Competency Focused Practice Questions

Mathematics (Volume 4) | Grade 10

Co-created by

CBSE Centre for Excellence in Assessment

and

Educational Initiatives

Preface

Assessments are an important tool that help gauge learning. They provide valuable feedback about the effectiveness of instructional methods; about what students have actually understood and also provide actionable insights. The National Education Policy, 2020 has outlined the importance of competency-based assessments in classrooms as a means to reform curriculum and pedagogical methodologies. The policy emphasizes on the development of higher order skills such as analysis, critical thinking and problem solving through classroom instructions and aligned assessments.

Central Board of Secondary Education (CBSE) has been collaborating with Educational Initiatives (Ei) in the area of assessment. Through resources like the Essential Concepts document and A- Question-A-Day (AQAD), high quality questions and concepts critical to learning have been shared with schools and teachers.

Continuing with the vision to ensure that every student is learning with understanding, Question Booklets have been created for subjects for Grade 10th and 12th. These booklets contain competency-based items, designed specifically to test conceptual understanding and application of concepts.

Process of creating competency-based items

All items in these booklets are aligned to the NCERT curriculum and have been created keeping in mind the learning outcomes that are important for students to understand and master. Items are a mix of Free Response Questions (FRQs) and Multiple-Choice Questions (MCQs). In case of MCQs, the options (correct answer and distractors) are specifically created to test for understanding and capturing specific errors/misconceptions that students may harbour. Each incorrect option can thereby inform teachers on specific gaps that may exist in student learning. In case of subjective questions, each question also has a detailed scoring rubric to guide evaluation of students' responses.

Each item has been reviewed by experts, to check for appropriateness of the item, validity of the item, conceptual correctness, language accuracy and other nuances.

How can these item booklets be used?

There are 121 questions in this booklet.

The purpose of these item booklets is to provide samples of high-quality competency-based items to teachers. The items can be used to–

- get an understanding of what good competency-based questions could look like
- give exposure to students to competency-based items
- assist in classroom teaching and learning
- get inspiration to create more such competency-based items

Students can also use this document to understand different kinds of questions and practice specific concepts and competencies. There will be further additions in the future to provide competency focused questions on all chapters.

The item booklets are aligned with the 2022-23 curriculum. However, a few questions from topic which got rationalized in 2023-24 syllabus are also there in the booklet which may be used as a reference for teachers and students.

Please write back to us to give your feedback.

Team CBSE

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Chapter - 1
Real Numbers

Free Response Questions

Q: 1 **Nidaa performed the division of $\frac{53}{83}$ on a calculator whose result is shown below. Even though the quotient has more digits, the calculator didn't display it all due to the limited display area.** **[1]**

Is the output of the division rational or irrational? Explain your answer.

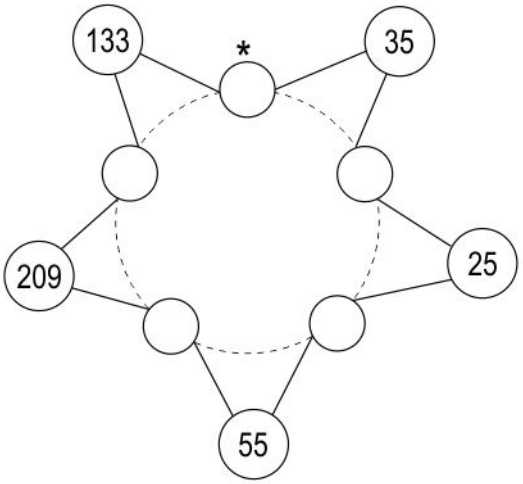
Q: 2 **2^n is not divisible by 6 where n is a positive integer.** **[1]**

Is the above statement true or false? If true, give a valid reason and if false, give an example.

Q: 3 **The prime factorisation of a natural number k is $(3 \times 5 \times p)$ where $p \neq 2$.** **[1]**

What is the prime factorisation of $10k^2$?

Q: 4 **In the figure below, the inner circles are filled with the prime factors of the numbers given in the outer circles. Each number from 1-26 corresponds to the letter in its position in the alphabet, A-Z. For instance, 1 is A, 2 is B, and so on.** **[3]**



Starting clockwise from *, find the word formed by the numbers in the inner circle. Show your work.

Q: 5 **For a positive integer n, m is a prime factor of n.** **[3]**

Show that m is not a factor of (n + 1).

Q: 6 **A rectangular arrangement of pens has rows and columns. Rohan takes away 3 rows of pens and then Sarah takes away 2 columns of pens from the remaining pens. The remaining pens are rearranged in p rows and q columns where p is a prime number.** **[3]**

If Rohan takes 24 pens and Sarah takes 18 pens, find all possible value(s) of p. Show your work.

Case Study

Answer the following questions based on the information given.

Sakshara International School organised a combined exhibition for grade 10 students of its three branches. 345 students from Mumbai branch, 405 students from Pune branch and 270 students from Nagpur branch participated in it. The following were planned for the exhibition:

1. Group projects: The students of each of the three branches were divided in groups for making various group projects such that each group had equal number of students and the number of groups was minimum.

2. Individual project: Each of total 1020 students had to submit an individual project. A fixed number of topics were allotted such that each topic had equal number of students.

3. Inter-state model making competition: A few equal number of students were selected from each branch to participate in the competition. Each branch was supposed to submit between 3 to 7 models.

Q: 7 **Use Euclid's Division Algorithm to find the number of different groups for the group projects. Show your work.** **[2]**

Q: 8 **A maths teacher asked his students to solve the below puzzle regarding the individual project.** **[2]**

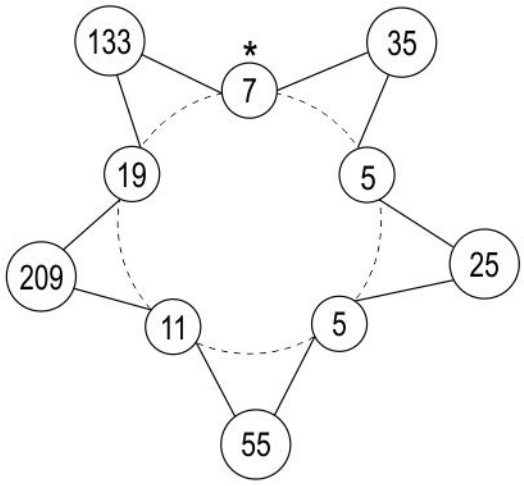
The number of students who got the same topic can be represented as $(2^n \times 5)$ where *n* is a positive integer having the maximum possible value.

Find *n* and the number of topics allotted. Show your work.

Q: 9 **Mumbai branch divided the students selected for inter-state model making competition into the groups of 12 students, Pune into the groups of 10 students and Nagpur into the groups of 15 students.** **[2]**

i) How many students were selected from each branch?
ii) How many models were submitted by individual branches and all the branches together?

Show your work.

Q.No	What to look for	Marks
1	**Writes that output is a rational number.**	**0.5**
	Explains the answer. For example, since the output $\frac{53}{83}$ can be represented in the form $\frac{p}{q}$, where $q \neq 0$, it is a rational number.	**0.5**
2	**Writes that the given statement is true and gives a reason. For example, writes that $2^n = 2 \times 2 \times 2 \times 2 \times \ldots$ n times and hence its only prime factor is 2 whereas prime factors of 6 are 2 and 3.**	**1**
3	**Writes the prime factorisation of $10k^2$ as $(2 \times 3^2 \times 5^3 \times p^2)$.**	**1**
4	**Redraws the factor tree diagram with the prime factors. The tree may look as follows:** 	**2**
	Uses the number to letter mapping and finds the word as GEEKS.	**1**
5	**Uses Euclid's division lemma and writes the equation for some positive integer p as:** $n = mp$ $\Rightarrow p = \frac{n}{m}$	**0.5**

Q.No	What to look for	Marks
	Assumes that *m* is a factor of (*n* + 1), uses Euclid's division lemma and writes the equation for some positive integer *q* as: $n + 1 = mq$	**0.5**
	Rearranges the above equation as: $q = \frac{n}{m} + \frac{1}{m}$	**0.5**
	Writes that *q* is a positive integer, $\frac{n}{m}$ is a positive integer but $\frac{1}{m}$ is not an integer and hence the above equation cannot be true.	**1**
	Hence, uses contradiction to conclude that *m* is not a factor of (*n* + 1).	**0.5**
6	**Writes that in the original rectangular arrangement, there are 8 pens in each row and 12 pens in each column.**	**1**
	Finds the remaining number of pens as 9 rows and 6 columns or 54 pens.	**0.5**
	Writes the prime factorisation of 54 as 2×3^3.	**1**
	Writes all the possible values of *p* as 2 or 3.	**0.5**
7	**Finds HCF of 345, 405 and 270 using Euclid's Division Algorithm as follows:** $405 = 345 \times 1 + 60$ $345 = 60 \times 5 + 45$ $60 = 45 \times 1 + 15$ $45 = 15 \times 3 + 0$ **Finds HCF of 405 and 345 as 15.**	**1**
	Finds HCF of 270 and 15 as follows: $270 = 15 \times 18 + 0$ **Concludes that HCF of 345, 405 and 240 is 15, hence there were 15 students in each group.**	**0.5**

Q.No	What to look for	Marks
	Finds the number of different groups for the group projects as: $\frac{345}{15} + \frac{405}{15} + \frac{270}{15} = 23 + 27 + 18 = 68$	**0.5**
8	**Factorises 1020 as: $2^2 \times 3 \times 5 \times 17$.** **From the above factorisation concludes that $2^n \times 5 = 2^2 \times 5$ and hence finds the maximum possible value of *n* as 2.**	**1**
	Finds the number of topics allotted as the remaining factors of 1020 as: **$3 \times 17 = 51$**	**1**
9	**i) Finds LCM of 12, 10 and 15 using prime factorisation as:** **$12 = 2 \times 2 \times 3$** **$10 = 2 \times 5$** **$15 = 3 \times 5$** **LCM $= 2^2 \times 3 \times 5 = 60$** **Concludes that 60 students were selected from each branch for the inter-state model making competition.**	**1**
	ii) Finds the number of models submitted by each branch as: **Mumbai $= \frac{60}{12} = 5$** **Pune $= \frac{60}{10} = 6$** **Nagpur $= \frac{60}{15} = 4$** **Finds the total number of models submitted as 15.**	**1**

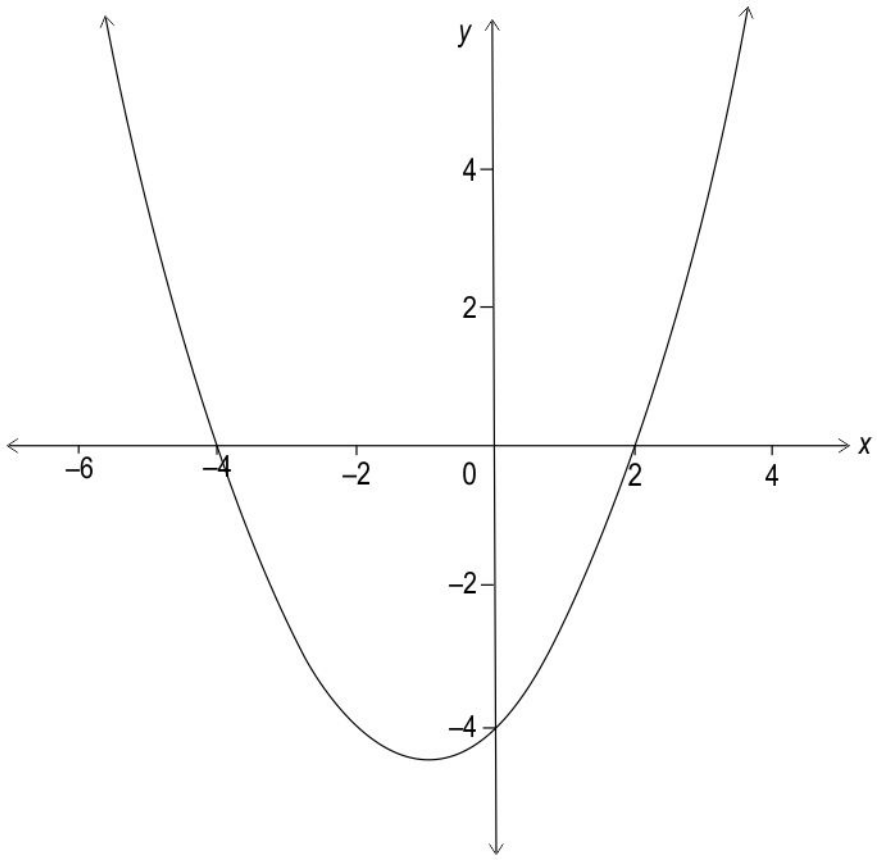
Chapter - 2
Polynomials

Multiple Choice Questions

Q: 1 **At which point will the graph of the polynomial $p(x) = (-x + 6x^2 - 1)$ intersects the negative x -axis?**

1 only $\frac{-1}{3}$
2 only $\frac{-1}{2}$
3 both $\frac{-1}{3}$ and $\frac{-1}{2}$
4 (none, it never intersects negative x -axis)

Q: 2 **Shown below is the graph of a quadratic polynomial.**



Which of these is the polynomial graphed above?

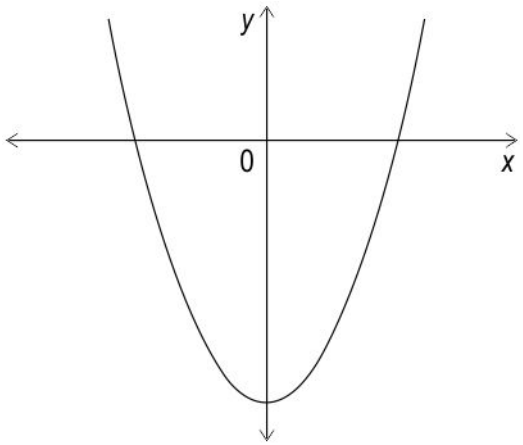
1 $(x - 2)(x + 4)$
2 $(x - 4)(x + 2)$
3 $\frac{1}{2}(x - 2)(x + 4)$
4 $\frac{1}{2}(x - 4)(x + 2)$

Free Response Questions

Q: 3 **State whether the following statement is true of false. Justify your answer.** **[1]**

If the graph of a polynomial has EXACTLY 2 zeroes, then the polynomial must be quadratic.

Q: 4 **A quadratic polynomial $f(x)$ has two real zeroes that are equal. Adah drew the graph of $f(x)$ as shown below.** **[1]**



Is Adah's graph correct? Explain your answer.

Q: 5 **Aasira multiplied a variable with 4, subtracted 12 and added the square of the original variable. She expressed the final expression as a product of 2 factors.** **[3]**

Her friend, Rishi, said that the factors will always have a difference of 8.

Is Rishi right? Show your work.

Q: 6 **$g(x) = px^2 + qx + 152$ is a polynomial where p and q are real numbers. The zeroes of $g(x)$ are distinct prime numbers. Find the:** **[5]**

i) zeroes of $g(x)$.

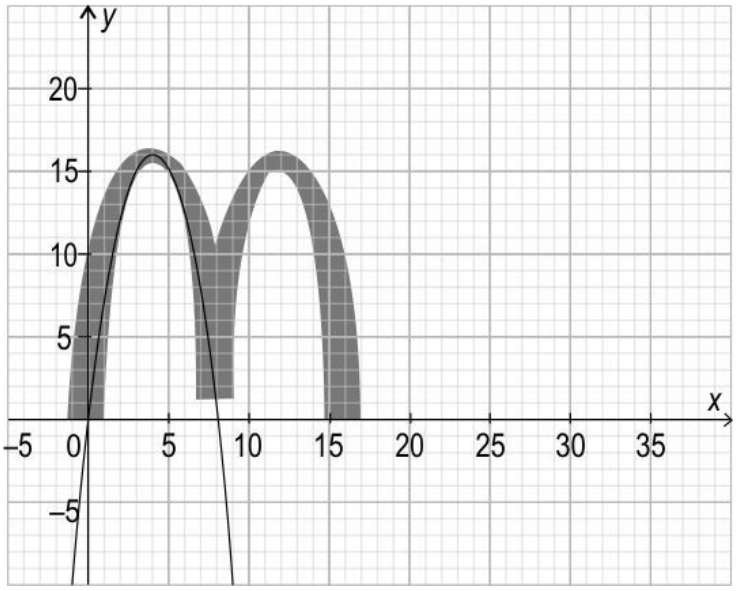
ii) values of p and q.

Show your work and give valid reasons.

Case-Based Questions

Answer the questions based on the given information.

Shown below is a logo that is made up of two intersecting golden arches, which are parabolic in shape. One such parabola, coinciding with the first arch in the logo, is shown in the graph below.



Q: 7 **Write an equation to represent the parabola shown in the graph.** **[2]**

Show your work and give valid reasons.

Q: 8 **State whether the following statements are true or false.** **[3]**

i) If the zeroes of the parabola, $ax^2 + bx + c = 0$, coinciding with the second arch in the logo are given by σ and 2σ, then *c* will be negative.

ii) If the logo is shifted so that it is symmetrical about the *y* -axis, then the constant term in the equation of the parabola made by the first arch will be positive.

Justify your answers.

Q.No	Correct Answers
1	1
2	4

Q.No	What to look for	Marks
3	Writes that the statement is false.	0.5
	Gives reason that while a quadratic polynomial must have a maximum of 2 zeroes, a graph with exactly 2 zeroes need not be that of a quadratic polynomial. For example: The graph of a cubic polynomial of the form $(x - a)(x - b)^2$ will have only two zeroes, a and b.	0.5
4	Writes that the graph Adah has drawn is incorrect.	0.5
	Gives a valid reason. For example, since $f (x)$ has real and equal zeroes, the graph of $f (x)$ intersects the x -axis at a unique point.	0.5
5	Assumes the original variable as x and frames the expression as $4 x - 12 + x^2$.	1
	Factorises the above expression as $(x - 2)(x + 6)$.	1
	Concludes that Rishi was right as the above factors have a difference of 8.	1
6	i) Writes the equation for the product of zeroes as: product of zeroes = $\frac{152}{p}$	1
	Writes the prime factorisation of 152 as $2^3 \times 19$.	0.5
	Writes that since the zeroes are distinct prime numbers, finds the zeroes of $g (x)$ as 2 and 19.	1
	Finds the value of p as $\frac{152}{38} = 4$.	0.5
	ii) Writes the equation for the sum of zeroes as: $2 + 19 = \frac{-q}{4}$	1
	Solves the above equation to find the value of q as (-84).	1

Q.No	What to look for	Marks
7	Identifies zeroes of the quadratic equation as 0 and 8. Identifies that the coefficient of x^2 must be negative, since the given parabola is facing downward.	1
	Takes $\alpha + \beta = \frac{-b}{a} = 8$ and $\alpha\beta = \frac{c}{a} = 0$, where α and β are the zeroes of the parabola, and a, b and c represent the coefficient of x^2, the coefficient of x and the constant respectively.	0.5
	Finds one equation representing the parabola, by picking a value for a and, accordingly choosing values for b and c. For example, when $a = (-1)$, the required equation is $-x^2 + 8x = 0$.	0.5
8	i) Writes that the statement is true.	0.5
	Justifies with a reason. For example, $\frac{c}{a} = 2\sigma^2$, which cannot be negative. a is negative as the parabola is facing downward. Since a is negative, c must also be negative.	1
	ii) Writes that the statement is false.	0.5
	Justifies with a reason. For example, When the parabola is shifted, the new zeroes of the first arch will be (-8) and 0. As 0 is a zero of the arch, $c = 0$. This is because $\alpha\beta = \frac{c}{a} = 0$, where α, β are zeroes of the polynomial.	1

Chapter - 3
Pair of Linear Equations in Two Variables

Free Response Questions

Q: 1 **Anjali solved the following equations for the value of x.** **[1]**

(i) $5x - 2y = 4$
(ii) $3x - y = 8$

Her solution is given below.

Step 1: Multiplied equation (ii) by 2 on both sides.

$6x - 2y = 16$.....(iii)

Step 2: Solved equations (i) and (iii) to get $x = (-20)$.

$$\begin{array}{r} 5x - 2y = 4 \\ -6x + 2y = 16 \\ \hline -x \quad\quad = 20 \end{array}$$

Anjali made a mistake while solving this. What was her mistake? Also, find the correct value of x.

Q: 2 **State true or false for the below statement and justify your answer** **[1]**

A pair of linear equations represented by intersecting lines can have two solutions.

Q: 3 **A pair of linear equations is shown below.** **[1]**

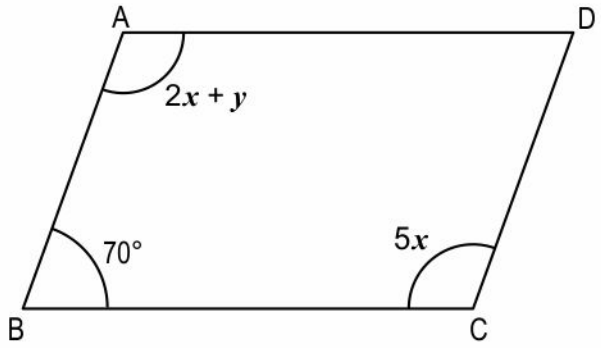
$(k - 1)x + y = k + 1$
$(k^2 - 1)x + (k + 1)y = 1 - k^2$

If $k > 1$, then how many solutions does this pair of equations have?

Q: 4 **The equations of the lines l_1, l_2, and l_3 are given by $5x + 3y = 2p$, $35x + 21y = pq$, and $100x + 4qy = 240$, respectively, where p and q are real numbers.** **[2]**

(i) For what values of p and q does the line l_3 coincide with l_1? Show your steps.
(ii) For the values of p and q found in question (i), are the lines l_1 and l_2 parallel? Justify your answer.

Q: 5 **Shown below is a parallelogram with ∠ABC = 70°.** **[2]**



(Note: The figure is not to scale.)

Find the values of *x* and *y*. Show your steps.

Q: 6 **Anisha lives 15 km away from her school. She walks to the bus stop and takes a bus to school everyday.** **[5]**

If she goes to the nearest bus stop, she needs to walk for 3 km and cover the rest by bus. This takes her 1.5 hours. If she walks to a bus stop further away, she needs to walk for 5 km and cover the rest by bus. This takes her 2 hours.

Frame equations and solve them to find the average speed Anisha walks at, as well as the average speed of the bus. Show your steps.

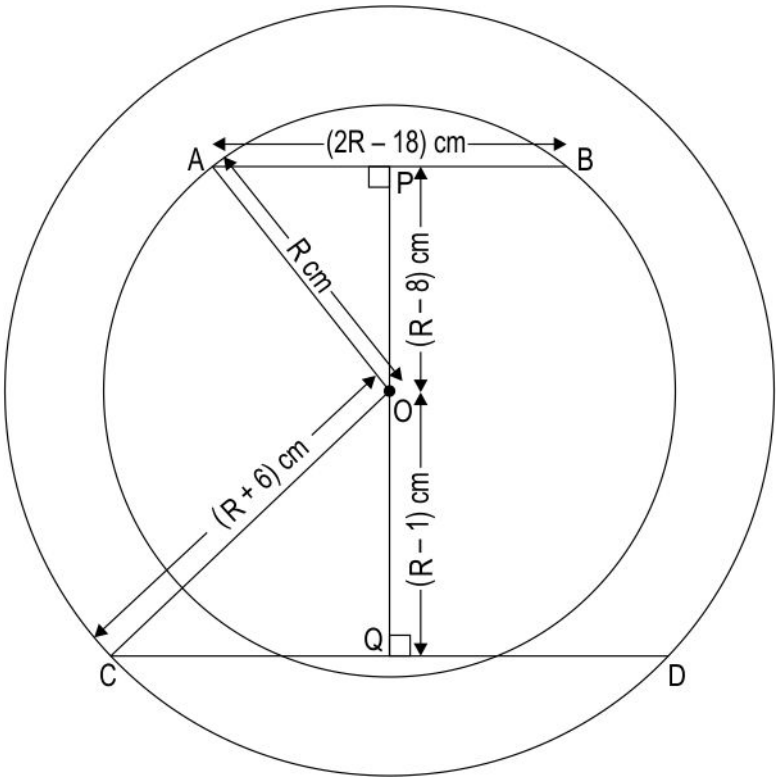
Q.No	What to look for	Marks
1	**Identifies that Anjali made a mistake in step 2 and 16 on the right hand side should be (-16).**	**0.5**
	Solves correctly to find (- *x*) = (- 12) or *x* = 12 as follows: $5x - 2y = 4$ $-6x + 2y = -16$ $-x = -12$	**0.5**
2	**States that the statement is false.**	**0.5**
	Gives the reason that a pair of linear equations represented by intersecting lines have only one point of intersection on the lines, which is a unique solution.	**0.5**
3	**Finds the ratio of the coefficients and concludes that there is no solution.** **For example, finds the ratio of coefficients as $\frac{1}{k+1} = \frac{1}{k+1} \neq \frac{1}{1-k}$, for *k* > 1.**	**1**
4	**i) Uses the condition for coincident lines for l_1 and l_3 as shown below:** $\frac{a_1}{a_3} = \frac{b_1}{b_3} = \frac{c_1}{c_3}$ **Finds *p* = 6 and *q* = 15.**	**1**
	ii) Checks if $l_1 \parallel l_2$ using the following relation: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ **Finds that $\frac{5}{35} = \frac{3}{21} \neq \frac{12}{90}$.** **Hence concludes that $l_1 \parallel l_2$.**	**1**

Q.No	What to look for	Marks
5	**Uses the properties of parallelograms to make the following equations:** **(i) 2 *x* + *y* = 5 *x*** **(ii) 5 *x* + 70° = 180°**	**1**
	Solves equation (ii) to get *x* = 22°.	**0.5**
	Substitutes *x* = 22° in equation (i) to get *y* = 66°.	**0.5**
6	**Takes average speed while walking and average speed of bus as *x* km/h and *y km/h* respectively.**	**0.5**
	Uses speed = $\frac{\text{distance}}{\text{time}}$ to frame equations $\frac{3}{x} + \frac{12}{y} = \frac{3}{2}$ and $\frac{5}{x} + \frac{10}{y} = 2$ respectively.	**1**
	Substitutes $\frac{1}{x} = m$ and $\frac{1}{y} = n$, where *m* and *n* are also variables.	**0.5**
	Solves equations *3m* + *12n* = 1.5 and *5m* + *10n* = 2 to find the values of *m* and *n* as $\frac{3}{10}$ and $\frac{1}{20}$ respectively.	**2**
	Finds the average speed of Anisha as *x* = $\frac{10}{3}$ km/h and average speed of bus as *y* = 20 km/h.	**1**

Chapter - 4
Quadratic Equations

Free Response Questions

Q: 1 **In the figure below, two concentric circles have centre O. Their radii are R and (R + 6) cm respectively.** **[5]**



(Note: The figure is not to scale.)

Find the lengths of the chords AB and CD. Show your work.

Q: 2 **Vitthal went on a long cycling round trip from his home to a nearby hill and back. The journey to the hill started with a 40 km flat road and then a 25 km uphill slope.** **[5]**

While going uphill, his average speed reduced by 10 km/hr compared to the flat road leading to an extra half-hour of travel time. However, he maintained the same average speed on the flat road in both directions.

i) Find the time taken by Vitthal to reach the end of 65 km stretch in the uphill direction.

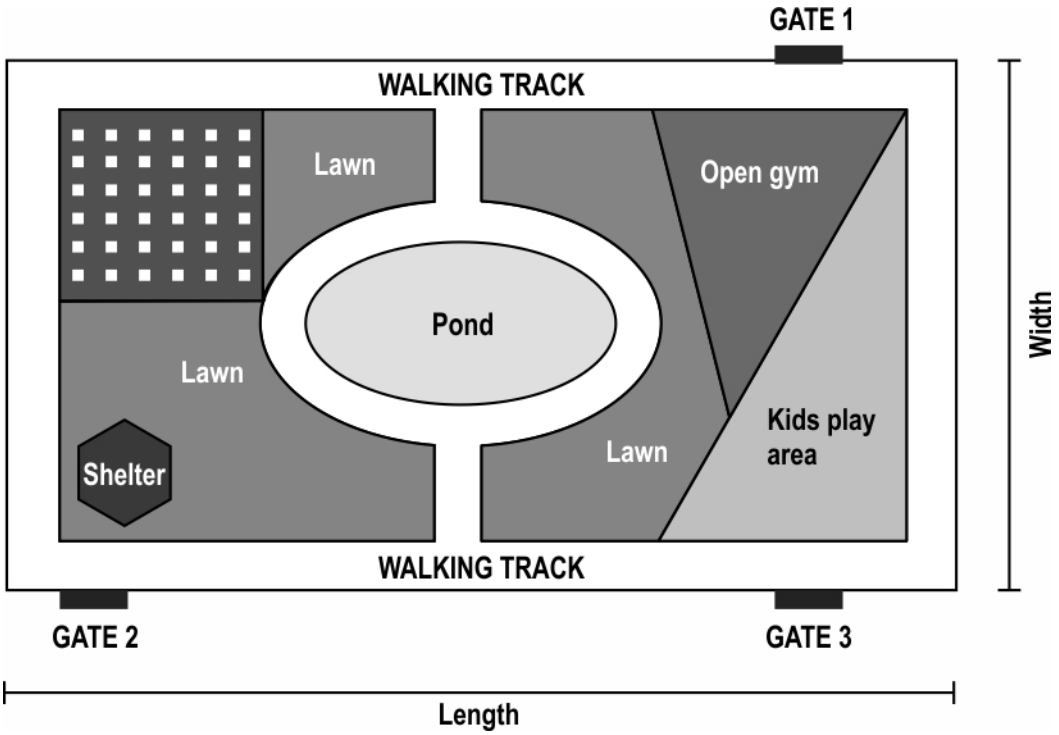
ii) If he took $2\frac{1}{2}$ hrs to reach home from the hill, find his average speed on the slope while descending.

Show your work.

Case Study

Study the given information and answer the questions that follow.

Bangalore city corporation is building parks in residential areas across the city. Shown below is one such park. The rectangular park consists of various components like walking track, kids play area, open gym, pond etc.



(Note: The image is not to scale.)

Q: 3 **Gate 3 has been placed exactly opposite to gate 1 on the boundary of the park. The distance between gate 3 and gate 2 is 1 m more than the distance between gate 3 and gate 2.** **[2]**

The shortest distance between gates 1 and 2 is 29 m, find the width of the park. Show your work.

Q: 4 **The caretaker of the park is attempting to plant saplings in the form of a square. That is, number of rows of saplings is the same as the number of columns of saplings. On arranging the saplings, he found that 24 saplings were still left with him. When he increased the number of rows and columns by 1, he found that he was short of 25 saplings.** **[2]**

Find the number of saplings available with him. Show your work.

Q: 5 **The city corporation is planning to install a rectangular sand table as shown below, for the kids in the play area. The carpenter is asked to design a rectangular table whose length is thrice its width and the area is 108 sq m.** **[1]**

(Note: The image is not to scale.)

Determine whether such a table can be made. Show your steps.

Q.No	What to look for	Marks
1	**Writes that a perpendicular from the centre to a chord bisects the chord, hence:** **AP = $\frac{1}{2}$ × AB = (R - 9) cm**	**0.5**
	Uses the pythagoras theorem in ΔAOP and writes the equation: **$(R)^2 = (R - 8)^2 + (R - 9)^2$**	**0.5**
	Solves the above equation to find the value of R as 5 cm and 29 cm.	**1.5**
	Replaces the values obtained of R in (2R - 18) cm and discards the value 5 cm because it gives negative value of AB. **Finds AB = 40 cm considering R = 29 cm.**	**1**
	Finds OQ = (29 - 1) = 28 cm and OC = (29 + 6) = 35 cm.	**0.5**
	Uses the pythagoras theorem in ΔCOQ and writes the equation for CQ as: **CQ = $\sqrt{[(35)^2 - (28)^2]}$ = 21 cm** **Finds the value of CD as 21 × 2 = 42 cm using the same logic as step 1.**	**1**
2	**i) Assumes Vitthal's average speed on the 40 km flat road to be *s* km/hr and the time taken by him to cover it as *t* hrs.** **Thus, finds the speed on the 25 km slope uphill as (*s* - 10) km/hr and the time taken to cover it as ($t + \frac{1}{2}$) hrs.** **Frames the equations:** **$s = \frac{40}{t}$ and** **(s - 10) = 25 ÷ ($t + \frac{1}{2}$)**	**1**
	Substitutes the value of *s* from the first equation into the second equation as: **$\frac{40}{t}$ - 10 = 25 ÷ ($t + \frac{1}{2}$)** **Simplifies the above equation to frame quadratic equation in *t* as:** **$t^2 - t - 2 = 0$**	**1.5**

Q.No	What to look for	Marks
	Factorises and solves the above equation to find the value of *t* as (-1) and 2. **Rejects (-1) and thus finds *t* as 2 hrs and ($t + \frac{1}{2}$) as $2\frac{1}{2}$ hrs.**	**1**
	Finds the time taken by Vitthal to reach the end of 65 km stretch in the uphill direction as: $2 + 2\frac{1}{2} = 4\frac{1}{2}$ **hrs.**	**0.5**
	ii) Writes that, Vitthal took 2 hrs to cover cover the flat road and hence finds the time taken to descend the 25 km slope as: $2\frac{1}{2} - 2 = \frac{1}{2}$ **hrs**	**0.5**
	Finds the speed on the slope while descending as: $25 \div \frac{1}{2} = 50$ **km/hr**	**0.5**
3	**Takes the distance between gates 1 and 3 as '*x*' m. Writes that the distance between gates 2 and 3 is (*x* + 1) m.** **Applies Pythagoras theorem to the triangle formed by gates 1, 2 and 3 and frames a quadratic equation as:** $x^2 + (x + 1)^2 = 29^2$ **or** $x^2 + x - 420 = 0$	**1**
	Solves the above quadratic equation and finds the value of *x* as 20m. **Concludes that the width of the park is 20m.**	**1**
4	**Takes the former number of rows and columns of saplings as *x* and finds the number of saplings available as** $x^2 + 24$.	**0.5**
	Takes the latter number of rows and columns of saplings as (*x* + 1) and finds the number of saplings available as $(x + 1)^2 - 25$.	**0.5**
	Equates the above two quadratic expressions and solves for *x* as: $x^2 + 24 = x^2 + 1 + 2x - 25$ $\Rightarrow x = 24$	**0.5**

Q.No	What to look for	Marks
	Finds the number of saplings available with the caretaker as $24^2 + 24 = 600$.	**0.5**
5	**Assumes the width as x, length as $3x$ and uses the given area to write the quadratic equation as:** **$3x^2 = 108$ or $x^2 - 36 = 0$**	**0.5**
	Finds the discriminant as $0^2 - (4)(1)(-36) = 144 > 0$ and concludes that it is possible to make such a table. **(Award full marks if the equation is solved to obtain $x = 6$ m instead of using the concept of discriminant.)**	**0.5**

Chapter - 5
Arithmetic Progressions

Multiple Choice Questions

Q: 1 **If a_n is the n^{th} term of an arithmetic progression whose common difference is d, then which of the following statements is valid?**

1. $a_{24} = a_1 + 24\,d$
2. $a_{25} = a_2 + 24\,d$
3. $a_{26} = a_2 + 24\,d$
4. None of these

Q: 2 **Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).**

Assertion (A) **: The difference between any two consecutive terms in the sequence of numbers √6, √24, √54, √96, ... is 3√6.**

Reason (R) **: The sequence of numbers √6, √24, √54, √96, ... form an arithmetic progression.**

1. Both (A) and (R) are true and (R) is the correct explanation for (A).
2. Both (A) and (R) are true but (R) is not the correct explanation for (A).
3. (A) is false but (R) is true.
4. Both (A) and (R) are false.

Free Response Questions

Q: 3 **Determine whether the following sequence is an arithmetic progression or not.** **[1]**

(-12 + 12 *a*), (-11 + 11 *a*), (-10 + 10 *a*),... where *a* is any rational number.

Show your work.

Q: 4 **Amit makes the following statement:** **[1]**

"The sequence of positive integers divisible by 2 but not by 6 form an arithmetic progression."

Check if Amit's statement is true. Give reason for your answer.

Q: 5 **The 3 rd and the 14 th terms of an arithmetic progression are (-9) and (35) respectively.** **[5]**
Which term of this arithmetic progression is five times the 6 th term? Show your work.

Q.No	Correct Answers
1	3
2	3

Q.No	What to look for	Marks
3	Identifies the two sets of consecutive terms and finds the difference between the terms in each set by subtracting a term from its next term. For example, Second term - First term $=(-11 + 11a) - (-12 + 12a)$ $= -11 + 11a + 12 - 12a$ $= (1 - a)$ Third term - Second term $= (-10 + 10a) - (-11 + 11a)$ $= -10 + 10a + 11 - 11a$ $= (1 - a)$	0.5
	Compares the difference and concludes that the given sequence is an arithmetic progression.	0.5
4	Lists the sequence of positive integers divisible by 2 but not by 6 as 2, 4, 8, 10, ...	0.5
	Identifies that the difference between the 2 nd and the 3 rd terms is not equal to the previous difference. $(4 - 2) = 2 \neq (8 - 4) = 4$ Concludes that Amit's statement is false.	0.5
5	Writes the 3 rd and the 14 th terms of the AP as: $a + 2d = -9$ $a + 13d = 35$ where a is the first term and d is the common difference of the AP.	1
	Solves the above pair of linear equations to obtain the values of a and d as (-17) and 4 respectively.	1.5
	Formulates the equation to find the n th term which is five times the 6 th term as: $a + (n - 1)d = 5(a + 5d)$	1

Q.No	What to look for	Marks
	Substitutes the values of *a* and *d* in the above equation and solves it as follows. **-17 + 4(*n* - 1) = 5(-17 + 20)** **=> -17 + 4(*n* - 1) = 15** **=> 4(*n* - 1) = 32** **=> (*n* - 1) = 8** **=> *n* = 9** **Concludes that the required term is the 9 th term.**	**1.5**

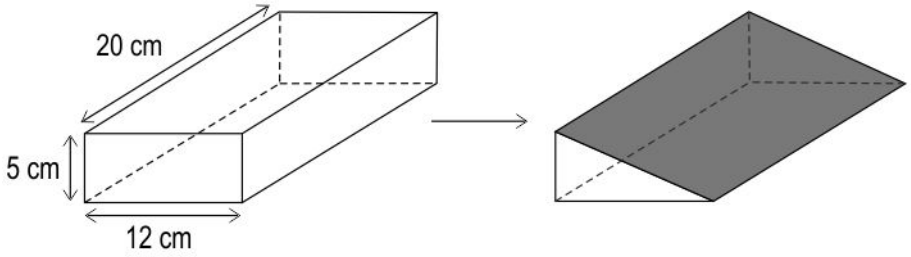
Chapter - 6
Triangles

Free Response Questions

Q: 1 **Give an example each for when two rectangles are:** **[1]**

i) similar.
ii) not similar.

Q: 2 **A painted cuboid, Solid P, is cut along a plane to get two identical solids. One of the identical solids, Solid Q, is shown below.** **[1]**

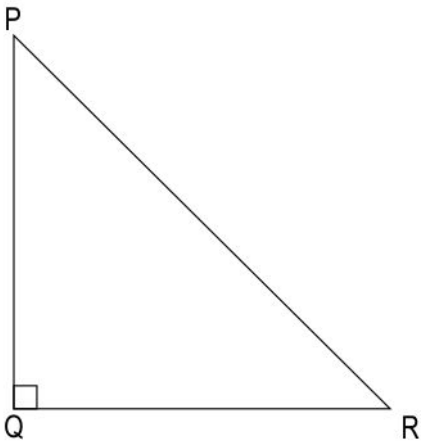


Solid P Solid Q

(Note: The figures are not to scale.)

What is the area of the face of Solid Q that is not painted? Show your work.

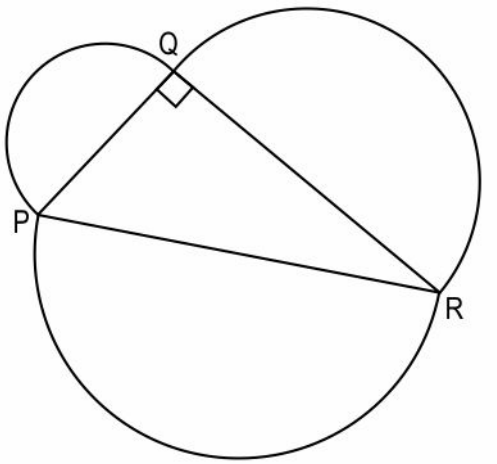
Q: 3 **Shown below is an isosceles right-angled ▲PQR. The area of ▲PQR is 18 cm^2.** **[1]**



(Note: The figure is not to scale.)

Find the length of PR. Show your work.

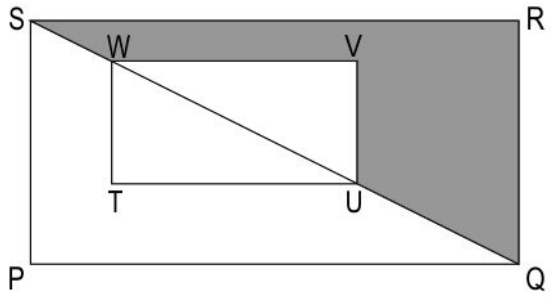
Q: 4 **Shown below is a figure. ▲PQR is a right-angled triangle. There are 3 semicircles with diameters as sides of ▲PQR. All length measurements are in cm.** **[3]**



(Note: The figure is not to scale.)

Show that the sum of the areas of semicircles with diameters PQ and QR is equal to the area of semicircle with diameter PR.

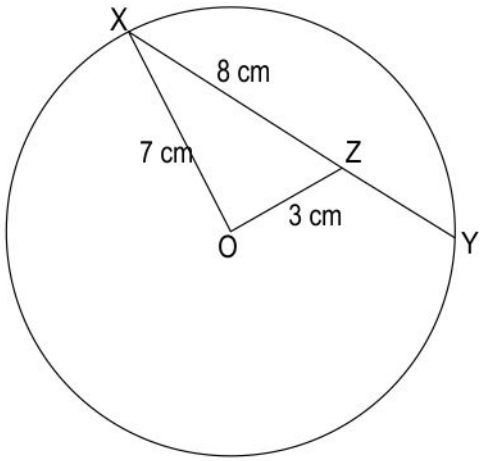
Q: 5 **Shown below is a figure with two rectangles. The ratio of UV:VW = QR:RS = 3:4. Area of TUVW is 36 cm^2.** **[3]**



(Note: The figure is not to scale.)

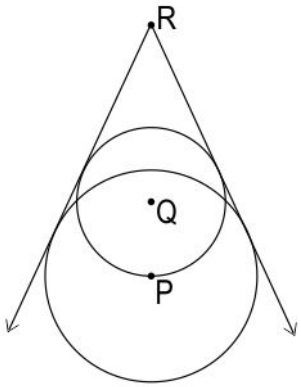
What is the area of the shaded region? Show your work.

Q: 6 **i) Two chords of a circle, PQ and MN intersect at a point T. Show that PT × TQ = MT × TN. Draw a figure.** **[5]**
ii) Shown below is a circle with centre O. Use the result from part i) to find the length of ZY. Show your work.



(Note: The figure is not to scale.)

Q: 7 **In the figure below, P, Q and R are collinear. P and Q are centres of the two circles. P lies on the circumference of the circle with centre Q. R is 10 cm from Q and 15 cm from P. Both circles have 2 common tangents from point R.** **[5]**



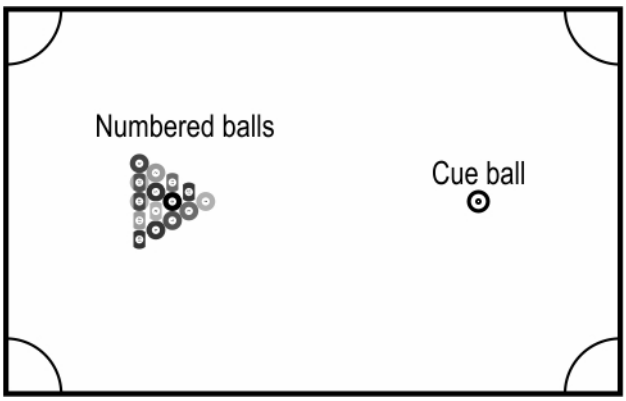
(Note: The figure is not to scale.)

Find the radius of circle P. Draw a rough figure and show your steps.

Case-Based Questions

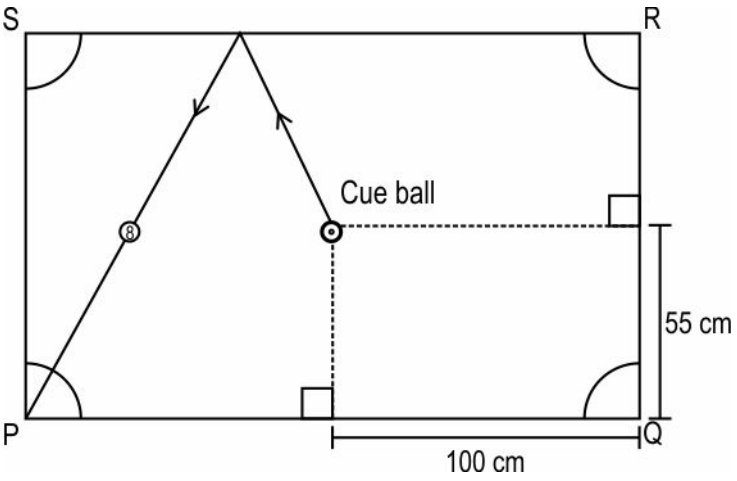
Answer the questions based on the given information.

The rectangular playing top of a pool table is 220 cm long and 110 cm wide. It has 4 pockets in the corners. When a ball hits a side of the table, it bounces off the side at the same angle as it hit that side. There are two kinds of balls - a white cue ball and 15 numbered coloured balls. The cue ball must be used hit a numbered ball into one of the pockets. Shown below is a pool table.



(Note: The figure is not to scale.)

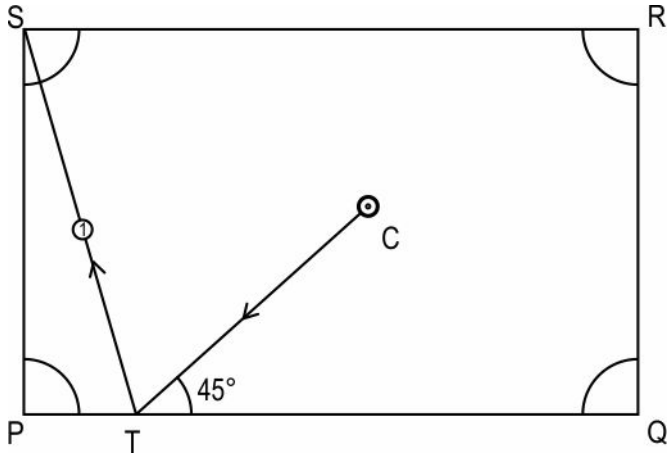
Q: 8 **Tanmay had hit a numbered ball into pocket P. The path followed by the cue ball and ball 8 is shown below. The cue ball's initial distance from the edges of the table is marked in the figure.** **[3]**



(Note: The figure is not to scale.)

What is the distance of the cue ball from pocket S when the ball hits side RS? Draw a diagram and show your work.

Q: 9 **Shown below is the path when Tanmay hits a ball number 1 in pocket S. The distance CT is 50 cm and TS is 120 cm. The cue ball hits the side PQ at an angle of 45°.** **[2]**

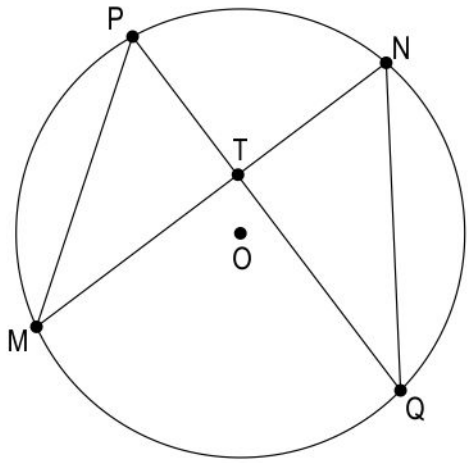


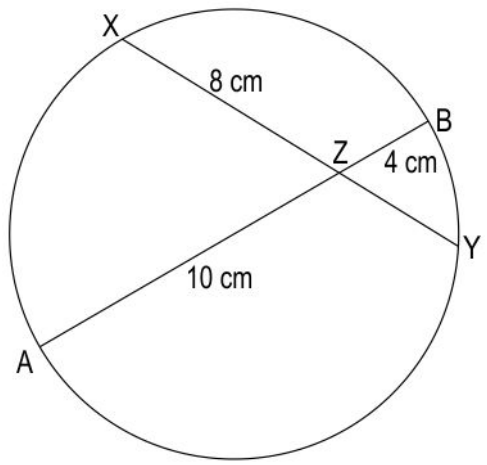
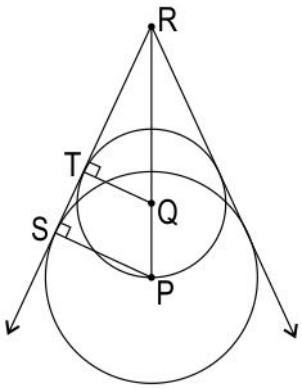
(Note: The figure is not to scale.)

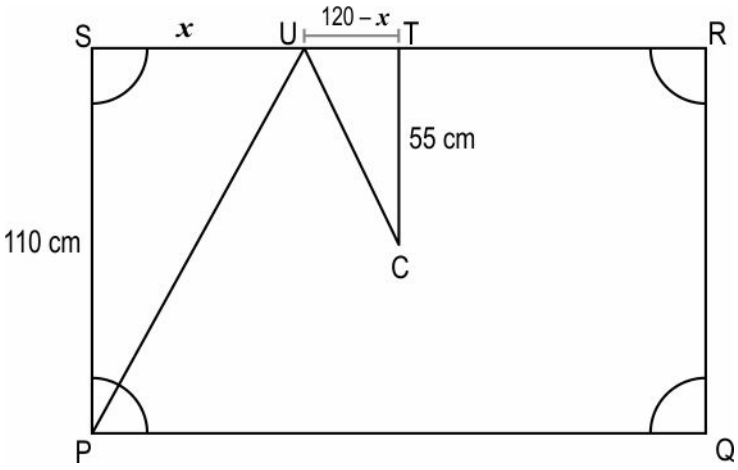
Find the distance between the cue ball's initial position and pocket S. Draw a rough figure, show your work and give valid reasons.

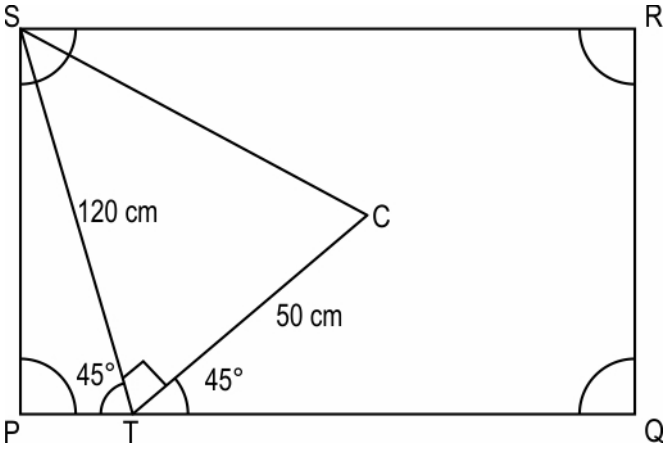
Q.No	What to look for	Marks
1	**i) Writes an example for when two rectangles are similar. For example,** **rectangle 1 has length and breadth of 3 cm and 4 cm respectively.** **rectangle 2 has length and breadth of 6 cm and 8 cm respectively.**	**0.5**
	ii) Writes an example for when two rectangles are not similar. For example, **rectangle 1 has length and breadth as 1 cm and 4 cm respectively.** **rectangle 2 has length and breadth as 2 cm and 5 cm respectively.**	**0.5**
2	**Finds the diagonal of the front face of Solid P as √(25 + 144) = 13 cm.**	**0.5**
	Finds the area of the face of Solid Q that is not painted as 13 × 20 = 260 cm^2.	**0.5**
3	**Assumes PQ = QR as *m* and writes the equation for the area of the triangle as:** $\frac{1}{2} \times m^2 = 18$ $\Rightarrow m = 6$	**0.5**
	Uses the Pythagoras theorem to find the length of PR as: $\sqrt{(m^2 + m^2)}$ $= 6\sqrt{2}$ cm	**0.5**
4	**Finds the area of semicircle with diameter PQ as:** $\frac{\pi PQ^2}{8}$ cm^2	**0.5**
	Finds the area of semicircle with diameter QR as: $\frac{\pi QR^2}{8}$ cm^2	**0.5**
	Finds the area of semicircle with diameter PR as: $\frac{\pi PR^2}{8}$ cm^2	**0.5**

Q.No	What to look for	Marks
	Finds the sum of the areas of semicircles with diameters PQ and QR as: $\frac{\pi PQ^2}{8} + \frac{\pi QR^2}{8} = \frac{\pi(PQ^2+QR^2)}{8}$ cm^2	**0.5**
	Uses the pythagoras theorem in ▲PQR to write $PQ^2 + QR^2 = PR^2$ and simplifies the above expression as: $\frac{\pi PR^2}{8}$ cm^2 **Hence, concludes that the sum of the areas of semicircles with diameters PQ and QR is equal to the area of semicircle with diameter PR.**	**1**
5	**Writes that in ▲UVW and ▲QRS,** $\frac{UV}{QR} = \frac{VW}{RS} = \frac{3}{4}$ **(given)** **∠UVW = ∠QRS (90°)**	**0.5**
	Concludes that ▲UVW ~ ▲QRS by SAS criterion of similarity.	**0.5**
	Finds area of ▲UVW as $\frac{1}{2} \times 36 = 18$ cm^2.	**0.5**
	Finds the area of ▲QRS as $18 \times \frac{16}{9} = 32$ cm^2.	**1**
	Finds the area of the shaded region as $32 - 18 = 14$ cm^2.	**0.5**

Q.No	What to look for	Marks
6	**i) Draws a circle with chords PQ and MN. Joins PM and QN to form △PMT and △NQT. The figure may look as follows:**  	**1**
	Writes that in △PMT and △NQT, **∠PMT = ∠NQT (angles in the same segment subtended by the same arc)** **∠TPM = ∠TNQ (angles in the same segment subtended by the same arc)** **Hence, △PMT ~ △NQT by AA similarity criterion.**	**1.5**
	Uses the above to write the ratio of sides as: $\frac{MT}{TQ} = \frac{PT}{TN}$ **=> PT × TQ = MT × TN**	**1**

Q.No	What to look for	Marks
	ii) Draws a rough figure with diameter AB. The figure may look as follows:  	**1**
	Finds length of ZY as $\frac{10\times4}{8}$ = 5 cm.	**0.5**
7	**Draws a rough figure with the radii of the two circles. The figure may look as follows:**  	**1**
	Writes that in ▲PSR and ▲QTR, **∠PRS = ∠QRT (common)** **∠PSR = ∠QTR = 90° (radius is perpendicular to the tangent at the point of contact)**	**1.5**

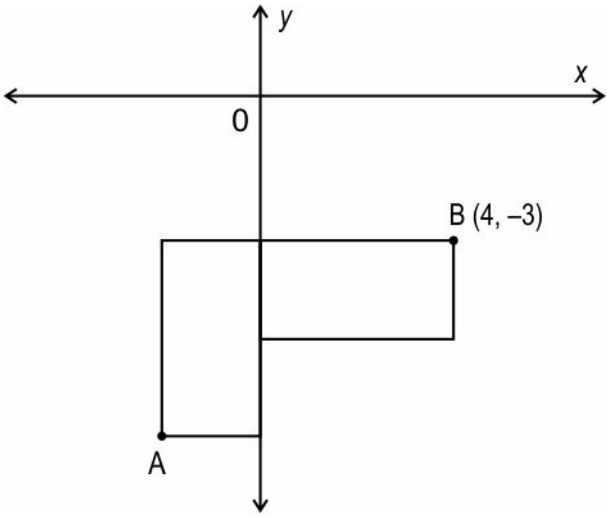
Q.No	What to look for	Marks
	Uses the above step to conclude that by AA criterion of similarity, ▲PSR ~ ▲QTR	**0.5**
	Finds the radius of circle Q as PR - PQ = 15 - 10 = 5 cm.	**0.5**
	Uses step 3 to write the ratio of sides as: $\frac{PS}{QT} = \frac{PR}{QR}$ $\Rightarrow \frac{PS}{5} = \frac{15}{10}$	**1**
	Uses the above step to find the radius of circle P as $\frac{15}{2}$ or 7.5 cm.	**0.5**
8	**Assumes SU as *x* cm and draws a rough diagram. The figure may look as follows:**  **(Note: The figure is not to scale.)**	**0.5**
	Writes that, in ▲PSU and ▲CTU, **∠PSU = ∠CTU = 90°** **∠SUP = ∠CUT (Angle at which ball hits = angle at which it bounces off)**	**1**
	Uses the above step to conclude that by AA criterion of similarity of triangles, ▲PSU ~ ▲CTU.	**0.5**

Q.No	What to look for	Marks
	Writes the ratio of the sides as: $\frac{x}{120-x} = \frac{110}{55}$	**0.5**
	Solves the above equation for *x* to find the distance of the ball from pocket S when the ball hits side RS as 80 cm.	**0.5**
9	**Draws a rough diagram. The diagram may look as follows:**  ***(Note: The figure is not to scale.)***	**0.5**
	Writes that, since the ball bounces off the side at the same angle as it hit that side, ∠CTS = 90°.	**0.5**
	Writes that, by using the Pythagoras theorem in ▲WVU, the distance between the cue ball's initial position and pocket S is $\sqrt{(50^2 + 120^2)}$ = 130 cm.	**1**

Chapter - 7
Coordinate Geometry

Multiple Choice Questions

Q: 1 **Shown below are 2 identical rectangles such that their breadth is half their length.**

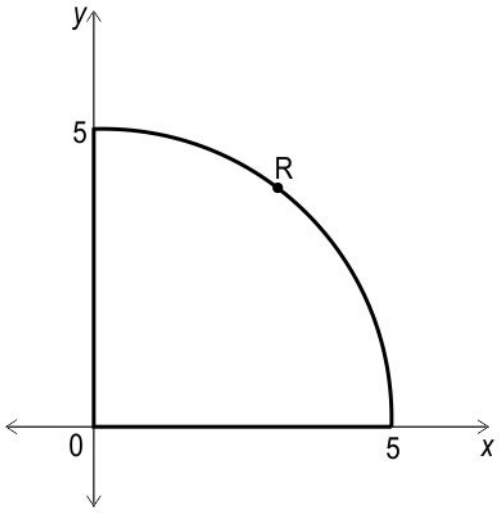


What are the coordinates of point A?

1 (4, -5) **2** (-4, -6) **3** (-2, -7) **4** (-2, -9)

Free Response Questions

Q: 2 **Shown below is a quarter of a circle with centre at (0, 0). An arbitrary point R lies on the boundary of the quadrant.** **[1]**

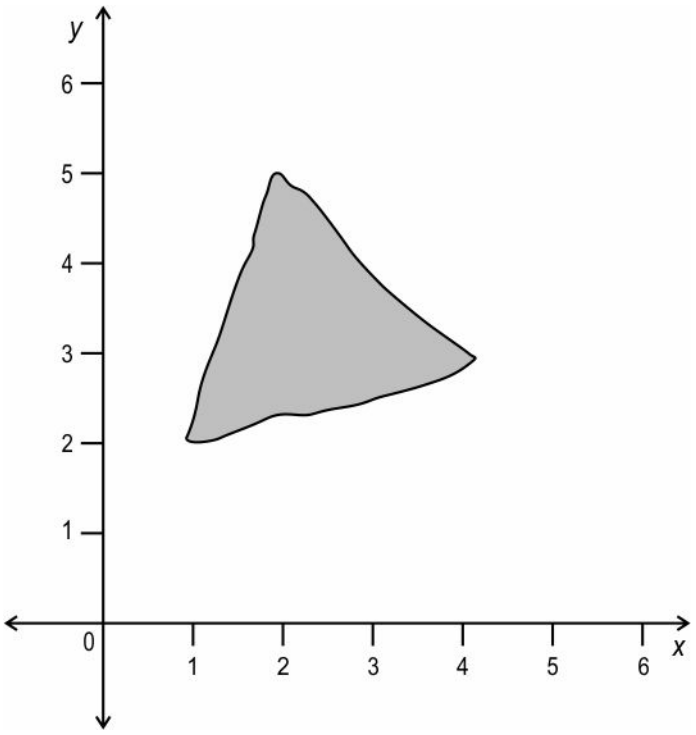


Write one possible pair of coordinates of point R.

Q: 3 **A circle has its centre at the origin. The radius of the circle is 5 units.** **[1]**

Does the point (3, -5) lie inside the circle, on its circumference or outside the circle? Show your work.

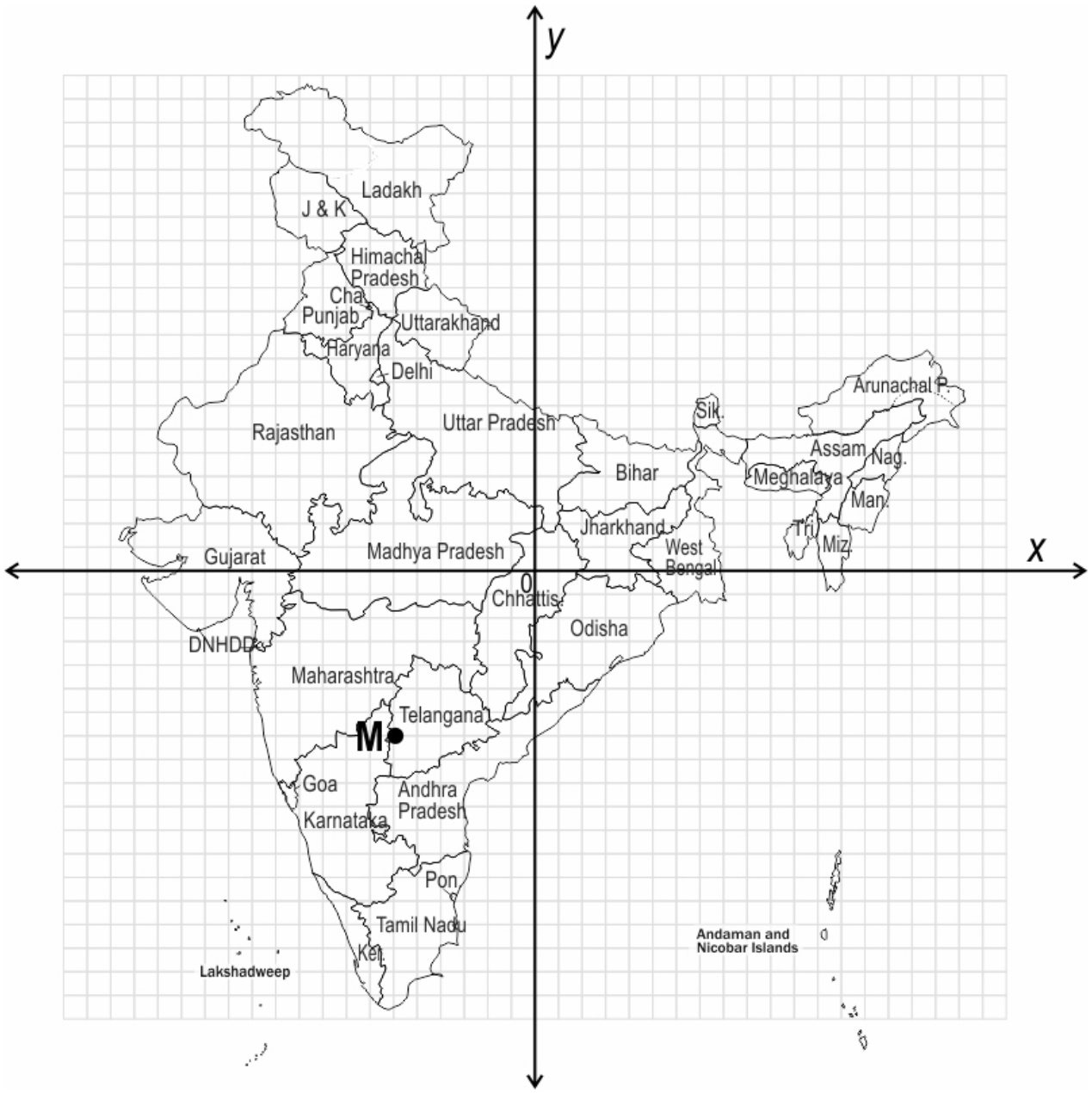
Q: 4 **Arshad was eating chips while working with graph paper. One chip fell on his graph paper as shown below.** **[2]**



Out of curiosity, he tried estimating the area of his chip.

What is the approximate area occupied by the chip? Show your work.

Q: 5 **Shown below is the map of India put on a coordinate plane where each small square represents 1 sq unit.** **[5]**



Alok has to travel from his home at point (0, 5) in Uttar Pradesh to point M(-6,-7) in Telangana. Assume that his travels happen in the shortest straight path.

i) Find the approximate distance he travels from his home to reach point M in Telangana.
ii) He plans to take 2 stops in his journey such that their journey is divided into 3 equal parts. Find the coordinates of his stops and the corresponding state.

Show your work.

Q.No	Correct Answers
1	3

Q.No	What to look for	Marks
2	Identifies the radius of the quadrant as 5 units, assumes the coordinates of point P as (x, y) and uses the distance formula to write: $x^2 + y^2 = 25$	0.5
	Writes one possible pair satisfying the above equation. For example, (3, 4).	0.5
3	Finds the distance of the point (3, -5) from the origin as: $\sqrt{\{3^2 + (-5)^2\}} = \sqrt{34}$ units	0.5
	Writes that since $\sqrt{34} > 5$, the point (3, -5) lies outside the circle.	0.5
4	Considers the coordinates of the triangular chip as (1, 2), (4, 3) and (2, 5).	0.5
	Writes the expression to estimate the area of the chip as $\frac{1}{2}[(3 - 5) + 4(5 - 2) + 2(2 - 3)]$.	1
	Evaluates the above expression and finds the approximate area occupied by the chip as 4 square units.	0.5
5	i) Finds the distance from his home to point (-6, -7) in Telangana as: $\sqrt{\{(-6 - 0)^2 + (-7 - 5)^2\}} = \sqrt{180}$ units	1
	ii) Finds the first stop by taking the ratio 1:2 and using section formula as: $\left(\frac{0-6}{3}, \frac{10-7}{3}\right)$ $= (-2, 1)$	1.5
	Locates the point (-2, 1) and identifies the corresponding state as Chattisgarh.	0.5
	Finds the second stop by using the midpoint formula as: $\left(\frac{-2-6}{2}, \frac{1-7}{2}\right)$ $= (-4, -3)$ (Award full marks if the section formula is used using the ratio 2:1.)	1.5

Q.No	What to look for	Marks
	Locates the point (-4, -3) and identifies the corresponding state as Telangana.	0.5

Chapter - 8
Introduction to Trigonometry

Multiple Choice Questions

Q: 1 **In a right-angled triangle, there is an acute angle *p* such that tan *p* = $\frac{12}{5}$.**

What is the value of sec (90° - *p*)?

1 $\frac{5}{13}$ **2** $\frac{5}{12}$ **3** $\frac{12}{13}$ **4** $\frac{13}{12}$

Q: 2 **Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).**

***Assertion (A)* : The value of tan 20° = $\frac{\tan 60°}{3}$ = $\frac{\sqrt{3}}{3}$.**

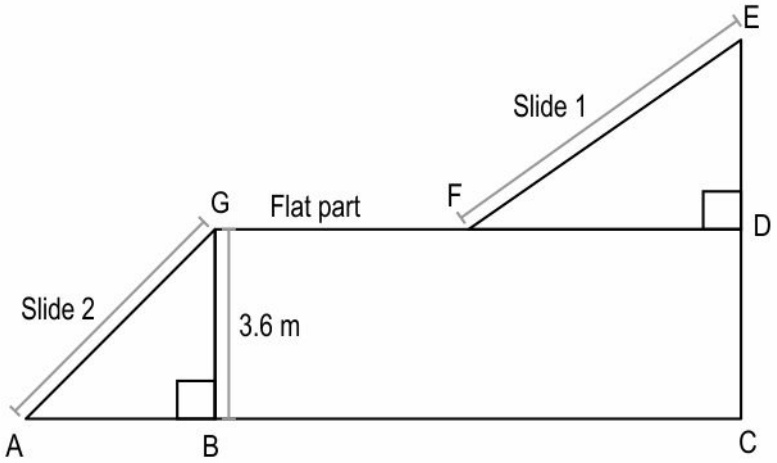
***Reason (R)* : For an acute angle θ, tan ($\frac{1}{3}$ θ) = $\frac{1}{3}$ tan θ.**

1 Both (A) and (R) are true and (R) is the correct explanation for (A).
2 Both (A) and (R) are true but (R) is not the correct explanation for (A).
3 (A) is false and (R) is true.
4 Both (A) and (R) are false.

Case-Based Questions

Study the given information and answer the questions that follow.

Shown below is the rough figure of the side view of a proposed water slide which has to be constructed in a water park.



(Note: The figure is not to scale.)
(Take √2 = 1.4, √3 = *1.7, wherever required.)*

Q: 3 **What should be the measure of the angle between slide 2 and ground if the length of AB is 1.2√3 m?**

1 30° **2** 45° **3** 60° **4** 90°

Q: 4 **What should be the value of tan AGB if the length of slide 2 is 6 m?**

1 $\frac{4}{3}$ **2** $\frac{4}{5}$ **3** $\frac{3}{4}$ **4** $\frac{3}{5}$

Q: 5 **If slide 1 makes an angle of 150° with the flat part and FD = 8.5 m, what is the height of the top point of slide 1 from the ground (EC)?**

1 5 m **2** 8.6 m **3** 10 m **4** 12.1 m

Q: 6 **What should be the length of slide 2 if the angle between slide 2 and ground is 30°?**

1 4.24 m **2** 5.04 m **3** 6.12 m **4** 7.2 m

Q: 7 **If ∠GAB = ∠EFD and ∠AGB = ∠FED, which of these is equal to sec ∠GAB?**

1 cos ∠EFD **2** cos ∠AGB **3** cosec ∠FED **4** cosec ∠EFD

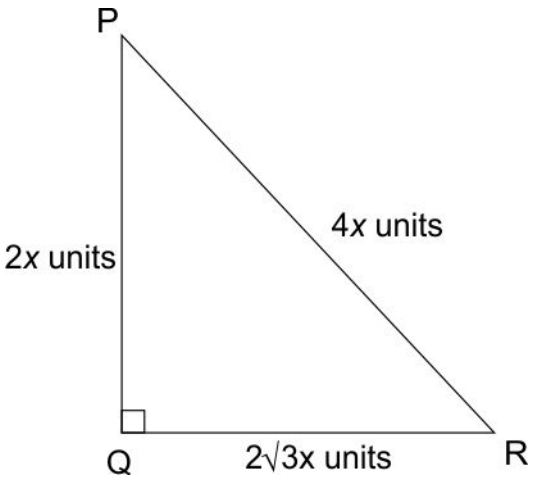
Free Response Questions

Q: 8 **Consider the statement given below.** **[1]**

In a right triangle, the value of cos A = √2 for some acute angle A.

Is the statement true or false? Give a valid reason.

Q: 9 **Shown below is a right-angled △PQR.** **[1]**



(Note: The figure is not to scale.)

What is measure of ∠QPR? Show your work.

Q: 10 **Prove that:** **[5]**

$$(1 + \tan x + \sec x)^2 = 2(1 + \sec x)(\sec x + \tan x)$$

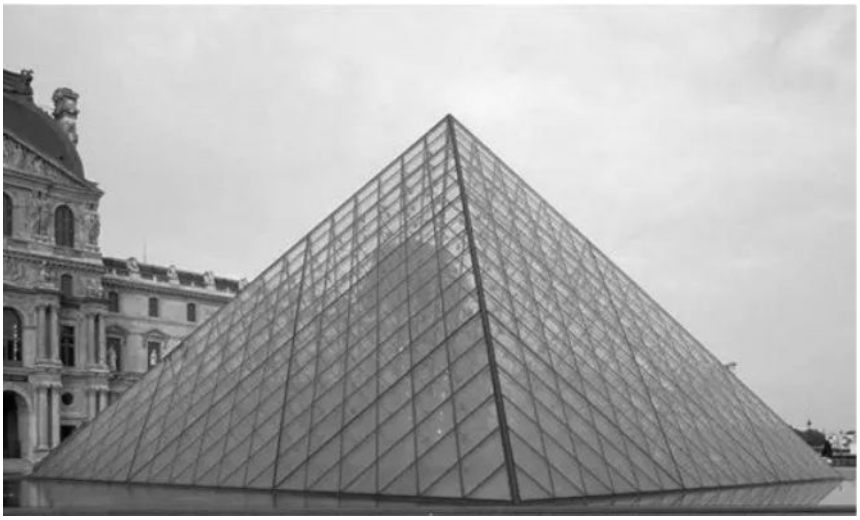
Q.No	Correct Answers
1	4
2	4
3	3
4	1
5	2
6	4
7	3

Q.No	What to look for	Marks
8	Writes that cos A = $\frac{\text{adjacent}}{\text{hypotenuse}}$, as hypotenuse is the largest side in a right triangle, the cosine ratio is always less than 1.	0.5
	Concludes that as √2 > 1, the given statement is false.	0.5
9	Uses an appropriate trigonometric ratio and finds the measure of ∠QPR as 60°. For example: tan ∠QPR = $\frac{2\sqrt{3}x}{2x}$ = tan 60° => ∠QPR = 60°	1
10	Expands the LHS of the given equation as: $1 + \tan^2 x + \sec^2 x + 2\tan x + 2\sec x + 2(\tan x)(\sec x)$	1
	Uses the identity $\sec^2 x - \tan^2 x = 1$ to simplify the above expression as: $2\sec^2 x + 2\tan x + 2\sec x + 2(\tan x)(\sec x)$	2
	Regroups the above expression as: $2\sec x (\sec x + 1) + 2\tan x (\sec x + 1)$	1
	Completes the factorisation of the above expression to get RHS as: $2(1 + \sec x)(\sec x + \tan x)$	1

Chapter - 9
Some Applications of Trigonometry

Multiple Choice Questions

Q: 1 **Shown below is The Louvre Museum, the world's most visited museum. In the shape of a square pyramid, it is 21.6 m high and has a base of edge 34 m.**

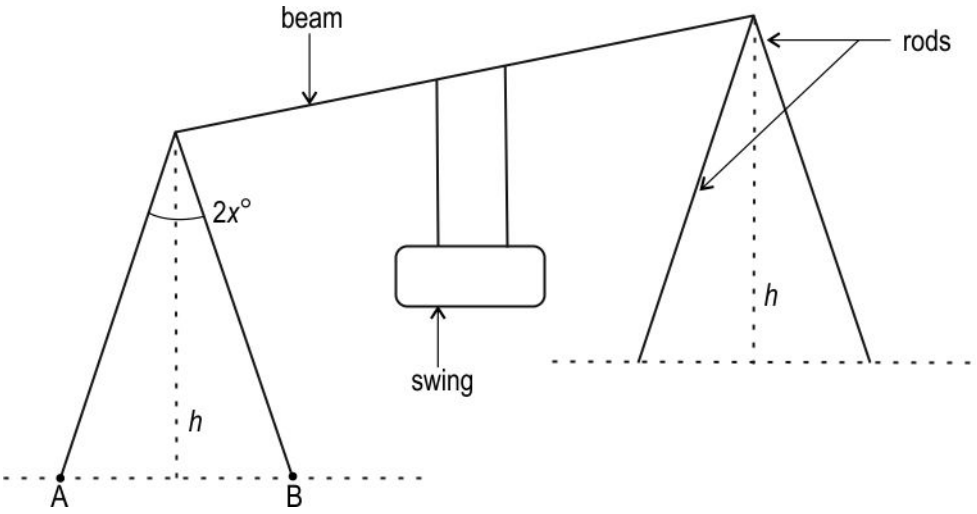


(Note: The image is for representation purpose only)

Which of these angles is closest to the angle of elevation of the top of the museum from the mid-point of its 34 m edge?

1 30° **2** 50° **3** 60° **4** 75°

Q: 2 **A park has a swing which is suspended to a beam. The beam is supported by a pair of identical rods on either side as shown in the figure below.**



The height of the beam from the ground is *h* metres and the angle between the rods on each side is 2 *x*°.

Which of the following is an appropriate expression for the distance AB, in terms of *h* and *x* ?

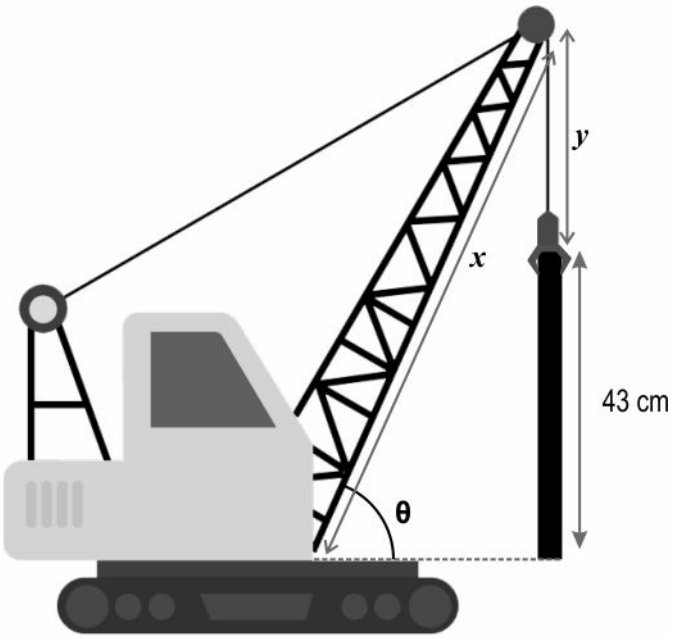
1 $h \tan 2x$

2 $2h \cot x$

3 $2h \tan x$

4 $2h \tan 2x$

Q: 3 **Ananya, Suman and Dipti see a crane lifting a metal rod, as shown in the following figure. They notice that more precision must be required in operating the crane as the rod gets closer to the base of the crane, since the rod could hit the crane if it tilts.**



(Note: The figure is not to scale.)

Taking the length of the crane's arm as *x* metres, and the length of the hanging line as *y* metres, they find the approximate horizontal distance between the end of the rod and the base of the crane's arm as follows:

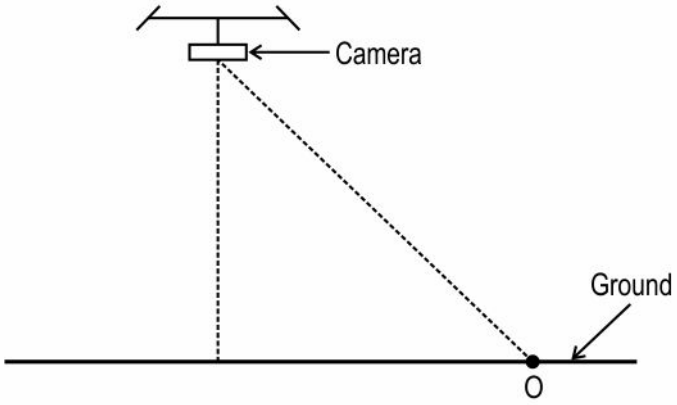
Ananya: $\frac{\tan\theta}{(y+43)}$**m**
Suman: *x* cos θ m
Dipti: *x* cosec θ m

Who is/are correct?

1 only Ananya
2 only Suman
3 only Suman and Dipti
4 only Ananya and Suman

Free Response Questions

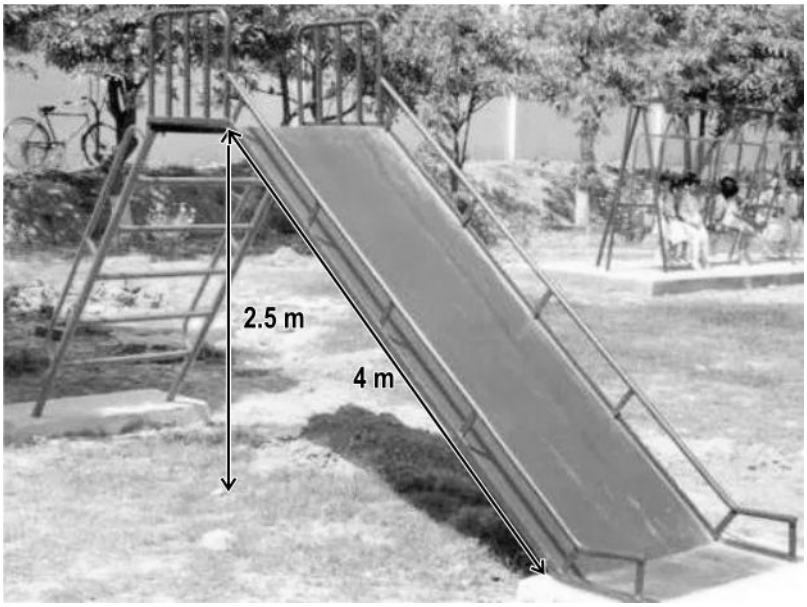
Q: 4 **A drone camera is used by a photographer for shooting videos. On some day, it is focussing at point O on the ground as shown in the figure.** **[1]**



The camera is at a perpendicular height of 6 m from the ground and at a distance of 4√3 m from point O.

Find the angle of depression of point O from the camera. Show your steps.

Q: 5 **Ajay wants to play on a newly installed slide in the playground, as shown in the figure below.** **[1]**



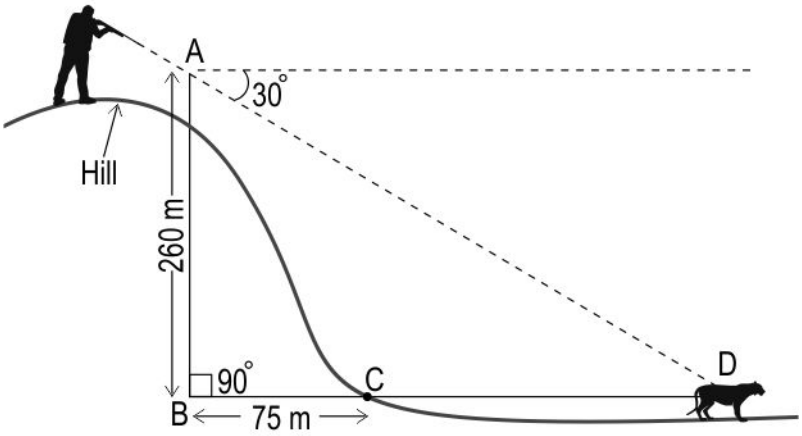
(Note: The figure is not to scale.)

For a slide to be safe for use, it is to be installed with the specification that the angle made by the slide with the ground should be less than 45°.

Is the slide in the playground safe for Ajay to use? Explain your reasoning.

(Note: Use √2 as 1.4.)

Q: 6 **A hunter is asked to stun a man-eater lioness with a stun gun from the top of a cliff. The angle of depression of the gun from the lioness is 30°. The vertical distance between point A and the lioness is 260 m and BC = 75 m (horizontal distance between point A to base point of the cliff).** **[1]**

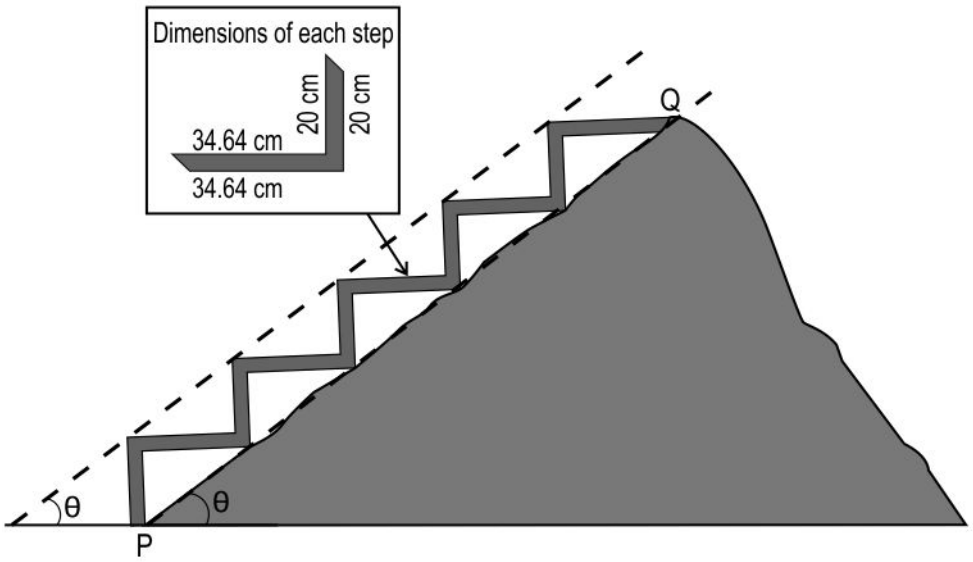


(*Note: The figure is not to scale*)

How far from point C at the base is the lioness standing? Round to the nearest whole number and show your work.

(*Note: Take √2 as 1.41 and √3 as 1.73.*)

Q: 7 **A hiking trail is built using stones' steps to reach the top of a small hill as shown below. There are a certain number of similar steps built each 34.64 cm wide and 20 cm high.** **[1]**

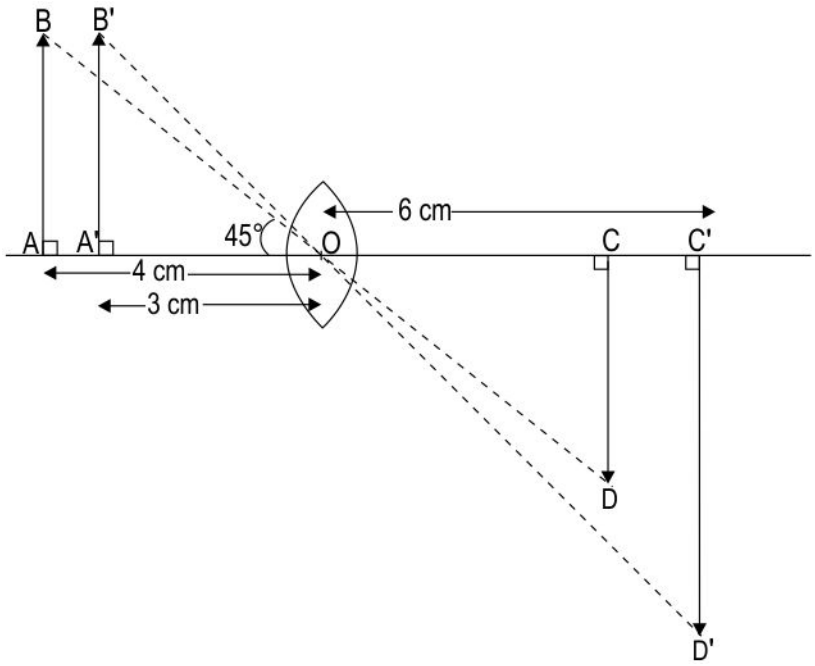


(Note: The figure is not to scale.)

What is the approximate angle of elevation from the point P at the base of the hill to peak Q? Show your work.

(*Note: Take √2 as 1.414 and* √3 as 1.732.)

Q: 8 **An inverted image CD is formed on the other side when an object AB is positioned in front of a convex lens at a distance of 4 cm from point O. Similarly, when the same object is placed at a distance of 3 cm, it forms an image C'D' as depicted in the diagram.** **[2]**



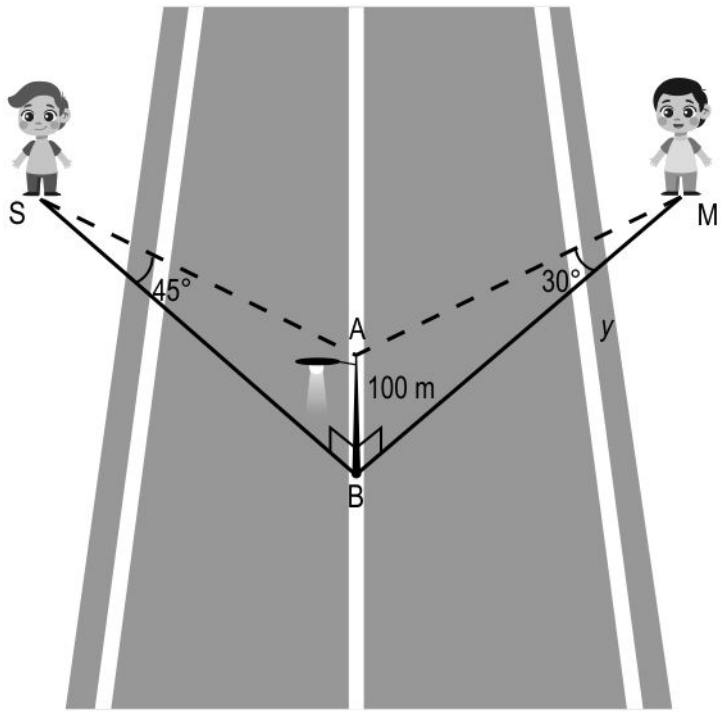
(Note: The figure is not to scale.)

i) Find the height of the object AB.

ii) Find the height of the image C'D'.

Show your work.

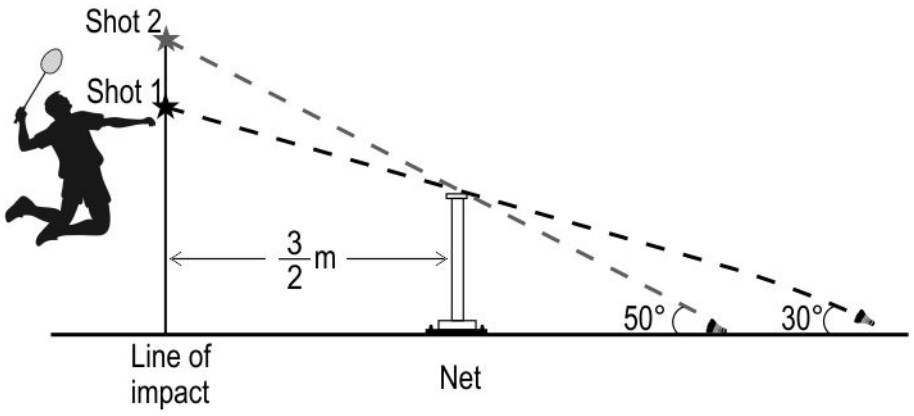
Q: 9 **Shoaib and Mihir are playing in their school playground which has a 100 m light pole. Shoib is standing towards the north of the light pole and Mihir is standing towards the east of the light pole. From the point where Shoaib and Mihir stand, the angle of elevation of the top of the pole is 45° and 30° respectively, as shown in the image below.** **[3]**



(Note: The figure is not to scale.)

Find the shortest distance between Shoib and Mihir. Show your work.

Q: 10 **A smash shot in badminton is when the shuttlecock travels in a straight line just above the nets. The line of impact and the net are perpendicular to the horizontal ground.** **[3]**

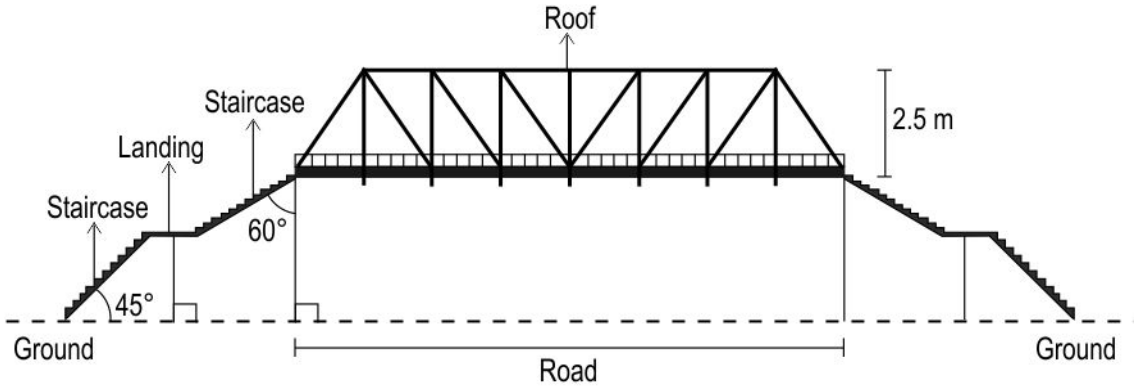


(Note: The figure is not to scale.)

How much higher is shot 2 than shot 1? Draw a rough diagram and show your work.

(Note: Take sin 30° as 0.5, cos 30° as 0.9, sin 50° as 0.8 and cos 50° as 0.6.)

Q: 11 **A pedestrian bridge is built across a main road to help pedestrians cross the road safely without slowing the traffic as shown below.** **[5]**

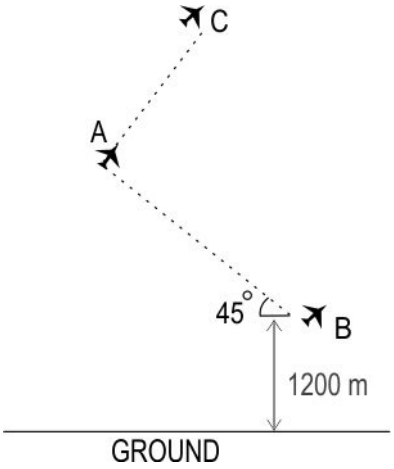


(*Note: Figure is not to scale.*)

The length of each staircase is approximately 3 metres and the length of each landing is 2 metres.

Find the approximate height of the roof from the ground. Show your work.

Q: 12 **Three fighter pilots are participating in a training activity. For one particular maneuver, planes A and C are at an altitude above plane B as shown below.** **[5]**



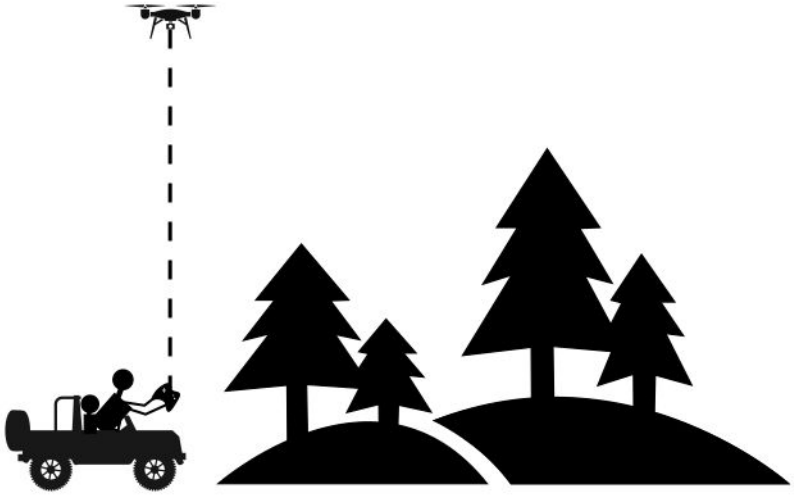
♦ The horizontal distance between planes A and B is equal to plane B's altitude.
♦ Planes A, B and C are placed such that ∠BAC = 90°, and the angle of elevation of plane C from plane B is 75°.

Find the:
i) altitude of plane A.
ii) shortest distance between planes A and C.
iv) shortest distance between planes B and C.

(Note: Consider the planes as point sized objects; the figure is not to scale.)

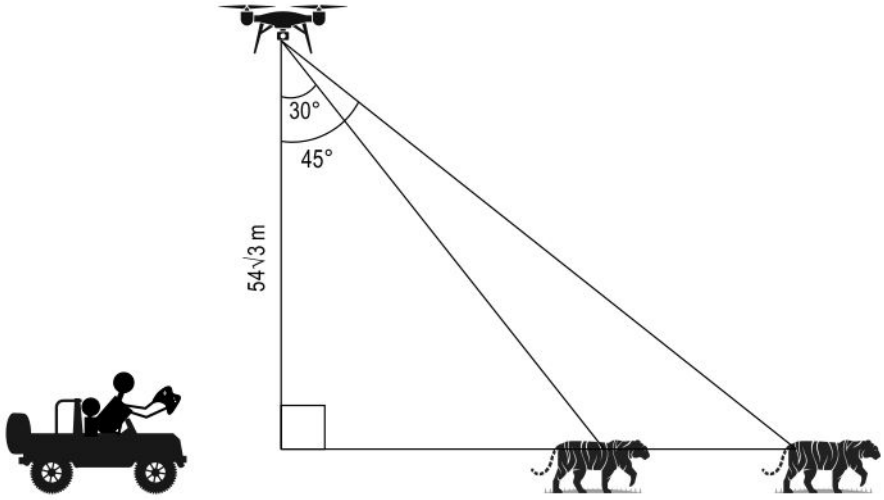
Case-Based Questions

Answer the questions based on the given information.
A drone, is an aircraft without any human pilot and is controlled by a remote control device. Its various applications include policing, surveillance, photography, precision agriculture, forest fire monitoring, river monitoring and so on.
David used an advanced drone with high resolution camera during an expedition in a forest region which could fly upto 100 m height above the ground level. David rode on an open jeep to go deeper into the forest. The initial position of drone with respect to the open jeep on which David was riding is shown below.



David started flying the drone as soon as the jeep started moving to enter the forest at an average speed of 10 m/s in the same direction as that of the jeep.

Q: 13 **At some point during the expedition, David kept the drone stationary for some time to capture the images of a tiger. The angle of depression from the drone to the tiger changed from 30° to 45° in 3 seconds as shown below.** **[2]**

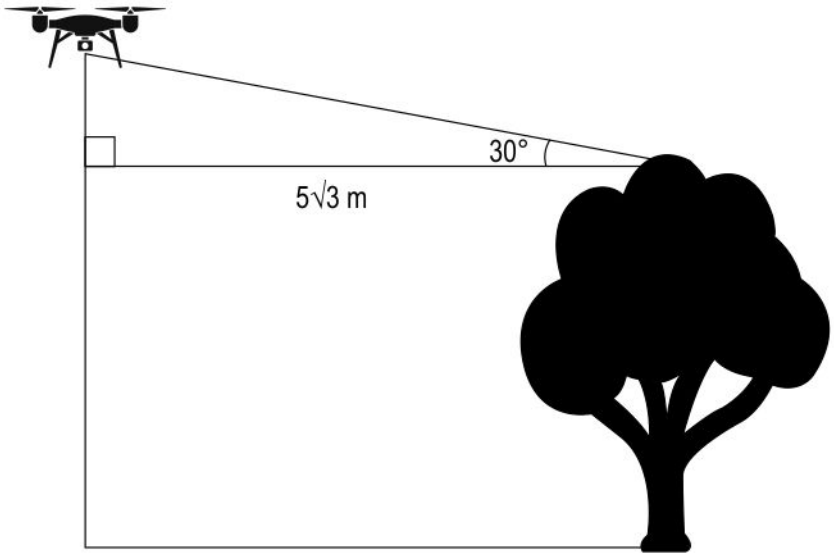


(Note: The figure is not to scale.)

What was the average speed of the tiger during that time? Show your work.

(Note: Take √3 as 1.73.)

Q: 14 **David reached near one of the tallest trees in the forest. He stopped the drone at a horizontal distance of 5√3 m from the top of the tree and at a vertical distance of 65 m below its maximum vertical range.** **[1]**



(Note: The figure is not to scale.)

If the angle of elevation of the drone from the top of the tree was 30°, find the height of the tree. Show your work.

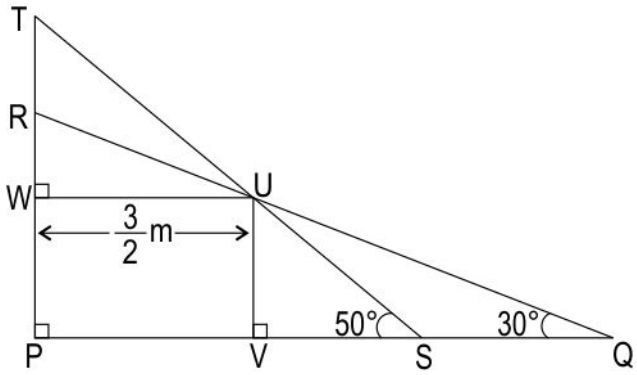
Q: 15 **The drone was flying at a height of 30√3 metres at a constant speed in the horizontal direction when it spotted a zebra near a pond, right below the drone.**
The drone travelled for 30 metres from there and it could see the zebra, at the same place, at an angle of depression of θ from it. **[1]**

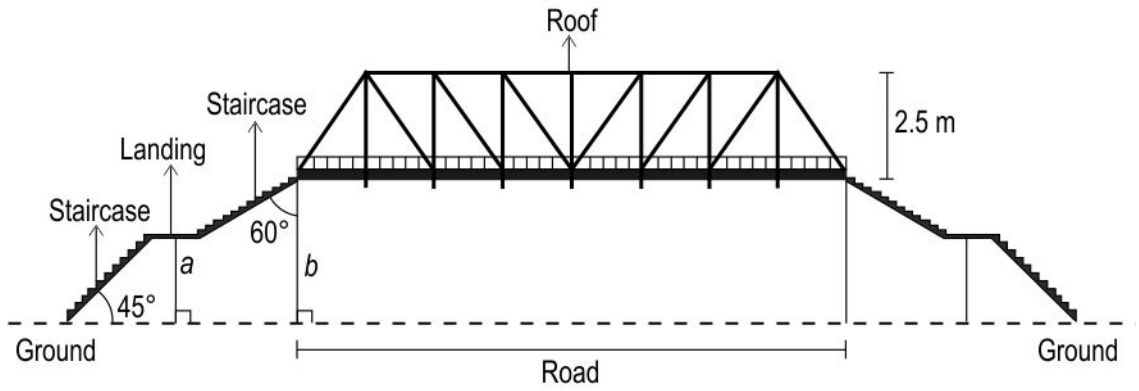
Draw a diagram to represent this situation and find θ. Show you work.

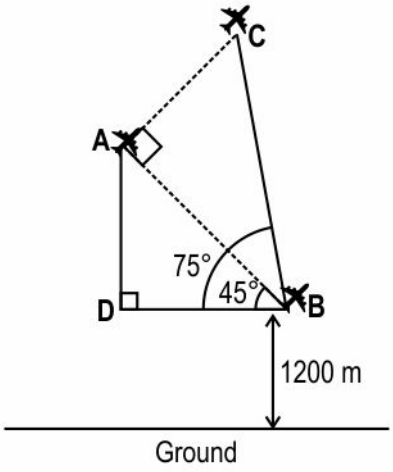
Q.No	Correct Answers
1	2
2	3
3	2

Q.No	What to look for	Marks
4	Uses sine ratio and writes: $\sin d = \frac{6}{4\sqrt{3}}$ $= \frac{\sqrt{3}}{2}$ where, d is the angle of depression.	0.5
	Finds $\angle d = 60°$.	0.5
5	Writes that the slide is safe for Ajay to use.	0.5
	Finds $\sin \theta = \frac{2.5}{4} = 0.625$, where θ is the angle at which the slide is inclined with the ground. Finds $\sin 45°$ as $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2} = 0.7$. Gives the following reason: Since $\sin \theta$ increases as θ increases when $0° < \theta < 90°$, if $\sin \theta < \sin 45°$, then $\theta < 45°$.	0.5
6	Finds BD as $260 \times \tan 60° = 260 \times \sqrt{3} = 260 \times 1.73 = 449.8$ m or 450 m.	0.5
	Finds distance of the lioness from the point C at the base as: CD = BD - BC = 450 - 75 = 375 m	0.5
7	Finds angle of elevation θ by solving for cot θ as follows: $\cot \theta = \frac{34.64}{20} = 1.732 = \sqrt{3}$ Hence, finds the value of θ as 30°.	1
8	i) From the figure, frames the equation as: $\frac{AB}{4} = \tan 45°$ Solves above to find the height of the object AB as 4 cm.	0.5
	ii) Assumes the ∠B'OA' to be θ. Writes the equation as: $\tan \theta = \frac{4}{3}$	0.5

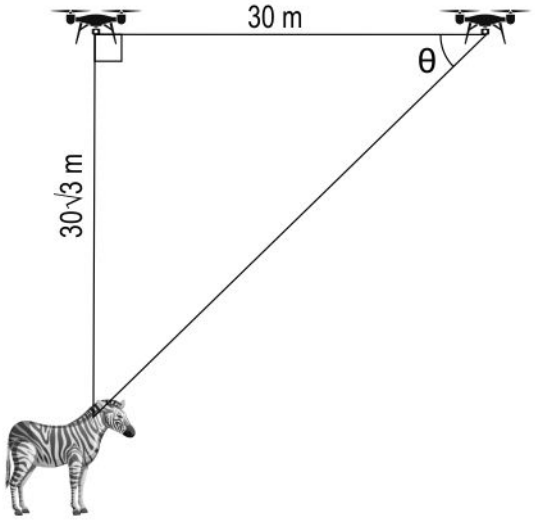
Q.No	What to look for	Marks
	Writes that alternate angles are equal and hence ∠C'OD' = θ. Writes the equation as: $\tan\theta = \frac{4}{3} = \frac{C'D'}{6}$ Finds the height of image C'D' as 8 cm. (Award full marks if any alternate method is correctly used.)	1
9	Finds the distance between the light pole and Shoib as: $\tan 45° = \frac{AB}{SB}$ $\Rightarrow 1 = \frac{100}{SB}$	0.5
	Solves the above equation and finds the distance between the light pole and Shoib as 100 m.	0.5
	Finds the distance between the light pole and Mihir as: $\tan 30° = \frac{AB}{MB}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{MB}$	0.5
	Solves the above equation and finds the distance between the light pole and Shoib as $100\sqrt{3}$ m.	0.5
	Uses Pythagoras' theorem to find the shortest distance between Shoib and Mihir as $\sqrt{[(100)^2 + (100\sqrt{3})^2]} = 200$ m.	1

Q.No	What to look for	Marks
10	**Draws a rough diagram with appropriate measurements. The diagram may look as follows:**  **(Note: The figure is not to scale.)**	**0.5**
	Finds ∠WUT as 50° and ∠WUR as 30°.	**1**
	Finds WT as $\frac{3}{2}$ tan 50° = $\frac{3}{2} \times \frac{0.8}{0.6}$ = 2 m.	**0.5**
	Finds WR as $\frac{3}{2}$ tan 30° = $\frac{3}{2} \times \frac{0.5}{0.9} = \frac{5}{6}$ m.	**0.5**
	Finds the height by which shot 2 is higher than shot 1 as: **2 - $\frac{5}{6} = \frac{7}{6}$ m**	**0.5**

Q.No	What to look for	Marks
11	**Given below is a rough figure of the figure in the question:**  **Identifies from the figure that the height of the roof from the ground is given by:** ***b* + 2.5 m** **or** ***a* + (*b* - *a*) + 2.5 m** **(Award full 1 mark even if the figure is not drawn.)**	**1**
	Identifies from the figure that: **sin 45° = $\frac{a}{3}$**	**0.5**
	Finds *a* by evaluating the above expression as: ***a* = $\frac{3}{\sqrt{2}}$ m**	**1**
	Identifies from the figure that: **sin 30° = cos 60° = $\frac{b-a}{3}$**	**1**
	Finds the value of *b a* s: **$\frac{3}{2} + \frac{3}{\sqrt{2}}$ m**	**1**

Q.No	What to look for	Marks
	Finds the height of the roof from the ground as: **(2.5 + $\frac{3}{2}$ + $\frac{3}{\sqrt{2}}$) m** **(*Note: Students are not expected to simplify the expression further.*)**	**0.5**
12	**Draws △ADB and △BAC. The figure may look as follows:**  **(Note: The figure is not to scale.)**	**1**
	i) Uses tan 45° = $\frac{AD}{DB}$ = 1 in △ADB to find AD = DB. **Writes that AD = 1200 m.** **(Award full marks if the student finds AD by using the properties of isosceles triangles.)**	**0.5**
	Finds plane A's altitude as 1200 + 1200 = 2400 m.	**0.5**
	ii) In △ADB, uses sin 45° = $\frac{AD}{AB}$ = $\frac{1}{\sqrt{2}}$. **Substitutes value of AD as 1200 m to find AB as 1200√2 m.**	**0.5**
	Finds ∠ABC as 75° - 45° = 30°.	**0.5**

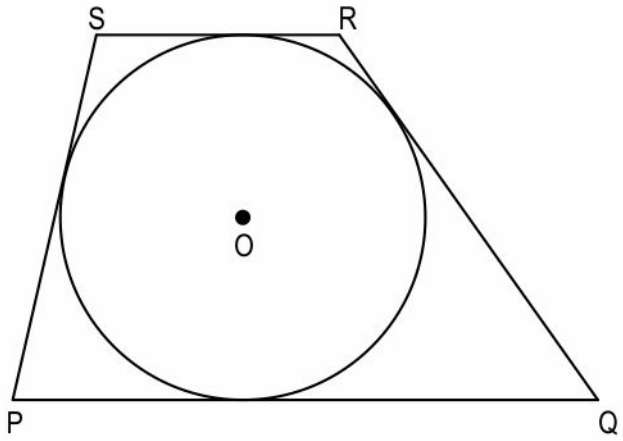
Q.No	What to look for	Marks
	In $\triangle ABC$, uses $\tan 30° = \frac{AC}{AB} = \frac{1}{\sqrt{3}}$. Substitutes value of AB as $1200\sqrt{2}$ m to find AC as $400\sqrt{6}$ m.	1
	iii) In $\triangle ABC$, uses $\cos 30° = \frac{AB}{BC} = \frac{\sqrt{3}}{2}$. Substitutes value of AB as $1200\sqrt{2}$ to find BC as $800\sqrt{6}$ m.	1
13	Assumes the horizontal distance between the drone and the tiger to be x when the angle of depression was 30° and finds the value of x as: $x = 54\sqrt{3} \times \tan 30° = 54\sqrt{3} \times \frac{1}{\sqrt{3}} = 54$ m	0.5
	Assumes the horizontal distance between the drone and the tiger after 3 seconds as y and finds the value of y as: $y = 54\sqrt{3} \times \tan 45° = 54\sqrt{3}$ m	0.5
	Finds the distance covered by the tiger in 3 seconds as: $54\sqrt{3} - 54 = 39.42$ m	0.5
	Finds the average speed of the tiger during that time as: $\frac{39.42}{3} = 13.14$ m/s.	0.5
14	Assumes the vertical distance between the top of the tree and the drone to be h and finds h as: $h = 5\sqrt{3} \times \tan 30° = 5\sqrt{3} \times \frac{1}{\sqrt{3}} = 5$ m.	0.5
	Finds the height of the tree as 100 - 65 - 5 = 30 m.	0.5

Q.No	What to look for	Marks
15	**Draws a rough diagram to represent the situation. The figure may look as follows:** 	**0.5**
	Finds the value of θ as: **tan $\theta = \frac{30\sqrt{3}}{30} = \sqrt{3}$.** **Thus finds the value of θ as 60°.**	**0.5**

Chapter - 10
Circles

Free Response Questions

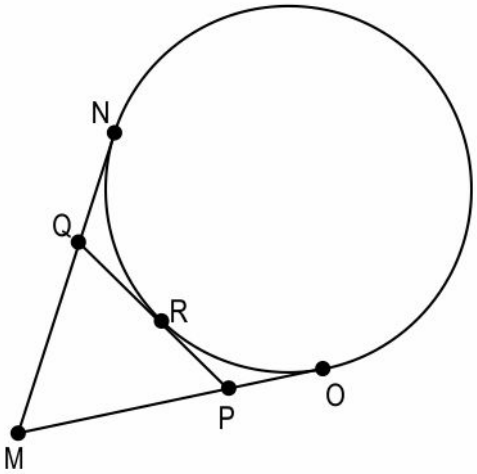
Q: 1 **Shown below is a circle O inscribed in a trapezium such that PQ || RS. The radius of the circle is 6 cm.** **[1]**



(Note: The figure is not to scale.)

What is the height of the trapezium? Show your work and give valid reasons.

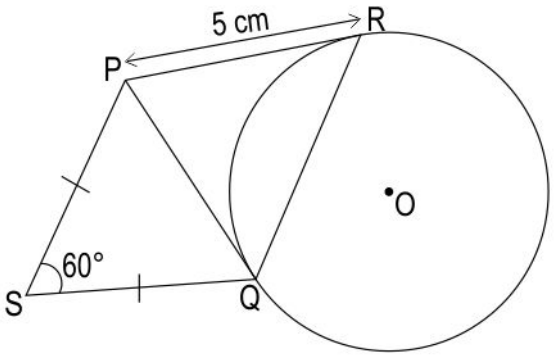
Q: 2 **Shown below is a circle with 3 tangents at points N, O and R. QN = PO = *x* units and ▲QMP is an equilateral triangle.** **[1]**



(Note: The figure is not to scale.)

Express the length MN in terms of *x*. Show your work.

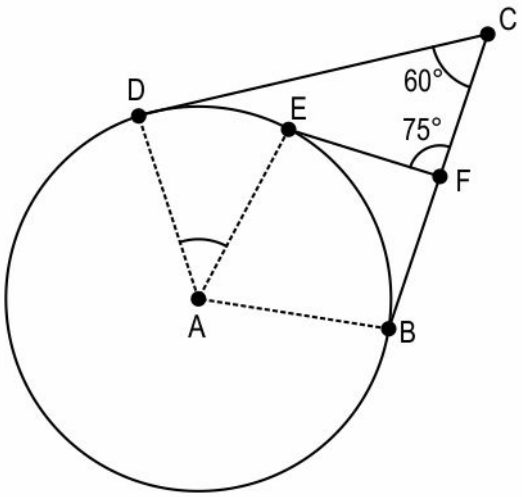
Q: 3 **In the figure below, PQ and PR are tangents to the circle.** **[1]**



(Note: The figure is not to scale.)

Find the perimeter of △SQP. Show your work.

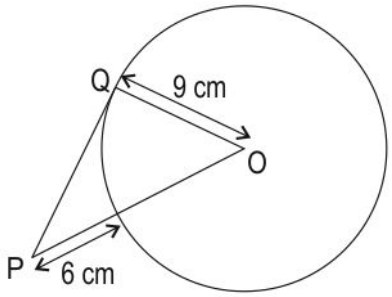
Q: 4 **Shown below is a circle with centre A. CD, CB and FE are tangents to the circle. ∠DCF = 60° and ∠EFC = 75°.** **[2]**



(Note: The figure is not to scale.)

Find the measure of ∠DAE. Show your work and give valid reasons.

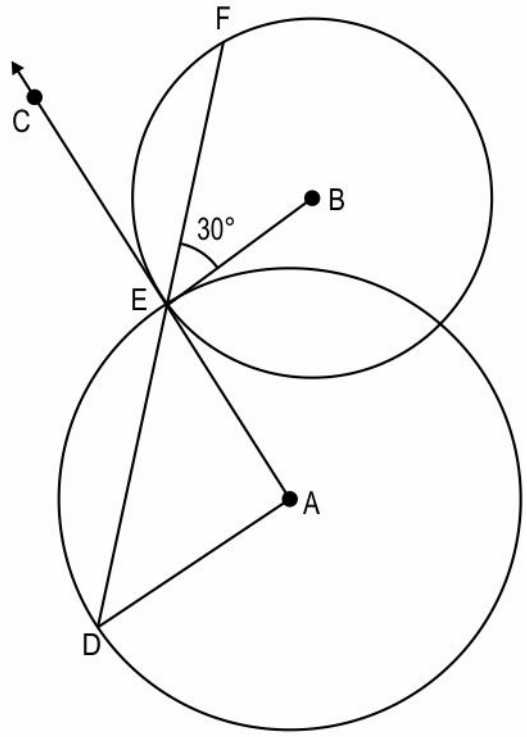
Q: 5 **Shown below is a circle with centre O. PQ is tangent to the circle at Q.** **[2]**



(Note: The figure is not to scale.)

What is the length of tangent PQ? Show your work and give valid reasons.

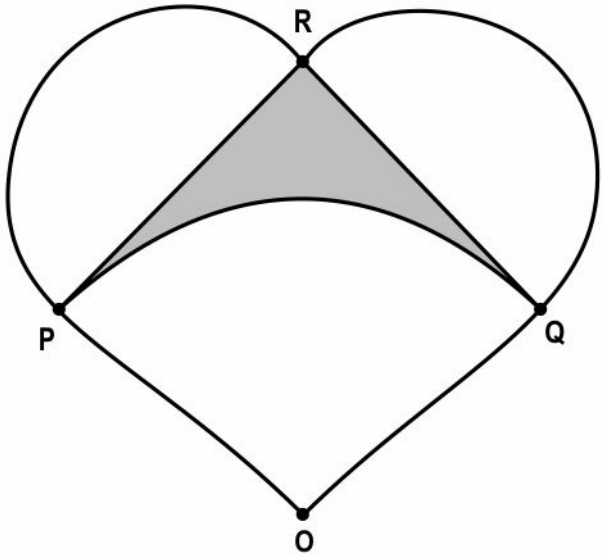
Q: 6 **Shown below are two circles with centres A and B. The circle with centre A has a radius of 5 cm. AC is a tangent to circle with centre B. FED is a straight line.** **[3]**



(Note: The figure is not to scale.)

What is the length of chord DE? Show your work and give valid reasons.

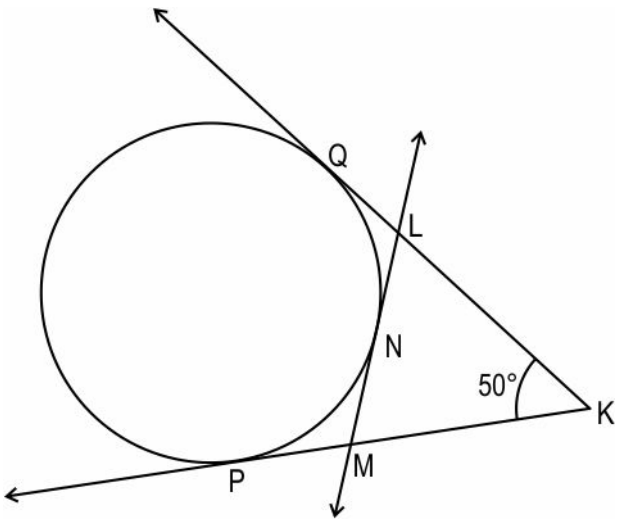
Q: 7 **In the figure below, PR and QR are tangents to a circle with centre O, at points P and Q. Two semicircles are drawn on tangents PR and QR. Each semicircle has an area of π square units. Quadrant POQ has an area of 2π square units.** **[3]**



(Note: The figure is not to scale.)

Find the area of the shaded region. Show your work and give valid reasons.

Q: 8 **Shown below is a circle with 3 tangents KQ, KP and LM.** **[3]**



(Note: The figure is not to scale.)

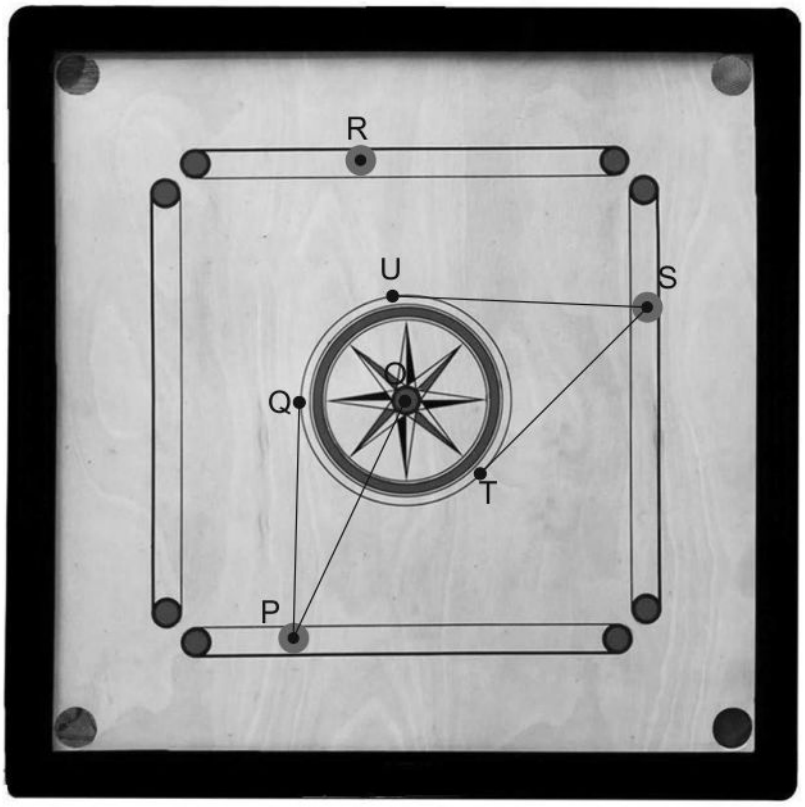
If PM:KL = 1:2, find the measure of ∠LMK. Show your steps.

Case Study

Answer the questions based on the given information.

The game of carrom is played on a square board with a pocket in each corner. They are played using small disks of wood or plastic known as carrom coins. A larger and heavier disk called a striker is used to push these coins across the board to the pockets. The positions of striker and a few coins at different instances in a game are shown in the figure:

P, R and S denote different positions of the striker.
Q, T and U denote different positions of the coins.
O is the centre of the carrom board.



The points P, Q and R do not lie on a straight line. The line PQ touches the circular part of the carrom board only at Q.

Q: 9 **The striker at P is 18 cm from the centre and ∠OPQ = 30°.** **[2]**

Find the distance between the striker at P and the coin at Q. Show your work and give valid reasons.

Q: 10 **Can QR be a tangent to the circle at Q? Give a valid reason.** **[1]**

Q: 11 **SU and ST are tangents to the circle at U and T respectively and ∠UQT = 55°.** **[2]**

Find ∠UST. Show your work and give valid reasons.

Q.No	What to look for	Marks
1	**Writes that the radius is perpendicular to the tangent at its point of contact, hence the diameter is the shortest distance between PQ and RS.**	**0.5**
	Finds the height of the trapezium as 2 × 6 = 12 cm.	**0.5**
2	**Identifies PR = PO = x, QR = QN = x and finds the length of PQ as 2 x units.**	**0.5**
	Identifies QM = PM = PQ = 2 x units and finds the length of MN as 2 x + x = 3 x units.	**0.5**
3	**Finds the length of PQ = PR = 5 cm.**	**0.5**
	Concludes that △SQP is an equilateral triangle and finds its perimeter as 3 × 5 = 15 cm.	**0.5**
4	**Writes that angles on a straight line are supplementary and finds the measure of ∠EFB as 180° - 75° = 105°.**	**0.5**
	Writes that a tangent to a circle is perpendicular to the radius through the point of contact and hence, ∠AEF = ∠ABF = ∠ADC = 90°.	**0.5**
	Writes that sum of angles in quadrilateral ABFE is 360° and finds the measure of ∠EAB as 360° - 285° = 75°.	**0.5**
	Writes that sum of angles in quadrilateral ABCD is 360° and finds the measure of ∠DAE as 360° - 315° = 45°.	**0.5**
5	**Finds the length of PO as 6 + 9 = 15 cm.**	**0.5**
	Writes that a tangent to a circle is perpendicular to the radius through the point of contact and hence ∠PQO = 90°.	**1**
	Uses pythagoras theorem in △PQO to find the length of tangent PQ as $\sqrt{(15^2 - 9^2)}$ = 12 cm.	**0.5**
6	**Writes that the radius is perpendicular to the tangent at the point of contact and finds ∠FEC as 90° - 30° = 60°.**	**1**

Q.No	What to look for	Marks
	Writes that alternate angles are equal and hence ∠AED = ∠FEC = 60°.	**0.5**
	Identifies that AD = AE and hence ∠AED = ∠ADE = 60°.	**0.5**
	Writes that sum of angles in a triangle is 180°, hence ∠DAE = 60°.	**0.5**
	Concludes from the above steps that ▲ADE is equilateral and hence the length of chord DE is 5 cm.	**0.5**
7	**Assumes the radius of the semicircles as *r* units and finds the diameter of the semicircles as:** $\frac{\pi r_2}{2} = \pi$ **=> 2 *r* = 2√2 units**	**0.5**
	Assumes the radius of the quadrant as *q* units and finds the radius of the quadrant as: $\frac{\pi q_2}{4} = 2\pi$ **=> *q* = 2√2 units**	**0.5**
	Writes that quadrilateral POQR is a square as all four sides measure 2√2 units and all vertex angles measure 90°.	**1**
	Finds the area of the square as 2√2 × 2√2 = 8 square units.	**0.5**
	Finds the area of the shaded region as (8 - 2π) square units.	**0.5**
8	**Assumes the lengths of PM as *x* units and KL as 2 *x* units. Writes the length of MN as *x* units.**	**0.5**
	Assumes the length of QL = LN as *y* units and writes the length of QK as (2 *x* + *y*) units.	**1**
	Writes the length of LM as MN + LN = (*x* + *y*) units.	**0.5**
	Writes the length of MK as (2 *x* + *y*) - *x* = (*x* + *y*) units.	**0.5**

Q.No	What to look for	Marks
	Writes that since LM = MK, the measure of ∠LMK = 180 - (50 + 50) = 80°.	**0.5**
9	**Finds that OQ is the radius of the circle and hence OQ is perpendicular to PQ.**	**0.5**
	Writes that in ▲OPQ: **PQ = OPcos 30° = 18 × $\frac{\sqrt{3}}{2}$**	**1**
	Simplifies the above expression and finds the distance between the striker at P and the coin at Q as 9√3 cm.	**0.5**
10	**Writes that only one tangent can be drawn from a point on the circle and since PQ and QR are two different straight lines and PQ is a tangent, QR cannot be a tangent to the circle at Q.**	**1**
11	**Finds ∠UOT as 110° and states that angles subtended by an arc at the centre of the circle is double the angle subtended by that arc anywhere on the circle.**	**1**
	Finds that ∠UST = 180° - 110° = 70° as OU is perpendicular to SU, OT is perpendicular to ST and angle-sum property of a quadrilateral.	**1**

Chapter - 11
Area Related to Circle

Free Response Questions

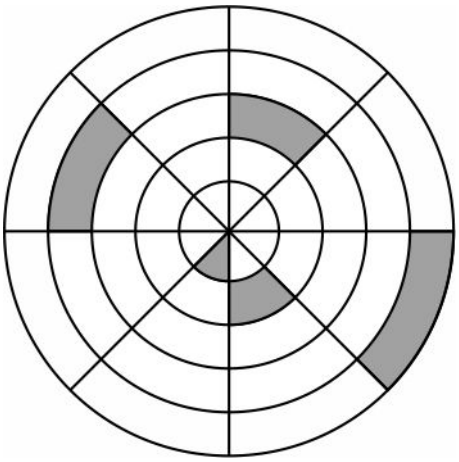
Q: 1 **Rohan got the question below in his school test.** **[1]**

"*A 7 cm chord of a circle subtends an angle of 60° at the centre. Find the area of the major sector.*"

After the test, he went to the teacher and said, "The question cannot be answered as it doesn't mention the radius of the circle".

Is Rohan right or wrong? Give a valid reason for your answer.

Q: 2 **Shown below is a figure such that each circle is divided into equal sectors by 4 straight lines. The combined area of the shaded region is 77 square units.** **[1]**



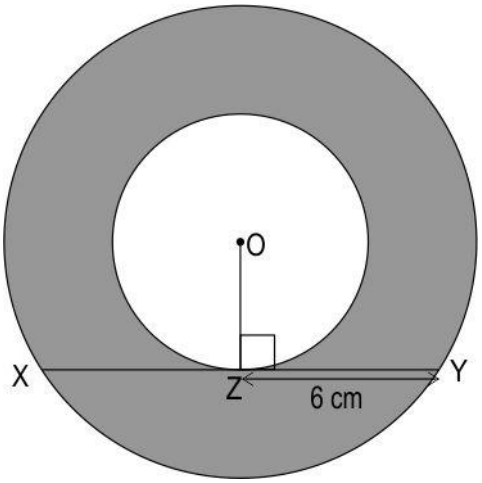
What is the radius of the largest circle? Show your work.

(Note: Take pi as $\frac{22}{7}$.)

Q: 3 **A chord of length 2√2 cm subtends an angle of 90° at the centre of a circle.** **[1]**

Find the area of the minor sector in terms of π. Show your work.

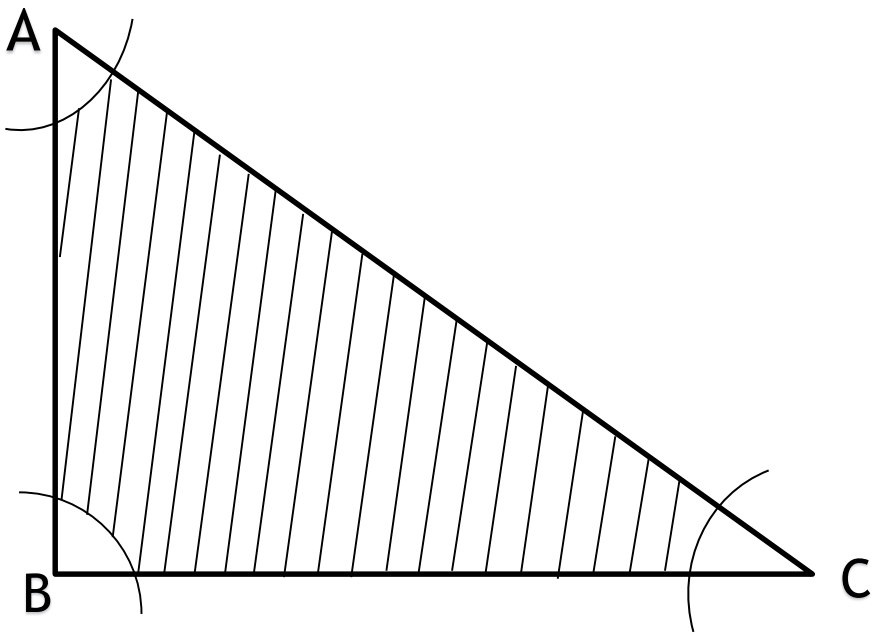
Q: 4 **Shown below are two concentric circles with centre O. XY is tangent to the inner circle at Z.** **[1]**



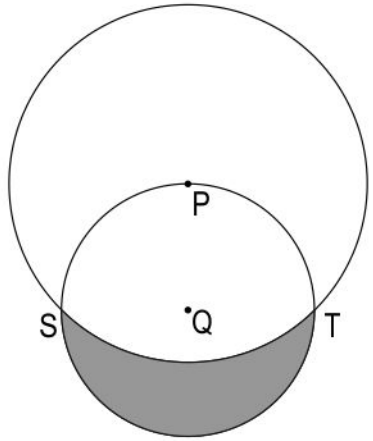
(Note: The figure is not to scale.)

What is the area of the shaded region in terms of π? Show your work.

Q: 5 **With the vertices A, B and C of a triangle ABC as centers, arcs are drawn with radii 5 cm each as shown in figure. If AB = 14 cm, BC = 48 cm and CA = 50 cm, then find the area of the shaded region. (Use π = 3. 14).**



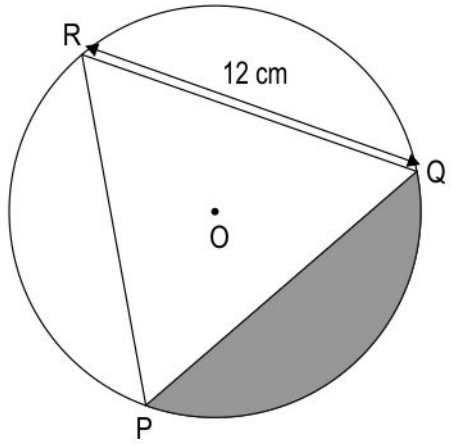
Q: 6 **Shown below are two circles with centres P and Q. Diameter ST is 6 cm.** **[5]**



(Note: The figure is not to scale.)

Find the area of the shaded region. Draw a rough diagram and show your work.

Q: 7 **Shown below is a circle with centre O. PQR is an equilateral triangle of side length 12 cm.** **[5]**



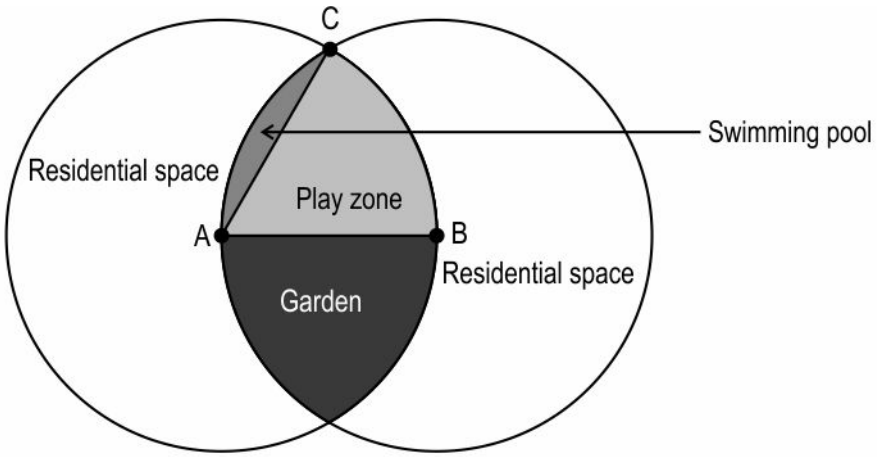
(Note: The figure is not to scale.)

Find the area of the shaded region in terms of π. Draw a rough diagram and show your work.

Case Study

Answer the following questions using the given information.

Shown below is a representation of some portion of an apartment complex. The area occupied by this portion is in the form of two identical intersecting circles whose centres are at A and B respectively. The radius of each circle is 21 metres. The intersecting area is converted into a recreational space comprising of a play zone, a garden and a swimming pool.



(Note: Take π as $\frac{22}{7}$) .

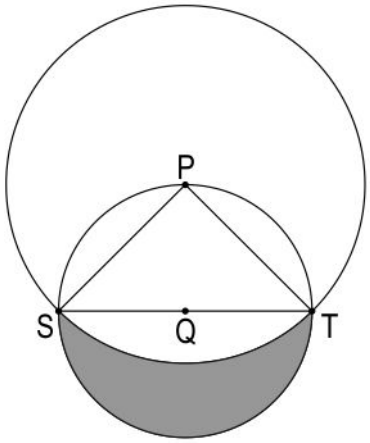
Q: 8 **Find the area of the play zone. Show your work.** **[2]**

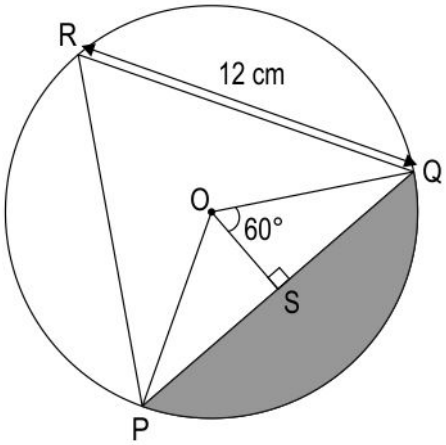
Q: 9 **The boundary of the recreational space is installed with some landscape lighting that costs is Rs 2500 per metre.** **[2]**

How much did it cost to install the lighting along the boundary? Show your work with valid reasons.

Q: 10 **If the area of the recreational space is 842 m^2, find the area of the residential space in the apartment. Show your work.** **[1]**

Q.No	What to look for	Marks
1	**Writes that Rohan is wrong and gives a reason. For example, since the chord extends an angle of 60° at the centre, it forms an equilateral triangle with the radii and hence, the radius is 7 cm.**	**1**
2	**Identifies that the shaded regions combined forms a sector, assumes the radius of the largest circle as *r* units and writes the equation as:** $\frac{1}{8} \times \frac{22}{7} \times r^2 = 77$	**0.5**
	Solves the above equation to find the value of *r* as 14 units.	**0.5**
3	**Identifies that the radii (*r* cm) and the chord make an isosceles right triangle, and uses the Pythagoras theorem to write:** $r^2 = 4\ cm^2$	**0.5**
	Finds the area of the minor sector as: $\frac{90}{360} \times \pi \times 4 = \pi\ cm^2$	**0.5**
4	**Assumes the radii of the outer and inner circles as R cm and *r* cm respectively. Writes the expression for the area of the shaded region as:** $\pi(R^2 - r^2)\ cm^2$	**0.5**
	Uses the Pythagoras theorem to find $(R^2 - r^2)\ cm^2$ as $36\ cm^2$ and hence finds the required area as $36\pi\ cm^2$.	**0.5**
5	**Area of Sector** $= \frac{Angle}{360} \times \pi r^2$	**1**
	So Area of all three Sectors $= \frac{180}{360} \times \pi r^2$ $= 39.25\ cm^2$	**1**
	Now, to find area of ΔABC, we find $S = \frac{a+b+c}{2} = \frac{48+50+14}{2}$ $S = 56$ cm	**1**
	Now, by herons formula, ar **(Δ ABC)** $= \sqrt{S(S-a)(S-b)(S-c)}$ (Δ **ABC)** $= \sqrt{56 \times 8 \times 6 \times 42}$ $= 336\ cm^2$	**1**
	So, Area of Shaded Region, =ar(Δ**ABC) - area of three sectors** $= (336 - 39.25)\ cm^2$ $= 296.75\ cm^2$	**1**

Q.No	What to look for	Marks
6	**Draws a rough diagram. The figure may look as follows:**  (Note: The figure is not to scale.)	**1**
	Uses properties of angles in a semicircle and writes that ∠SPT = 90°.	**0.5**
	Uses pythagoras theorem in ΔSPT where SP = PT to write: $SP^2 + PT^2 = 6^2$ $\Rightarrow SP^2 = 18\ cm^2$	**1**
	Finds the area of ΔSPT as $\frac{1}{2} \times 18 = 9\ cm^2$.	**0.5**
	Finds the area of sector PST in circle with centre P as $\frac{90}{360} \times \pi \times 18 = \frac{9\pi}{2}\ cm^2$.	**1**
	Finds the area of semicircle with diameter ST as $\frac{1}{2} \times \pi \times 3^2 = \frac{9\pi}{2}\ cm^2$.	**0.5**
	Finds the area of the shaded region as $\frac{9\pi}{2} - \frac{9\pi}{2} + 9 = 9\ cm^2$.	**0.5**

Q.No	What to look for	Marks
7	**Draws a rough figure. The figure may look as follows:**  ***(Note: The figure is not to scale.)***	**1**
	Writes that angle subtended by a chord at the centre is double that of the circumference and hence finds ∠POQ as 120°.	**0.5**
	Writes that OS is perpendicular to PQ, hence ∠QOS = 60° and SQ = 6 cm.	**0.5**
	Finds the length of the radius, OQ as $\frac{6}{\sin 60°}$ } = 4√3 cm.	**0.5**
	Finds the length of OS as 4√3 × cos 60° = 2√3 cm. **(Award full marks if pythagoras theorem is used correctly.)**	**0.5**
	Finds the area of ▲OPQ as $\frac{1}{2}$ × 12 × 2√3 = 12√3 cm^2.	**0.5**
	Finds the area of sector POQ as $\frac{120}{360}$ × π × 4√3 × 4√3 = 16π cm^2.	**1**
	Finds the area of the shaded region as (16π - 12√3) cm^2.	**0.5**
8	**Writes that AB, BC and CA being radii of identical circles, are equal making ▲ABC an equilateral triangle.** **Hence concludes that ∠CAB = 60°.**	**1**

Q.No	What to look for	Marks
	Finds the area of the sector forming the playzone as: **$\frac{60}{360} \times \frac{22}{7} \times 21^2 = 231\ m^2$**	**1**
9	**Writes that AB, BC and CA being radii of identical circles are equal making $\triangle$ABC an equilateral triangle.** **Hence concludes that $\angle BAC = 60^o$.**	**0.5**
	Finds the arc length BC as: **$\frac{60}{360} \times 2\pi \times 21 = 22$ m**	**0.5**
	Calculates the length of the boundary or perimeter of the recreational space as: **4 × length of arc BC = 4 × 22 = 88 m**	**0.5**
	Finds the cost of installing the landscape lighting as 88 x 2500 = Rs 220000.	**0.5**
10	**Finds the area of each circle as $\frac{22}{7} \times 21^2 = 1386\ m^2$.**	**0.5**
	Finds the area of the residential space as: **(2 × area of circle) - (2 × area of recreational space)** **= 2 × (1386 - 842)** **= 1088 m^2**	**0.5**

Chapter - 12
Surface Areas and Volumes

Multiple Choice Question

Q: 1 **The table below shows the measurements of 3 right circular cones.**

Cone	Radius (in cm)	Slant Height (in cm)
P	3	5
Q	5	7
R	3.5	10

Which of these have the same curved surface area?

1 only P and Q
2 only Q and R
3 only R and P
4 (P, Q and R have different curved surface areas because they have different radii and slant heights)

Free Response Questions

Q: 2 **State whether the following statement is true or false. Explain your answer.** **[1]**

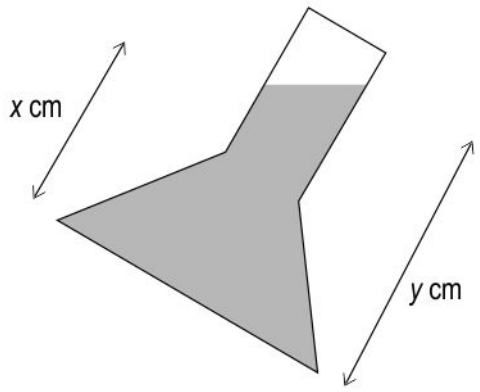
If a cylinder and a cone have equal radii and equal volume, then the height of the cylinder is 3 times that of the cone.

Q: 3 **Two solid hemispheres are joined together to make a sphere.** **[1]**

The total surface area of the sphere is _____ the sum of the total surface areas of the hemispheres.

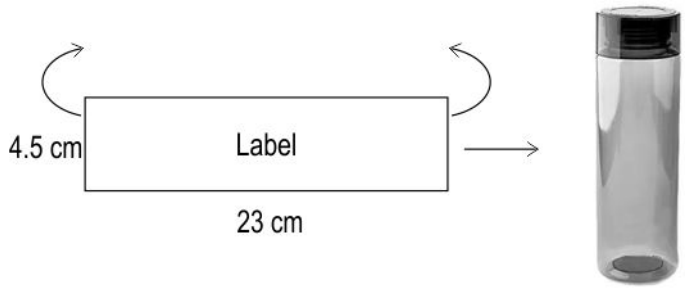
Fill in the blank and give a valid reason.

Q: 4 **Shown below is a flask comprising of a cylinder on top of a frustum. In a tilted position, the height of the liquid is marked.** **[1]**



Write an expression for height of the liquid when the flask is in upright position.

Q: 5 **Vidit is a designer who had printed a 23 cm by 4.5 cm rectangular label. He is now 3D printing a cylindrical water bottle for the label. He wants the label to be wrapped around the bottle such that there is an overlap of 1 cm for sticking.** **[2]**

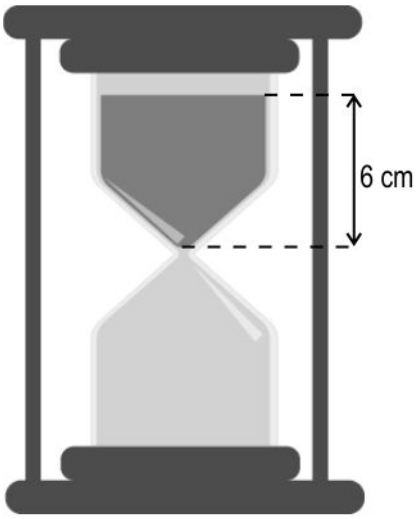


(Note: The figures are not to scale.)

What should be the radius of the water bottle? Show your work.

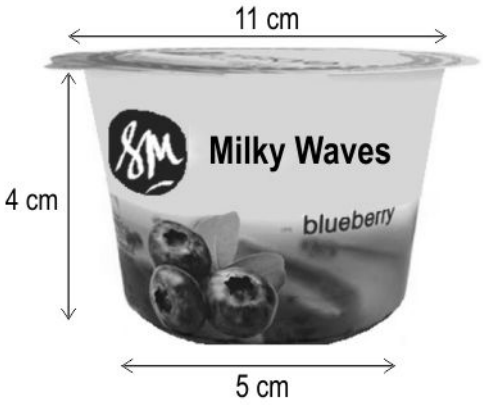
(Note: Take π as $\frac{22}{7}$.)

Q: 6 **Shown below is a 5-minute sand timer. At the beginning, the sand has a height of 6 cm. After 5 minutes, the sand only occupies space in the cylindrical portion.** **[3]**



If the height of each conical section is *h* cm, then find the height of the sand in the bottom portion, after 5 minutes, in terms of *h*. Show your work.

Q: 7 **Sudha's Printing Company has an order to print labels for flavoured yogurt cups for the brand Milky Waves, such that the label covers the entire curved surface of the cup. A picture of the cup is shown below.** **[5]**

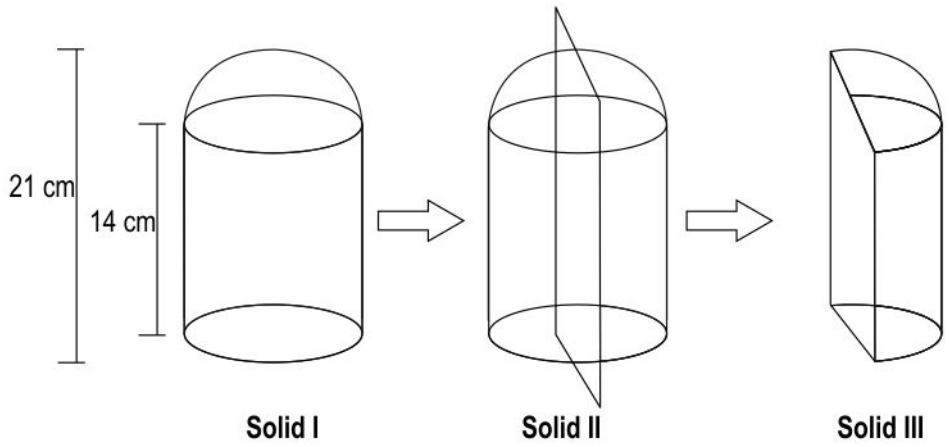


Each of Sudha's rectangular printing sheets is 1 m long and 2 m wide and about 40% of each sheet is wasted due to the shape of the cup.

Approximately how many labels can she print on one sheet? Show your work.

(Note: Assume that each label covers the curved surface area of the cup without any overlap; the figure is not to scale; use π as 3.14.)

Q: 8 **A solid is made using a cylinder and a hemisphere. It is then dipped in red paint and cut vertically along the axis of symmetry as shown below. The unpainted surface of solid III is then painted yellow.** **[5]**



(Note: The figures are not to scale.)

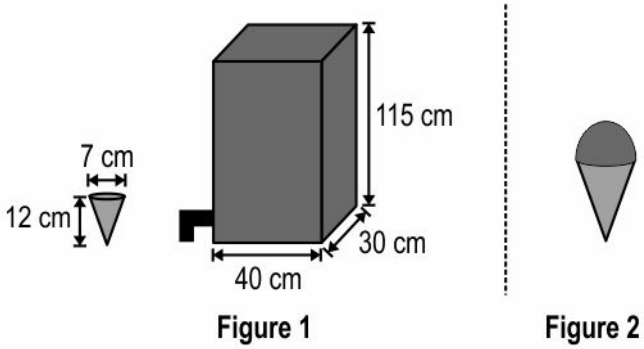
Find the surface area of solid III that is painted:

i) red.
ii) yellow.

Show your work.

(Note: Take π as $\frac{22}{7}$.)

Q: 9 **A restaurant stores ice-cream in a box with a dispenser attached for filling ice-cream cones. The dimensions of the box and the ice-cream cones used by the restaurant are shown in Figure 1 below. To make each serving of dessert, the cone is first filled with ice-cream and then topped with a hemispherical scoop of ice-cream taken from the same box, as shown in Figure 2.** **[5]**



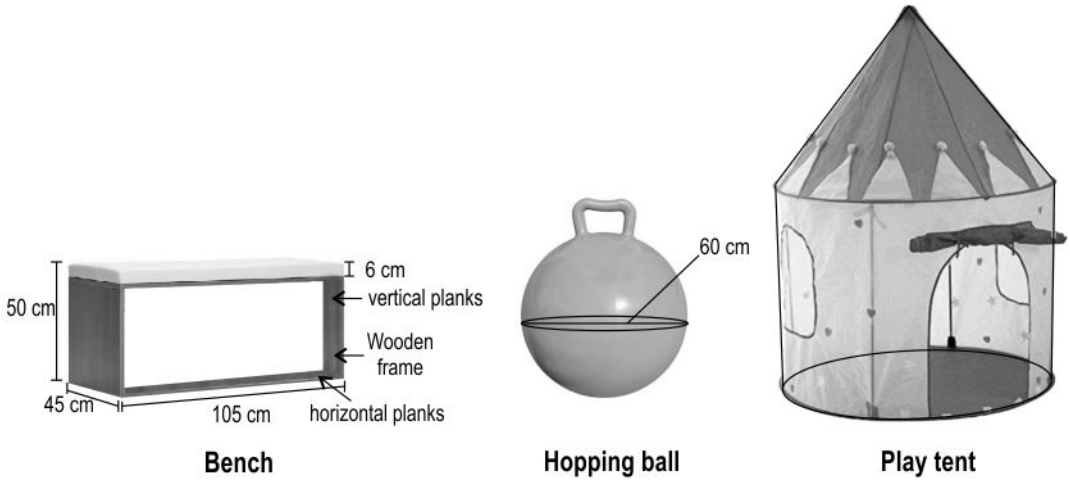
Approximately how many desserts can be served out of a completely filled box of ice-cream? Show your steps.

(Note: Take π as $\frac{22}{7}$.)

Case Study

Answer the questions based on the given information.

An indoor kids play area has a cuboidal sitting bench, a hopping ball and a play tent as shown in the figure. The hopping ball has a handle attached to a sphere. Air is filled in the spherical part which is locked using a peg. The tent consists of a conical section exactly on top of a cylindrical section.



Bench Hopping ball Play tent

(Note: The figure is not to scale.)

The height of the cylindrical section of the tent is one and a half times the height of the conical section of the tent. The height and the diameter of the conical section of the tent are equal.

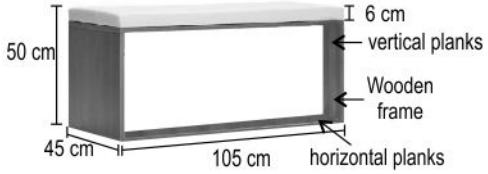
Q: 10 **Find the ratio of the volume of the cylindrical section to the volume of the conical section of the tent. Show your work.** **[2]**

Q: 11 **A kid pulls out the peg from the hopping ball. The ball starts to deflate such that the volume of the spherical part decreases at the rate of 18000 cm^3 per minute.** **[1]**

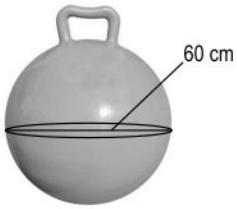
How long does it take to deflate the entire ball? Give your answer to the nearest minute.

Q: 12 **The bench has a wooden frame consisting of four wooden planks. The thickness of each plank is 2 cm. The vertical wooden planks are fitted between the horizontal wooden planks.** **[2]**

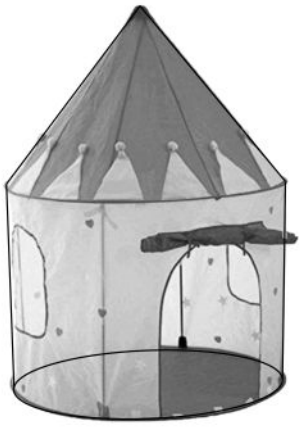
If the weight of each wooden plank is 0.5 g per cm^3, what is the total weight of the wood in the frame? Show your work.



Bench



Hopping ball



Play tent

Q.No	Correct Answers
1	2

Q.No	What to look for	Marks
2	Writes the equation by equating the volumes as $\pi r^2 H = \frac{1}{3} \pi r^2 h$, where H is the height of cylinder, h is the height of cone and r is the radius.	0.5
	Simplifies the above to get $H = \frac{h}{3}$ and concludes that the statement is false.	0.5
3	Writes that the total surface area of the sphere is <u>less than</u> the sum of the total surface areas of the hemispheres.	0.5
	Gives reason that, since two solid hemispheres are joined, the areas of the flat surfaces of the hemispheres are not part of the surface area of the sphere.	0.5
4	Writes an expression for height of the liquid when the flask is in upright position as $\frac{x+y}{2}$ cm.	1
5	Finds the length of the label after the overlap as 23 - 1 = 22 cm.	0.5
	Assumes the radius of the bottle as r cm and writes the equation as: $2 \times \frac{22}{7} \times r = 22$	1
	Solves the above equation to find the radius of the water bottle as $\frac{7}{2}$ cm or 3.5 cm.	0.5
6	Assumes the radius of the base as r cm and the height of the sand in the cylindrical bottom portion after 5 minutes as h_1 cm.	0.5
	Finds the height of the sand in the cylindrical top portion as (6 - h) cm.	0.5
	Writes the equation for the volume of the sand as: $\pi r^2 h_1 = \frac{1}{3} \pi r^2 h + \pi r^2 (6 - h)$	1
	Simplifies the above equation to find the height of the sand in the bottom portion, after 5 minutes, in terms of h as: $h_1 = \frac{1}{3} h + 6 - h$ $\Rightarrow h_1 = 6 - \frac{2}{3} h$ cm	1

Q.No	What to look for	Marks
7	Finds the radii of the top and bottom of the frustum as 5.5 cm and 2.5 cm respectively.	0.5
	Finds the slant height of the frustum as 5 cm as follows: $\sqrt{4^2 + (5.5 - 2.5)^2} = 5$ (Award 0.5 marks if only the formula for the slant height of a frustum is correctly written.)	1
	Finds CSA of frustum as $3.14 \times (5.5 + 2.5) \times 5 = 125.60\ cm^2$. (Award 0.5 marks if only the formula for the CSA of a frustum is correctly written.)	1
	Finds the area of one printing sheet in square centimetres as $20000\ cm^2$.	0.5
	Finds the usable area of the sheet as about 60% of $20000\ cm^2 = 12000\ cm^2$	0.5
	Divides $12000\ cm^2$ by $125.60\ cm^2$ to get quotient as approximately 95.54.	1
	Writes that approximately 95 labels can be printed on one sheet, since about $12000\ cm^2$ area is usable on the sheet.	0.5
8	Finds the radius of the hemisphere and cylinder as 21 - 14 = 7 cm.	0.5
	i) Finds the surface area of the hemisphere in solid I as $2 \times \frac{22}{7} \times 7^2 = 308\ cm^2$.	1
	Finds the curved surface area of the cylinder in solid I as $2 \times \frac{22}{7} \times 7 \times 14 = 616\ cm^2$.	1
	Finds the surface area of the bottom of solid I as $\frac{22}{7} \times 7^2 = 154\ cm^2$.	0.5
	Finds the surface area of solid III painted red as $\frac{1}{2}(308 + 616 + 154) = 539\ cm^2$.	1

Q.No	What to look for	Marks
	ii) Finds the surface area of solid III painted yellow as: **surface as area of semicircle + area of rectangle** $= (\frac{1}{2} \times \frac{22}{7} \times 7^2) + (14^2)$ $= 273\ cm^2$.	**1**
9	**Uses the formula $l \times b \times h$ to find the volume of the box as 1,38,000 cm^3, where l = 30 cm, b = 40 cm and h = 115 cm.**	**1**
	Uses the formula $\frac{1}{3} \pi r^2 h$ to find the volume of the ice-cream cone as 154 cm^3, where r = 3.5 cm and h = 12 cm.	**1.5**
	Uses the formula $\frac{2}{3} \pi r^3$ to find the volume of the hemisphere as 89.83 cm^3.	**1.5**
	Finds the volume of 1 serving of dessert as the (volume of cone) + (volume of hemisphere) = 243.83 cm^3. **Rounds the volume of 1 serving off to 244 cm^3.**	**0.5**
	Finds the approximate number of desserts that can be served as 565, on solving $\frac{1,38,000}{244} = 565.57$.	**0.5**
10	**Takes the height of the conical section to be h cm. Writes that:** **radius of the cylindrical section = radius of the conical section = $\frac{h}{2}$ cm**	**0.5**
	Finds the volume of the conical section as: $\frac{1}{3} \times \pi \times \left(\frac{h}{2}\right)^2 \times h$ $= \frac{\pi h^3}{12} cm^3$	**0.5**
	Finds the volume of the cylindrical section as $\frac{3}{8} \pi h^3$ cm^3 where the height of the cylinder is given by $\frac{3h}{2}$ cm.	**0.5**

Q.No	What to look for	Marks
	Finds the ratio of the volume of the cylindrical section to the volume of the conical section as 9 : 2. The working may look as follows: **volume of cylindrical section : volume of the conical section** $= \frac{3}{8}\pi h^3 : \frac{1}{12}\pi h^3$ $= \frac{3}{2} : \frac{1}{3}$ **= 9 : 2**	**0.5**
11	**Finds the volume of the spherical part of the ball as 36000π cm^3 (or 113040 cm^3) by substituting 30 cm for the radius in the formula for the volume of a sphere.**	**0.5**
	Divides the volume obtained in previous step by 18000 cm^3 to find the total time taken to deflate the ball as around 6 minutes.	**0.5**
12	**Finds the volume of the wood in the horizontal wooden planks as follows:** **volume of the wood in the horizontal wooden planks** **= 2 × volume of each horizontal wooden plank** **= 2 × (105 × 45 × 2)** **= 18900 cm^3**	**0.5**
	Finds the height of the vertical wooden planks as: **total height of the bench - height of the seat - 2(thickness of the horizontal wooden plank)** **= 50 - 6 - 4** **= 40 cm**	**0.5**
	Finds the volume of wood in the vertical wooden planks as follows: **volume of wood in the vertical wooden planks** **= 2 × volume of each horizontal plank = 2 × (40 x 2 x 45) = 7200 cm^3**	**0.5**
	Finds the weight of the wood in the frame as follows: **weight of the wood in the frame** **= 0.5 × (total volume of the wood in the planks)** **= 0.5 × (18900 + 7200)** **= 13050 grams or 13.05 kg.** **(Award full marks if the correct answer is obtained by a suitable alternate method.)**	**0.5**

Chapter - 13
Statistic

Multiple Choice Questions

Q: 1 **The chart below shows the marks obtained by students of sections A and B of grade 10. The results are recorded in groups as follows:**

	Number of students	
Mark	Section A	Section B
20 - 29	1	2
30 - 39	1	1
40 - 49	10	9
50 - 59	11	11
60 - 69	5	4
70 - 79	2	3

Based on the above information, two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).

Assertion (A): The median mark of section A is equal to the median mark of section B.

Reason (R): The cumulative frequency of the median class and the preceding class are the same for both the sections.

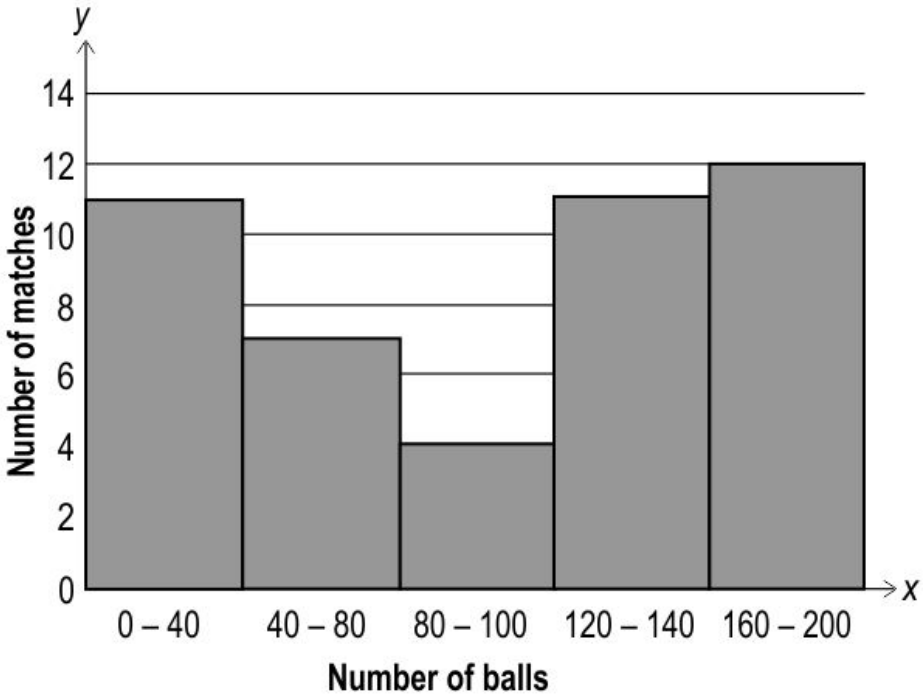
1 Both (A) and (R) are true and (R) is the correct explanation for (A).
2 Both (A) and (R) are true but (R) is not the correct explanation for (A).
3 (A) is true but (R) is false.
4 (A) is false but (R) is true.

Case Study

Study the given information and answer the questions that follow.

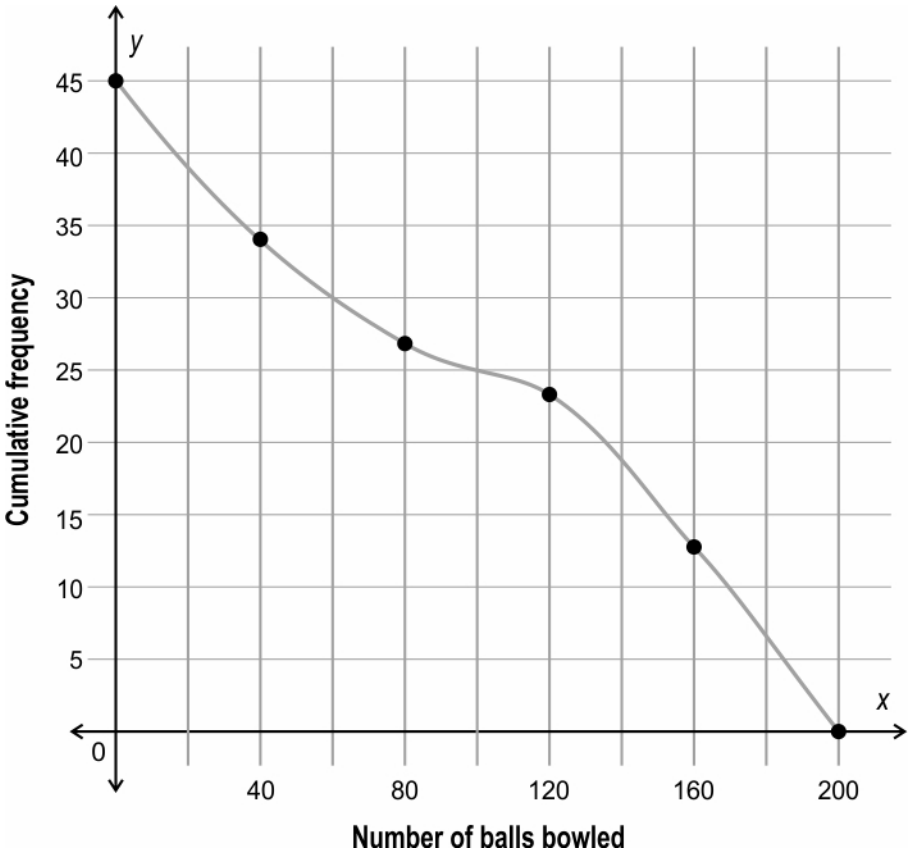
The game of cricket is a bat and ball game played between two teams, each consisting of 11 players. The length of a match is determined by the total number of balls bowled by both the teams.

Shown below is a histogram for the number of matches that were finished in or less than 200 balls.



(Note: Round all calculations to two decimal places.)

Q: 2 **Shown below is an ogive for the given data.**



Which of the following can be determined from the above graph?

i) Least number of balls bowled in a match.
ii) The number of matches with 80 balls bowled.
iii) The total number of matches played with less than 200 balls bowled.

1 only ii) **2** only iii) **3** only i) and ii) **4** only ii) and iii)

Q: 3 **Ankit used the given data and found the mean number of balls bowled in each match as 105.33 balls.**

Which of the following is definitely true?

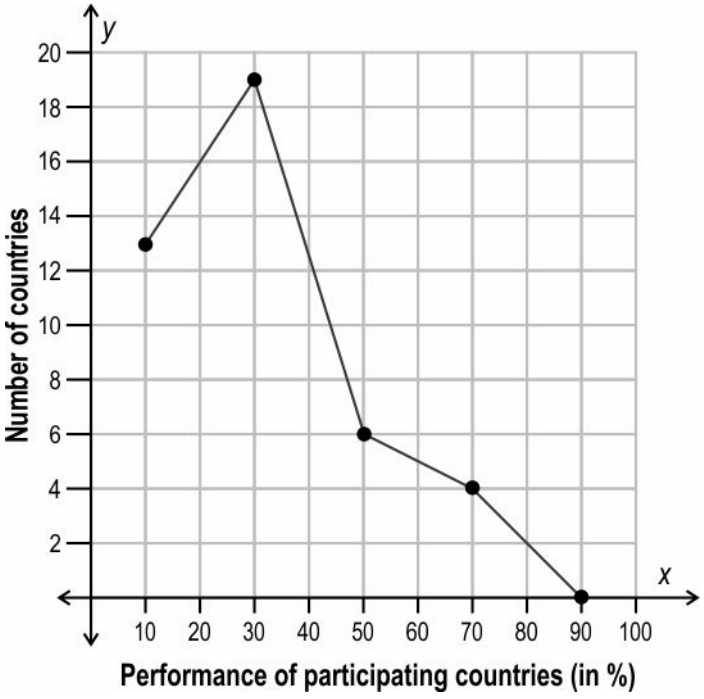
1 Mean number of balls bowled cannot be a decimal.
2 Mean number of balls bowled can be a decimal and 105.33 balls is the actual mean.
3 105.33 balls is an approximate mean as the exact number of matches with the number of balls bowled is not known.
4 (cannot be determined as method used by Ankit is unknown)

Q: 4 **What is the median class?**

1 40 - 80 **2** 80 - 120 **3** 120 - 160 **4** 160 - 200

Free Response Questions

Q: 5 **Shown below is the frequency polygon. It represents the performance of all participating countries in a question in an international assessment, TIMSS 2011.** **[1]**



If Japan's performance was 43%, did it perform better or worse than the average performance? Show your work.

Q: 6 **A football match is 90 minutes long and is divided into 15 minute intervals to collect data, like 0-15, 15-30, so on.** **[1]**

All goals scored in a football match between Brazil and Serbia at FIFA 2022 were in the 60-75 minute interval.

What is the mode of this data? Show your work.

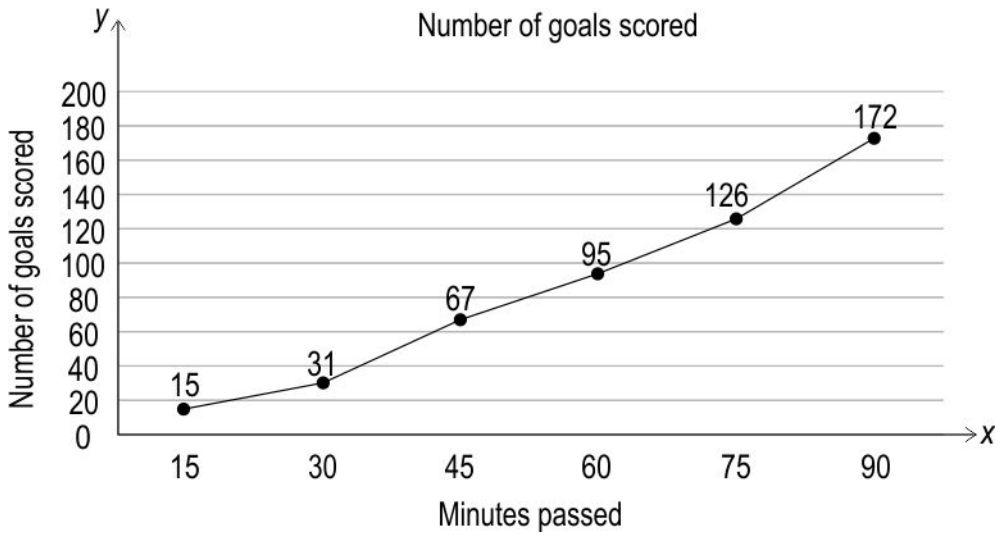
(Note: Any extra time to be ignored.)

Q: 7 **The median of the following distribution is 35. Some of the entries in the table are missing.** **[2]**

Class Interval	Frequency	Cumulative Frequency
10 – 20	5	5
20 – 30		A
30 – 40	5	
40 – 50		40
50 – 60	5	45

Find the value A. Show your steps.

Q: 8 **The graph below shows the number of goals scored upto a given minute-mark in all football matches in FIFA World Cup 2022.** **[5]**



Find the approximate minute in the 90-minute game before which about 50% of the goals in FIFA World Cup 2022 were scored. Show your work.

Q.No	Correct Answers
1	1
2	2
3	3
4	3

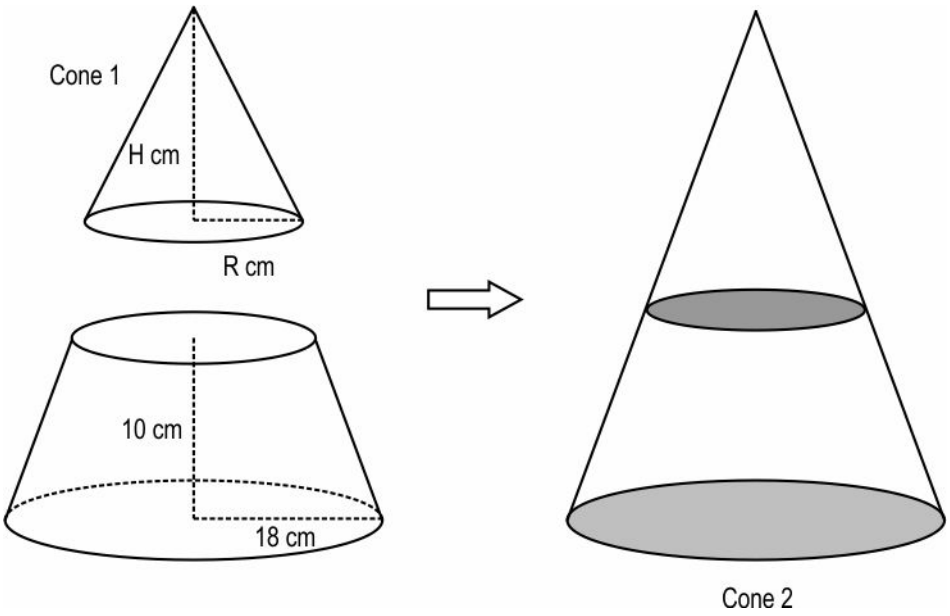
<table>
<tr><th>Q.No</th><th>What to look for</th><th>Marks</th></tr>
<tr><td rowspan="2">5</td><td>Finds the average performance of all countries as $\frac{130+570+300+280}{42} = \frac{1280}{40}$ or approximately 30%.</td><td>0.5</td></tr>
<tr><td>Writes that Japan performed better than the average performance.</td><td>0.5</td></tr>
<tr><td>6</td><td>Finds the mode of this data as $60 + \frac{1}{2} \times 15 = 67.5$ minutes.</td><td>1</td></tr>
<tr><td rowspan="2">7</td><td>Writes that $n = 45$ and $\frac{n}{2} = 22.5$.</td><td>0.5</td></tr>
<tr><td>Uses the formula of the median of grouped data and finds A as follows.
$35 = 30 + (\frac{22.5-A}{5} \times 10)$
$\Rightarrow A = 20$</td><td>1.5</td></tr>
<tr><td rowspan="2">8</td><td>Constructs the cumulative frequency distribution table as:
<table><tr><th>Class Intervals</th><th>Frequency</th><th>Cumulative Frequency</th></tr><tr><td>0-15</td><td>15</td><td>15</td></tr><tr><td>15-30</td><td>16</td><td>31</td></tr><tr><td>30-45</td><td>36</td><td>67</td></tr><tr><td>45-60</td><td>28</td><td>95</td></tr><tr><td>60-75</td><td>31</td><td>126</td></tr><tr><td>75-90</td><td>46</td><td>172</td></tr></table></td><td>2</td></tr>
<tr><td>Writes that $\frac{172}{2}$ = 86th observation lies in the class 45-60 and hence it is the median class.</td><td>1</td></tr>
</table>

Q.No	What to look for	Marks
	Substitutes the values in the formula for the median to get $45 + \frac{86-67}{28} \times 15$, where 45 = the lower limit of median class (l) 67 = the cumulative frequency of the class preceding the median class (cf) 28 = frequency of median class (f) 86 = $\frac{1}{2}$ of number of observations 15 = the class size (h)	1
	Finds the approximate median minute as $45 + (\frac{2}{3} \times 15) = 55$ minutes.	1

Chapter - 14
Application of Multiple Concepts

Multiple Choice Questions

Q: 1 **Shown below is a frustum, cone 1 and cone 2. Cone 2 is made by joining cone 1 to the frustum.**



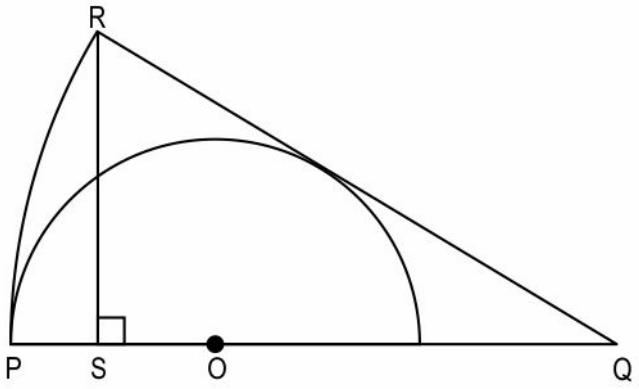
(Note: The figures are not to scale.)

Which of these could be the values of R and H for cone 1?

1 R = 9 cm; H = 5 cm
2 R = 6 cm; H = 5 cm
3 R = 9 cm; H = 20 cm
4 R = 6 cm; H = 20 cm

Free Response Questions

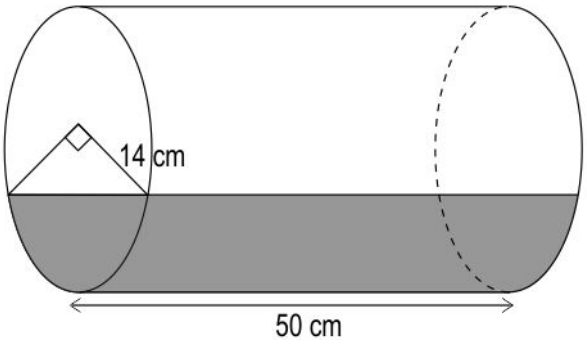
Q: 2 **Shown below is a semi-circle with centre O inscribed in a circular sector PQR. QR = 6 cm and RS = 2 cm.** **[5]**



(Note: The figure is not to scale.)

Find the radius of the semicircle. Draw a figure and show your work.

Q: 3 **Shown below is a horizontal cylinder of base radius 14 cm and length 50 cm. It is filled with water upto a certain height.** **[5]**

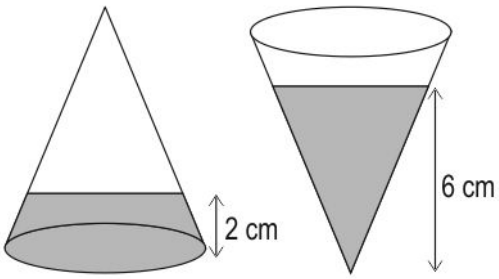


(Note: The figure is not to scale.)

Find the approximate volume of water in the cylinder. Draw a rough figure and show your steps.

(Note: Take π as $\frac{22}{7}$.)

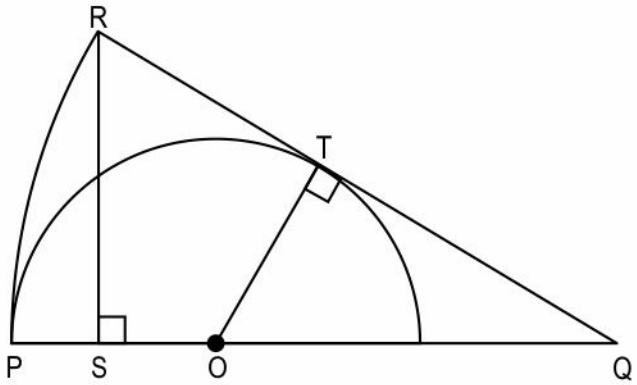
Q: 4 **A right-circular cone has a certain volume of water. Shown below is the cone in two orientations - upright and inverted.** **[5]**

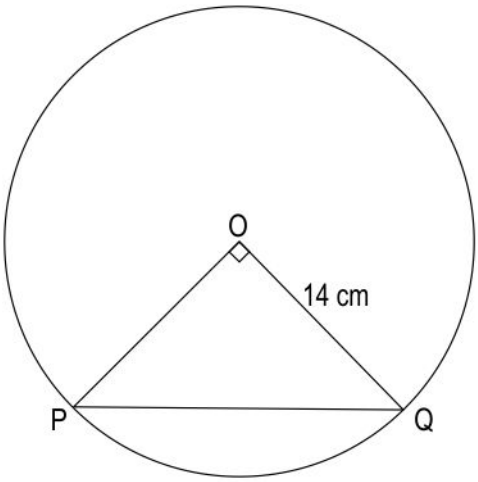


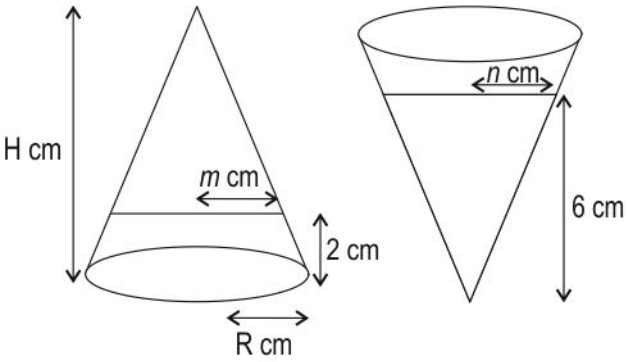
(Note: The figures are not to scale.)

Find the height of the cone. Show your work.

Q.No	Correct Answers
1	2

Q.No	What to look for	Marks
2	**Draws a figure with radius OT as *r* cm such that OT ⊥ QR. The figure may look as follows:**  ***(Note: The figure is not to scale.)***	**1**
	For ▲OQT and ▲RQS, writes that: **∠OTQ = ∠RSQ = 90°** **∠OQT = ∠RQS (common)** **Hence, ▲OQT ~ ▲RQS by AA similarity criterion.**	**1.5**
	Writes that PQ = QR = 6 cm as PQ and QR are radii of the circle with centre Q.	**0.5**
	Uses the above step to write the ratio of sides as: $\frac{OT}{RS} = \frac{OQ}{QR}$ $\Rightarrow \frac{r}{2} = \frac{6-r}{6}$	**1**
	Solves the above equation to find the radius of the semicircle as $\frac{12}{8}$ cm or 1.5 cm.	**1**

Q.No	What to look for	Marks
3	**Draws a rough figure of the base circle. The figure may look as follows:**  ***(Note: The figure is not to scale.)***	**1**
	Finds the area of sector POQ as $\frac{90}{360} \times \frac{22}{7} \times 14 \times 14 = 154\ cm^2$. **(Award 0.5 marks if only the formula for the area of a sector is written correctly.)**	**1**
	Finds the area of $\triangle$POQ as $\frac{1}{2} \times 14 \times 14 = 98\ cm^2$.	**1**
	Finds the area of segment PQ as $154 - 98 = 56\ cm^2$.	**1**
	Finds the approximate volume of water in the cylinder as $56 \times 50 = 2800\ cm^3$.	**1**

Q.No	What to look for	Marks
4	**Redraws the given figures and assumes the height as H and radii as *m*, *n* and R. The figures may look as follows:**  	**0.5**
	Uses similarity of triangles to write the relation for the upright cone as: $\frac{m}{R} = \frac{H-2}{H}$ $\Rightarrow m = \frac{(H-2)R}{H}$	**0.5**
	Uses similarity of triangles to write the relation for the inverted cone as: $\frac{n}{R} = \frac{6}{H}$ $\Rightarrow n = \frac{6R}{H}$	**0.5**
	Writes the equation for the volume of water in the two cones as: $\frac{1}{3}\pi R^2 H - \frac{1}{3}\pi m^2 (H - 2) = \frac{1}{3}\pi n^2 (6)$	**0.5**
	Substitutes values of *m* and *n* and simplifies the above equation as: $H - \frac{(H-2)^3}{H^2} = \frac{6^3}{H^2}$	**1**
	Simplifies the above equation as: $(H - 2)^3 = H^3 - 216$	**0.5**
	Simplifies the above equation as: $3H^2 - 6H - 104 = 0$	**0.5**

Q.No	What to look for	Marks
	Uses the quadratic formula to find the height of the cone as: $H = \frac{6+\sqrt{1284}}{6}$ cm (Rejects $H = \frac{6-\sqrt{1284}}{6}$ cm as height cannot be negative.)	**1**

Chapter - 15
Probability

Multiple Choice Question

Q: 1 **Pratik has blue and green coins of the same size in a bag. He has 50 coins each of blue and green.**

He is randomly picking up one coin at a time without replacement. He does not see which coin he has picked.

What is the MINIMUM number of coins he would have to pick to definitely get a pair of blue or green coins?

1 2 **2** 3 **3** 4 **4** 5

Free Response Questions

Q: 2 **Drish lives in India and Hugh lives in the USA. The date formats of both the countries is given below.** **[3]**

India: day/month
USA: month/day

They wrote dates everyday in 2022. If a day in 2022 is randomly selected, what is the probability that:

i) both their dates in the two formats are the same on that day?

ii) the date written by Hugh is a valid date for Drish in India?

Show your work and give valid reasons.

Q: 3 **Two jars, A and B, hold 5 identical coins each, numbered from 0 to 9. Jar A contains even-numbered coins, while Jar B contains odd-numbered coins. One coin from each jars is randomly chosen simultaneously, without looking. The selected coins are combined to form a new number.** **[5]**

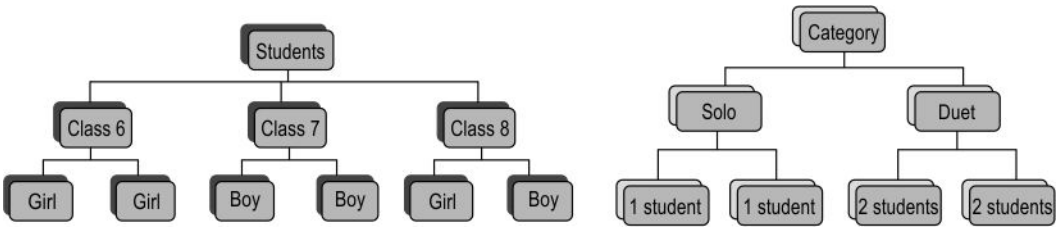
i) The coin from Jar A represents the tens place and the coin from Jar B represents the ones place. Find the probability that the number formed is:
a) greater than 50.
b) equal to 50.

ii) If the rule is changed such that the coin from Jar B represents the tens place and the coin from Jar A represents the ones place, does the probability of getting a number greater than 50 increase/decrease?

iii) The coins from the Jars are re-distributed equally such that each jar has some even and some odd coins. Write a rule with the appropriate arrangement of coins in both the jars such that the probability of forming an odd number is higher on combining coins one from each jar.

Show your work.

Q: 4 **6 students from Daffodil school participated in an inter school dance competition. Each of these 6 students were limited to one performance. There were 2 solo dance categories and 2 duet dance categories as depicted by the flow charts below.** **[5]**



The school's dance teacher used a chit system to select one performance for each of the 6 students in the below order:

Solo 1 --> Duet 1 --> Solo 2 --> Duet 2

i) If one girl was selected from class 6 for Solo 1, find the probability of NOT selecting both girls or both boys for Duet 1? ii) Find the probability of selecting one girl and one boy for Duet 1 such that only one student was left in each class.

iii) After selecting one girl and one boy for Duet 1 only one student was left in each class. The student who got selected for Solo 2 had the probability $\frac{2}{3}$ of getting selected. Was it a girl or a boy and from which class he/she could have been?

Show you work.

Q.No	Correct Answers
1	2

Q.No	What to look for	Marks
2	i) Writes that there are 12 dates in 2022 where the day and the month are interchangeable such as: 01/01, 02/02, 03/03, ... and so on	1
	Finds the probability that the date written by both of them for a random day in 2022 is exactly the same as $\frac{12}{365}$, as 2022 is a non-leap year.	0.5
	ii) Writes that since there are 12 months in a year, Hugh's date's day can have values from 1-12 of every month such that it is a valid date for Drish. Hence, the total number of favourable outcomes are 12 × 12 = 144.	1
	Finds the probability that the date written by Hugh for a random day in the USA format is a valid date for Drish in India as $\frac{144}{365}$.	0.5
3	i) a) Writes that the number formed on combining coins chosen from both the jars will be greater than 50 if either 6 or 8 is selected from Jar A, thus finds its probability as: $\frac{2}{5}$ = 0.4 (Award full marks if all the possible outcomes are listed and then probability is found.)	1
	b) Reasons that the number 50 cannot be formed because it has an even digit at its one's place, but the coins in Jar B are all odd, thus finds its probability as 0. (Award full marks if all possible outcomes are listed and then probability is found.)	0.5
	ii) Writes the possible 25 outcomes as {10, 12, 14, 16, 18, 30, 32, 34, 36, 38, 50, 52, 54, 56, 58, 70, 72, 74, 76, 78, 90, 92, 94, 96, 98} Finds the probability of number formed being more than 50 as: $\frac{14}{25}$ or 0.56 Concludes that the probability of number formed being greater than 50 increases on changing the rule.	1.5

Q.No	What to look for	Marks
	iii) Finds one such rearrangement of coins as: **Jar A: 0, 1, 2, 3, 4** **Jar B: 5, 6, 7, 8, 9** **Forms the rule that the coin from Jar B should represent the ones place and the coin from Jar A should represent the tens place.**	**1.5**
	Reasons that this arrangement of coins satisfies the mentioned condition and as Jar B has more odd numbered coins than even, the probability of getting an odd number will be higher in this rule.	**0.5**
4	**i) Assumes the students who participated from from class 6 were G1 and G2, class 7 were B1 and B2 and class 8 were G3 and B3 and G1 was selected for Solo 1.** **Writes all the possible outcomes on selecting 2 students out of the remaining students as:** **{(G2, B1), (G2, B2), (G2, G3), (G2, B3), (B1, B2), (B1, G3), (B1, B3), (B2, G3), (B2, B3), (G3, B3)}**	**1**
	Finds the probability of NOT selecting both girls or both boys for the Duet 1 as: **$1 - \frac{4}{10} = 0.6$**	**1**
	ii) Finds the desired outcomes of the possible outcomes from step 1 for Duet 1 as: **{(B1, G3), (B2, G3)}** **Finds the probability of selecting one girl and one boy for Duet 1 such that only one student was left in each class as:** **$\frac{2}{10} = 0.2$**	**1**
	iii) Writes that, either (B1, G3) or (B2, G3) were selected for Duet 1, the remaining in the group would have been: **Either** **Class 6: G2** **Class 7: B2** **Class 8: B3** **Or** **Class 6: G2** **Class 7: B1** **Class 8: B3**	**1**

Q.No	What to look for	Marks
	Concludes that in either of the above cases, only a boy either from class 7 or class 8 could have been selected with the probability $\frac{2}{3}$.	**1**

16. Annexure
Correct Answer Explanation

Chapter Name	Q.No	Correct Answer	Correct Answer Explanation
Introduction to trigonometry	1	2	As PQR is a right-angled triangle, ∠P and ∠R are complementary angles.
			Therefore, tan P = cot R.
			Hence, option B is the correct answer.
			PQ = PR (tangents to a circle from a point are equal),
			∠OQP = ∠ORP = 90° (tangents of a circle is perpendicular to radius).
			A unique quadrilateral which would be a square is formed when either ∠ROQ = 90° or ∠RPQ = 90°.
			Hence, option C is the correct answer.
Some Applications of trigonometry	2	3	The height h divides the triangle with base AB into two congruent triangles using RHS congruency criterion.
			In either one of the triangles,
			tan x = (AB/2)/h
			=> AB = 2h tan x
			Hence, option C is the correct answer.
Probability	1	2	The possible combinations when two coins are picked are {(G,G), (G,B), (B,G), (B,B)}, not all combinations have a pair of Green or Blue coins, hence, there is not a definite chance of picking a pair of blue or green coins.
			The possible combinations when three coins are picked are {(B,B,B), (B,B,G), (B,G,B), (G,B,B), (G,G,B), (G,B,G), (B,G,G), (G,G,G)}. Each combination in this sample space has a pair of blue or green coins, hence, there is a definite chance of picking a pair of blue or green coins.
			Hence, option B is the correct answer.

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