle AOB$, we have

OA=OB (Radii of the same circle)

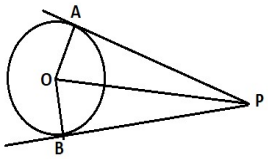
∠OAB=∠OBA (Angles opposite to equal sides)

∠OAP=∠OBP=90 (∵Radius ⊥Tangent)

⇒∠PAB=∠PBA

SECTION B - Short Answer Questions

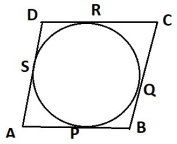
Q1. ΔAOP≅ ΔBOP, ∠APO=30° , use tan 30 in ΔAOP



Q2. AE=EC and DE=BE (lengths of tangents are equal)

AB=AE+EB = EC+DE=CD

Q3. AP=AS , BP=BQ, RC=CQ , DR=DS



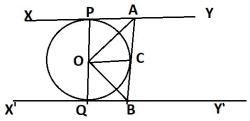
AB+DC=AP+PB+DR+RC=AS+BQ+DS+CQ =(AS+DS)+(BQ+CQ)=AD+BC

AB+AB=AD+AD

2AB=2AD ⇒ AB=AD ⇒ ABCD is a rhombus

Q4. ΔAPO≅ ΔACO and ΔOBC≅ ΔOBQ

∠AOP=∠AOC and ∠BOC=∠BOQ , use POQ as straight angle.



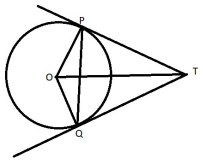
Q5. OPBQ is a square , so r=11 cm

Q6. ΔPSO≅ ΔPTO⇒ ∠OPS=∠OPT=60°

Use cos 60° in ΔPSO

Q7. ∠QSR=70°

Q8. ∠PTQ= 180-∠POQ=180-(180-2∠OPQ) = 2∠OPQ



Q9. PQ= 27 cm

Q10. ∠APB = 60° (by using sinθ in ΔPBO , get $\theta = 30°$)

PB=PA ⇒ ∠PBA=∠PAB=60°

Q11. Join BD, AC . In . ΔPDB ~ ΔPAC (∠P is common , ∠PAC=180-∠BDC = ∠BDP)

$\frac{PD}{PA} = \frac{PB}{PC}$ ⇒ DC = 2 cm

Q12. 70°

SECTION C - Long Answer Questions

Q1.TP=$\frac{20}{3}$

(PR=4cm , OR=3cm , ΔPOR~ΔTOP by AA criteria , use side proportionality)

Q2. Proof of theorem 10.2

Q3. ΔADO^I ~ΔACO ⇒ $\frac{AO^I}{AO} = \frac{DO^I}{CO}$ ⇒ $\frac{r}{3r} = \frac{DO^I}{CO}$

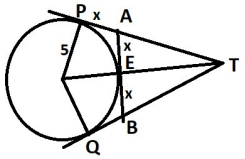
Q4. The other two sides are 13 cm and 15 cm. (Hint: use area of triangle)

Q5. ∠RQS=30°

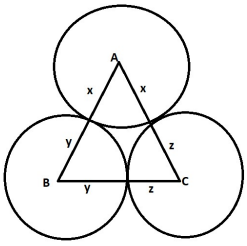
Q6. Proof

Q7. ∠CQA=30° , ∠CBA=60°

Q8. AB = 6.6 cm (PT=12 cm , $TA^2=TE^2+EA^2 \Rightarrow (12-x)^2=64+x^2$)



Q9.Radii of three circles are 3 cm , 5 cm and 1 cm. (use x+y=8 , y+z=6, x+z=4)

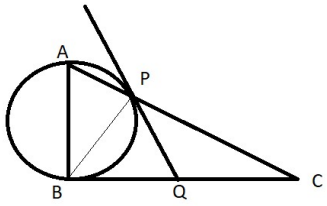


Q10. BQ = QP ⇒ ∠QBP = ∠QPB …….. (1)

∠PBC + ∠PCB = 90° , ∠QPB + ∠QPC = 90° ……(2)

⇒ ∠QCP = ∠CPQ ⇒ QC = QP

So , BQ = QC



Q11. AB = 15 cm AC = 13 cm

Case Study

CASE STUDY 1	CASE STUDY 2
1) 12m . Pythagoras Theorem because Δ NSA is a right-angled triangle (NS ⊥ SA)	1) 7 AD=AF=x cm BD=BE=y cm CF=CE= z cm AB = x + y= 12cm BC = y + z = 8 cm CA= z + x = 10 cm AB+BC+CA= 30 cm x +y +y +z +z +x = 30 x + y + z = 15 AD= 7cm
2) $90° – (\theta/2)$ Sum of the four angles of a quadrilateral is 360^0. Also ∠ NAS = ∠ NAR	$60cm^2$ Area of ΔABC = Area of ΔOAB + Area of ΔOBC +Area of ΔOCA

Constructions

Key Points

1. Division of a line segment in a given ratio.
2. Construction of tangents to a circle

Short Answer Questions
Section A (2 Mark Questions)

Q1. Draw a line segment of length 8.4 cm and divide it in the ratio 7:5

Q2. Draw a circle of radius 4cm. From a point 8cm away from its centre, construct pair of tangents to the circle.

Short Answer Questions

SECTION B (3 MARK QUESTIONS)

Q1. Draw a line segment AB of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle .

Q2. Construct a pair of tangents to a circle of radius 4 cm from a point which is at a distance of 6 cm from its centre.

Q3. Draw a line segment of length 8 cm and divide it internally in the ratio 4:5.

Q4. 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.

Q5. Draw a circle of radius 3 cm. From a point P, 7 cm away from its centre draw two tangents to the circle. Measure the length of each tangent.

Q6. Construct two tangents PT and PQ to a circle of radius 4 cm and centre O such that $\angle TOQ=120°$.

Q7. To a circle of radius 5 cm, draw two tangents which are inclined to each other at an angle of 60°.

Q8. Draw a circle of radius 3·5 cm. Draw two tangents to the circle which are perpendicular to each other.

Q9. Draw a line segment of 6 cm and divide it in the ratio 3 : 2.

Q10. Draw a line sgment AB of length 7 cm. Using a ruler and compasses, find a point P on AB such that $\frac{AP}{PB}=\frac{3}{5}$.

Q11. 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.

Answer Key

Short Answer Questions

4. The length of the tangent = 4 cm.

5. The length of the tangent = 6.3 cm

SOME APPLICATION OF TRIGONOMETRY

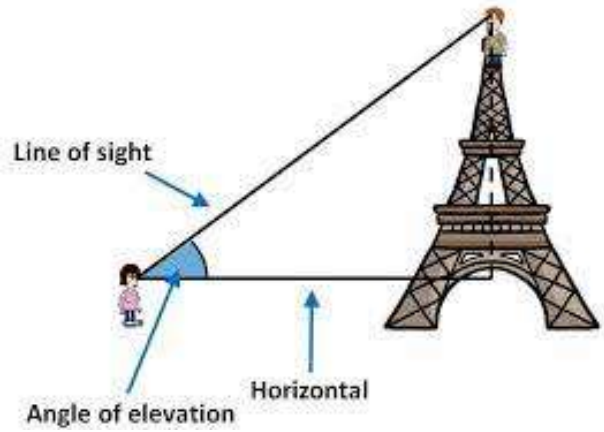
HEIGHTS AND DISTANCES: Trigonometry is used for finding the heights and distances of various objects, without measuring them.

Line of sight is the line drawn from the eye of the observer to the point on the object viewed by the observer.

Horizontal level is the horizontal line through the eye of the observer.

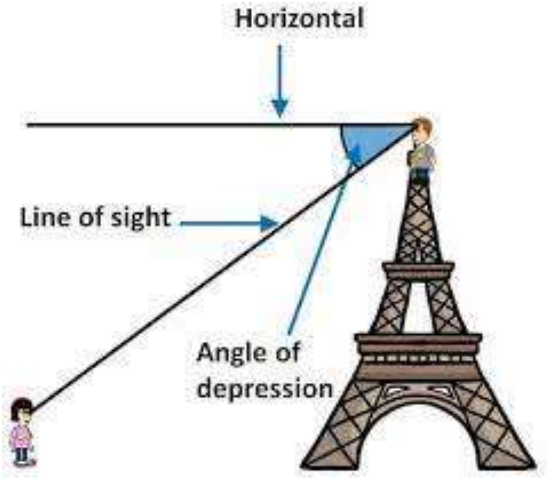
ANGLE OF ELEVATION

The angle of elevation is relevant for objects above horizontal level.
It is the angle formed by the line of sight with the horizontal level.



ANGLE OF DEPRESSION

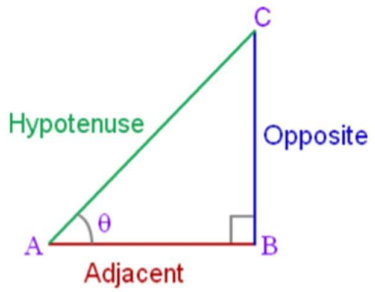
The angle of depression is relevant for objects below horizontal level.
It is the angle formed by the line of sight with the horizontal level.



IMPORTANT POINTS TO REMEMBER:

In this right triangle ∠B = 90°. If we take ∠A as acute angle, then -

AB is the base, as the side adjacent to the acute angle.
BC is the perpendicular, as the side opposite to the acute angle.
AC is the hypotenuse, as the side opposite to the right angle.



Trigonometric ratios with respect to ∠A

RATIO	FORMULA	VALUE	ALTERNATIVE FORMULA	SHORT FORM
sin A	$\frac{opposite}{hypotenuse}$	$\frac{BC}{AC}$	$\frac{perpendicular}{hypotenuse}$	$\frac{P}{H}$
cos A	$\frac{adjacent}{hypotenuse}$	$\frac{AB}{AC}$	$\frac{base}{hypotenuse}$	$\frac{B}{H}$
tan A	$\frac{opposite}{adjacent}$	$\frac{BC}{AB}$	$\frac{perpendicular}{base}$	$\frac{P}{B}$
cosec A	$\frac{hypotenuse}{opposite}$	$\frac{AC}{BC}$	$\frac{hypotenuse}{perpendicular}$	$\frac{H}{P}$
sec A	$\frac{hypotenuse}{adjacent}$	$\frac{AC}{AB}$	$\frac{hypotenuse}{base}$	$\frac{H}{B}$
cot A	$\frac{adjacent}{opposite}$	$\frac{AB}{BC}$	$\frac{base}{perpendicular}$	$\frac{B}{P}$

RECIPROCAL RELATION BETWEEN TRIOGONOMETRIC RATIOS

$\sin A = \frac{1}{\text{Cosec A}}$	$\text{cosec A} = \frac{1}{\sin A}$	sin A. cosec A = 1
$\cos A = \frac{1}{\sec A}$	$\sec A = \frac{1}{\cos A}$	cos A. sec A=1
$\tan A = \frac{1}{\text{Cot A}}$	$\cot A = \frac{1}{\tan A}$	tan A. cot A= 1

QUOTIENT RELATION

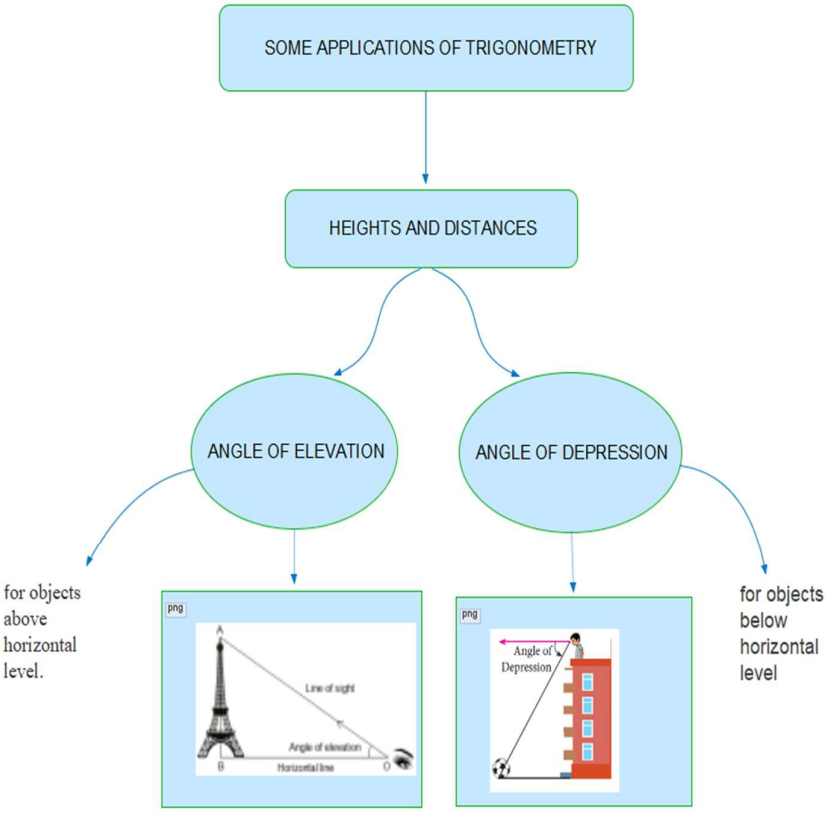
$\tan A = \frac{\sin A}{\cos A}$
$\cot A = \frac{\cos A}{\sin A}$

TRIGONOMETRIC RATIOS OF SOME SPECIFIC ANGLES

Trigonometry Table

	0°	30°	45°	60°	90°
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec θ	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec θ	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot θ	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

MIND MAP



VERY SHORT ANSWER
SECTION A (2 MARK QUESTIONS)

Q1. An airplane at an altitude of 200m observes the angles of depression of opposite points on the two banks of a river are to be 45^0 and 60^0.Find the width of the river. (Take $\sqrt{3}$=1.73)

Q2. A tree 12m high is broken by the wind in such a way that its top touches the ground and makes an angle 60^0 with the ground. At what height from the bottom, the tree is broken by the wind. (Take $\sqrt{3}$=1.73)

Q3. At some time of the day the length of the shadow of a tower is equal to its height. Find the sun's altitude at that time.

Q4. A ladder 15m long makes an angle of 60^0 with the wall. Find the height of the point where the ladder touches the wall.

Q5. A vertical pole 20m long casts a shadow $20\sqrt{3}$m long. Find the sun's altitude. At the same time a tower casts a shadow 90m long. Determine the height of the tower.

Q6. The tops of two towers of heights x and y standing on level ground, making angles 30^0 and 60^0 respectively at the Centre of the line joining their feet. Find x: y.

Q7. From a balloon vertically above a straight road, the angles of depression of two cars at an instant are found to be 45^0 and 60^0.If the cars are 100m apart, find the height of the balloon.

Q8. The angle of elevation of the top of the first storey of a building is 30^0 at a point on the ground distant 15m from its foot. How high its second storey will be if the angle of elevation of the top of the second storey at the same point is 45^0.

Q9. From a bridge, 25m high, the angle of depression of a boat is 45^0. Find the horizontal distance of the boat from the bridge.

Q10. A 1.8m tall girl stands at a distance of 4.6m from a lamp post and casts a shadow of 5.4m on the ground. Find the height of the lamp post.

Q11. Two poles are 25m and 15m high and the line joining their tops make an angle of 45^0 with the horizontal. Find the distance between these poles

Q12. If two towers of height h_1 and h_2 subtend angles of 60^0 and 30^0 respectively at the midpoint of the line joining their feet, then find the value of h_1: h_2

Q13. If the height of a vertical pole is $\sqrt{3}$ times the length of its shadow on the ground, then what is the angle of elevation of the sun at that time

SHORT ANSWER

SECTION B (3 MARK QUESTIONS)

Q1. From a point on the ground, the angles of elevation of the bottom and top of a water tank kept on the top of the 30 m high building are 30^0 and 45^0 respectively. Find the height of the water tank?

Q2. From the top of a multi-storeyed building, 90m high, the angles of depression of the top and the bottom of a tower are observed to be 30^0 and 60^0 respectively. Find the height of the tower?

Q3. Two ships are there in the sea on either side of a lighthouse in such a way that the ships and the base of the lighthouse are in the same straight line. The angles of depression of two ships as observed from the top of the lighthouse are 60^0 and 45^0. If the height of the lighthouse is 200m, find the distance between the two ships. (Use $\sqrt{3} = 1.73$)

Q4. From the top of a 300 metre high light-house, the angles of depression of two ships, which are due south of the observer and in a straight line with its base, are 60^0 and 30^0.Find their distance apart?

Q5. 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 60^0 and from the same point, the angle of elevation of the top of the pedestal is 45^0. Find the height of the pedestal? (Use $\sqrt{3} = 1.73$)

Q6. A peacock is sitting on the top of a tree. It observes a serpent on the ground making an angle of depression of 30^0. The peacock with the speed of 300 metre/ minute catches the serpent in 12 seconds. What is the height of the tree?

Q7. An aero plane, at an altitude of 1200 m, finds that two ships are sailing towards it in the same direction. The angles of depression of the ships as observed from the aeroplane are 60^0 and 30^0 respectively. Find the distance between the two ships?

Q8. If the angles of elevation of the tops of two statues of heights m_1 and m_2 are 60^0 and 30^0 respectively from the mid-point of the line segment joining their feet, then find the ratio $m_1 : m_2$?

Q9. From the top of a 7m high building, the angle of elevation of the top of a cable tower is 60^0 and the angle of depression of its foot is 45^0. Determine the height of the tower?

Q10. The angle of elevation of the top of a hill from the foot of a tower is 60^0 and the angle of elevation of the top of the tower from the foot of the hill is 30^0. If the tower is 50 m high, find the height of the hill?

Q11. 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.

Q12. Two pillars of equal heights are on either side of a road, which is hundred metres wide. The angles of elevation of the tops of the pillars are 60^0 and 30^0 at a point on the road between the pillars. Find the position of the point between the pillars?

Q13. An observer 1.5 m tall is 20.5 m away from a tower 22 m high. Determine the angle of elevation of the top of the tower from the eye of the observer?

LONG ANSWER

SECTION C (4 MARK QUESTIONS)

Q1. The angle of elevation of a cloud from a point 100 metre above the surface of a lake is 30^0 and angle of depression of the reflection of cloud in the lake is 60^0. Find the height of the cloud.

Q2. From the top of a tower 60m high, the angles of depression of the top and bottom of a vertical lamppost are observed to be 30^0 and 60^0 respectively. Find:

Q1. The horizontal distance between the tower and the lamppost.

Q2. The height of the lamp post.

Q3. From a point on a cricket ground, the angle of elevation of the top of a tower is found to be 30^0 at a distance of 225 m from the tower. On walking 150 m towards the tower, again the angle of elevation is found. Find the new angle of elevation and the height of the tower?

Q4. From the top of a tower, the angle of depression of an object on the horizontal ground is found to be 60^0. On descending 20 m vertically downwards from the top of the tower, the angle of depression of the object is found to be 30^0. Find the height of the tower.

Q5. From a window 15metres high above the ground in a street, the angles of elevation and depression of the top and foot of another house on the opposite side of the street are 30° and 45° respectively. Show that the height of the opposite house is 23.65 m. (Use $\sqrt{3} = 1.73$)

Q6. 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 changes to 30°. If the plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the plane in km per hour.

Q7. An aeroplane is flying at a height of 300 m above the ground. Flying at this height the angle of depression from the aeroplane of two points on the banks of a river in opposite directions are 45° and 30° respectively. Find the width of the river. (Use $\sqrt{3} = 1.732$)

Q8. As observed from the top of 100m high lighthouse from the sea level, the angles of depression of two ships are 30° and 45°. If one should be exactly behind the other on the same side of the Lighthouse, find the distance between the two ships. (Use $\sqrt{3} = 1.732$)

Q9. From a point P on the ground the angle of elevation of top of the tower is 30° and that of a flag staff fixed on the top of a tower is, 60°. If the length of a flagstaff is 5m, find the height of the tower.

Q10. The angle of elevation of the top of a vertical Tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 30°. Find the height of the tower.

Q11. The angle of elevation of the top of a hill at the foot of a tower is 60° and the angle of depression of the top of the tower of the foot of the hill is 30°. If the tower is 50 m high find the height of the hill?

CASE STUDY QUESTIONS

CASE STUDY 1

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 meters) in height.

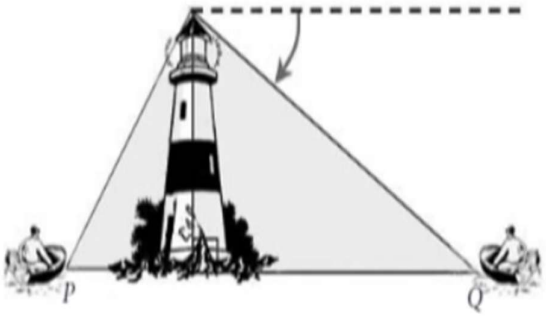
Based on the above information answer the following questions

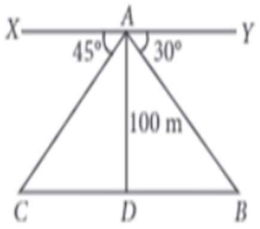
1. They want to see the tower at an angle of 60^0.So they want to know the distance where they should stand and hence find the distance.
2. If the altitude of the sun is at 60^0, then what is the height of the vertical tower that will cast a shadow of length 20m?

CASE STUDY 2:

LIGHT HOUSE

A boy is standing on the top of light house. He observed that boat P and boat Q are approaching to light house from opposite directions. He finds that angle of depression of boat P is 45^0 and angle of depression of boat Q is 30^0. He also knows that height of the light house is 100m.



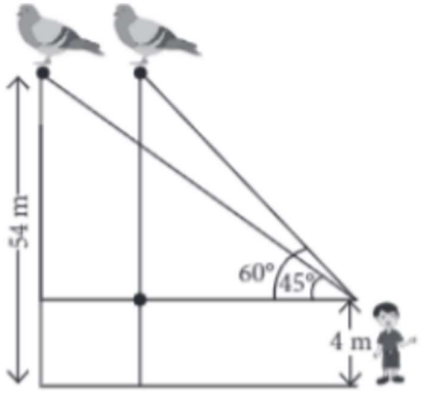


Based on the above information, answer the following questions.

(i) What is the length of CD?

(ii) What is the length of BD?

CASE STUDY 3:



A boy 4 m tall spots a pigeon sitting on the top of a pole of height 54m from the ground. The angle of elevation of the pigeon from the eyes of boy at any instant is 60^0. The pigeon flies

away horizontally in such a way that it remained at a constant height from the ground. After 8 seconds, the angle of evaluation of the pigeon from the same point is 45^0 (take $\sqrt{3} = 1.73$) .

Based on the above information, answer the following questions.

1. Find the distance of first position of the pigeon from the eyes of the boy.
2. How much distance the pigeon covers in 8 second

ANSWER KEY

VERY SHORT ANSWER			
Q No.	Answer	Q No.	Answer
1	x + y = 315.33m	8	$(15-5\sqrt{3})$m
2	5.567	9	25m
3	45^0	10	$\frac{10}{3}$m
4	7.5m	11	10m
5	$30\sqrt{3}$m	12	3 : 1
6	1:3	13	60^0
7	$50(3+\sqrt{3})$m		

Short Answer Type		Long Answer	
Q No.	Option	Q No.	Answer
1	$30(\sqrt{3}-1)$	1	200m
2	60 metres	2	a) $20\sqrt{3}$m b) 40m
3	315.33 m	3	Angle of Elevation= 60^0 Height = $75\sqrt{3}$m
4	$200\sqrt{3}$ m	4	30m
5	2.2 m (approx…)	6	864 km/hr
6	30m	7	Width of river= 819.6m
7	$800\sqrt{3}$ m	8	Distance between two ships= 73.2 m
8	3 : 1	9	Height of the tower = 2.5m

9	$7(\sqrt{3}+1)$ m	10	Height of the tower = 15 m
10	150m	11	Height of the hill = 150m
11	$20\sqrt{3}$ m		
12	25m		
13	45 °		

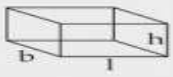
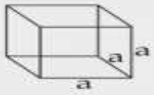
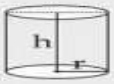
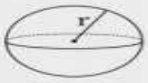
CASE STUDY QUESTIONS

CASE STUDY 1	CASE STUDY 2	CASE STUDY 3
1) $14\sqrt{3}$	1) 100 m	1) $\frac{100}{\sqrt{3}}$ m
2) $20\sqrt{3}$ m	2) $100\sqrt{3}$ m	2) 21.09m

UNIT IV - MENSURATION

SURFACE AREAS AND VOLUMES

IMPORTANT FORMULAE AND CONCEPTS

Name of the solid	Figure	Volume	Laterial/Curved Surface Area	Total Surface Area
Cuboid		lbh	$2lh + 2bh$ or $2h(l+b)$	$2lh+2bh+2lb$ or $2(lh+bh+lb)$
Cube		a^3	$4a^2$	$4a^2+2a^2$ or $6a^2$
Right circular cylinder		πr^2h	$2\pi rh$	$2\pi rh + 2\pi r^2$ or $2\pi r(h+r)$
Right circular cone		$\frac{1}{3}\pi r^2h$	πrl	$\pi rl + \pi r^2$ or $\pi r(l+r)$
Sphere		$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere		$\frac{2}{3}\pi r^3$	$2\pi r^2$	$2\pi r^2+\pi r^2$ or $3\pi r^2$

SURFACE AREAS AND VOLUMES OF COMBINATIONS OF SOLIDS

T. S. A. = T. S. A. (Cube) + C. S. A. (Cone) − Base Area (Cone)

Volume = Volume (Cube) + Volume (Cone)

T. S. A. = T. S. A. (Cube) + C. S. A. (Hemisphere) − Base Area (Hemisphere)

Volume = Volume (Cube) + Volume (Hemisphere)

T. S. A. = T. S. A. (Cube) + T. S. A. (Cylinder) − Base Area (Cylinder)

Volume = Volume (Cube) + Volume (Cylinder)

T. S. A. = C. S. A. (Cylinder) + C. S. A. (Cone) + Base Area (Cylinder)

Volume = Volume (Cone) + Volume (Cylinder)

T. S. A. = C. S. A. (Cone) + C. S. A. (Hemisphere)

Volume = Volume (Cone) + Volume (Hemisphere)

CONVERSION OF SOLID FROM ONE SHAPE TO ANOTHER

Example -1:

Sphere

Cylinder

Volume = V_1 Volume = V_2

$V_1 = V_2$

$\Rightarrow \frac{4}{3}\pi(R)^3 = \pi(r)^2H$

Example -2:

Cone

Volume = V_1

Sphere

Volume = V_2

$V_1 = V_2$

$\therefore \frac{1}{3} \times \pi \times r^2 \times h = \frac{4}{3} \times \pi \times R^3$

- Surface areas and volumes of combinations of solids

  Surface areas and volumes of combinations of solids of any two of the following:

  cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.

- Conversion of Solid from One Shape to Another

  Problems involving converting one type of metallic solid into another and other mixed problems.(Problems with combination of not more than two different solids).

* Deleted Topics

  Frustum of a cone (Total surface area and volume of Frustum of a cone

SHORT ANSWER QUESTIONS

SECTION A (2 MARK QUESTIONS)

Q1. 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).

Q2. 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.

Q3. Volume and surface area of a solid hemisphere are numerically equal. What is the diameter of hemisphere?

Q4. If the total surface area of a solid hemisphere is 462 cm^2, find its volume. ($\pi = 3.14$)

Q5. Two cubes, each of side 4 cm are joined end to end. Find the surface area of the resulting cuboid.

Q6. A vessel is in the form of a hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14 cm and the total height of the vessel is 13 cm. Find the total (inner) suface area of the vessel. (Use $\pi = 22/7$)

Q7. The largest possible sphere is carved out of a wooden solid cube of side 7 cm. Find the volume of the wood left.

Q8. A cone of height 20 cm and radius of base 5 cm is made up of modelling clay. A child reshapes it in the form of a sphere. Find the diameter of the sphere.

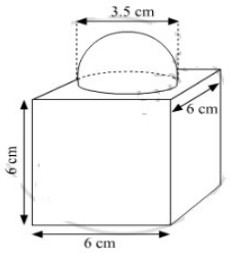
Q9. A solid sphere of radius 10.5 cm is melted and recast into smaller solid cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed. (Use $\pi = 22/7$)

Q10. What is the capacity of a cylindrical vessel with a hemispherical portion raised upward at the bottom?

Q11. A solid piece of iron in the form of a cuboid of dimension 49 cm × 33 cm × 24 cm is melted to form a solid sphere. Find the radius of sphere.

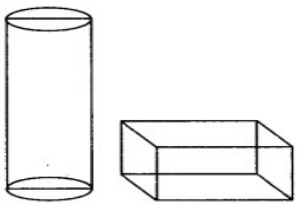
Q12. A vessel is in the form of a hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14 cm and the total height of the vessel is 13 cm. Find the total (inner) suface area of the vessel. (Use $\pi = 22/7$)

Q13. In Figure, is a decorative block, made up of two solids-a cube and a hemisphere. The base of the block is a cube of side 6 cm and the hemisphere fixed on the top has a diameter of 3.5 cm. Find the total surface area of the block. (Use $\pi = 22/7$)



Q14. A conical vessel, with base radius 5 cm and height 24 cm, is full of water. This water is emptied into a cylindrical vessel of base radius 10 cm. Find the height to which the water will rise in the cylindrical vessel. (Use $\pi = 22/7$)

Q15. A 21 m deep well with diameter 6 m is dug and the earth from digging is evenly spread to form a platform 27 m x 11 m. Find the height of the platform.



SHORT ANSWER QUESTIONS

SECTION B (3 MARK QUESTIONS)

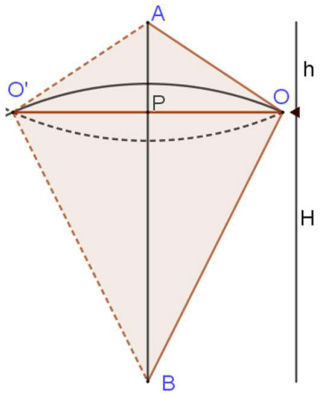
Q16. 12 Solid spheres of the same size are made by melting a solid metallic cone of base radius 1cm and height of 48 cm. Find the radius of each sphere.

Q17. Two cubes each of volume 27 cm^3 are joined end to end to form a solid. Find the surface area of the resulting cuboid.

Q18. Find the number of plates 1.5 cm in diameter and 0.2 cm thick can be fitted completely inside a right circular cylinder of height 10 cm and diameter 4.5 cm

Q19. A cylindrical glass tube with radius 10 cm has water up to a height of 9 cm. A metal cube of 8 cm edge is immersed completely. By how much water level will rise in the glass tube?

Q20. A solid metallic object is shaped like a double cone as shown in figure. Radius of base of both cones is same but their heights are different. If this cone is immersed in water, find the quantity of water it will disperse



Q21. If the areas of three adjacent faces of a cuboid are **X, Y** and **Z** respectively, then find the volume of the cuboid.

Q22. Find the volume (in cm^3) of the largest right circular cone that can be cut off from a cube of edge 4.2 cm.

Q23. A wooden article was made by scooping out a hemisphere of radius 7 cm, from each end of a solid cylinder of height 10 cm and diameter 14 cm. Find the total surface area of the article (use $\pi = \frac{22}{7}$)

Q24. A heap of rice is in the form of a cone of base diameter 24 m and and height 3.5 m. Find how much canvas cloth is required to just cover the heap?

Q25. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the solid cylinder is 1628 cm^2, find the volume of the cylinder. (use $\pi = \frac{22}{7}$)

Q26. A toy is in the shape of a solid cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 21 cm and 40 cm respectively, and the height of cone is 15 cm, then find the total surface area of the toy.(use $\pi = 3.14$)

Q27. The dimensions of a metallic cuboid are 1m x 0.8m x 0.64m. It is melted and recast into a cube. Find the surface area of the cube.

Q28. Three cubes of iron whose edges are 3 cm, 4 cm and 5 cm respectively, are melted and formed into a single cube, what will be the edge of the new cube so formed ?

Q29. A solid sphere of radius 10.5 cm is melted and recast into smaller solid cone, ach of radius 3.5 cm and height 3 cm. Find the number of cones so formed.

Q30. A cubical block of side 0.07 m is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid

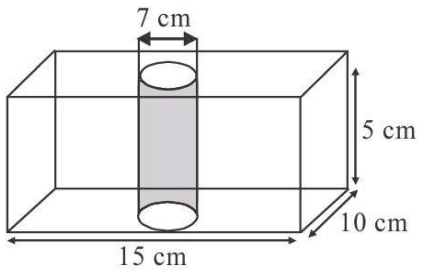
LONG ANSWER QUESTIONS

SECTION C (4 MARK QUESTIONS)

Q31. A tent is in the shape of a right circular cylinder up to a height of 300 cm and conical above it. The total height of the tent is 1350 cm and radius of its base is 1400cm. Find the cost of cloth required to make the tent at the rate of `80 per square metre. (Take $\pi = \frac{22}{7}$)

Q32. A hemispherical bowl of internal diameter 0.36 m contains liquid. This liquid is filled into 72 cylindrical bottles of diameter 6cm.Find the height of each bottle, if 10% l iquid is wasted in this transfer.

Q33. From a cuboidal solid metallic block of dimensions 15cm X 10cm X 5cm a cylindrical hole of diameter 0.07m is drilled out. Find the surface area of the remaining block. ($\pi = \frac{22}{7}$)



Q34. A metallic cylinder has radius 0.03cm and height 0.05cm. To reduce its weight a conical hole is drilled in the cylinder. The conical hole has a radius of 3/2cm and its depth is 8/ 9cm. calculate the ratio of the volume of metal left in the cylinder to the volume of metal taken out in conical shape.

Q35. A hollow cylindrical pipe is made up of copper. It is 21 dm long. The outer and inner diameters of the pipe are 10cm and 6cm respectively. Find the volume of copper used in making the pipe ($\pi=\frac{22}{7}$)

Q36. A farmer connects a pipe of internal diameter 20cm. from a canal into a cylindrical tank which is 10m in diameter and 2cm deep. If the water flows through the pipe at the rate of 4km per hour, in how much time will the Tank be filled completely?

Q37. A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.

Q38. A hollow sphere of internal and external diameter 4cm and 8cm respectively is melted to form a cone of base diameter 8cm. find the height and the slant height of the cone.

Q39. A hemispherical tank, full of water is emptied by a pipe at the rate of $\frac{25}{7}$ liters/sec. How much time will it, take to empty half of the tank, if the diameter of the base of the tank is 3m?

Q40. Water running in a cylindrical pipe of inner diameter 7cm, is collected in a container at the rate of 192.5 liter per minute. Find the rate of flow of water in the pipe in km/h.

Q41. A well of diameter 4cm is dug 14m deep. The earth taken out is spread evenly all around the well to form a 40cm high embankment. Find the width of the embankment.

Q42. A vessel full of water is in the form of an inverted cone of height 0.08m and the radius of its top, which is open is 5cm. 100 spherical lead balls are dropped into the vessel. One-fourth of the water flows out of the vessel. Find the radius of the spherical ball.

Q43. The radius of two right circular cylinders are in the ratio 2:3 and their heights are in the ratio of 5:4. Calculate the ratio of their curved surface areas and ratio of their volumes.

Q44. A container shaped right circular cylinder having base radius 6cm and heights 15cm. is full of ice cream. The ice cream is to be filled into cones of height 12cm. and radius 3cm, having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream.

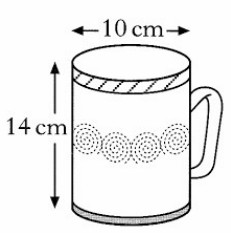
Q45. A solid copper sphere of surface area 1386 sq.cm. is melted and drawn into a wire of uniform cross. Section if the length of the wire is 31.5m, find the diameter of the wire.

($\pi = \frac{22}{7}$)

CASE STUDY BASED QUESTIONS

Case study question 1

During Covid times people prefer using homogenized milk, UHT Processed and aseptically packed in an exceptional six layer, tamper-proof Tetra Packaging with 0% bacteria and 100% pure health. This new six layer interfere proof, prevents air and freshness, light and bacteria from entering the pack. As an effect, the milk stays fresh and pure for a minimum of 180 days until opened, even without refrigeration.The 500ml milk is packed in cuboidal containers of dimensions 15 x 8 x 5 . These milk packets are then packed in cuboidal cartons of dimension 30x 32 x 15 .(All dimensions are in cm)



Based on the above given information answer the following questions

1. How many liters of milk will a carton contain?
2. How much cardboard is needed to make the carton if 10% of wastage is taken into account?

Case study question 2

An antique box and its dimensions excluding the stand is given below.

1. Considering the thickness of the box to be negligible,
   How much velvet cloth will be needed to cover the cuboidal inner area?
2. How many gold coins of diameter 2cm and thickness 0.5cm will fill $\frac{1}{7}^{th}$ of the volume of the dome of jewelry box.

Case study question 3

Gulab jamun is a milk-solid-based sweet, originating in India and a type of mithai popular in India, Nepal, Pakistan, the Maldives, and Bangladesh, as well as Myanmar. It is also declared as the national dessert of Pakistan officially by Government of Pakistan. For preparing gulab jamun the dough is divided into small balls, deep fried and then soaked in sugar syrup.

A dough is made in the shape of a sphere of radius 4.2cm. A gulab jamun contains sugar syrup up to about 70% of its volume




Based on the above given information answer the following questions

1. How much sugar syrup will be left out after soaking all the jamuns, if one makes quarter liter syrup
2. How much silver foil will we need to coat one third of all the Gulab jamun surface?

Answer Key

SHORT ANSWER (SECTION A)			
Question	Answer	Question	Answer
1	h=3cm	9	126 cones
2	5	10	$= \pi r^2 h - \frac{2}{3}\pi r^3 = \frac{\pi r^2}{3}(3h - 2r)$
3	6cm	11	21 cm
4	2156/3= 718.666…	12	572 cm^2
5	160 cm^2	13	225.625cm^2

6	572 cm^2	14	2cm
7	163.33…	15	2m
8	5cm		

Short answer	Long Answer
16. 1cm 17. Surface area = 90 cm^2 18. No. of plates = 450 19. Water will rise = 1.629 cm 20. Water displaced = $\frac{1}{3}\pi r^2(h+H)$ 21. Volume = $\sqrt{XYZ}$ 22. Volume = 19.4cm^3 23. Surface area = 1056 cm^2 24. Curved surface area = 471.42sq.cm 25. Volume = 4620 cm^2 26. Total Surface area = 5463.6 cm^2 27. Surface area = 38400 cm^2 28. Edge = 6 cm 29. No. of cones = 126 30. a) Greatest diameter = 7 cm b) Surface area =332.5 cm^2	31. Cost of cloth required = Rs 82,720 32. 5.4 cm 33. Total surface area = 583 cm^2 34. (Hint: Don't put the value of π) 133: 2 35. Put 10 cm =1 dm, volume = 10560 cm^3 36. Time = 1 hour 15 minute 37. Ratio = 1: $\sqrt{3}$ 38. Height = 14 cm, slant height =2$\sqrt{53}$ cm 39. (Hint : 1m^3 = 1000 l) Time = 16 min 30 sec 40. (Hint : 1l = 1000 cm^3), Rate of flow = 3km/hr 41. Width of embankment = 10 m 42. Radius = 0.5 cm 43. a) Ratio of curved surface areas = 5 : 6 b) Ratio of volumes = 5 : 9 44. No. of cones = 10 45. Diameter = 1.4 cm

Case study questions

Case study -1

1. (30×32×15)/(15×8×5) = 2 x 4 x 3 = 24 boxes.
So 24 x 500ml = 12 liters.

2. TSA + 10% of TSA
TSA = 2(30x15 + 32 x1 5 + 15x8)
= 2(450+ 480 + 120)=2100.
Cardboard needed = 2100+210=3310cm^2

Case study -2

1. CSA + BA = 2h(l+b) + lb

= 2 x 10 (14 + 30) + 14 x 30

= 880 + 420 = 1300cm^2

2. n x volume of one coin = $\frac{1}{7}$(volume of box)

n= 210

Case study -3

1. 70% of total volume = 310.5×0.7

= 217.35

Syrup left = 250-217.35

=32.65ml

2. One eighth of the surface area of 64 gulab jamuns= ⅛ x 13.86 x 64

= 110.88 cm^2

STATISTICS

SYLLABUS

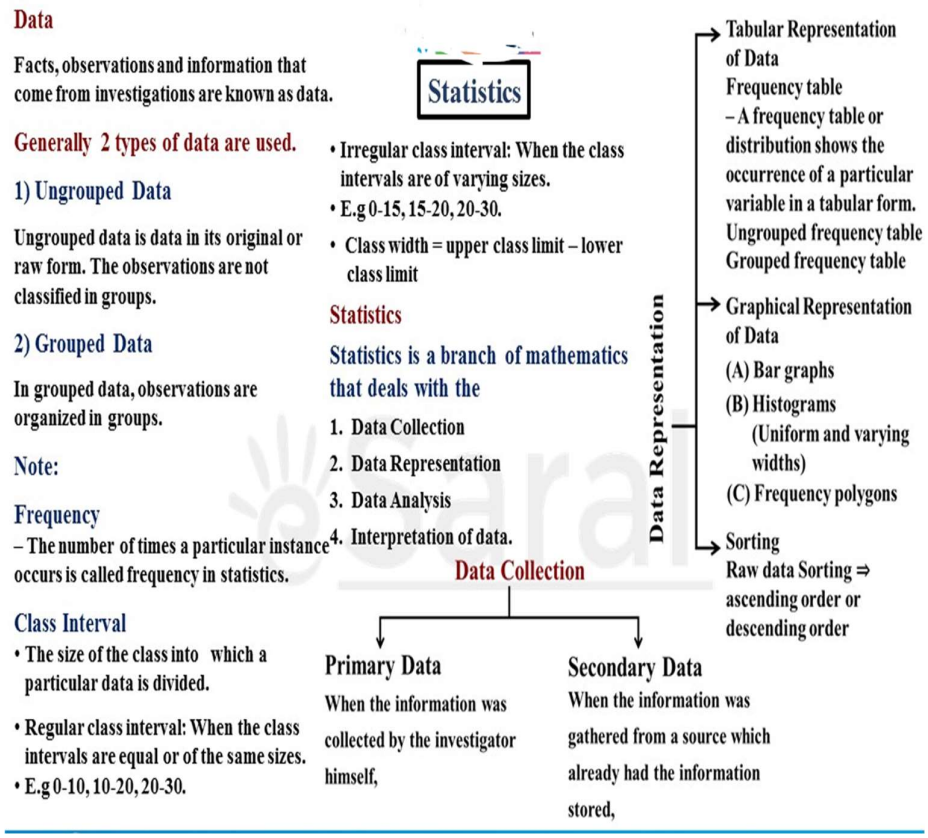
Mean , Median& Mode of grouped data

Mean by Direct Method & Assumed Mean Method

DELETED TOPICS

Step deviation method for finding the mean& Cumulative Frequency Graph

MIND MAP



ARITHMETIC MEAN

- Direct Method $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$
- Assumed Mean Method $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$

MODE

COMPUTATION OF MODE FOR A CONTINOUS FREQUENCY DISTRIBUTION

Algorithm

1. Obtain the continuous frequency distribution

2. Determine the class of maximum frequency either by inspection or by grouping method
3. This class is called the modal class
4. Obtain the values of the following from the frequency distribution table

$l = lower\ limit\ of\ the\ modal\ class$

$f_1 = frequency\ of\ modal\ class$

$h = width(size)$ of the modal class

$f_0 = frequency\ of\ the\ class\ preceding\ the\ modal\ class$

$f_2 = frequency\ of\ the\ class\ following\ the\ modal$ class

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

MEDIAN OF GROUPED DATA

Algorithm

1. Obtain the frequency distribution
2. Prepare the cumulative frequency column
3. Obtain n = $(\sum f_i)$ and $\frac{n}{2}$
4. See the cumulative frequency just greater than (nearer to) $\frac{n}{2}$ and determine the corresponding class. This class is known as *median class*
5. Obtain the values of the following from the frequency distribution table

$l = lower\ limit\ of\ the\ median\ class$

$f = frequency\ of\ median\ class$

$h = width(size)\ of\ the\ median\ class$

$cf = cumulative\ frequency\ of\ the\ class\ preceding\ the\ median\ class$

Substitute the values in the following formula

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

THE EMPIRICAL RELATIONSHIP BETWEEN THE THREE MEASURES OF CENTRAL TENDENCY

$$\mathbf{3\ median = mode + 2\ mean}$$

Short Answer Questions

SECTION A (2 mark questions)

Q1. Find the mean of the following distribution using assumed mean method

Class	0-10	10-20	20-30	30-40	40-50
Frequency	7	12	13	10	8

Q2. The mean and median of 100 observations are 50 and 52 respectively. The value of the largest observation is 100. It was later found that it is 110 not 100. Find the true mean and median.

Q3. From the following distribution, find the lower limit of the median class

Class interval	85-89	90-94	95-99	100-104	105-109
Frequency	10	12	11	5	30

Q4. Find the unknown values in the following table.

Class Interval	Frequency	Cumulative Frequency
0-10	5	5
10-20	7	a
20-30	b	18
30-40	5	C
40-50	d	30

Q5. For the following distribution find the modal class

Marks	Numberof Students
Below 10	3
Below 20	12
Below 30	27
Below 40	57
Below 50	75
Below 60	80

Q6. Find the value of p, if the arithmetic mean of the following distribution is 25

C I	0-10	10-20	20-30	30-40	40-50
F	5	8	15	P	6

Q7. Find the mode of the following data

CI	1-3	3-5	5-7	7-9	9-11
F	7	8	2	2	1

Q8. Find $\bar{x}$, if $d_i = x_i - 25$; $\sum f_i d_i = 20$; $\sum f_i = 100$

Q9. Find mode, using an empirical relation, when it is given that mean and median are 10.5 and 9.6 respectively

Q10. Change the following distribution in to a '$more\ than\ type'$ distribution table

Classes	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	5	15	20	23	17	11	9

Q11. The frequency distribution table showing daily income of 100 workers of a factory is given below. Convert this table to a frequency distribution table of '$less\ than\ type$'.

Daily income (₹)	200-300	300-400	400-500	500-600	600-700
No of workers	12	18	35	20	15

SHORT ANSWER QUESTIONS

SECTION B (3 MARK QUESTIONS)

Q1. Daily wages of a factory workers are recorded as follows. Find the mode of the given distribution

Daily wages	131-136	137-142	143-148	149-154	155-160
No of workers	5	27	20	18	12

Q2. Find the median of the following distribution

Marks obtained	0-10	10-20	20-30	30-40	40-50	50-60
Number of Students	8	10	12	22	30	18

Q3. The median of the following data is 525. Find the missing frequency x

CLASS	FREQUENCY
0-100	2
100-200	5
200-300	x
300-400	12
400-500	17
500-600	20
600-700	15
700-800	9
800-900	7
900-1000	4

Q4. The following data gives the information on the observed life times (in hours) of 150 electrical components. Find the mode of the distribution

Life time (in hours)	0-20	20-40	40-60	60-80	80-100
Frequency	15	10	35	50	40

Q5. Determine the missing frequency x, from the following data, when mode is 67.

Class	40-50	50-60	60-70	70-80	80-90
Frequency	5	x	15	12	7

Q6. The lengths of 40 leaves of a plant are measured correct to the nearest millimetre and the data obtained is represented in the following table. Find the median length of the leaves

Length of leaf in (mm)	No of leaves
118-126	3
127-135	5
136-144	9

145-153	12
154-162	5
163-171	4
172-180	2

Q7. The mean of the following distribution is 48 and the sum of all frequencies is 50. Find the missing frequencies.

Class	20-30	30-40	40-50	50-60	60-70
Frequency	8	6	x	11	y

Q8. Find the mean of the following distribution by appropriate method

Class	20-30	30-40	40-50	50-60	60-70
Frequency	25	40	42	33	10

LONG ANSWER QUESTIONS

SECTION C (4 MARK QUESTIONS

Q1.If the median of the data is 32.5, find the value of x and y

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Total
Frequency	x	5	9	12	y	3	2	40

Q2.Find the median of the following data

Class	Less than 10	Less than 30	Less than 50	Less than 70	Less than 90	Less than 110	Less than 130	Less than 150
Frequency	0	10	25	43	65	87	96	100

Q3.The median of the following data is 50. Find the values of p and q if sum of all frequencies is 90 .

Mark	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Frequency	p	15	25	20	q	8	10

Q4. The table below shows the salaries of 280 persons.

Calculate the median and mode of the given data

SALARY (In thousand Rupees)	Number of Persons
5-10	49
10 -15	133
15-20	63
20-25	15
25-30	6
30-35	7
35-40	4
40-45	2
45-50	1

Q5. In the following frequency distribution. the frequency of a class interval is missing. It is known that the mean of the distribution is 52. Find the missing frequency X.

Wages (in Rs)	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	3	4	X	2	6	13

Q6. The daily wages of 110 workers, obtained in a survey are tabulated below. Compute the mean daily wages and modal daily wages of these workers.

Daily wages(₹)	100-120	120-140	140-160	160-180	180-200	200-220	220-240
No.of workers	10	15	20	22	18	12	13

Q7. Find the median of the following data, if the total frequency is 400

Class	50-52	53-55	56-58	59-61	62-64
Frequency	15	110	135	115	25

CASE STUDY QUESTIONS

CASE STUDY I

Q8. A group of students decided to make a project on statistics. They are collecting the heights (in cm) of 51 girls of class X A, B, C of their school. After collecting the data, they arranged the data in the following less than cumulative frequency distribution table form:

Height (in cm)	No of girls
Less than 140	4
Less than 145	11
Less than 150	29
Less than 155	40
Less than 160	46
Less than 165	51

ANSWER THE QUESTIONS BASED ON THE ABOVE INFORMATION

1. What is the mean of lower limits of median and modal class?
2. Calculate Median of the above data

CASE STUDY II

Q9. The following tables shows the age distribution of case admitted during a day in two different hospitals

Table 1

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

Table 2

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
No. of cases	8	16	10	42	24	12

Based on the above data answer the following questions

1. From table 1, find mean of the given data
2. From table 2, find mode of the given data

CASE STUDY III

Q10. Stopwatch was used to find the time that it took a group of students to run 100m

Time (in sec)	0-20	20-40	40-60	60-80	80-100
No.of students	8	10	13	6	3

Answer the following Questions

1) Estimate the mean time taken by a student to finish the race
2) Find the Sum of upper limits of median class and modal class.

ANSWER KEY

SECTION A

1	25
2	Mean=50.10 Median = 52
3	Lower limit of median class = 99.5
4	a=12 , b=6, c=23,d=7
5	Modal class = 30 -40
6	$p = 6$
7	Mode= 3.28
8	$\bar{x} = 25.2$
9	Mode = 7.8
10	more than 0 — 100 more than10 — 95 more than 20 — 80 more than 30 — 60 more than 40 — 37 more than 50 — 20 more than 60 — 9
11	Less than 300 — 12 Less than 400 — 30 Less than 500 — 65 Less than 600 — 85 Less than 700 — 100

SECTION B

1	Mode=141.05
2	Median = 39.09
3	x = 9
4	Mode = 72
5	x=3
6	Median = 146.75
7	$x = 12 , y = 13$
8	Mean = 42.5

SECTION C

1	$x = 3 , y = 6$
2	Median = 76.36
3	$p = 5, q = 7$
4	Median=13421 mode = 12727
5	x = 7
6	Mean=170.18 mode= 166.67
7	median = 57.16
8	a) 145 , b) 149.03
9	a) 35.37 , b) 41.4
10	a) 43 seconds, b) 120

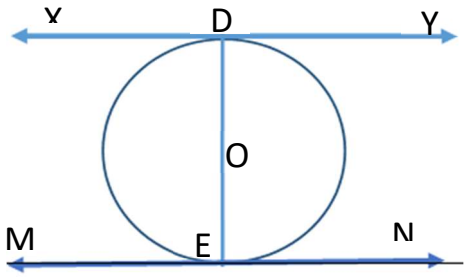
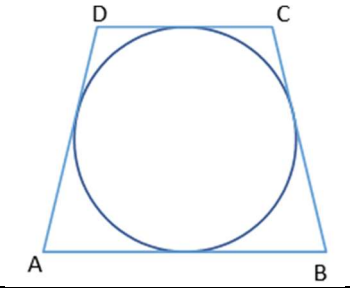
CBSE Sample Question Paper
Mathematics- Basic (241)
Class- X, Session: 2021-22
TERM II

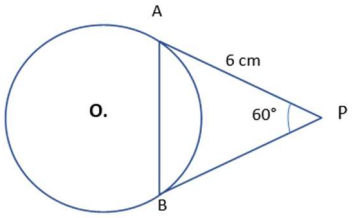
Time Allowed: 2 hours **Maximum Marks: 40**

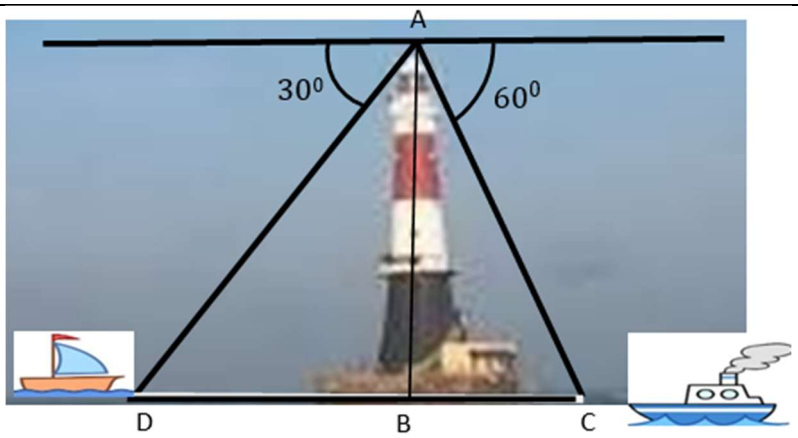
General Instructions:

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 intwo questions.
3. Section B comprises of 4questions of 3 marks each. Internal choice has been provided inone question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been providedin one question. It contains two case study-based questions.

<table>
<tr><td></td><td>SECTION A</td><td></td></tr>
<tr><td>Q.No</td><td></td><td>Marks</td></tr>
<tr><td>1</td><td>Find the value of k for which quadratic equation $3x^2 - 7x - 6 = 0$.
OR
Find the values of k for which the quadratic equation $3x^2 + kx + 3 = 0$ has real and equal roots.</td><td>2</td></tr>
<tr><td>2</td><td>Three cubes each of volume 64cm^3 are joined end to end to form a cuboid. Find the total surface area of the cuboid so formed?</td><td>2</td></tr>
<tr><td>3</td><td>An inter house cricket match was organized by a school. Distribution of runs made by the students is given below. Find the median runs scored.
<table>
<tr><td>Runs Scored</td><td>0 -20</td><td>20 -40</td><td>40-60</td><td>60-80</td><td>80-100</td></tr>
<tr><td>Number of students</td><td>4</td><td>6</td><td>5</td><td>3</td><td>4</td></tr>
</table></td><td>2</td></tr>
<tr><td>4</td><td>Find the common difference of the AP 4,9,14, … If the first term changes to 6 andthe common difference remains the same then write the new AP</td><td>2</td></tr>
<tr><td>5</td><td>The mode of the following frequency distribution is 38. Find the value of x.
<table>
<tr><td>Class Interval</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td></tr>
<tr><td>Frequency</td><td>7</td><td>9</td><td>12</td><td>16</td><td>x</td><td>6</td><td>11</td></tr>
</table></td><td>2</td></tr>
</table>

6	XY and MN are the tangents drawn at the end points of the diameter DE of the circle with centre O. Prove that $XY \parallel MN$.  **OR** In the given figure, a circle is inscribed in the quadrilateral ABCD. Given AB=6cm, BC=7cm and CD=4cm. Find AD  	2
	SECTION B	
7	An AP 5, 8, 11…has 40 terms. Find the last term. Also find the sum of the last 10 terms.	3
8	A tree is broken due to the storm in such a way that the top of the tree touches the ground and makes an angle of 30^0 with the ground. Length of the broken upper partof the tree is 8 meters. Find the height of the tree before it was broken. **OR** Two poles of equal height are standing opposite each other on either side of the road 80m wide. From a point between them on the road the angles of elevation of the top of the two poles are respectively 60^0 and 30^0. Find the distance of the pointfrom the two poles.	3
9	PA and PB are the tangents drawn to a circle with centre O. If PA= 6 cm and □ APB=60^0, then find the length of the chord AB.	3

<table>
<tr><td></td><td> 
</td><td></td></tr>
<tr><td>10</td><td>The sum of the squares of three positive numbers that are consecutive multiples of5 is 725. Find the three numbers.</td><td>3</td></tr>
<tr><td></td><td>SECTION C</td><td></td></tr>
<tr><td>11</td><td>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.
OR
Draw a pair of tangents to a circle of radius 6cm which are inclined to each other atan angle of 60^0. Also find the length of the tangent.</td><td>4</td></tr>
<tr><td>12</td><td>The following age wise chart of 300 passengers flying from Delhi to Pune is prepared by the airline staff
<table>
<tr><td>Age</td><td>Less than 10</td><td>Less than 20</td><td>Less than 30</td><td>Less than 40</td><td>Less than 50</td><td>Less than 60</td><td>Less than 70</td><td>Less than 30</td></tr>
<tr><td>No of passengers</td><td>14</td><td>44</td><td>82</td><td>134</td><td>184</td><td>245</td><td>287</td><td>300</td></tr>
</table>
Find the mean age of the passengers</td><td>4</td></tr>
<tr><td>13</td><td>A lighthouse is a tall tower with light near the top. These are often built on islands, coasts or on cliffs. Lighthouses on water surface act as a navigational aid to the mariners and send warning to boats and ships for dangers. Initially wood, coal wouldbe used as illuminators. Gradually it was replaced by candles, lanterns, electric lights. Nowadays they are run by machines and remote monitoring.
Prongs Reef lighthouse of Mumbai was constructed in 1874 -75. It is approximately 40 meters high and its beam can be seen at a distance of 30 kilometres. A ship anda boat are coming towards the lighthouse from opposite directions. Angles of depression of flash light from the lighthouse to the boat and the ship are 30^0 and 60^0respectively</td><td></td></tr>
</table>

	 I. Which of the two, boat or the ship is nearer to the light house. Find itsdistance from the lighthouse? II. Find the time taken by the boat to reach the light house if it is moving atthe rate of 20 km per hour.	2 2
14	Krishnanagar is a small town in Nadia District of West Bengal. Krishnanagar clay dolls are unique in their realism and quality of their finish. They are created by modelling coils of clay over a metal frame. The figures are painted in natural coloursand their hair is made either by sheep's wool or jute. Artisans make models startingfrom fruits, animals, God, goddess, farmer, fisherman, weavers to Donald Duck and present comic characters. These creations are displayed in different national and international museums. Here are a few images (not to scale) of some clay dolls of Krishnanagar.  Doll-1 Doll-2 Doll-3 Doll-4 The ratio of diameters of red spherical apples in Doll-1 to that of spherical oranges in Doll-2 is 2:3. In Doll-3, male doll of blue colour has cylindrical body anda spherical head. The spherical head touches the cylindrical body. The radius of both the spherical head and the cylindrical body is 3cm and the height of the cylindrical body is 8cm. Based on the above information answer the following questions:	

	1) What is the ratio of the surface areas of red spherical apples in Doll -1 to that of spherical oranges in Doll-2.? 2) The blue doll of Doll-3 is melted and its clay is used to make the cylindrical drum of Doll - 4. If the radius of the drum is also 3cm, find the height of the drum.	2 2

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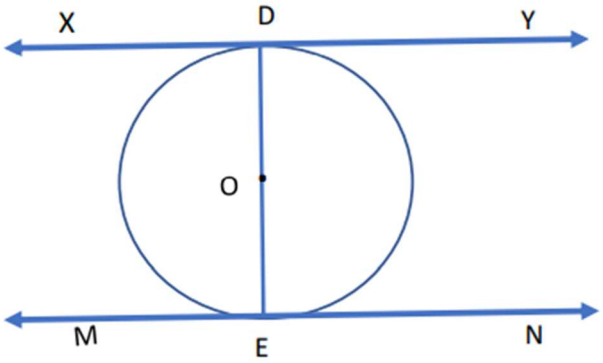
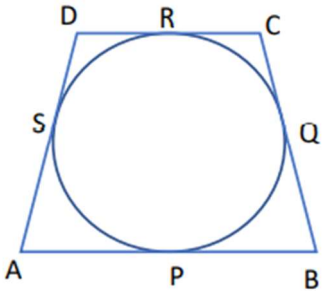
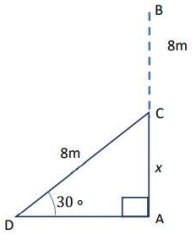
Marking Scheme

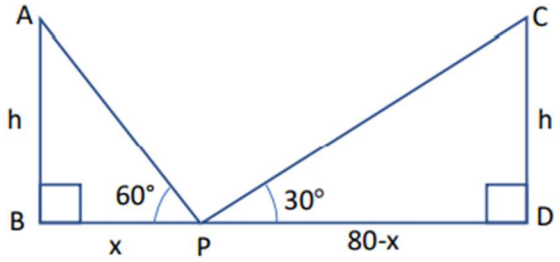
Mathematics –
Basic(241)Class- X
Session- 2021-22
TERM II

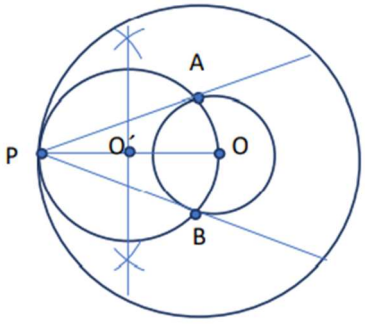
Q.N.	HINTS/SOLUTION	Marks
1	$3x^2 - 7x - 6 = 0$ $\Rightarrow 3x^2 - 9x + 2x - 6 = 0$ $\Rightarrow 3x(x-3) + 2(x-3) = 0$ $\Rightarrow (x-3)(3x+2) = 0$ $x = 3, -\frac{2}{3}$ **OR** Since the roots are real and equal, $\therefore D = b^2 - 4ac = 0$ $\Rightarrow k^2 - 4\times3\times3 = 0$ ($\because a = 3, b = k, c = 3$) $\Rightarrow k^2 = 36$ $\Rightarrow k = 6 \text{ or } -6$	1/2 1/2 1 1 1/2 +1/2
2	Let l be the side of the cube and L, B, H be the dimensions of the cuboid Since $l^3 = 64\ cm^3 \therefore l = 4\ cm$ Total surface area of cuboid is $2[LB + BH + HL]$, Where L=12, B=4 and H=4 $=2(12 \times 4 + 4 \times 4 + 4 \times 12)\ cm^2 = 224 cm^2$	1/2 1/2 1
3		1/2

Runs scored	Frequency	Cumulative Frequency
0-20	4	4
20-40	6	10
40-60	5	15
60-80	3	18
80-100	4	22

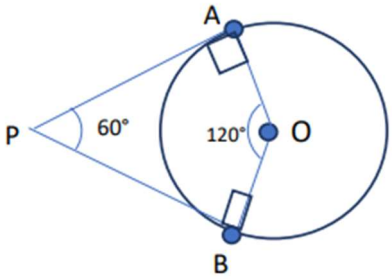
	Total frequency (N) = 22 $\frac{N}{2}$ = 11; So 40-60 is the median class. Median = $l + \frac{(\frac{N}{2})-cf}{f} \times h$ = $40 + \frac{11-10}{5}$ x 20 = 44 runs	1/2 1/2 1/2
4	The common difference is 9 - 4=5 If the first term is 6 and common difference is 5, then new AP is,6, 6+5, 6+10… =6,11,16….	1 1
5	∵ Mode = 38. ∴ The modal class is 30-40. Mode = $l + \frac{f_1-f_0}{2f_1-f_0-f_2} \times h$	1/2 1/2
6	 ∵XY is the tangent to the circle at the point D ∴ OD ⊥ XY ⇒ ∠ ODX = 90^0 ⇒ ∠ EDX = 90^0 Also, MN is the tangent to the circle at E ∴ OE ⊥ MN⇒ ∠ OEN = 90^0 ⇒ ∠ DEN = 90^0 ⇒ ∠ EDX = ∠ DEN ($each$ 90^0). which are alternate interior angles. ∴ XY ‖ MN **OR**	**1/2** **1/2** **1**

	 ∵Tangent segments drawn from an external point to a circle are equal ∴ BP=BQCR=CQDR=DSAP=AS ⇒BP+CR+DR+AP = BQ+CQ+DS+AS ⇒ AB+DC = BC+AD ∴ AD= 10-7= 3 cm	
	Section-B	
7	First Term of the AP(a) = 5 Common difference (d) = 8-5=3 Last term = a_{40} = a+(40-1) d = 5 + 39 × 3 = 122 Also $a_{31} = a + 30d = 5 + 30 \times 3 = 95$ Sum of last 10 terms = $\frac{n}{2}(a_{31} + a_{40})$ $= \frac{10}{2}(95 + 122)$ $= 5 \times 217 = 1085$	**1** **1** **1**
8	Let, AB be the tree broken at C, Also let $AC = x$ In Δ CAD, $\sin 30^0 = \frac{AC}{DC}$ $\Rightarrow \frac{1}{2} = \frac{x}{8}$ $\Rightarrow x = 4\ m$ ⇒the length of the tree is = 8+4 =12  **OR** Let AB and CD be two poles of height h meters also let P be a point between them onthe road which is x meters away from foot of first pole AB, PD= (80-x) meters. In ΔABP, $tan60° = \frac{h}{x} \Rightarrow h = x\sqrt{3}$. ... (1) In ΔCDP, $tan\ 30o = \frac{h}{80-x} \Rightarrow h = \frac{80-x}{\sqrt{3}}$ ….(2)	**1** **1/2** **1/2** **1(CORRECT FIG)** **1** **1/2**

	$x\sqrt{3} = \frac{80-x}{\sqrt{3}}[\because LHS(1) = LHS(2), so\ equating\ RHS]$ $\sqrt{3}$ $\Rightarrow 3x = 80 - x \Rightarrow 4x = 80 \Rightarrow x = 20m$ So, $80 - x = 80 - 20 = 60m$ Hence the point is 20m from one pole and 60 meters from the other pole  	**1/2** **1** FOR FIG
9	PA = PB (Tangent segments drawn to a circle from an external point are equal) $\therefore$ In ΔAPB, $\angle$ PAB = $\angle$ PBA Also, $\angle$ APB = 60^0 In ΔAPB, sum of three angles is 180^0. Therefore, $\angle$ PAB + $\angle$ PBA = 180^0 - $\angle$ APB= $180^0 - 60^0 = 120^0$. $\therefore \angle$ PAB = $\angle$ PBA = 60^0 ($\because \angle$ PAB = $\angle$ PBA) $\because \Delta APB$ is an equilateral triangle	**1** **1** **1**
10	Let the three consecutive multiples of 5 be $5x$, $5x$+5, $5x$+10.Their squares are $(5x)^2, (5x+5)^2$and$(5x+10)^2$. $(5x)^2 + (5x+5)^2 + (5x+10)^2 = 725$ $\Rightarrow 25x^2 + 25x^2 + 50x + 25 + 25x^2 + 100x + 100 = 725$ $\Rightarrow 75x^2 + 150x - 600 = 0$ $\Rightarrow x^2 + 2x - 8 = 0$ $\Rightarrow (x+4)(x-2) = 0$ $\Rightarrow x = -4, 2$ $\Rightarrow x = 2$ (ignoring –ve value) So the numbers are 10, 15 and 20	**1** **1** **1**
	Section-C	
11	Draw two concentric circles with center O and radii 3cm and 7cm respectively.Join OP and bisect it at O', so $PO' = O'O$ Construct circle with center O' and radius $O'O$ Join PA and PB	**1** **1** **1** **1**



OR



Draw a circle of radius 6cm
Draw OA and Construct $\angle AOB = 120^0$
Draw $\angle OAP = \angle OBP = 90^0$
PA and PB are required tangents
Join OP and apply $\tan\angle APO = \tan 30° = \frac{6}{PA}$
⇒ Length of tangent = $6\sqrt{3}$ cm

12

Converting the cumulative frequency table into exclusive classes, we get:

Age	No of passengers(f_i)	x_i	$f_i x_i$
0-10	14	5	70
10-20	30	15	450
20-30	38	25	950
30-40	52	35	1820
40-50	50	45	2250
50-60	61	55	3355
60-70	42	65	2730
70-80	13	75	975
	$\sum f_i = 300$		$\sum f_i x_i = 12600$

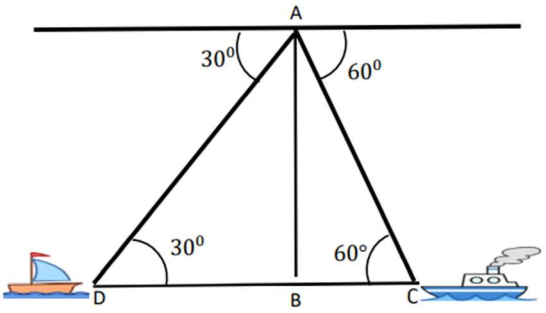
2

Mean age = $\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{12600}{300}$

1

$\bar{x} = 42$

1

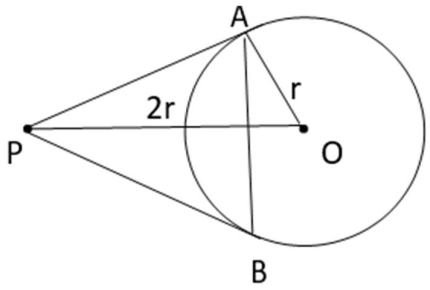
13 (i)	The ship is nearer to the lighthouse as its angle of depression is greater. In $\Delta\, ACB, tan\ 60° = \frac{AB}{BC}$ $\sqrt{3} = \frac{40}{BC}$ $\therefore\ BC = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} m$	**1** **1**
(ii)	 In Δ ADB, tan 30 ° $= \frac{AB}{BD}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{DB}$ $\therefore\ DB = 40\sqrt{3}m$ Time taken to cover this distance = $\left(\frac{60}{2000} \times 40\sqrt{3}\right) minutes = \frac{60\sqrt{3}}{100} = 2.076$ minutes	**1** **1** **1**
14(i)	Let $r_1 and\ r_2$ be respectively the radii of apples and oranges $\because 2r_1 : 2r_2 = 2:3 \Rightarrow r_1 : r_2 = 2:3$ $4\pi r_1^2 : 4\pi r_2^2 = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{2}{3}\right)^2 = 4:9$	**1/2** **1 ½**
(ii)	Let the height of the drum be h. Volume of the drum = volume of the cylinder + volume of the sphere $\pi 3^2 h = \left(\pi 3^2 \times 8 + \frac{4}{3}\pi 3^3\right) cm^3 \Rightarrow h = (8 + 4) cm \Rightarrow h = 12 cm$	**1** **1**

CBSE Sample Question Paper
Mathematics- Standard (041)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

General Instructions:

1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. All questions are compulsory.
3. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided intwo questions.
4. Section B comprises of 4questions of 3 marks each. Internal choice has been provided inone question.
5. Section C comprises of 4 questions of 4 marks each. An internal choice has been providedin one question. It contains two case study based questions.

Section A		
Q No		**Marks**
1	Find the value of $a_{25} - a_{15}$ for the AP: 6, 9, 12, 15, …… OR If 7 times the seventh term of the AP is equal to 5 times the fifth term, thenfind the value of its 12^{th} term.	**2**
2	Find the value of m so that the quadratic equation $mx(5x - 6) = 0$ has twoequal roots.	**2**
3	From a point P, two tangents PA and PB are drawn to a circle C (O, r). If OP = 2r, then find ∠APB. What type of triangle is APB? 	**2**
4	The curved surface area of a right circular cone is 12320 cm². If the radius of its base is 56cm, then find its height.	**2**

5 Mrs. Garg recorded the marks obtained by her students in the following table. She calculated the modal marks of the students of the class as 45. While printing the data, a blank was left. Find the missing frequency in the table givenbelow **2**

Marks obtained	0 -20	20 -40	40-60	60-80	80-100
Number of students	5	10	----	6	3

6 If Ritu were younger by 5 years than what she really is, then the square of her age would have been 11 more than five times her present age. What is her present age? **2**

OR

Solve for x: $9x^2 - 6px + (p^2 - q^2) = 0$

Section-B

7 Following is the distribution of the long jump competition in which 250 students participated. Find the median distance jumped by the students. Interpret the median **3**

Distance in (m)	0 -1	1 - 2	2 - 3	3 - 4	4 - 5
Number of students	40	80	62	38	30

8 Construct a pair of tangents to a circle of radius 4cm, which are inclined toeach other at an angle of 60°. **3**

9 The distribution given below shows the runs scored by batsmen in one-daycricket matches. Find the mean number of runs. **3**

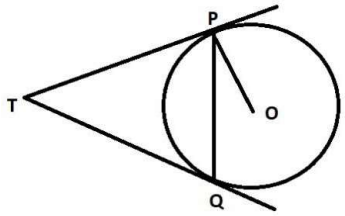
Runs Scored	0 - 40	40 - 80	80 - 120	120 - 160	160 - 200
Number of Batsmen	12	20	35	30	23

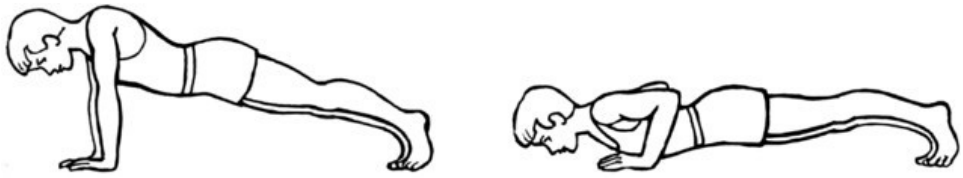
10 Two vertical poles of different heights are standing 20m away from each other on the level ground. The angle of elevation of the top of the first pole from the foot of the second pole is 60° and angle of elevation of the top of the second pole from the foot of the first pole is 30°. Find the difference between the heightsof two poles. (Take $\sqrt{3} = 1.73$) **3**

OR

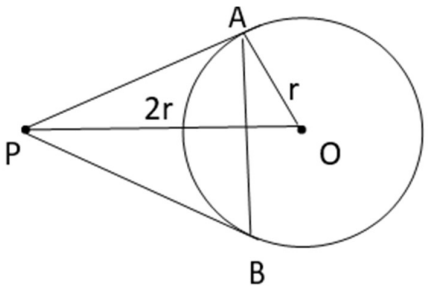
A boy 1.7 m tall is standing on a horizontal ground, 50 m away from a building.The angle of elevation of the top of the building from his eye is 60°. Calculate the height of the building. (Take $\sqrt{3} = 1.73$)

Section-C

11	The internal and external radii of a spherical shell are 3cm and 5cm respectively. It is melted and recast into a solid cylinder of diameter 14cm, findthe height of the cylinder. Also find the total surface area of the cylinder. $(Take\ \pi\ =\ \frac{22}{7}$	**4**
12	Prove that the angle between the two tangents drawn from an external point toa circle is supplementary to the angle subtended by the line segment joining thepoints of contact to the centre. **OR** 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**
13	**<u>Case Study-1</u>** Trigonometry in the form of triangulation forms the basis of navigation, whetherit is by land, sea or air. GPS a radio navigation system helps to locate our position on earth with the help of satellites. A guard, stationed at the top of a 240m tower, observed an unidentified boat coming towards it. A clinometer or inclinometer is an instrument used for measuring angles or slopes(tilt). The guard used the clinometer to measure theangle of depression of the boat coming towards the lighthouse and found it to be 30°. 	

	(Lighthouse of Mumbai Harbour. Picture credits - Times of India Travel) I. Make a labelled figure on the basis of the given information and calculatethe distance of the boat from the foot of the observation tower. II. After 10 minutes, the guard observed that the boat was approaching thetower and its distance from tower is reduced by $240(\sqrt{3} - 1)$ m. He immediately raised the alarm. What was the new angle of depression ofthe boat from the top of the observation tower?	2 2
14	**Case Study-2** Push-ups are a fast and effective exercise for building strength. These are helpful in almost all sports including athletics. While the push-up primarily targets the muscles of the chest, arms, and shoulders, support required from other muscles helps in toning up the whole body.  Nitesh wants to participate in the push-up challenge. He can currently make 3000 push-ups in one hour. But he wants to achieve a target of 3900 push-upsin 1 hour for which he practices regularly. With each day of practice, he is ableto make 5 more push-ups in one hour as compared to the previous day. If on first day of practice he makes 3000 push-ups and continues to practice regularlytill his target is achieved. Keeping the above situation in mind answer the following questions: i) Form an A.P representing the number of push-ups per day and hence find the minimum number of days he needs to practice before the day his goal is accomplished? ii) Find the total number of push-ups performed by Nitesh up to the day hisgoal is achieved.	2 2

Marking Scheme
Class – X, Session -2021-22
TERM II
Subject – Mathematics (Standard)

SECTION A		
Q. No	HINTS/SOLUTION	MARKS
1	a = 6, d = 3 ; a_{25} = 6 + 24(3) = 78 a_{15} = 6 + 14(3) = 48 ; a_{25} - a_{15} = 78 - 48 = 30 OR $7(a + 6d) = 5(a + 4d)$ $\Rightarrow 2a + 22d = 0 \Rightarrow a + 11d = 0 \Rightarrow t_{12} = 0$	1 1 1 1
2	$5mx^2 - 6mx + 9 = 0$ $b^2 - 4ac = 0 \Rightarrow (-6m)^2 - 4(5m)(9) = 0$ $\Rightarrow 36m(m - 5) = 0$ $\Rightarrow$ m = 0, 5 ; rejecting m=0, we get m = 5	 1 1
3	 let $\angle APO = \theta$ $Sin\theta = OA/OP = 1/2 \Rightarrow \theta = 30°$ $\Rightarrow \angle APB = 2\theta = 60°$ Also $\angle PAB = \angle PBA = 60°$ ($\because PA = PB$) $\Rightarrow \triangle APB$ is equilatera	 1/2 1/2 1/2 1/2
4	CSA (cone) = πrl = 12320 (22/7) x 56 x l = 12320 l = 70 cm $h = \sqrt{70^2 - 56^2} = 42\ cm$	1/2 1 1/2
5	Modal class is *40-60*, *l=40, h=20,* f_1*=?,* f_0*=10,* f_2*=6* $45 = 40 + 20[\frac{f_1 - 10}{2f_1 - 10 - 6}]$ $\Rightarrow$ *1 /4* = $(f_1 - 10)/(2f_1 - 16)$ $2f_1$*-16=4*f_1*-40* $\Rightarrow f_1$*=12*	1/2 1/2 1
6	Let the present age of Ritu be x years $(x - 5)^2 = 5x + 11$	 1

	$x^2 - 15x + 14 = 0$½	
	$(x - 14)(x - 1) = 0 \Rightarrow x = 1 \text{ or } 14$	1/2
	x = 14 years (rejecting $x = 1$ as in that case Ritu's age 5 years ago will be –ve)	1/2
	OR	
	$9x^2 - 6px + (p^2 - q^2) = 0$	
	$a = 9, \quad b = -6p, \quad c = p^2 - q^2$	
	$D = b^2 - 4ac = (-6p)^2 - 4(9)(p^2 - q^2) = 36q^2$	1/2
	$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{6p \pm 6q}{18} = \frac{p+q}{3} \text{ or } \frac{p-q}{3}$	1/2 1
	SECTION B	
7		

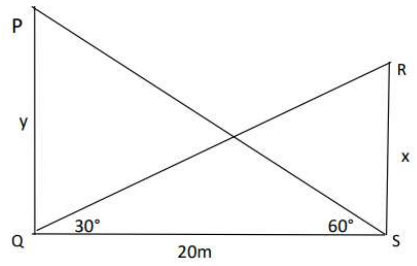
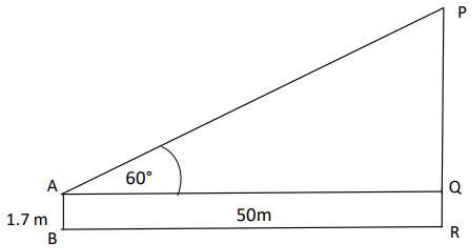
Distance (in m)	0 - 1	1 – 2	2 - 3	3 - 4	4 - 5
Number of Students	40	80	62	38	30
cf	40	120	182	220	250

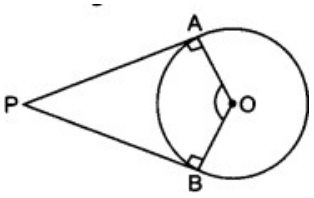
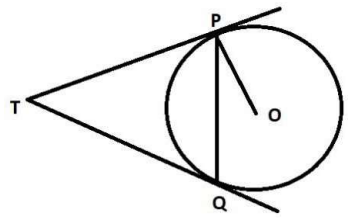
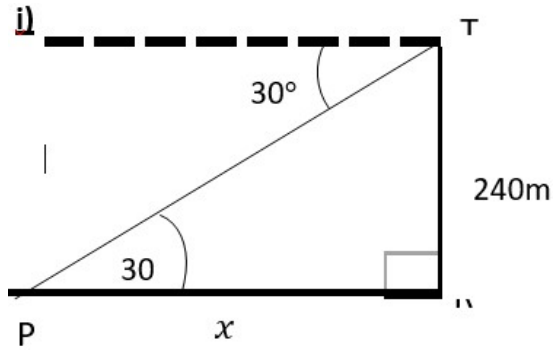
	$n/2 = 250/2 = 125 \Rightarrow median\ class\ is\ 2-3, l = 2, h = 1, cf = 120, f = 62$	1
	Median=l+(n/2 – cf)/f x i	1/2
	=2+5/62	
	=129/62 = 2 (5/62)m or 208m	1
	50% of students jumped below 2(5/62) m and 50 % above it	1/2
8	Draw a circle of radius 4 cm	1
	Draw OA and construct $\angle AOB = 120^0$	1
	Draw $\angle OAP = \angle OBP = 90^0$	1
	PA and PB are required tangents	
9		

Runs scored	0-40	40-80	80-120	120-160	160-200	Total
No. of Batsmen	12	20	35	30	23	120
x_i	20	60	100	140	180	
f_ix_i	240	1200	3500	4200	4140	13280

1 ½

1 ½

	$mean(\overline{x}) = \frac{\sum f_i x_i}{\sum f_i}$ = 13280/120 = 110.67 runs	
10	 $In\ \Delta PQS, tan60° = y/20 \Rightarrow y = 20\sqrt{3}$m $In\ \Delta RSQ, tan30° = x/20 \Rightarrow x = (20/\sqrt{3})\ m$ $y - x = 20\sqrt{3} - (20\ \sqrt{3}) = 40/\sqrt{3} = (40\sqrt{3})/3 = 23.06$m OR  Let PR be the building and AB be the boy $In\ \Delta PQR, tan60^0$ =PQ/50 $\Rightarrow PQ = 50\sqrt{3}m$ Height of the building = PR = $(50\sqrt{3} + 1.7)m$ = $88.2m$	1 1/2 1/2 1 1 1 1
	SECTION C	
11	Volume of shell = Volume of cylinder $\Rightarrow 4\ \pi/3\ [\ 5^3\ -\ 3^3] = \pi(7)^2h$ $\Rightarrow h = 8/3\ = 2\frac{2}{3}$ TSA of cylinder is $2\pi r(r+h)=2$ x (22/7)x 7 x (7+8/3)=44 x 29/3=1276/3 cm^2 or 425.33 cm^2	1 ½ 1 1 ½

12	 $\angle OAP + \angle OBP + \angle APB + \angle AOB = 360^o$ $\Rightarrow 90^0 + 90^0 + \angle APB + \angle AOB = 360^o$ ($\because Tangent \perp radius$) $\Rightarrow \angle APB + \angle AOB = 180^0$	$1\frac{1}{2}$
	OR	
	 Let $\angle PTQ = \theta$ TPQ is an isosceles triangle. $\angle TPQ = \angle TQP = \frac{1}{2}(180° - \theta) = 90° - \frac{\theta}{2}$ $\angle OPT = 90°$ $\angle OPQ = \angle OPT - \angle TPQ = 90° - \left(90° - \frac{\theta}{2}\right) = \frac{\theta}{2}$ $\angle OPQ = \frac{1}{2}\angle PTQ$ $2\angle OPQ = \angle PTQ$	$1\frac{1}{2}$ $1\frac{1}{2}$ $1\frac{1}{2}$
13	Case Study-1  In ΔPTR, $tan\ 30° = \frac{240}{x} \Rightarrow$ x = $240\sqrt{3}m$ ii) Distance of boat from tower=$240\sqrt{3} - 240\left(\sqrt{3} - 1\right) = 240m$ $The\ angle\ of\ depression = \theta, then\ tan\theta = \frac{240}{240} = 1 \Rightarrow \theta = 45°$	1 1

14	3000, 3005, 3010, ...,3900. $a_n = a + (n-1)d$ 3900 = 3000 + (n - 1)5 $\Rightarrow 900 = 5n - 5 \Rightarrow 5n = 905 \Rightarrow n = 181$ Minimum number of days of practice = $n - 1 = 180\ days$ 2) $S_n = \frac{n}{2}(a + l)$ $= \frac{181}{2} \times (3000 + 3900) = 624450$ pushups	1 1 1 1

PRACTICE PAPERS

Sample Question Paper- 1

Mathematics- Basic (241)

Class- X Session: 2021-22

TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

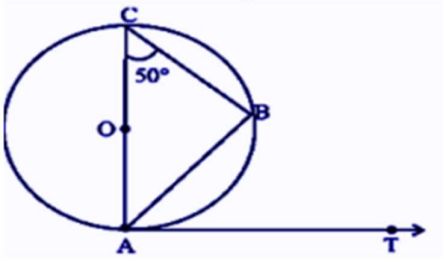
General Instructions:

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	
Q:No		**MARKS**
1.	A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then calculate the height of the wall OR A ladder, leaning against a wall, makes an angle of 60° with the horizontal. If the foot of the ladder is 2.5 m away from the wall, find the length of the ladder	**2**
2.	A solid metallic spherical ball of diameter 6 cm is melted and recast into a cone with diameter of the base as 12 cm, Find height of the cone ?	**2**
3.	If a tower 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then what is the angle of elevation of the sun?	**2**
4.	The arithmetic mean of the following distribution is 50. Find the missing frequency p.	**2**

Class Interval	Frequency
0 – 20	7
20 – 40	6
40 – 60	9
60 – 80	13
80 – 100	p

5. AB is a chord of the circle and AOC is its diameter such that angle ACB = 50°. If AT is the tangent to the circle at the point A, then find ∠ BAT **2**



OR

Prove that a parallelogram circumscribing a circle is a rhombus.

6. Find the mode of the following data **2**

Class Interval	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50
Frequency	9	13	35	20	15	8

SECTION B

7. (a)For what values of k , the quadratic equation kx (x – 2) + 6 = 0 have two equal roots? **3**

(b)Find the roots of the quadratic equation $x^2 + 6x + 5 = 0$

8. Prove that the lengths of the tangents from an external point to a circle are equal. Using this result Prove that a Parallelogram circumscribing a circle is a Rhombus **3**

9. The angle of elevation of the top of a building for the foot of the tower is 30^o and the angle of elevation of the top of a tower from the foot of the building is 60^o . If the tower is 50m high, find the height of the building. **3**

OR

A vertical tower stands on the ground is surmounted by a flag-staff of height 5 m. From a point on the ground, the angle of elevation of the bottom of the flag staff is 45^o and that of the top of the flag-staff is 60^o . Find the height of the tower. ($\sqrt{3} = 1.732$)

10. The sum of the squares of two consecutive odd numbers is 394. Find the numbers **3**

SECTION C

11. 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 length of the tangents **4**

OR

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

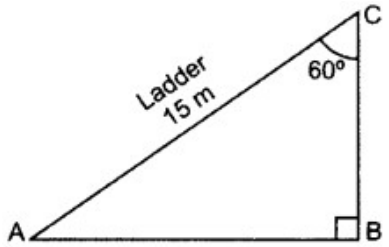
12. Find the missing frequencies in the following frequency distribution table if n = 100 and median is 32 **4**

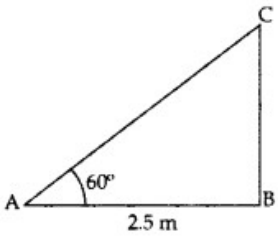
Class Interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	10	x	25	30	y	10

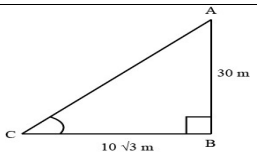
13. The historical monument Gol Gumbaz is the tomb of king Muhammad Adil Shah, Adil Shah Dynasty. It is located in Vijayapura, Bijapur, Karnataka. Construction of the tomb was started in 1626 and completed in 1656.In this

	monument one can find combination of solid figures. There are cubical bases & hemispherical domes at the top.  (i) Find the total surface area of the hemispherical dome having radius 7 cm (ii) A block of the Gol Gumbaz is in the shape of a cylinder of diameter 0.5 cm with two hemispheres stuck to each of its ends. The length of the shape is 2cm. Find the volume of the block (Use $\pi = 3.14$)	**2** **2**
14.	Ashin is a plant lover. She has a wide range of plant collection. She decides to open a nursery. The planted pots had to be arranged to make it impressive for a buyer on seeing the beautiful flowering plants. She makes an arrangement in such a way that the number of pots in the first row is 3, second row is 5, third row is 7 and so on…  (i) If Ashin wants to place a total of 120 pots, how many rows should be made in this arrangement? (ii) Find the difference in number of pots placed in 8^{th} row and 3^{rd} row	**2** **2**

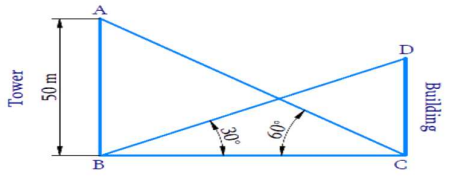
MARKING SCHEME
CLASS- X SESSION- 2021-22
TERM 2
SUBJECT- MATHEMATICS (BASIC)

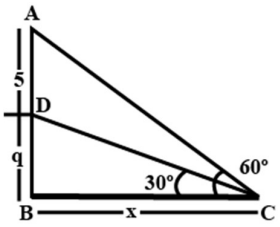
<table>
<tr><td></td><td>SECTION A</td><td></td></tr>
<tr><td>Qn no:</td><td>HINT/SOLUTION</td><td>MARKS</td></tr>
<tr><td>1.</td><td> 

∠BAC = 180° – (90° + 60°) = 30°
sin 30° = $\frac{BC}{AC}$
½ =BC/15
2BC = 15
BC = 15/2 m or 7.5 m
OR
Let AC be the ladder
$\cos 60° = \frac{AB}{AC}$
$\frac{1}{2} = \frac{2.5}{AC}$
 

∴ Length of ladder, AC = 5 m 2.5 m</td><td>1
1
1
1</td></tr>
<tr><td>2.</td><td>Volume of the spherical ball Vs= $\frac{4}{3}\pi r^3 = 36\pi cm^3$
Volume of the cone made from sphere Vc=$\frac{1}{3}\pi r^2 h = 12h\pi cm^3$
⇒Vs= Vc⇒ 36π =12hπ ⇒h= 36/12 = 3cm</td><td>1
1
1</td></tr>
<tr><td>3.</td><td> 

In rt triangle ABC , tan $\theta = \frac{30}{10\sqrt{3}} = \sqrt{3}$
But tan 600 = $\sqrt{3}$, Therefore $\theta = 60^0$, Hence sun's elevation is 60^0</td><td>1
1</td></tr>
<tr><td>4.</td><td><table>
<tr><td>Class Interval</td><td>Frequency(fi)</td><td>Class mark (xi)</td><td>fixi</td></tr>
<tr><td>0 - 20</td><td>12</td><td>10</td><td>120</td></tr>
</table></td><td>1</td></tr>
</table>

	20 – 40 | 15 | 30 | 450 40 – 60 | 32 | 50 | 1600 60 – 80 | P | 70 | 70p 80 – 100 | 13 | 90 | 1170 | $\sum$xi = 72 + p | | . $\sum fixi = 3340 + 70p$ $53 = \frac{3340+70p}{72+p}$, p = 28	1
5.	$\angle ABC$ = 90^0 (Angle in a semicircle) In Δ ABC , $90^0 + 50^0 + \angle BAC$ = 180^0(Angle sum) $\angle BAC$ = 40^0 $\angle CAT$ = 90^0 (Tangent perpendicular to radius) But $\angle CAT$ = $\angle CAB + \angle BAT$ $\angle BAT$ = $90^0 - 40^0 = 50^0$ OR Correct figure,given ,to prove ,correct proof	½ ½ 1 1 1
6.	Modal class 30 = 35 l = 30,f_1=35,f_0=13,f^2=20,h=5 Mode = l + $(\frac{f1-f0}{2fi-f0-f2})$h On substituting , mode = 32.97	½ ½ 1
7.	(a) kx(x−2)+6=0 , $kx^2-2kx+6=0$ Since the roots are equal, b^2 - 4ac = 0 $(-2k)^2=4(k)(6)$, $4k^2=4k(6)$ ∴k=6 (b) Appling Quadratic formula, x = - 1 , - 5	½ ½ ½ 1 ½
8.	Correct figure , given ,to prove , correct proof	1 ½ x 2 = 3
9.	 Let the height of the tower be AB and the height of the building be CD In ΔABC, tan 60° = AB/BC √3 = 50/BC , BC = 50/√3 ....(i) In ΔBCD, tan 30° = CD / BC	½ ½ ½ 1 ½

	$1/\sqrt{3} = CD / BC$, $1/\sqrt{3} = CD / 50/\sqrt{3}$ [from (i)] $CD = 1/\sqrt{3} \times 50/\sqrt{3}$, $CD = 50/3$ Height of the building CD = 50/3 m. OR  Given that the Height of Flagstaff =5 m Now, Let the Height of the Tower be q and distance of a point from the Tower be x In △ABC $\tan 60^0 = \frac{5+q}{x}$, $5 + q = x\sqrt{3}$ .....(1) In △DBC $\tan 30^0 = q/x \Rightarrow x = q.\sqrt{3}$ .....(2) From (1) and (2) $\Rightarrow 5+q=3q \Rightarrow 2q=5 \Rightarrow q=2.5$ Therefore, Height of Tower =2.5 m	½ ½ ½ ½ ½
10.	let the two numbers be $2x-1$ and $2x+1$. Given that the sum of their squares is 394 $(2x-1)^2+(2x+1)^2=394$ $4x^2+1-4x+4x^2+1+4x=394$ Solving for x, x=7 ,The two odd numbers,$2n-1$ and $2n+1$ are 13 and 15	½ 1 1 ½
11.	Correct construction	3
12.	class f cf 0-10 10 10 10-20 x 10+x 20-30 25 35+x 30-40 30 65+x	½

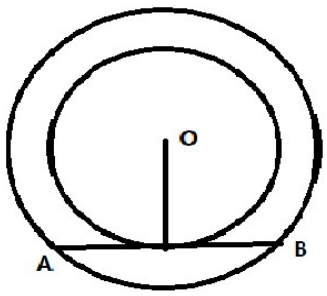
	40-50 y 65+x+y 50-60 10 75+x+y 75+x+y 75+x+y=100 , x+y=25 f=30,h=10,cf=35+x, $\frac{n}{2}$=50 Median=l+($\frac{\frac{n}{2}-cf}{f}$)×h , 32=(3050−35−x)×10 6=15−x , x=9 ∴y=16	½ 1 1
13.	(i) Radius of the hemisphere is 7 cm. Total surface area of the hemisphere =3πr^2 =3×$\frac{22}{7}$×7^2 =462 cm^2 (ii) Volume of block= Volume of both the hemispherical parts + Volume of cylindrical part The hemisphere and the cylinder will have the same radius r =0.25cm Since total length of the shape is 2 cm, the length of the cylindrical part will be 2−0.25−0.25=1.5cm Hence, Volume of the block = 2 x $\frac{2}{3}$ π r^3 + πr^{2}h On substituting the values , Volume = 0.36 cm^3	2 ½ ½ 1
14.	(i) S_n = n/2 (2a + (n- 1)d) 120 = n/2 (2x3 + (n – 1) 2) Solving for n, n= 10, Hence there should be 10 rows of this arrangement (ii) $a_8 – a_3$ = a + 7d –(a + 2d) a = 3 , d = 2 , on substituting Difference in number of pots placed in 8th row and 3rd row = 10	½ ½ 1 ½ 1 ½

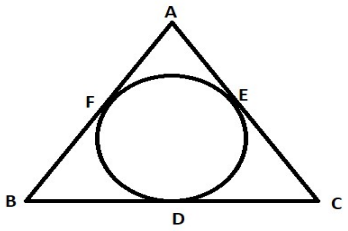
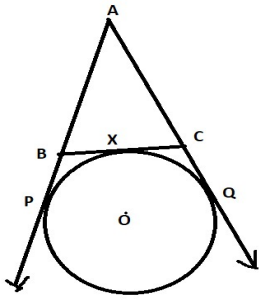
Sample Question Paper - 2
MATHEMATICS-BASIC (241)
CLASS-X SESSIOIN-2021-22
TERM II

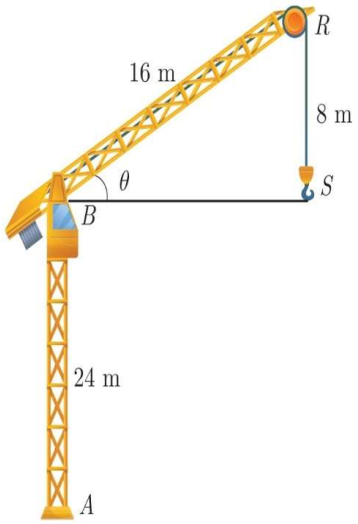
Time Allowed:- 2 hours **Maximum Marks: 40**

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 4 questions of 3 marks each. Internal choice has been provided in one questions.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one questions. It contains two case study based questions

<table>
<tr><td></td><td>SECTION A</td><td></td></tr>
<tr><td>Q.No</td><td></td><td>Marks</td></tr>
<tr><td>1</td><td>Find the value of k for which quadratic equation $9x^2$+8kx+16=0 has equal roots ?
OR
Find the roots of quadratic equation $9x^2 - 15x + 6 = 0$</td><td>2</td></tr>
<tr><td>2</td><td>A solid sphere of radius 3 cm is melted and then cast into smaller spherical balls each of diameter 0.6 cm . Find the number of balls thus obtained</td><td>2</td></tr>
<tr><td>3</td><td>Find the mode of the following distribution of marks obtained by 80 students
<table>
<tr><td>Marks obtained</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td></tr>
<tr><td>Number of students</td><td>6</td><td>10</td><td>12</td><td>32</td><td>20</td></tr>
</table></td><td>2</td></tr>
<tr><td>4</td><td>Which term of AP:21,42,63,…..is 420 ?</td><td>2</td></tr>
<tr><td>5</td><td>Two concentric circles of centre O are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle AB
 
</td><td>2</td></tr>
</table>

	OR The incircle of ΔABC touches the sides BC, CA and AB at D , E , and F respectively. If AB = AC ,prove that BD = CD  	
6	If the mean of the following frequency distribution is 27. Find the value of p Class interval | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 Frequency | 8 | P | 12 | 13 | 10	2
	SECTION B	
7	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
8	The height of a tower is 10 m. Calculate the length of shadow when the sun's altitude is 45^0 **OR** A ladder 15 meters long just reaches the top of the vertical wall. If the ladder makes an angle of 60^0 with the wall , find the height of the wall	3
9	In the given figure, find the perimeter of ΔABC. If AP = 10 cm  	3
10	The product of two successive multiples of 3 is 180. Determine the numbers	3
	SECTION C	

<table>
<tr><td>11</td><td>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.
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 its length</td><td>4</td></tr>
<tr><td>12</td><td>The median of the distribution given below is 35.Find the values of x and y , if the sum of all frequencies is 170
<table>
<tr><td>Variable</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td></tr>
<tr><td>Frequency</td><td>10</td><td>20</td><td>x</td><td>40</td><td>y</td><td>25</td><td>15</td></tr>
</table></td><td>4</td></tr>
<tr><td>13</td><td>Tower cranes are a common fixture at any major construction site. They are pretty hard to miss-they often raise hundreds of feet into the air , and can reach out just as far. The construction crew uses the tower crane to lift steel , concrete , large tools like acetylene torches and generators and a wide variety of other building materials
 

A crane stands on a level ground. It is represented by a tower AB of height 24 m and a jib BR. The jib is of length 16 m and can rotate in a vertical plane about B.A vertical cable, RS, carries a load S. The diagram above shows current position of jib, cable and load
1.Find the distance BS</td><td>2</td></tr>
</table>

	2.Find the angle that the jib BR makes with the horizontal	2
14	Ramesh a juice seller has set three types of glasses with inner diameter 5 cm to serve customers. The height of the glasses is 10 cm Type A-A glass with plane bottom Type B-A glass with hemispherical raised bottom Type C-A glass with conical raised bottom of height 1.5 cm  **- A Glass with a plane bottom** **Type A**  **- A glass with a hemispherical raised bottom** **Type B**  **- A glass with conical raised bottom** **Type C** 1) Find which glass has maximum capacity and which has minimum capacity? (Use π=3.14) 2) If vessel type A is melted to form spheres of radius 0.5 cm .How many spheres can be obtained from it ?	2 2

Marking Scheme

Mathematics –Basic(241)

Class- X Session- 2021-22

TERM II

<table>
<tr><th>Q.No</th><th>HINTS/SOLUTION</th><th>MARKS</th></tr>
<tr><td>1</td><td>$b^2 - 4ac = 0$
$(8k)^2 - 4x9x16 = 0$
$k^2 = \frac{576}{64} = 9$
k=±3
OR
$9x^2 - 15x + 6 = 0$
$9x^2 - 9x - 6x + 6 = 0$
(9x-6)(x-1) = 0
$x = \frac{2}{3}$, $x = 1$</td><td>1

1

1

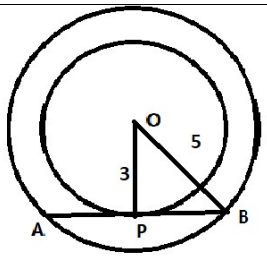
1</td></tr>
<tr><td>2</td><td>Number of balls = $\frac{Volume\ of\ bigger\ sphere}{Volume\ of\ smaller\ sphere}$
$= \frac{3\ x\ 3\ x\ 3}{0.6\ x\ 0.6\ x\ 0.6}$
=125</td><td>1

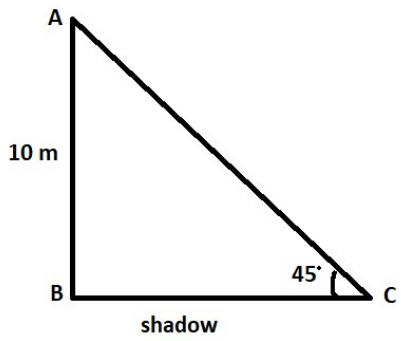
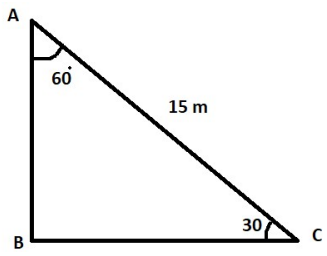
1</td></tr>
<tr><td>3</td><td>
<table>
<tr><td>Marks</td><td>No. of students</td></tr>
<tr><td>0-10</td><td>6</td></tr>
<tr><td>10-20</td><td>10</td></tr>
<tr><td>20-30</td><td>12</td></tr>
<tr><td>30-40</td><td>32</td></tr>
<tr><td>40-50</td><td>20</td></tr>
</table>
$f_1 = 32$, $f_0 = 12$, $f_2 = 20$
Mode = $l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] x\ h$
$=30 + \left[\frac{32-12}{2x32-12-20}\right] x\ 10$
$= 30 + \frac{20}{32}$ x 10
$= \frac{290}{8}$
=36.25</td><td>1

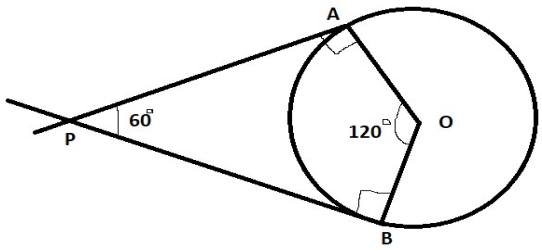
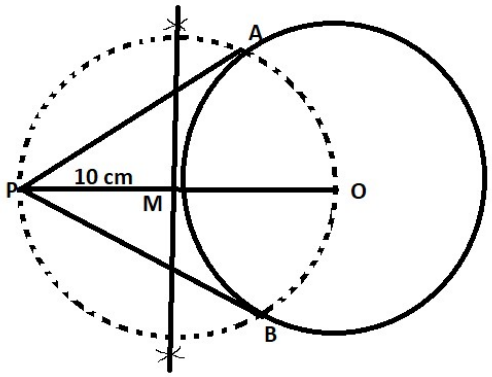
1/2

1/2</td></tr>
<tr><td>4</td><td>$a_n = a + (n-1)d$
420 = 21 (n-1) 21
420-21 = (n-1) 21
399/29 = n-1
19 = n-1
n = 20</td><td>1

1</td></tr>
</table>

5	 In rt ΔOPB by pythagorous theorem $OB^2 = OP^2 + PB^2$ 5^2-3^2 = PB^2 PB = 3 AB=2x PB=2x 3 = 6 cm	 1 1
	OR AF=AE(The length of tangents from external FB =BD an external point in a circle equal)…(1) EC=CD Given AB = CD AF + FB = AE + EC AE + BD = AE + CD (from (1)) BD = CD	 1 1
6	<table><tr><th>Class Interval</th><th>f_i</th><th>x_i</th><th>f_ix_i</th></tr><tr><td>0-10</td><td>8</td><td>5</td><td>40</td></tr><tr><td>10-20</td><td>p</td><td>15</td><td>15p</td></tr><tr><td>20-30</td><td>12</td><td>25</td><td>300</td></tr><tr><td>30-40</td><td>13</td><td>35</td><td>455</td></tr><tr><td>40-50</td><td>10</td><td>45</td><td>450</td></tr></table> Mean = $\frac{\sum f_i x_i}{\sum f_i}$ $27=\frac{1245+15p}{43+p}$ P = 7	1 1/2 1/2
	SECTION B	
7	a = 5 , $a_n = 45$, $S_n = 400$ $S_n = \frac{n}{2}(a + l)$ $400 = \frac{n}{2}(5 + 45)$ $\frac{800}{50} = n$ n = 16 $a_n = a + (n-1)d$ 45 = 5 + (16 – 1) d 45 – 5 = 15d $d = \frac{45}{15} = \frac{8}{3}$	½ 1 ½ 1

8	 Let AB be the 10 m tower and BC be the length of shadow tan $45^0 = \frac{AB}{BC}$ $1 = \frac{10}{BC}$ BC = 10 m Length of shadow = 10 m **OR**  Let AB be the height of wall and AC be the length of ladder ,	1 1 1
9	Perimeter of ΔABC =AB + BC + AC = AB+BX+CX+AC = (AB+B)P+(AC+CQ) (BX=BP , CX =CQ) =AP+AQ (AP=AQ) = 2 AP =2 X 10 = 20 cm	1 1 1
10	Let one of the multiple of 3 be 3x Successive multiple of 3 = 3x + 3 3x(3x+3) = 180 $9x^2 + 9x - 180 = 0$ $X^2 + x - 20 = 0$ (x-4)(x+5) X = 4 , x=-5 Multiples of 3 are 12,15 and -15 ,-12	1 1 1
	SECTION C	

11		
	Draw a circle of radius 6 cm	1
	Draw OA and construct $\angle AOB = 120^0$	1
	Draw $\angle OAP = \angle OBP = 90^0$	1
	PA and PB are required tangents	
	Length of tangents = 10.4 cm (approx.)	1
	OR	
		
	Draw a circle of radius 6 cm with centre O	1
	Draw OP 10 cm and bisect it at M	1
	With M as the centre draw a circle intersecting previous circle at A and B	1
	Join PA and PB	
	PA=PB= 8 cm	1

12

Variable	Frequency	Cumm Frequency(cf)
0-10	10	10
10-20	20	30
20-30	X	30+x
30-40	**40**	**70+x**
40-50	y	70+x+y
50-60	25	95+x+y
60-70	15	110+x+y

N=170 — 1

110+x+y=170

X + y =60 — 1

$\frac{n}{2} = 85$, l=30 ,cf = 30+x , f=40 , l=30

Median = $l + \frac{\frac{n}{2} - cf}{f} \times h$ — 1

$35 = 30 + \frac{(85-30-x)}{40} \times 10$

X= 35 , y= 25 — 1

13

1)

In right ΔRSB , by Pythagoras theorem

$16^2 = 8^2 + BS^2$

$16^2 - 8^2 = BS^2$

$BS = 8\sqrt{3}$ cm — 2

2)

$\sin \theta = \frac{RS}{BR}$

$= \frac{8}{16}$

$\sin \theta = \frac{1}{2}$

$\theta = 30^0$ — 2

1)

r =2.5 cm

Height = 10 cm

Volume of glass type A = $\pi r^2 h$= 3.14 x 2.5 x 2.5 x 10

= 196.25 cm^3 — 1

Volume of glass type B = Volume of cylinder - Volume of hemispherical base

= 196.25 + 2/3 πr^3

= 196.25 – 32.71 = 163.54 cm^3

Volume of glass type C = Volume of cylinder - Volume of conical base

= 196.25 + 1/3 πr^2 — 1

= 196.25 – 9.81 = 163.54 cm^3

Type A is maximum volume and Type B has minimum volume

	2) Number of spheres $= \frac{\text{Volume of type A}}{\text{Volume of one sphere}}$ $= 375$	1 1
14	1) r =2.5 cm Height = 10 cm Volume of glass type A = $\pi r^2 h$= 3.14 x 2.5 x 2.5 x 10 = 196.25 cm^3 Volume of glass type B = Volume of cylinder - Volume of hemispherical base = 196.25 + 2/3 πr^3 = 196.25 – 32.71 = 163.54 cm^3 Volume of glass type C = Volume of cylinder - Volume of conical base = 196.25 + 1/3 πr^2 = 196.25 – 9.81 = 163.54 cm^3 Type A is maximum volume and Type B has minimum volume 2) Number of spheres $= \frac{\text{Volume of type A}}{\text{Volume of one sphere}}$ $= 375$	 2 2

Sample Question Paper

Mathematics- Standard (041)

Class- X, Session: 2021-22

TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

BLUE PRINT

S. NO	NAME OF CHAPTER	SA I 2Marks	SA II 3Marks	LA 4Marks	TOTAL
1	QUADRATIC EQUATIONS	4(2)	-	-	4(2)
2	ARITHMETIC PROGRESSION	2(1)	-	4(1)*	6(2)
3	CIRCLES	2(1)	-	4(1)	6(2)
4	CONSTRUCTIONS	-	3(1)	-	3(1)
5	SOME APPLICATIONS OF TRIGONOMETRY	-	3(1)	4(1) *	7(2)
6	SURFACE AREA AND VOLUMES	2(1)	-	4(1)	6(2)
7	STATISTICS	2(1)	6(2)	-	8(3)
TOTAL		**12(6)**	**12(4)**	**16(4)**	**40(14)**

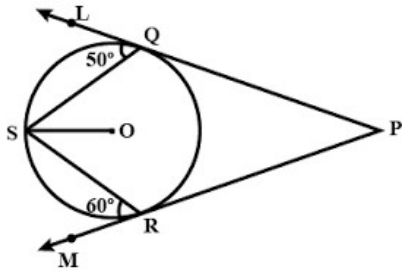
***CASE STUDY BASED QUESTIONS**

Sample Question Paper
Mathematics- Standard (041)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

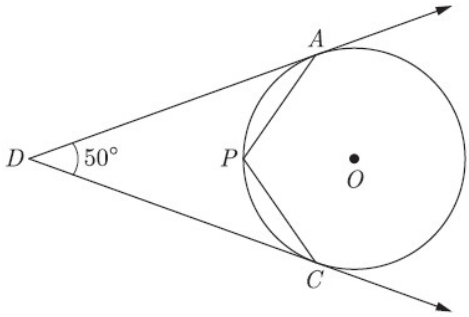
General Instructions:

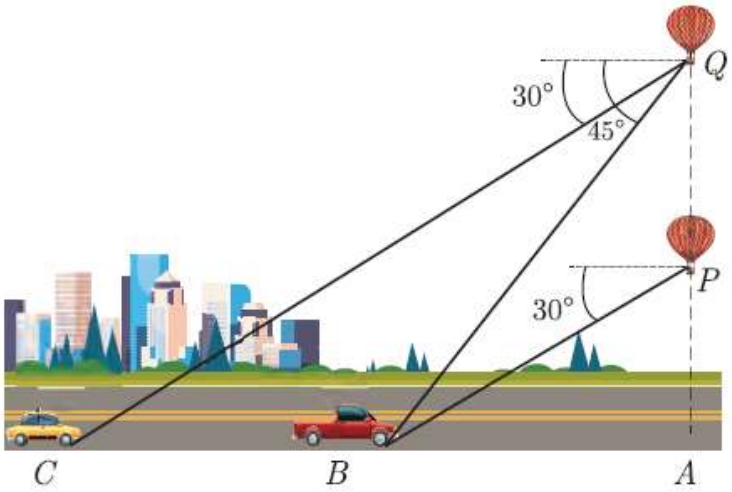
1. **The question paper consists of 14 questions divided into 3 sections A, B, C.**
2. **All questions are compulsory.**
3. **Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.**
4. **Section B comprises of 4questions of 3 marks each. Internal choice has been provided in one question.**
5. **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		
Q NO.		**MARKS**
1	Find the 4th term from the end of the AP -11, -8, -5, ..., 49. **OR** Find the value of the middle most term (s) of the AP : –11, –7, –3,..., 49.	2
2	Find the values of k for the following quadratic equation, so that it has two equal roots. $kx(x - 2) + 6 = 0.$	2
3	In figure, PQ and PR are tangents to the circle with center O and S is a point on the circle such that $\angle SQL = 50^0$ and $\angle SRM = 60^0$. Find $\angle QSR$. 	2

<table>
<tr><td>4</td><td>The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the solid cylinder is 1628 sq. cm, find the radius and height of the cylinder. ($\pi = \frac{22}{7}$)</td><td>2</td></tr>
<tr><td>5</td><td>The mode of the following frequency distribution is 36. Find the missing frequency f.
<table>
<tr><td>Class</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td></tr>
<tr><td>Frequency</td><td>8</td><td>10</td><td>f</td><td>16</td><td>12</td><td>6</td><td>7</td></tr>
</table></td><td>2</td></tr>
<tr><td>6</td><td>Had Salma scored 10 more marks in her mathematics test out of 30 marks, 9 times these marks would have been the square of her actual marks. How many marks did she get in the test?
OR
Solve the quadratic equation, $2x^2 + ax - a^2 = 0$ for x .</td><td>2</td></tr>
<tr><td colspan="3">SECTION B</td></tr>
<tr><td>7</td><td>Find the mean of the following distribution :
<table>
<tr><th>Height (in cm)</th><th>No. of students</th></tr>
<tr><td>Less than 75</td><td>5</td></tr>
<tr><td>Less than 100</td><td>11</td></tr>
<tr><td>Less than 125</td><td>14</td></tr>
<tr><td>Less than 150</td><td>18</td></tr>
<tr><td>Less than 175</td><td>21</td></tr>
<tr><td>Less than 200</td><td>28</td></tr>
<tr><td>Less than 225</td><td>33</td></tr>
<tr><td>Less than 250</td><td>37</td></tr>
<tr><td>Less than 275</td><td>45</td></tr>
</table></td><td>3</td></tr>
</table>

	Less than 300 | 50	
8	Construct a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.	3
9	The following table shows the weights (in gms) of a sample of 100 apples, taken from a large consignment. Weight (in gms) | No. of Apples 50 – 60 | 8 60 – 70 | 10 70 – 80 | 12 80 – 90 | 16 90 – 100 | 18 100 – 110 | 14 110 – 120 | 12 120 – 130 | 10 Find the median weight of apples.	3
10	The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 45°. Find the height of the tower. **OR** 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 4 m from the banks, find the width of the river. (Take √3 =1.732)	3
	SECTION C	
11	504 cones, each of diameter 3.5 cm and height 3 cm, are melted and recast into a metallic sphere. Find the diameter of the sphere and hence find its surface area. Use $\pi = \frac{22}{7}$.	4

12	In the given figure, O is the centre of the circle Determine $\angle APC$, if DA and DC are tangents and $\angle ADC = 50°$.  **OR** Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.	4
13	**CASE STUDY 1** 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 roller in the 6^{th} year and 1130 roller in the 9^{th} year.	2 + 2 = 4

	(i) How many road rollers the company might have produced in its first year ? What was the company's production in the 8^{th} year ? (ii) Find the total number of road rollers produced by the company till now?	
14	**CASE STUDY 2** A hot air balloon is a type of aircraft. It is lifted by heating the air inside the balloon, usually with fire. Hot air weighs less than the same volume of cold air (it is less dense), which means that hot air will rise up or float when there is cold air around it, just like a bubble of air in a pot of water. The greater the difference between the hot and the cold, the greater the difference in density, and the stronger the balloon will pull up.  Lakshman is riding on a hot air balloon. After reaching at height x at point P , he spots a lorry parked at B on the ground at an angle of depression of 30^0. The balloon rises further by 50 metres at point Q and now he spots the same lorry at an angle of depression of 45^0 and a car parked at C at an angle of depression of 30^0. (i) What is the relation between the height x of the balloon at point P and distance d between point A and B? When balloon rises further 50 metres, then what is the relation between new height y and d ?	2 + 2 = 4

	(ii) Find the distance between the lorry and the car.	

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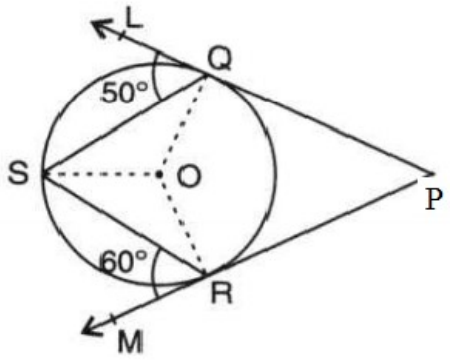
Sample Question Paper- Marking Scheme
Mathematics- Standard (041)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

MARKING SCHEME

SECTION A		
Q NO		**MARKS**
1	$a = -11,\ d = 3\ ,\ an = 49$ $an = a + (n-1)d$ $49 = -11 + (n-1) \times 3$ $n - 1 = 20$ $n = 21$ Fourth term from the end =18th term $a_{18} = a+(18-1)d = -11 + 17 \times 3 = -11+51 = 40$ [Alternate Method can also be adopted] OR Here, $a = -11$, $d = -7 - (-11) = 4$, $a_n = 49$ We have $a_n = a + (n-1)\,d$ So, $49 = -11 + (n-1) \times 4$ i.e., $60 = (n-1) \times 4$ i.e., $n = 16$ As n is an even number, there will be two middle terms which are $(16/2)^{th}$ and $(16/2)+1)^{th}$ term 8^{th} term and the 9^{th} term. $a_8 = a + 7d = -11 + 7 \times 4 = 17$	1 1 1

	$a_9 = a + 8d = -11 + 8 \times 4 = 21$ So, the values of the two middle most terms are 17 and 21, respectively.	1
2	Given quadratic equation. $kx(x - 2) + 6 = 0.$ i.e:; $kx^2 - 2kx + 6 = 0$ Since the equation has two equal roots , $b^2 - 4ac = 0$ $(-2k)^2 - 4 \times k \times 6 = 0$ $4k(k - 6) = 0$ $k=0$ or $k = 6$ k cannot be 0 , so $k = 6$	½ ½ 1
3	Join OQ and OR  $\angle ORP = \angle OQP = 90^0$ (The tangent to the circle is perpendicular to the radius of the circle at the point of contact.) $\angle OQS = 90^\circ - 50^\circ \Rightarrow \angle OQS = 40^\circ$ $\angle ORS = 90^\circ - 60^\circ \Rightarrow \angle ORS = 30^\circ$ OS=OQ=OR= radius.....(1) $\angle OSQ = \angle OQS$.....(2) $\angle OSR = \angle ORS$.....(3) [angles opposite to equal sides of an isosceles triangle are equal.]	½ ½ ½

	$\angle QSR = \angle OSQ + \angle OSR \Rightarrow \angle QSR = 40^\circ + 30^\circ \Rightarrow \angle QSR = 70^\circ$	½
4	We have $r + h = 37$ ……(1) and $2\pi r\,(r + h) = 1628$ ……(2) Thus $2\pi r \times 37 = 1628$ $2\pi r = \frac{1628}{37}$ & $r = 7$ cm Substituting $r = 7$ in (1) we have $h = 30$ cm.	½ ½ ½ ½
5	The mode = 36 . Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 Frequency | 8 | 10 | f | 16 | 12 | 6 | 7 Modal class = 30-40 l=30, $f_0 = f$, $f_1 = 16$, $f_2 = 12$, h = 10 mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$ $36 = 30 + \frac{16-f}{2\times16-f-12} \times 10$ $6 = \frac{16-f}{20-f}$ x10 f= 10	½ 1 ½
6	Let Salma's actual marks be x Therefore, 9 $(x + 10) = x^2$ i.e., $x^2 - 9x - 90 = 0$ i.e., $x^2 - 15x + 6x - 90 = 0$ i.e., $x(x - 15) + 6(x - 15) = 0$ i.e., $(x + 6)(x - 15) = 0$ Therefore, $x = -6$ o r $x = 15$ Since x is the marks obtained, $x \neq -6$. Therefore, $x = 15$.	1 1

So, Ajita got 15 marks in her mathematics test.

OR

$2x^2 + ax - a^2 = 0$

By quadratic formula ,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-a \pm \sqrt{a^2 + 4 \times 2 \times a^2}}{2 \times 2}$$

$$= \frac{-a \pm \sqrt{9a^2}}{4}$$

$$= \frac{-a \pm 3a}{4}$$

$$= \frac{-4a}{4}, \frac{2a}{4}$$

$$= -a, \frac{a}{2}$$

1

1

SECTION B

7 We prepare following table to find mean.

Class Interval	Frequency f_i	x_i	$d_i = x_i - a$	$f_i d_i$
50-75	5	62.5	- 125	- 625
75-100	6	87.5	-100	- 600
100- 125	3	112.5	-75	-225
125- 150	4	137.5	-50	-200
150 175	3	162.5	-25	-75
175 - 200	7	a=187.5	0	0

200 – 225	5	212.5	25	125	
225 – 250	4	237.5	50	200	
250 – 275	8	262.5	75	600	
275 - 300	5	287.5	100	500	
total	50			-300	2

Mean = a + $\frac{\Sigma f_i d_i}{\Sigma f_i}$ = 187.5 – (300/50) = 181.5 — 1

8 Correct construction — 3

9

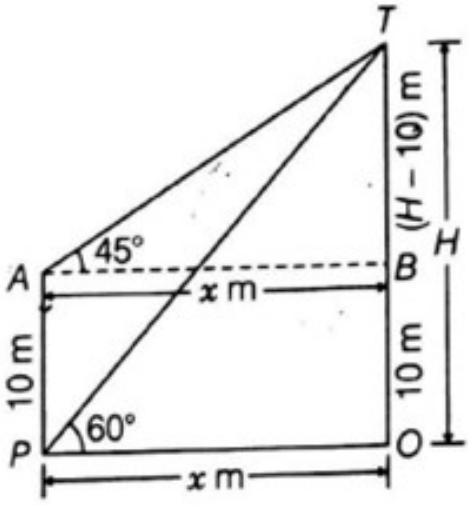
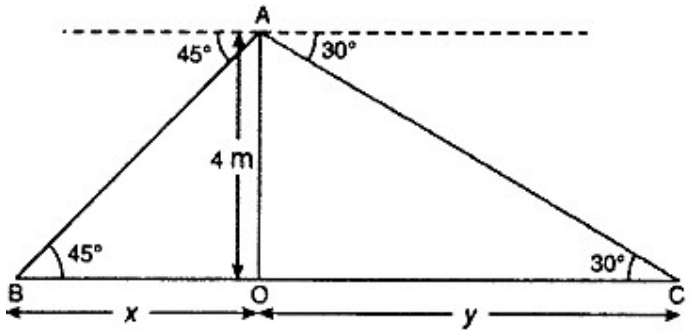
Weight (in gm)	No. of Apples	Cumulative Frequency(cf)
50 – 60	8	8
60 – 70	10	18
70 – 80	12	30
80 – 90	16	46
90 – 100	18	64
100 – 110	14	78
110 – 120	12	90
120 – 130	10	100

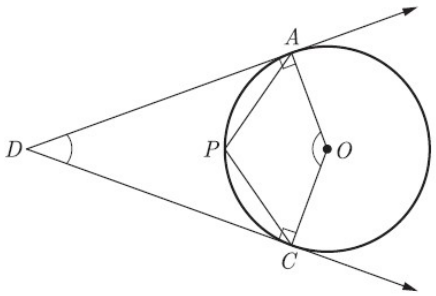
1

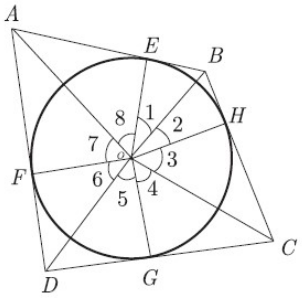
We have n = 100 , n/2 =50

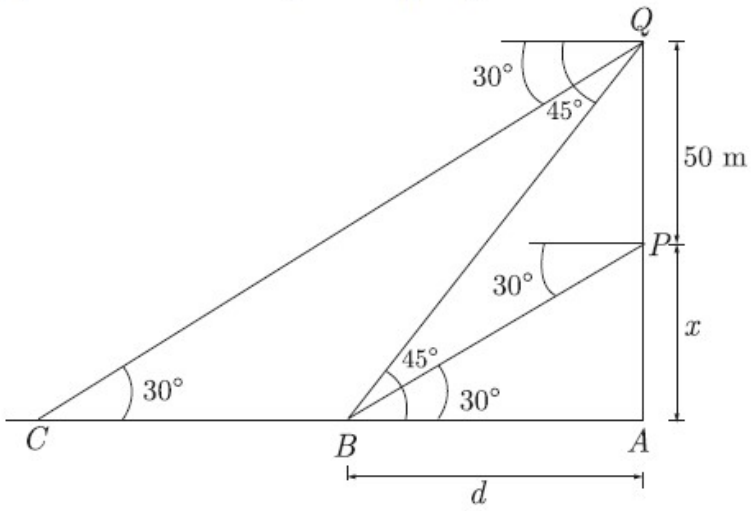
Median class = 90 – 100

l=90 , cf = 46 , f = 18 , h = 10 — ½

	Median $= l + \frac{(\frac{n}{2} - cf)}{f} \times h$ $= 90 + \frac{50-}{18} \times 10 = 90 + 40/18 = 92.2$ g Median weight of apples = 92.2 g	1 ½
10	Let OT be the tower.  (correct fig) In ΔPOT , $\tan 60^0 = \frac{H}{x} \Rightarrow \sqrt{3} = \frac{H}{x} \Rightarrow H = x\sqrt{3}$ ……(1) In ΔABT , $\tan 45^0 = \frac{H-1}{x} \Rightarrow 1 = \frac{H-1}{x} \Rightarrow x = H - 10 \Rightarrow$ x = $x\sqrt{3} - 10$ $\Rightarrow$ x = $\frac{10}{\sqrt{3}-1} \Rightarrow$ x = 5 ($\sqrt{3}$ + 1) m Height of tower = H = $5\sqrt{3}$ ($\sqrt{3}$ + 1) m **OR** Given : Height of bridge from river AO = 4 m  	1 ½ ½ 1 1

	BO = x, and CO = y From right angled ΔAOB, AO/BO = tan 45° ⇒ 4/x = 1 ⇒ x = 4 m ……(i) Again from right angled ΔAOC, AO/CO = tan 30° ⇒ 4/y = 1/√3 ⇒ y = 4√3 m ……(ii) From equation (i) and (ii) Width of river = x + y = 4√3 + 4 = 4(√3 + 1) = 4(1.732 + 1) = 4(2.732) = 10.92 m Hence, width of river is 10.92 m	½ ½ 1
	SECTION C	
11	Volume of sphere is equal to the volume of 504 cones. $\frac{4}{3}\pi r R^3 = 504 \times \frac{1}{3}\pi r^2 h$ $\Longrightarrow 4R^3 = 504 \times r^2 h$ $\Longrightarrow R^3 = 504 \times \left(\frac{3.5}{2}\right)^2 \times 3$ $\Longrightarrow R^3 = 504$ x $\frac{3.5}{2} \times \frac{3.5}{2} \times \frac{3.5}{2}$ x 3 = 9 x 3.5 x 3.5x 3.5 x 3 $R = 3\,x3.5 = 10.5\ cm$ Diameter of sphere = 21 cm Surface area = $4\pi r^2 = 4 \times \frac{22}{7} \times 10.5 \times 10.5 = 1386\ cm^2$.	½ 1 1 ½ 1
12	Join OA and OC  Figure with correct construction …… Since *DA* and *DC* are tangents from point *D* to the circle with centre *O*, and radius is always perpendicular to tangent, thus $\angle DAO = \angle DCO = 90^0$ and	 ½

	$\angle ADC + \angle DAO + \angle DCO + \angle AOC = 360^0$ $50^0 + 90^0 + 90^0 + \angle AOC = 360^0$ 230c $+\angle AOC = 360^0$ $\angle AOC = 360^0 - 230^0 = 130^0$ Now, Reflex $\angle AOC = 360^0 - 130^0 = 230^0$ $\angle APC$= ½ reflex $\angle AOC$ $= 115^0$	1 1 ½
	OR	
	 	1
	Correct figure …… A circle centre O is inscribed in a quadrilateral $ABCD$ as shown in figure.. Since OE and OF are radius of circle, $OE = OF$ Tangent drawn at any point of a circle is perpendicular to the radius through the point contact. Thus $\angle OEA = \angle OFA = 90^0$ Now in ΔAEO and ΔAFO, $OE = OF$ $\angle OEA = \angle OFA = 90^0$ $OA = OA$ (Common side) Thus $\Delta AEO \cong \Delta AFO$ (SAS congruency) $\angle 7 = \angle 8$ (CPCT) Similarly, $\angle 1 = \angle 2$ $\angle 3 = \angle 4$ $\angle 5 = \angle 6$ Since angle around a point is 360^0 $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360^0$	1 ½ 1 ½

	$2\angle 1 + 2\angle 8 + 2\angle 4 + 2\angle 5 = 360^0$ $\angle 1 + \angle 8 + \angle 4 + \angle 5 = 180^0$ $\angle AOB + \angle COD = 180^0$ Hence Proved.	1
13	**CASE STUDY 1** (i) Let a be the production in first year and d be the increase every year in production. We have $a_6 = 800$ and $a_9 = 1130$ $a + 5d = 800$ ...(1) $a + 8d = 1130$ ...(2) Solving (1) and (2), we get $d = 110$ $a = 800 - 5x110 = 250$ The company produced 250 road rollers in its first year Since, $a = 250$ and $d = 110$ $a_8 = a + (8 - 1)d$ $= 250 + 7x110 = 1020$ The company produced 250 road rollers in its 8th year. (ii) The total number of road rollers produced by the company till now = S_{10} $= \frac{10}{2}$ [2 x 250 + 9 x 110] = 7450	1 1 2
14	**CASE STUDY 2**  (i) In ΔAPB , $\tan 30^0$ = AP /AB	

	$\frac{1}{\sqrt{3}} = \frac{x}{d} \Rightarrow d = x\sqrt{3}$ or $d^2 = 3x^2$ ……(1)	1
	In ΔAQB , $\tan 45^0$ = AQ /AB $\Rightarrow$ AB = AQ $\Rightarrow d = y$……(2)	1
	(ii) In ΔAQC , $\tan 30^0$ = AQ /AC $\frac{1}{\sqrt{3}} = \frac{x+50}{d+BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x+50}{x\sqrt{3}+BC} \Rightarrow BC = 50\sqrt{3}\, m$ Distance between the car and lorry is $50\sqrt{3}\, m$	2

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SAMPLE QUESTION PAPER - 2
MATHEMATICS – STANDARD (041)
CLASS X SESSION 2021-22
TERM – II

Time Allowed : 2 Hrs **Maximum Marks: 40**

General Instructions:

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

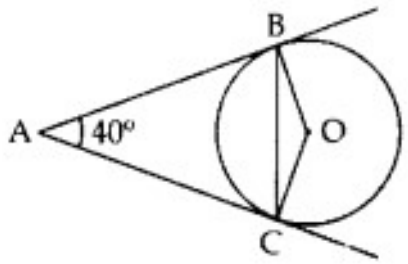
SECTION – A

1. Find the value of k if the discriminant of the equation $kx^2 - 3\sqrt{2}x + 4\sqrt{2} = 0$ is 10.
2. Find the 12^{th} term from the end of the A.P $-2, -4, -6, \ldots\ldots, -100$.

OR

Find the sum of first seven numbers which are multiples of 2 as well as 9.

3. In the given figure, AB and AC are tangents to the circle with centre o such that $\angle BAC = 40°$. Then calculate $\angle BOC$ and $\angle OBC$



4. If the volumes of two spheres are in the ratio 64 : 27, find the ratio of their surface areas.
5. If the mean of the following data is 18.75. find the value of p.

x_i	10	15	20	25	30
f_i	5	*10*	p	8	2

6. Solve the following quadratic equation for x: $x^2 - 2ax - (4b^2 - a^2) = 0$

OR

Three consecutive natural numbers are such that the square of the middle number exceeds the difference of the squares of the other two by 60. Find the numbers.

SECTION – B

7. Draw a circle of radius 4 cm. From a point 6cm from its centre, construct a pair of tangents to the circle and measure their lengths.
8. Given below is the distribution of weekly pocket money received by students of a class.

   Calculate the pocket money that is received by most of the students.

Pocket Money (in ₹)	0 - 10	20 - 40	40 - 60	60 - 80	80 – 100	100 – 120	120 – 140
No. of students	2	2	3	12	18	5	2

9. A survey regarding the heights (in cm) of 51 boys of class X of a school was conducted and the following data was obtained.

Height (in cm)	**Number of boys**
Less than 140	4
Less than 145	11
Less than 150	29
Less than 155	40
Less than 160	46
Less than 165	51

10. 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$3000\sqrt{3}$ m, find the speed of the aeroplane.

OR

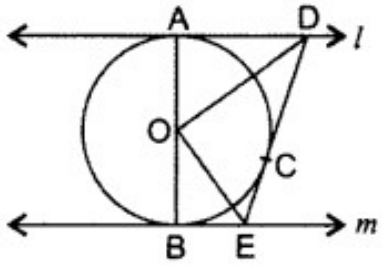
From the top of a hill, the angle of depression of two consecutive kilometer stones due East are found to be 30^0 and 45^0. Find the height of the hill. (Use $\sqrt{3} = 1.73$)

SECTION – C

11. In the figure, l and m are two parallel tangents to a circle with centre O, touching the circle

at A and B respectively. Another tangent at C intersects the line I at D and m at E.

Prove that ∠DOE = 90°.



OR

Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

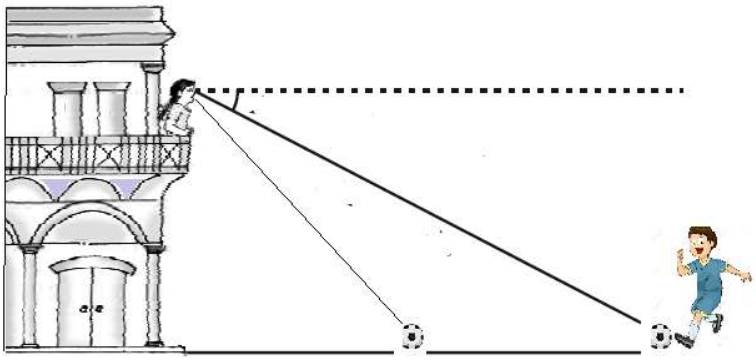
12. A model of a rocket is in the form of a right circular cylinder closed at the lower end and surmounted

by a cone with the same radius as that of the cylinder. The diameter and height of the cylinder are

6 cm and 12 cm respectively. If the slant height of the conical portion is 5 cm, then find the total surface area of the rocket.

13. Case Study – 1

One fine evening, Surabhi was standing on the balcony of her house watching her brother Sonu play ball. She observes the ball at an angle of depression 30°. The ball is now approaching the foot of the buiding in a straight line with a uniform speed. Six second's later, the angle of depression of the ball is found to be 60°. Now the ball is at a point 25m away from the foot of the building..



Based on the above information, answer the following questions:

(a) Find the distance between the two positions of the ball.

(b) Find the speed of the ball and total time taken to reach the foot of the building.

14. Case Study – 2

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 lines (see below figure). 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..

Keeping the above situation in mind, answer the following questions:

(a) What is the distance run to pick up the 6^{th} potato?

(b) What is the total distance run by the competitor?

ANSWERS:

1. $\frac{1}{2\sqrt{2}}$
2. – 78 OR 504.
3. 140^{O} and 20^{O}
4. 16 : 9
5. p = 7
6. x = a – 2b , a + 2b. OR 9 ,10 ,11.
7. 4.48 cm
8. Rs. 86.32 (approx.)

9. 149.03 m

10. 1.365 km OR 720 km.

11. .

12. 301.44 cm2

13. (a) 50m (b) $\frac{25}{3} m$/s , 7.8 seconds.

14. 40m, 370m.