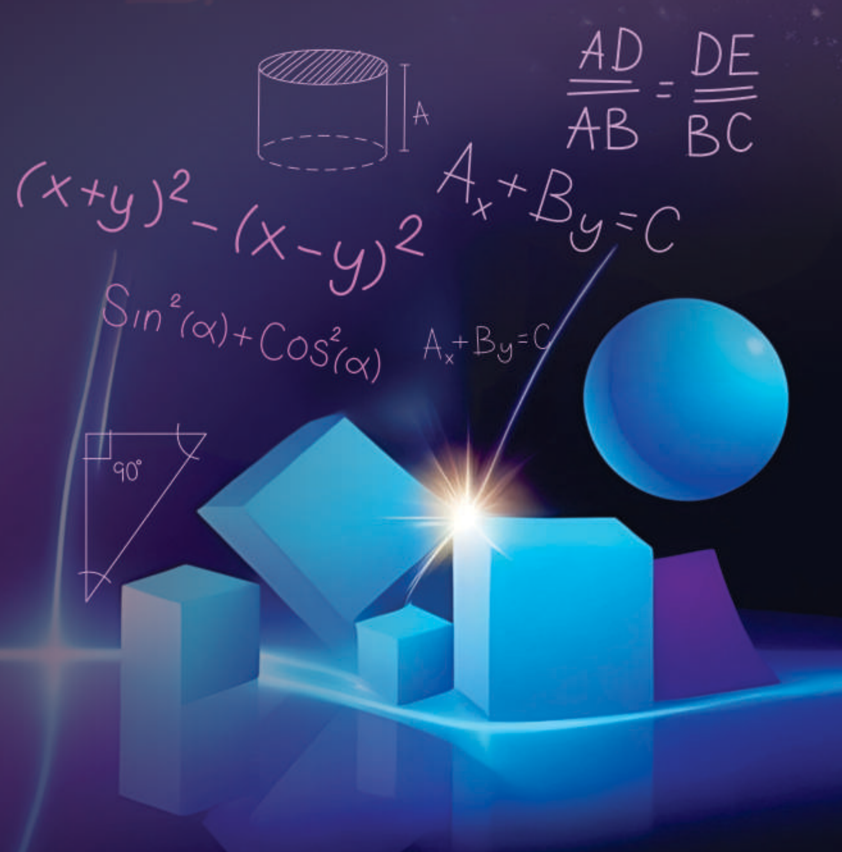
2026 EXAMINATION

CBSE QUESTION & CONCEPT BANK

Chapter-wise & Topic-wise with Competency Questions

CLASS 10



Chapter-wise
CONCEPT MAPS

Important Questions with Detailed Explanations
NCERT & EXEMPLAR

Handpicked & High yield from Past 10 Years
PYQs

Revision Blue Print & Solved Questions
COMPETENCY FOCUSED

CBSE 2025 Past Year & SQP Solved Papers
LATEST CBSE PAPERS

As per Latest Pattern
MOCK TESTS

MATHEMATICS
BASIC

Chapter-wise Weightage and Trend Analysis of
CBSE Past 6 Years' Papers

MATHEMATICS					
CHAPTERS	**2020**	**2022**	**2023**	**2024**	**2025**
Real Numbers	5	–	6	6	6
Polynomials	5	–	2	5	4
Pair of Linear Equations in Two Variables	4	–	5	6	6
Quadratic Equations	5	4	8	4	5
Arithmetic Progressions	5	6	5	5	5
Triangles	6	–	7	8	8
Coordinate Geometry	6	–	6	6	6
Introduction to Trigonometry	7	–	6	7	6
Some Applications of Trigonometry	4	7	6	5	6
Circles	3	6	8	7	7
Areas Related to Circles	3	–	5	5	4
Surface Areas and Volumes	4	4	5	5	6
Statistics	5	8	6	7	6
Probability	6	–	5	4	5

**The marks allotment mentioned above is chapter-wise and includes internal choice questions as well. Therefore, the total might not match the Maximum Marks of the respective Previous Year Paper.*

**For the year 2021, the exam was not conducted.*

Question Typology

YEAR	Objective Questions		Subjective Questions				
	MCQs	A/R	Fill in the Blanks	VSA	SA	LA	Case Based type
2025	18	2	–	5	6	4	3
2024	18	2	–	5	6	4	3
2023	18	2	–	5	6	4	3
2022	–	–	–		10	2	2
2021	Exam Not Conducted						

Evolving Trends in CBSE Exam Patterns

2021

❖ Exam Not Conducted

2022

❖ Question paper contains 14 questions

❖ It was a descriptive paper which contains very short question (2 marks), short questions (3 marks), long questions (4 marks), and two case studies.

❖ Internal choice has given in section A, B and C.

2023

❖ Rationalised Content Onwards

❖ Assertion/Reason questions are introduced from this year onwards.

❖ 3 case based questions with internal choices are added.

❖ The number of sections in the paper increased to 5 sections (A, B, C, D and E) compared to 2022.

❖ Competancy based questions are increased in number.

❖ Internal choice has given in section B,C,D and E

❖ MCQ (1 Mark), VSA (2 Marks), SA (3 Marks), LA (5 Marks), Case Based (4 Marks) 2023 onwards,

2024

❖ No changes in exam pattern

2025

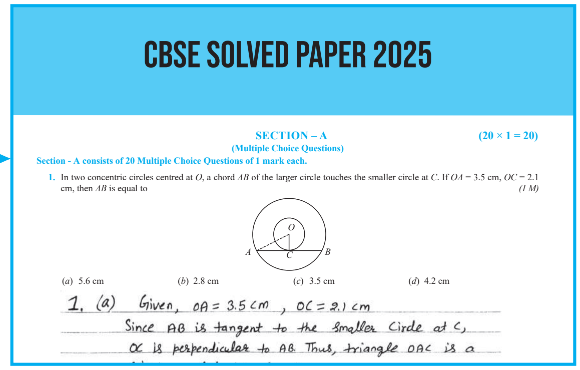
❖ No changes in exam pattern

HOW TO USE THIS BOOK

This book is structured to support your learning journey of preparing for your board exams through a variety of engaging and informative elements. Here's how to make the most of it:

CBSE Solved Paper of 2025 with Handwritten Answer: *Get yourself updated with the latest Board Question Papers. With handwritten answers, learn the practical application of concepts and effective answering techniques to achieve higher scores.*

CBSE Solved Paper


CBSE SOLVED PAPER 2025

SECTION – A (20 × 1 = 20)
(Multiple Choice Questions)
Section - A consists of 20 Multiple Choice Questions of 1 mark each.

1. In two concentric circles centred at O, a chord AB of the larger circle touches the smaller circle at C. If $OA = 3.5$ cm, $OC = 2.1$ cm, then AB is equal to (1 M)

(a) 5.6 cm (b) 2.8 cm (c) 3.5 cm (d) 4.2 cm

1. (a) Given, OA = 3.5 cm, OC = 2.1 cm
Since AB is tangent to the smaller circle at C,
OC is perpendicular to AB. Thus, triangle OAC is a

At the start of every chapter, you'll find a thoughtfully chosen image and a quote that captures the main idea and motivation of the topic. This approach aims to get your interest and give you a glimpse of the theme ahead.

Before diving into the details, we outline the syllabus and analyze the weightage given to each topic over the past five years. This helps you prioritize your study focus based on the significance of each section.

Preview

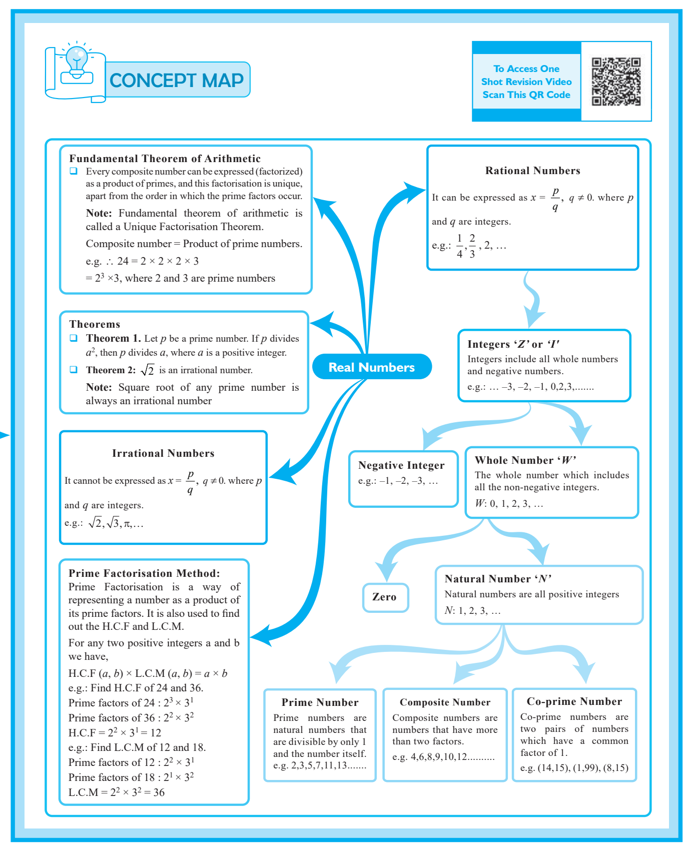

"Smartphone uses real numbers to calculate the amount of data you have used. If your data plan includes 1.5 GB of data per day, and you've used 0.75 GB, the phone calculates the remaining data using subtraction in the set of real numbers."

SYLLABUS & WEIGHTAGE

List of Concept Names	Years				
	2021	2022	2023	2024	2025
The Fundamental Theorem of Arithmetic (Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples)	Exam not Conducted	–	2 Q (1 M each) 1 Q (4 M)	1 Q (2 M) 1 Q (3 M)	1 Q (2 M)
Revisiting Irrational Numbers (Proofs of irrationality of $\sqrt{2}, \sqrt{3}, \sqrt{5}$)		–	–	1 Q (1 M) 1 Q (2 M)	1 Q (1 M) 1 Q (3 M)

The concept map appears to be a comprehensive study aid that outlines key concepts in a structured format, featuring definitions, diagrams, and processes. For a student, it would serve as a visual summary, making complex ideas more accessible and aiding in revision and understanding of concept for their curriculum.

Concept Map



1 | GEOMETRICAL MEANING OF THE ZEROES OF A POLYNOMIAL

Important Terms

- **Polynomial:** Polynomial has two words, Poly (meaning "many") and Nomial (meaning "terms"). A polynomial is defined as an expression that includes variables, constants, and exponents.
- **General form of the Polynomial:** $p(x) = a_nx^n + a_{(n-1)}x^{(n-1)} + a_{(n-2)}x^{(n-2)} + \dots + a_1x^1 + a_0$. (where n is a whole number and $a_0, a_1, a_2, \dots, a_n$ are real numbers) is called a polynomial in one variable x of degree n.
- **Degree of the Polynomial:** The highest power of the variable x in the given polynomial $p(x)$, is known as the degree of the polynomial.
- **Linear Polynomial:** If the degree of the given polynomial is one then, it is known as the linear polynomial. *e.g.,* $2x - 3, x + 5$
- **Quadratic Polynomial:** If the degree of the given polynomial is two then, it is known as the quadratic polynomial. *e.g.,* $2x^2 - 3$, $x^2 + \sqrt{3}\ x + 5$, $\frac{y}{5} + y^2 - \sqrt{2}$, etc.
- **Cubic Polynomial:** If the degree of the given polynomial is three then, it is known as the cubic polynomial.
- *e.g.,* $2 - x^3, x^3, 3 - x^2 + x^3, 3x^3 - 2x^2 + x - 1$,etc.
- **The value of $p(x)$ at $x = k$:** If $p(x)$ is a polynomial in x, and if k is any real number, then the value obtained by replacing x by k in $p(x)$, is called the value of $p(x)$ at $x = k$, and is denoted by $p(k)$.
- **Zero of a Polynomial $p(x)$:** If $p(k) = 0$, then the real number k is said to be a zero of a polynomial $p(x)$.
- **Zero of the Linear Polynomial:** If k is a zero of $p(x) = ax + b$, then $p(k) = ak + b = 0$, *i.e.,* $k = -\frac{b}{a}$.

Important Concepts

- **Geometrical Meaning of the Zeroes of a Polynomial:**

  (*i*) The linear polynomial $ax + b$, $a \neq 0$, has exactly one zero, namely, $\left(-\frac{b}{a}, 0\right)$.

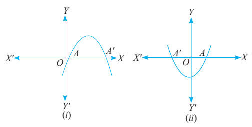
  (*ii*) The zeroes of a quadratic polynomial $ax^2 + bx + c$, $a \neq 0$, are precisely the x-coordinates of the points where the parabola $(ax^2 + bx + c)$ representing $y = ax^2 + bx + c$ intersects the x-axis.

  Equation $y = ax^2 + bx + c$ has one of the two shapes either open upwards like ∪ or open downwards like ∩ depending on whether $a > 0$ or $a < 0$. (These curves are called parabolas.)

  From our observation about the shape of the graph of $y = ax^2 + bx + c$, the following three cases arise:

Case (*i*): Here, the graph cuts x-axis at two distinct points A and A'.

The x-coordinates of A and A' are the two zeroes of the quadratic polynomial $ax^2 + bx + c$ in this case (see Fig. *i* & *ii*)



(*i*) (*ii*)

Important Terms:

Important terms often serve as foundational concepts upon which more complex ideas are built. Introducing them early ensures students have a solid understanding before delving into more advanced topics.

Important Concepts:

Familiarizing with key concepts in advance helps prepare cognitive framework for processing and integrating new information. By highlighting important concepts upfront, students are better equipped to identify connections and relationships between various ideas presented in the chapter.

Important Derivations:

Derivations bridge the gap between theoretical concepts and their practical application, showing students how abstract ideas translate into real-world scenarios.

Important Formulas:

Introducing important formulas upfront brings clarity to the chapter's objectives, guiding students' focus towards essential mathematical principles that will be explored further.

Important Derivations

- **Theorem 1:** Let p be a prime number. If p divides a^2, then p divides a, where a is a positive integer.

  Proof: Let the prime Factorisation of a be as follows:

  $a = p^1, p^2, \dots p^n$, where $p^1, p^2, \dots, p^n$ are primes, not necessarily distinct.

  Therefore, $a^2 = (p^1, p^2, \dots p^n)(p^1 \cdot p^2 \dots p^n) = (p^1)^2, (p^2)2 \dots (p^n)^2$.

  Now, we are given that p divides a^2. Therefore, from the Fundamental Theorem of Arithmetic, it follows that p is one of the prime factors of a^2. However, using the uniqueness part of the Fundamental Theorem of Arithmetic, we realize that the only prime factors of a^2 are $p^1, p^2, \dots, p^n$. So p is one of $p^1, p^2, \dots, p^n$.

  Now, since $a = p^1, p^2, \dots p^n$.

  p divides a.

Important Formulas

Cube

- Area of four walls = Lateral surface area = $4a^2$
- Total surface area (T.S.A) of the cube = $6a^2$
- Length of diagonal of the cube = $\sqrt{3}a$

Cuboid

- Area of four walls of a room = Lateral surface area = $2h\ (l + b)$
- Total surface area (T.S.A) of the cuboid = $2\ (lb + bh + lh)$
- Length of diagonal of the cuboid = $\sqrt{l^2 + b^2 + h^2}$

Sphere

- Surface area (S.A.) of the sphere = $4\pi r^2$

Hemisphere

- Curved surface area (C.S.A.) of the hemisphere = $2\pi r^2$
- Total surface area (T.S.A.) of the hemisphere = $3\pi r^2$

Right Circular Cylinder

- Area of each end of the cylinder = πr^2
- Curved surface area (C.S.A) of the cylinder = (circumference of circle × height of cylinder) = $2\pi rh$
- Total surface area (T.S.A) of the cylinder = $2\pi r\ (h + r)$

Cone

- Slant Height $(l) = \sqrt{(r^2 + h^2)}$
- Curved surface area (C.S.A.) of cone = πrl
- Total surface area (T.S.A) of cone = $\pi r(r + l) = \pi r(r + \sqrt{(h^2 + r^2)})$

Real Life Applications

Here are some real-life applications of real numbers:

1. Banking and Finance:

- **Interest rates:** Real numbers are used to represent interest rates on loans and investments.
- **Account balances:** Real numbers are used to represent the balances in bank accounts, investments, and financial transactions.

Different Problem Types

Type I: Expressing a Positive Integer as a Product of its Prime Factors

Suppose we need to find the prime factorisation of 176

Solution:

Step I: Divide the given number by the smallest prime number 2.

Here, we divide 176 by 2 $\Rightarrow 176 \div 2 = 88$

Step II: Again, divide the quotient of step 1 by the smallest prime number 2.

So, 88 is again divided by 2 $\Rightarrow 88 \div 2 = 44$

Step III: Repeat the process, until the quotient becomes 1.

Now, again divide 44 by 2 $\Rightarrow 44 \div 2 = 22$

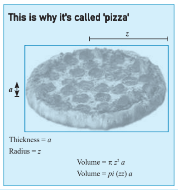
22 is divisible by 2. So, divide it again by 2 $\Rightarrow 22 \div 2 = 11$

As 11 is a prime number, divide it by 11 to get 1 $\Rightarrow 11 \div 11 = 1$

2	176
2	88
2	44
2	22
11	11
	1

Step IV: Finally, multiply all the prime factors that are the divisors. Prime factorisation of 176 is $2 \times 2 \times 2 \times 2 \times 11 = 2^4 \times 11$

Memes



Real Life Applications:

Connecting abstract math to real scenarios deepens comprehension and aids in problem-solving.

Learning how math connects with other subjects shows that it's useful in many areas and helps us understand different topics better.

Different Problem Types:

Presenting different types of problems encourages critical thinking and creativity by challenging students to approach each problem uniquely, analyse it, develop strategies, and adapt their approaches to find solutions.

Different problem types challenge students to analyse problems from diverse angles, fostering critical thinking skills essential for problem-solving.

Memes:

Memes are a popular form of internet humour and culture. With creativity we have captured students' attention to make them more receptive to the material that follows.

Memorable memes help students retain and recall key mathematical ideas more effectively during studying and assessments

COMPETENCY BASED SOLVED EXAMPLES

Multiple Choice Questions (1 M)

1. **If the H.C.F of 360 and 64 is 8, then their L.C.M is:** *(An)* (CBSE, 2023)
   (*a*) 2480 (*b*) 2780 (*c*) 512 (*d*) 2880

Sol. We are given:
H.C.F (360, 64) = 8
The formula to find L.C.M using H.C.F and product of the numbers is:
$$\text{L.C.M. } (a, b) = \frac{a \times b}{\text{H.C.F}(a,b)}$$
Substituting the given values:
$a = 360, b = 64$
$$\text{L.C.M } (360, 64) = \frac{360 \times 64}{8} = \frac{23040}{8} = 2880$$

2. **The least number that is divisible by all the natural numbers from 1 to 10 (both inclusive) is** *(An)* (NCERT Exemplar)
   (*a*) 10 (*b*) 100 (*c*) 504 (*d*) 2520

Sol. The least number divisible by all the numbers from 1 to 10 will be the L.C.M of the following number: 1, 2, 3, 4, 5, 6, 7, 8, 9 & 10.
Prime factorisation of these numbers are $1 = 1, 2 = 2, 3 = 3, 4 = 2 \times 2, 5 = 5, 6 = 2 \times 3, 7 = 7, 8 = 2 \times 2 \times 2, 9 = 3 \times 3, 10 = 2 \times 5$
So, the L.C.M of these number is
$1 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7 = 2520$

Key Takeaways
Check that the correct option should be divisible by all the natural numbers 1–10 as the L.C.M is the lowest common multiple.

3. **120 can be expressed as a product of its prime factors as** *(An)* (CBSE, 2020)
   (*a*) $5 \times 8 \times 3$ (*b*) 15×2^3
   (*c*) $10 \times 2^2 \times 3$ (*d*) $5 \times 2^3 \times 3$

Sol. Let's find the prime factors of 120:
$120 = 2 \times 60 = 2 \times 2 \times 30$
$= 2 \times 2 \times 2 \times 15 = 2 \times 2 \times 2 \times 3 \times 5$
So, the prime factorization of 120 is $2^3 \times 3 \times 5$.

4. **If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$; x, y are prime numbers, then H.C.F (a, b) is** *(An)* (CBSE SQP, 2023)
   (*a*) xy (*b*) xy^2 (*c*) x^3y^3 (*d*) x^2y^2

Sol. It is given that, $a = x^3y^2$ and $b = xy^3$, where x and y are prime numbers.
L.C.M (a, b) = L.C.M (x^2y^2, xy^3)
= The highest of powers of x and $y = x^3y^3$
H.C.F (a, b) = H.C.F (x^2y^2, xy^3)
The lowest of powers of x and $y = xy^2$
Hence, H.C.F$(a, b) = xy^2$ and L.C.M$(a, b) = x^3y^3$.

5. **The L.C.M of smallest two-digit composite number and smallest composite number is** *(An)* (CBSE SQP, 2023)
   (*a*) 12 (*b*) 4 (*c*) 20 (*d*) 44

Sol. By prime factorisation, we get;
$4 = 1 \times 2 \times 2$
$10 = 1 \times 2 \times 5$
Now, L.C.M of 4, $10 = 2 \times 2 \times 5 = 20$
Therefore, the L.C.M of the smallest two-digit composite number and the smallest composite number is 20.

Key Takeaways
The smallest 2-digit number = 10 and the smallest composite number = 4

6. **If two positive integers a and b can be expressed as $p = ab^2$ and $q = a^3b$; a, b being prime numbers, then L.C.M (p, q) is** *(Ap)* (NCERT Exemplar)
   (*a*) ab (*b*) a^2b^2 (*c*) a^3b^2 (*d*) a^3b^3

Sol. Let's express each polynomial as a product of the power of irreducible factors.
$p = ab^2 = a \times b^2, q = a^3b = a^3 \times b$
To find the L.C.M, raise each irreducible factor to the greatest exponent.
$\therefore$ L.C.M $= a^3 \times b^2 = a^3b^2$

Mistakes 101 : What not to do!
Sometimes, students take the term with the lower power from numbers to calculate the L.C.M of numbers.

7. **The ratio between the L.C.M and H.C.F of 5, 15, 20 is** *(Ap)*
   (*a*) 9 : 1 (*b*) 4 : 3
   (*c*) 11 : 1 (*d*) 12 : 1

Sol. Prime factorisations are:
$5 = 5^1, 15 = 3^1 \times 5^1, 20 = 2^2 \times 5^1$
L.C.M $(5, 15, 20) = 2^2 \times 3^1 \times 5^1 = 60$
H.C.F $(5, 15, 20) = 5^1 = 5$
$$\text{Ratio} = \frac{\text{LCM}}{\text{HCF}} = \frac{60}{5} = 12$$
Ratio = 12 : 1

CBSE Class – X MATHEMATICS 46

Solved Examples

For each topic, solved examples are provided including tagging of Competencies, PYQs, CBSE SQPs etc that exemplify how to approach and solve questions. This section is designed to reinforce your learning and improve problemsolving skills.

MISCELLANEOUS EXERCISE

Multiple Choice Questions (1 M)

1. The solution of equations $x - y = 2$ and $x + y = 4$ is: (CBSE SQP, 2023)
   (*a*) 3 and 1 (*b*) 4 and 3 (*c*) 5 and 1 (*d*) –1 and –3
2. If a pair of linear equations is inconsistent then their graph lines will be
   (*a*) parallel (*b*) always coincident
   (*c*) always intersecting (*d*) intersecting or coincident
3. If $2x - 3y = 7$ and $(a + b)x - (a + b - 3)y = 4a + b$ have an infinite number of solutions then
   (*a*) $a = 5, b = 1$ (*b*) $a = -5, b = 1$
   (*c*) $a = 5, b = -1$ (*d*) $a = -5, b = -1$

ANSWER KEYS

Multiple Choice Questions

1. (*a*) 2. (*a*) 3. (*d*) 4. (*a*) 5. (*d*) 6. (*c*) 7. (*c*) 8. (*c*) 9. (*a*) 10. (*c*)
11. (*a*) 12. (*c*) 13. (*a*) 14. (*c*)

Assertion and Reason

1. (*b*) 2. (*a*) 3. (*d*) 4. (*c*)

Case Based Questions

Case Based-II

(*i*) (*c*) (*ii*) (*b*) (*iii*) (*a*) (*iv*) (*c*) (*v*) (*d*)

Case Based-V

(*i*) (*d*) (*ii*) (*c*) (*iii*) (*b*) (*iv*) (*d*) (*v*) (*c*)

HINTS & EXPLANATIONS

Multiple Choice Questions

1. (*a*) Given: $x - y = 2$ … (*i*)
   $x + y = 4$ … (*ii*)
   Adding eqn. (*i*) and (*ii*), we get $2x = 6 \Rightarrow x = 3$
   Put the value of x in equation (*i*), we get
   $3 - y = 2 \Rightarrow y = 1$
   Hence, $x = 3, y = 1$
2. (*a*) A pair of linear equations is inconsistent when there is no solution to the pair, which is possible if there is no common points in the lines represented by the pair of linear equations, which is possible if the lines are parallel.
3. (*d*) We have,
   $2x - 3y = 7$ … (*i*)
   and $(a + b)x - (a + b - 3)y = 4a + b$ … (*ii*)
   $\Rightarrow a_1 = 2,\ b_1 = -3,\ c_1 = -7$
   $a_2 = a + b, b_2 = -a - b + 3$ and $c_2 = -4a - b$
   For infinite number of solutions,
   $$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{2}{a+b} = \frac{-3}{-(a+b-3)} = \frac{-7}{-(4a+b)}$$
   $$\Rightarrow \frac{2}{a+b} = \frac{3}{a+b-3} = \frac{7}{4a+b}$$
   For $\frac{2}{a+b} = \frac{3}{a+b-3}$
   $\Rightarrow 2a + 2b - 6 = 3a + 3b \Rightarrow a + b = -6$ … (*i*)
   For $\frac{3}{a+b-3} = \frac{7}{4a+b}$
   $\Rightarrow 12a + 3b = 7a + 7b - 21 \Rightarrow 5a - 4b = -21$ … (*ii*)
   Adding eqn (*i*) and eqn (*ii*) by multiplying eqn (*i*) by 4.
   $4(a + b) + 5b - 4b = -6 \times 4 + (-21)$
   $\Rightarrow 9a = -45 \Rightarrow a = -5$
   Substituting this in eqn (*i*)
   $-5 + b = -6$
   $b = -6 + 5 = -1$
   Hence, $a = -5$ and $b = -1$

At the end of each chapter, you'll find additional exercises intended to test your grasp of the material. These are great for revision and to prepare for exams.

Answer Key and Explanations including Topper's Explanations, Mistake 101, Nailing the right answer and Key takeaway to know how to write the ideal answer.

Answer Key

MOCK TEST PAPER-1

Time allowed : 3 hours **Maximum Marks : 80**

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and follow them:

(i) *This question paper contains **38** questions. **All** questions are compulsory.*
(ii) *Question Paper is divided into 5 Sections-**Section A, B, C, D and E.***
(iii) *In **Section A question number 1 to 18 are** Multiple Choice Questions **(MCQs)** and question number **19 & 20** are Assertion-Reason based **questions of 1 mark each.***
(iv) *In **Section-B question number 21 to 25 are** Very Short Answer (VSA) type **questions of 2 marks each.***
(v) *In **Section-C question number 26 to 31 are** Short Answer (SA) type **questions carrying 3 marks each.***
(vi) *In **Section-D question number 32 to 35 are** Long Answer (LA) type **questions carrying 5 marks each.***
(vii) *In **Section-E question number 36 to 38 are** Case Study based questions **carrying 4 marks each. Internal choice is provided in 2 marks question in each case-study.***
(viii) ***There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.***
(ix) ***Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.***
(x) ***Use of calculators is NOT allowed.***

SECTION - A

Section - A consists of Multiple Choice type questions of 1 mark each.

1. The least number that is divisible by all the natural numbers from 1 to 10 (both inclusive) is
   (*a*) 10 (*b*) 100 (*c*) 504 (*d*) 2520
2. If the zeroes of the quadratic polynomial $ax^2 + bx + c, c \neq 0$ are equal, then
   (*a*) c and a have opposite signs (*b*) c and b have same sign
   (*c*) c and a have same sign (*d*) c and b have opposite sign
3. The given pair of linear equations $x + 2y - 5 = 0$ and $-3x - 6y + 15 = 0$ have
   (*a*) Exactly one solution (*b*) Exactly two solutions
   (*c*) Infinitely many solutions (*d*) No solution
4. If $ax^2 + bx + c = a(x - p)^2$, the relation among a, b and c is:
   (*a*) $abc = 1$ (*b*) $a + c - 2b = 0$
   (*c*) $b^2 - ac = 0$ (*d*) $b^2 = 4ac$
5. If the numbers $n - 2, 4n - 1$ and $5n + 2$ are in AP then value of n is
   (*a*) 1 (*b*) 4 (*c*) –4 (*d*) –2

Mock Test

Mock Test Papers: Test your preparedness with our Mock Test Papers designed to mirror the format and difficulty of real exams. Use the detailed explanations to identify areas of strength and opportunities for improvement.

CONTENTS

Upcoming CBSE SQPs/APQs can be accessed through this QR

Questions have been categorized according to the Bloom's Taxonomy (as per CBSE Board).
The following abbreviations have been used in the book:

(*Un*) - Understanding (*Re*) - Remembering (*Ap*) - Applying
(*An*) - Analysing (*Cr*) - Creating (*Ev*) - Evaluating

CBSE SOLVED PAPER 2025

Time allowed : 3 hours **Maximum Marks : 80**

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and strictly follow them:

(i) *This question paper contains **38** questions. **All** questions are compulsory.*

(ii) *Question Paper is divided into **FIVE** Sections-**SECTION A, B, C, D** and **E.***

(iii) *In Section -**A**, question numbers **1** to **18** are Multiple Choice Questions (MCQs) and question numbers **19** & **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In Section-**B**, question numbers **21** to **25** are Very Short Answer (VSA) type questions of **2** marks each.*

(v) *In Section-**C**, question numbers **26** to **31** are Short Answer (SA) type questions carrying **3** marks each.*

(vi) *In Section-**D**, question numbers **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In Section-**E**, question numbers **36** to **38** are **case - based integrated units** of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in **2** questions in Section-**B**, **2** questions in Section-**C**, **2** questions in Section-**D** and **3** questions of **2** marks in Section-**E**.*

(ix) *Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.*

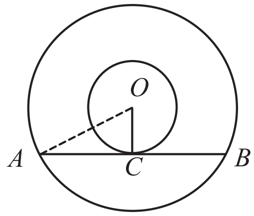
(x) *Use of calculators is **NOT allowed.***

SECTION – A (20 × 1 = 20)

(Multiple Choice Questions)

Section - A consists of 20 Multiple Choice Questions of 1 mark each.

1. In two concentric circles centred at O, a chord AB of the larger circle touches the smaller circle at C. If $OA = 3.5$ cm, $OC = 2.1$ cm, then AB is equal to *(1 M)*



(*a*) 5.6 cm (*b*) 2.8 cm (*c*) 3.5 cm (*d*) 4.2 cm

1. (a) Given, $OA = 3.5$ cm, $OC = 2.1$ cm

Since AB is tangent to the smaller circle at C, OC is perpendicular to AB. Thus, triangle OAC is a right angled triangle at C.

Using Pythagoras theorem in $\triangle OAC$,

$$OA^2 = OC^2 + AC^2$$
$$\Rightarrow (3.5)^2 = (2.1)^2 + AC^2$$
$$\Rightarrow 12.25 = 4.41 + AC^2$$
$$\Rightarrow AC^2 = 12.25 - 4.41 = 7.84$$
$$\Rightarrow AC = \sqrt{7.84} = 2.8 \text{ cm}$$

$\because$ AB is a chord and C is the midpoint (as OC is perpendicular to AB).

$\therefore$ AB = 2 AC

Hence, $AB = 2 \times 2.8 = 5.6$ cm.

2. Three coins are tossed together. The probability that at least one head comes up, is *(1 M)*

(*a*) $\frac{3}{8}$ (*b*) $\frac{7}{8}$ (*c*) $\frac{1}{8}$ (*d*) $\frac{3}{4}$

2. (b) When three coins are tossed, the total number of possible outcomes is $2^3 = 8$

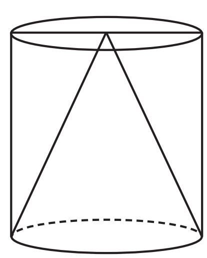
And, The outcomes are HHH, HHT, HTH, THH, HTT, THT, TTH, TTT.

The number of favorable outcomes for at least one head = 7

Hence, the probability of getting at least one head

$$= \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{7}{8}$$

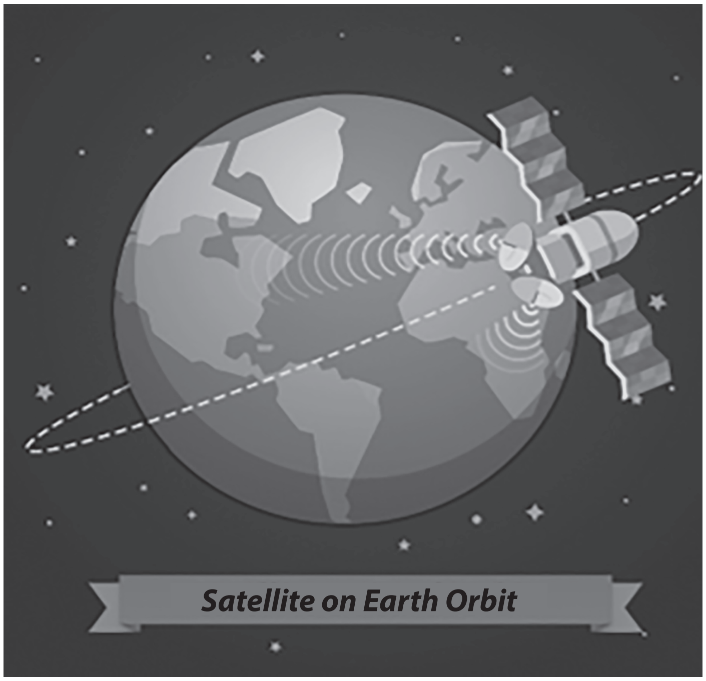
3. The volume of air in a hollow cylinder is 450 cm³. A cone of same height and radius as that of cylinder is kept inside it. The volume of empty space in the cylinder is *(1 M)*



(*a*) 225 cm³ (*b*) 150 cm³ (*c*) 250 cm³ (*d*) 300 cm³

CIRCLES

10


Satellite on Earth Orbit

"Circles are used to describe the paths, or orbits, that satellites follow around the Earth. These circular orbits help satellites stay at the same height, which is important for tasks like broadcasting TV, reporting weather, and helping with GPS navigation. Understanding these orbits helps people keep track of satellites and ensure they function properly."

SYLLABUS & WEIGHTAGE

List of Concept Names	Years				
	2021	2022	2023	2024	2025
Tangent to a Circle (The tangent at any point of a circle is perpendicular to the radius through the point of contact)	Exam was not Conducted	1 Q (2 M) 1 Q (4 M)	2 Q (1 M each) 1 Q (2 M) 1 Q (3 M)	1 Q (1 M) 1 Q (5 M)	1 Q (5 M) 2 Q (1 M each)
Number of Tangents from a Point on a Circle (The length of tangent from an external point to a circle are equal, Number of tangents from a point to a circle)		–	1 Q (1 M)	1 Q (1 M)	1 Q (5 M)

CONCEPT MAP

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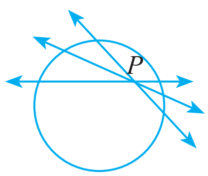
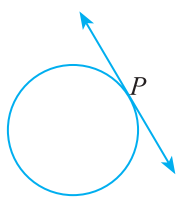
Circles

Number of tangents

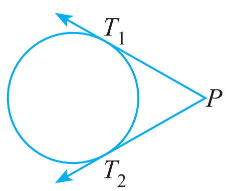
- There are no tangent to a circle passing through a point lying inside the circle.



- There is one and only one tangent to a circle passing through a point lying on the circle.

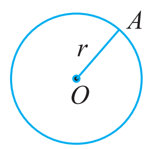


- There are exactly two tangents to a circle through a point lying outside the circle.



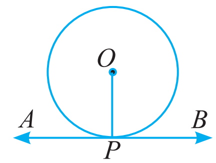
Definition

The locus of a point that is equidistant from a fixed point is known as a circle. The fixed point is called centre and the distance between the fixed point and the point on the circle is called radius.



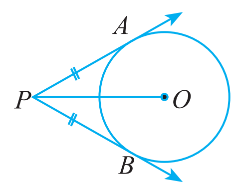
Theorem 1

The tangent at any point of a circle is perpendicular to the radius through the point of contact.



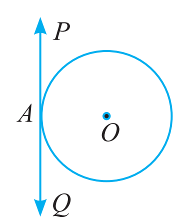
Theorem 2

The lengths of tangents drawn from an external point to a circle are equal.



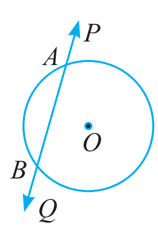
Tangent

A line intersecting a circle at only one point is known as tangent and the intersecting point is known as point of contact.



Secant

A line intersecting a circle at two different points is known as secant.



Terms Related to Circle:

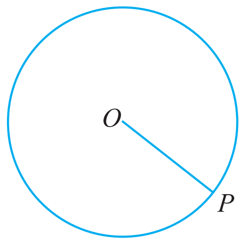
1. Chord
2. Arc
3. Sector
4. Segment
   (a) Minor segment
   (b) Major segment

1 TANGENT TO A CIRCLE

Important Terms

- **Circle:** The collection of all the points whose distance from a fixed point is constant is known as a circle.

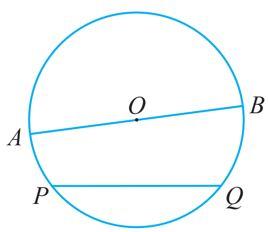
  Here, the fixed point is called the Centre of the circle, and the distance between the fixed point (centre) and any point on the circle is called the Radius of the circle.



  Here, O is the fixed point or the Centre of the Circle and OP is the radius of the circle.

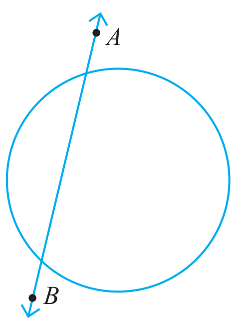
- **Chord:** A line segment joining any two different points on a circle is called the Chord of the circle.

  If a chord passes through the centre of a circle then the chord is known as the Diameter of the circle.



  In the figure, PQ is a chord of the circle, and AOB, or simply AB is the diameter of the circle.

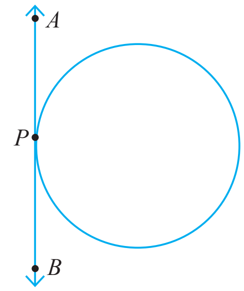
- **Secant:** A line that intersects a circle at two different points is called a Secant of that circle.



  In the figure, AB is secant to the circle.

- **Tangent:** A line that touches the circle at a point (or intersects the circle at only one point) is called a Tangent to the circle.

  The point at which the tangent touches a circle is called the Point of Contact.



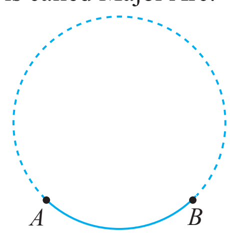
  Here, APB is tangent to the circle and P is the point of contact.

- **Note:** (*i*) Tangent is a special case of secant when the two endpoints of its corresponding chord coincide.

  (*ii*) At any point on a circle, only one tangent can be drawn.

- **Arc:** A piece of a circle between any two different points is called an Arc of that circle.

  Between any two points on a circle, there are two arcs. One is smaller than the other. The smaller arc is known as Minor Arc and the larger is called Major Arc.



  In the figure, AB (solid) represents a minor arc and AB (dotted) represents a major arc.

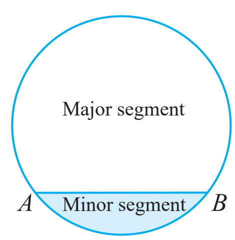
  Note: When both the arcs, major and minor, are equal then each is called Semicircle.

- **Circumference:** The length of the whole circle is known as Circumference.

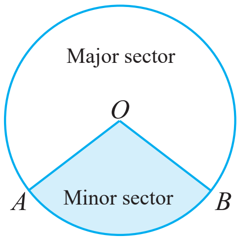
- **Segment:** In a circle, the region between a chord and an arc is called a Segment of the circle.

  As in the case of arc, there are two types of segments.

  - **Minor Segment:** The region between a chord and a minor arc is called Minor Segment.
  - **Major Segments:** The region between a chord and a major arc is called Major Segment.



- **Sector:** A sector of a circle is the region between an arc and two radii, joining the endpoints of the arc and the centre.
  - **Minor Sector:** The region between a minor arc and two radii, joining the endpoints of the arc and the centre, of a circle is known as the Minor Sector of the circle.
  - **Major Sector:** The region between a major arc and two radii, joining the endpoints of the arc and the centre, of a circle is known as the Major Sector of the circle.

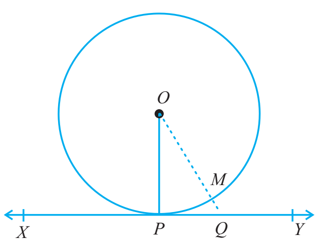


Important Derivations

- **Theorem 1: The tangent at any point of a circle is perpendicular to the radius through the point of contact.**

The tangent at any point of a circle is perpendicular to the radius through the point of contact.

Given: A circle with centre O and a tangent XY at a point P of the circle. **(CBSE, 2016)**



To prove: $OP \perp XY$.

Construction: Other than P, take a point Q, on XY and join OQ.

Proof: Q is a point on the tangent XY, other than the point of contact P. Hence Q lies outside the circle.

Let OQ intersect the circle at M.

Then, $OM < OQ$ [$\because$ a part (OM) of line segment (OQ) is less than the whole line segment (OQ)] … (i)

But, $OP = OM$ [radii of the same circle]. … (ii)

From equation (i) and (ii), we get

$$OP < OQ$$

Therefore, OP is shorter than any other line segment drawn from O to any point on XY, except P.

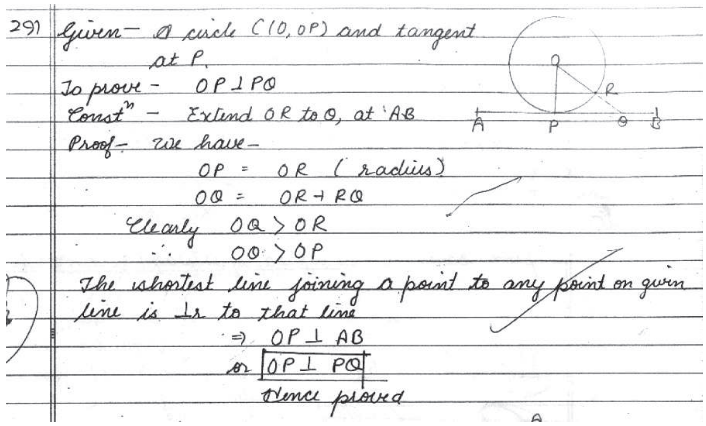
Or, we can say that, OP is the shortest distance between the point O and the line XY.

And also we know that the shortest distance of a point from the given line is the perpendicular distance.

Therefore, $OP \perp XY$. Hence, proved.

Note: Converse of the above theorem is also valid and is given as- **A line drawn through the end of a radius of a circle and perpendicular to the radius is tangent to the circle.**

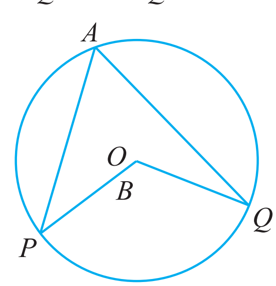
Topper's Explanation ***(CBSE 2016)***


29) Given– A circle C(O, OP) and tangent at P.
To prove – OP ⊥ PQ
Const^n – Extend OR to Q, at AB
Proof– we have–
OP = OR (radius)
OQ = OR + RQ
Clearly OQ > OR
∴ OQ > OP
The shortest line joining a point to any point on given line is ⊥r to that line
⇒ OP ⊥ AB
or OP ⊥ PQ
Hence proved

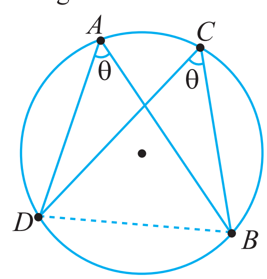
Important Concepts

Some important concepts related to a circle are given below:

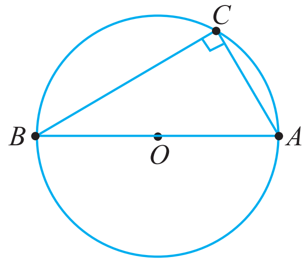
- Equal chords of a circle subtend equal angles at the centre.
- The perpendicular from the centre of a circle to a chord bisects the chord.
- The perpendicular distances of equal chords of a circle (or of congruent circles) are equal from the centre (or centres).
- Congruent arcs (or equal arcs) of a circle subtend equal angles at the centre.
- The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.i.e., $\angle POQ = 2\angle PAQ$



- Angles in the same segment of a circle are equal.



- An angle in a semicircle is a right angle.



- The sum of either pair of opposite angles of a cyclic quadrilateral is 180º.

Real Life Applications

- Cycling is a great way to keep our bodies fit, and when riding a bicycle, you may have noticed that the wheel moves along a road. Since the wheel is circular and the road is straight, the road touches the circle at only one point, and so the road becomes tangent to the circle at each point where the wheels roll on it. This is an example of a tangent to a circle.

Different Problem Types

Type I: On Finding the Length of the Tangent or Radius of a Circle:

Step I: Identify circle-related lengths and points.

Step II: Recognize tangent's perpendicularity to the radius.

Step III: Formulate a right triangle with radius, tangent, and line to the center.

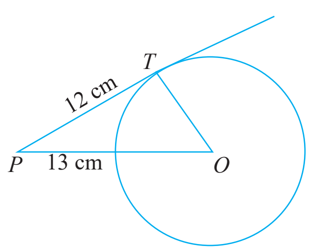
Step IV: Apply Pythagoras theorem.

Step V: Solve for radius or tangent length.

Example: A point P is 13 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 12 cm. Find the radius of the circle.

Solution: Since tangent to a circle is perpendicular to the radius through the point of contact.

$$\therefore\ \angle OTP = 90°$$



In right triangle OTP, we have

$OP^2 = OT^2 + PT^2$

$\Rightarrow 13^2 = OT^2 + 12^2$

$\Rightarrow OT^2 = 13^2 - 12^2 = (13 - 12)(13 + 12) = 25$

$\Rightarrow OT = 5.$

Hence, radius of the circle is 5 cm.

TYPE II: Question Based on the Result that the Tangent to a Circle at a Point is Perpendicular to the Radius through the Point:

Step I: Identify key elements such as the circle's center, tangent segments, and any mentioned angles.

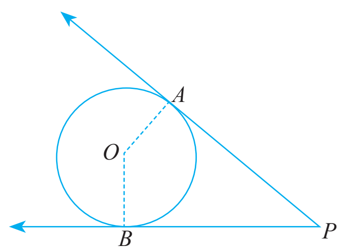
Step II: Apply the property that a tangent to a circle is perpendicular to the radius, forming a 90° angle at the point of tangency.

Step III: Recognize that in a cyclic quadrilateral, opposite angles sum to 180°, indicating the quadrilateral is cyclic.

Step IV: Utilize the tangent property to establish 90° angles between tangent segments and radii. Then, use angle sum properties to confirm the sum of opposite angles is 180°.

Example: In the given figure, O is the centre of the circle. PA and PB are tangent segments. Show that the quadrilateral $AOBP$ is cyclic.

Solution: Since tangent at a point to a circle is perpendicular to the radius through the point.



$\therefore OA \perp AP$ and $OB \perp BP$

$\Rightarrow \angle OAP = 90°$ and $\angle OBP = 90°$

$\Rightarrow \angle OAP + \angle OBP = 90° + 90° = 180°$

In quadrilateral $OAPB$, we have

$\angle OAP + \angle APB + \angle AOB + \angle OBP = 360°$

$\Rightarrow (\angle APB + \angle AOB) + (\angle OAP + \angle OBP) = 360°$

$\Rightarrow \angle APB + \angle AOB + 180° = 360°$

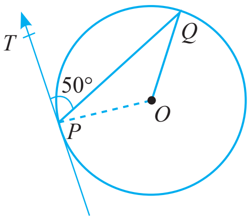
$\Rightarrow \angle APB + \angle AOB = 180°$

We can say that the quadrilateral $AOBP$ is cyclic.

COMPETENCY BASED SOLVED EXAMPLES

Multiple Choice Questions **(1 M)**

1. In Fig. 1, O is the centre of circle. PQ is a chord and PT is tangent at P which makes an angle of 50° with PQ. ∠POQ is *(Un)* (CBSE, 2020)



(*a*) 130° (*b*) 90°

(*c*) 100° (*d*) 75°

Sol. Radius from the centre makes an angle of 90° at the point where the tangent meets the circle.

$\angle OPQ = (90 - 50)° = 40°$ $\angle OPQ = \angle OQP = 40°$

(Triangle *OPQ* is isosceles)

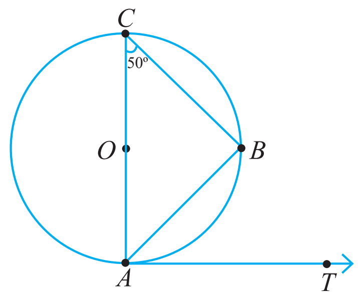
By Angle sum property of triangle we get,

$\angle POQ = (180 - 80)° = 100°$

2. In the figure, *AB* is a chord of the circle and *AOC* is its diameter such that ∠*ACB* = 50º. If *AT* is the tangent to the circle at the point *A*, then ∠*BAT* is equal to

(Re) (NCERT Exemplar)

(*a*) 65º (*b*) 60º (*c*) 50º (*d*) 40º



Sol. Since, the angle in a semicircle is 90º.

So, $\angle ABC = 90°$

In ΔACB,

$\angle A + \angle B + \angle C = 180°$ [Angle sum property]

$\Rightarrow \angle A + 90° + 50° = 180°$ [$\angle C = 50°$]

$\Rightarrow \angle A = 180° - 140° = 40° \Rightarrow \angle A$ or $\angle OAB = 40°$

Since tangent to a circle is perpendicular to the radius drawn through the point of contact.

So, *OA* is perpendicular to *AT*.

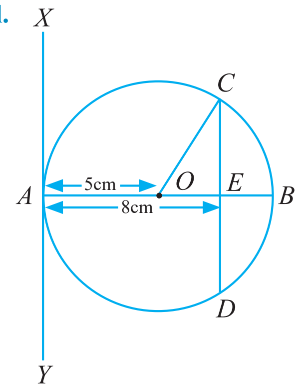
$\Rightarrow \angle OAT = 90° \Rightarrow \angle OAB + \angle BAT = 90°$

$\Rightarrow \angle BAT = 90° - 40° = 50°$ [Since, $\angle OAB = 40°$]

3. At one end *A* of a diameter *AB* of a circle of radius 5 cm, tangent *XAY* is drawn to the circle. The length of the chord *CD* parallel to *XY* and at a distance 8 cm from *A* is *(Un)* (NCERT Exemplar)

(*a*) 4 cm (*b*) 5 cm (*c*) 6 cm (*d*) 8 cm

Sol.



Since, $XY \parallel CD$

$\Rightarrow CD \perp AO \Rightarrow CD \perp AE \Rightarrow \angle OEC = 90°$

$\therefore$ In $\angle OEC$,

$CE^2 = OC^2 - OE^2$ [By Pythagoras theorem]

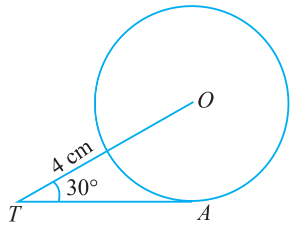
$\Rightarrow CE^2 = 5^2 - 3^2 = 25 - 9 = 16$

$\therefore CE = 4$ cm $\Rightarrow CD = 2 \times 4 = 8$ cm

Mistakes 101 : What not to do!

Students misinterpret that all chords drawn in a circle are equal in length, overlooking variations in chord lengths based on their positions relative to the centre.

4. In the given figure, *TA* is a tangent to the circle with centre *O* such that *OT* = 4 cm, ∠*OTA* = 30°, then length of *TA* is: *(An)*



(*a*) $2\sqrt{3}$ cm (*b*) 2 cm (*c*) $2\sqrt{2}$ cm (*d*) $\sqrt{3}$ cm

Sol. We know tangent makes 90° with the Radius.

Given $\angle ATO = 30°$ & $OT = 4$ cm

$$\cos 30° = \frac{AT}{OT} = \frac{AT}{4} \Rightarrow \frac{\sqrt{3}}{2} = \frac{AT}{4}$$

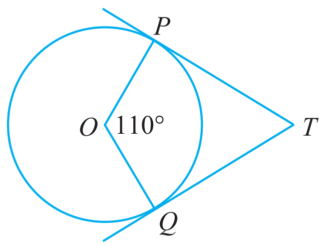
$$\Rightarrow AT = 4 \times \frac{\sqrt{3}}{2} = 2\sqrt{3} \text{ cm}$$

Mistakes 101 : What not to do!

Students may incorrectly apply properties related to tangents, such as the angle between a tangent and a radius being 90°. They might forget to consider the subtended angle or misinterpret the angle formed by a tangent and a chord.

5. In figure, if TP and TQ are the two tangents to a circle with centre O so that ∠POQ = 110°, then ∠PTQ is equal to ***(Ap)*** **(CBSE SQP, 2023)**

(*a*) 60° (*b*) 70°
(*c*) 80° (*d*) 90°



Sol. Given, $\angle POQ = 110°$

We know,

$\angle OPT = \angle OQT = 90°$ (Angle between the tangent and the radial line at the point of intersection of the tangent at the circle)

Now, in quadrilateral $POQT$

Sum of angles = 360°

$\Rightarrow \angle OPT + \angle OQT + \angle PTQ + \angle POQ = 360°$

$90° + 90° + \angle PTQ + 110° = 360°$

$\Rightarrow \angle PTQ = 360° - 290°$

$\Rightarrow \angle PTQ = 70°$

Answer Key

1. (*c*) 2. (*c*) 3. (*d*) 4. (*a*) 5. (*b*)

Assertion and Reason (1 M)

Direction: **In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:**

(*a*) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

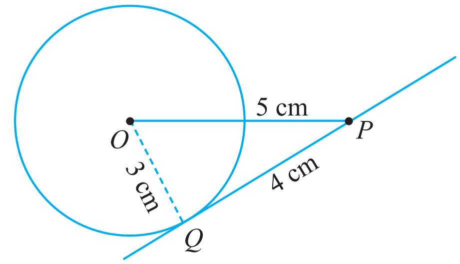
(*b*) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(*c*) Assertion (A) is true, but Reason (R) is false.

(*d*) Assertion (A) is false, but Reason (R) is true.

1. Assertion (A): If in a circle with centre *O*, the radius of the circle is 3 cm and distance of a point *P*, from the centre of a circle is 5 cm, then length of tangent *PQ*, where *Q* is a point on the circle, will be 4 cm.

Reason (R): (hypotenuse)^2 = (base)^2 + (height)^2 ***(Cr)***



Sol. In the given figure.

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

$25 = 9 + 16$

$25 = 25$

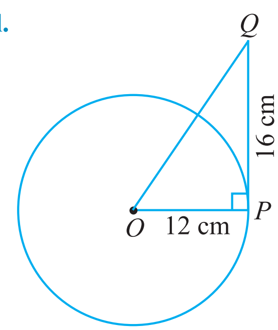
Hence L.H.S = R.H.S

∴ Both assertion (A) and reason (R) is true and reason (R) is the correct explanation of assertion (A).

2. Assertion (A): At a point *P* of a circle with centre *O* and radius 12 cm, a tangent *PQ* of length 16 cm is drawn. Then, *OQ* = 20 cm.

Reason (R): The tangent at any point of a circle is perpendicular to the radius through the point of contact. ***(Cr)***

Sol.



$PQ = 16$ cm and $OP = 12$ cm

Tangent drawn through the end point of a radius is perpendicular to the radius.

So, $OP \perp PQ$

Now, by Pythagoras theorem

(hypotenuse)^2 = (base)^2 + (height)^2

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

$\Rightarrow OQ^2 = 12^2 + 16^2 = 144 + 256 = 400$

$\Rightarrow OQ = \sqrt{400} = 20$ cm

Assertion is true.

Reason is also true by theorem.

As we used a theorem to prove assertion.

So, reason is correct explanation of the assertion

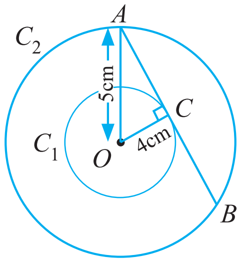
Nailing the Right Answer

Always draw accurate diagrams representing the given information in the problem. Pay attention to the positions of points, lines, and circles, and use a ruler and compass if necessary to ensure precision.

3. Assertion (A): If the radii of two concentric circles are 4 cm and 5 cm, then the length of each chord of one circle which is tangent to the other circle is 3 cm.

Reason (R): The tangent at any point of a circle is perpendicular to the radius through the point of contact. ***(Re)***

Sol.



We have, $AO = 5$ cm, $OC = 4$ cm

and $OC \perp AC$ (By theorem 1)

$\therefore\ AC^2 = AO^2 - OC^2$

$= 5^2 - 4^2 = 25 - 16 = 9 \Rightarrow AC = 3$

Also, in C_2, as the line passing through the centre and $\perp$ to a chord, bisects the chord.

$\therefore$ Length of the required chord $= AB = 2 \times AC = 2 \times 3 = 6$ cm

So, assertion is False.

Reason is true by theorem 1.

Thus, assertion is false and reason is true.

Key Takeaways

Apply the Pythagoras as theorem and properties of right triangles in problems involving tangent-secant or secant-secant intersections.

Answer Key

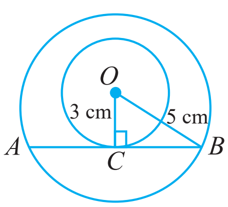
1. (a) 2. (a) 3. (d)

Subjective Questions

Very Short Answer Type Questions (1 or 2 M)

1. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of larger circle whcih touches the smaller circle. ***(Ev)*** **(CBSE, 2020)**

Sol.



(½ M)

In ΔOCB

$BC = \sqrt{5^2 - 3^2} = 4\,\text{cm}$ *(1 M)*

$AB = 2 \times BC = 8$ cm *(½ M)*

2. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle. ***(Cr)***

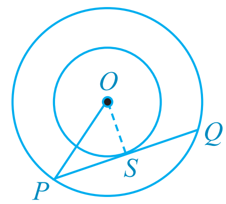
Sol. Given: Two concentric circles are of radii 5 cm and 3 cm.

To find: The length of the chord of the larger circle which touches the smaller circle.

PQ is chord of a larger circle and tangent of a smaller circle.

As, tangent is perpendicular to the radius at the point of contact S.

$\therefore\ \angle OSP = 90°$ *(½ M)*



In ΔOSP (Right angled triangle) using Pythagoras Theorem, we get

$OP^2 = OS^2 + SP^2 \Rightarrow 5^2 = 3^2 + SP^2$ *(½ M)*

$\Rightarrow SP^2 = 25 - 9 = 16 \Rightarrow SP = \pm 4$

SP is length of tangent and cannot be negative

$\therefore\ SP = 4$ cm. *(½ M)*

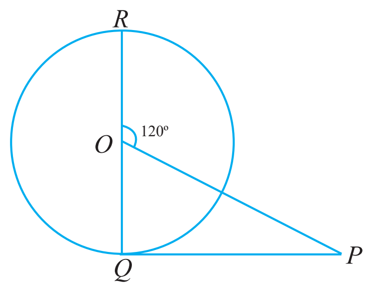
$QS = SP$ (Perpendicular from center bisects the chord considering the larger circles)

Therefore, $QS = SP = 4$ cm

Length of the chord, $PQ = QS + SP = 4 + 4 = 8$ cm

Therefore, the length of the chord of the larger circle is 8 cm. *(½ M)*

3. PQ is a tangent drawn from an external point P to a circle with centre O and QOR is the diameter of the circle. If $\angle POR = 120°$, What is the measure of $\angle OPQ$? ***(An)***



Sol. $\because\ OQ \perp QP$ (By Theorem 1)

So, $\angle OQP = 90°$

Also,

$\because\ \angle ROP + \angle QOP = 180°$ (Supplementary angles)

$\Rightarrow 120° + \angle QOP = 180°$

$\Rightarrow \angle QOP = 180° - 120° = 60°$ *(1 M)*

$\because$ In ΔOQP,

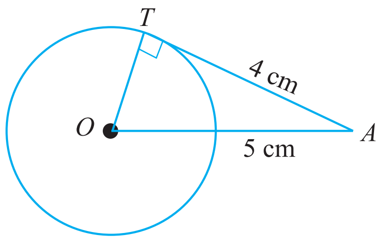
$\angle QOP + \angle OQP + \angle OPQ = 180°$

$\Rightarrow 60° + 90° + + \angle OPQ = 180°$

$\Rightarrow \angle OPQ = 180° - 60° - 90° = 30°$ *(1 M)*

4. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle. ***(Ev)* (CBSE SQP, 2023)**

Sol.



(½ M)

In ΔOTA, $\angle OTA = 90°$ *(½ M)*

By Pythagoras theorem

$\Rightarrow OA^2 = OT^2 + AT^2$ *(½ M)*

$\Rightarrow (5)^2 = OT^2 + (4)^2$

$\Rightarrow 25 - 16 = OT^2$

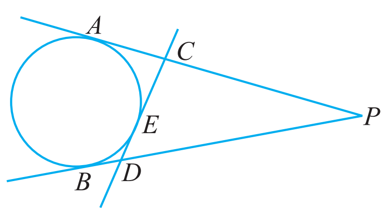
$\Rightarrow 9 = OT^2$

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

$\Rightarrow$ Radius of circle = 3 cm *(½ M)*

Short Answer Type Questions (2 or 3 M)

1. From an external point *P*, two tangents, *PA* and *PB* are drawn to a circle with centre *O*. At a point *E* on the circle, a tangent is drawn to intersect *PA* and *PB* at *C* and *D*, respectively. If *PA* = 10 cm, find the perimeter of ΔPCD. ***(Ap)***



Sol. $PA = PB$; $CA = CE$; $DE = DB$ [Tangents to a circle] *(½ M)*

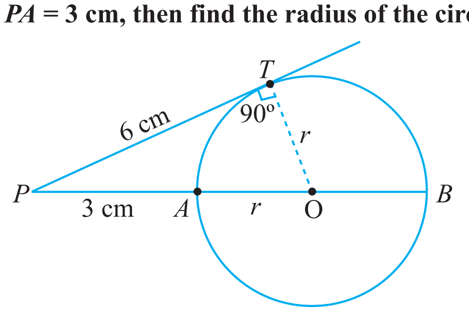
Perimeter of $\Delta PCD = PC + CD + PD$

$= PC + CE + ED + PD = PC + CA + BD + PD$

$= PA + PB$ *(1 M)*

Perimeter of $\Delta PCD = PA + PA = 2PA = 2(10) = 20$ cm *(½ M)*

2. In the figure, *O* is the centre of the circle and *PT* is the tangent drawn from the point *P* to the circle. Secant *PAB* passes through the centre *O* of the circle. If *PT* = 6 cm and *PA* = 3 cm, then find the radius of the circle. ***(Cr)***



Sol. In the figure *AB* is diameter of the circle and *OA* = *r* (radius of the circle)

Join *OT*.

$\therefore \Delta OTP = 90°$.

[$\because$ Radius is $\perp$ to tangent at the point of contact] *(½ M)*

In right angled ΔOTP, $OP = OA + PA = (r + 3)$ cm *(½ M)*

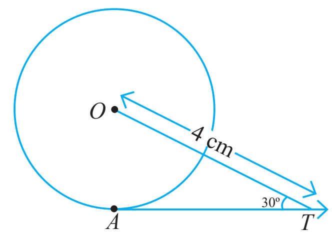
By Pythagoras theorem,

$OP^2 = OT^2 + PT^2 \Rightarrow (r + 3)^2 = r^2 + (6)^2$ *(½ M)*

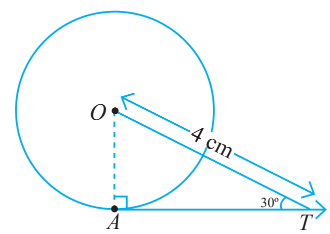
$\Rightarrow r^2 + 6r + 9 = r^2 + 36 \Rightarrow 6r = 27 \Rightarrow r = \frac{9}{2} = 4.5$

Hence, the radius of the circle = 4.5 cm. *(½ M)*

3. In the given figure, *AT* is a tangent to the circle with centre '*O*' such that *OT* = 4 cm and $\angle OTA = 30°$. Find *AT*. ***(Un)***



Sol. Join *OA*.



(½ M)

$\because OA \perp AT$ [Radius is $\perp$ ar to tangent at the point of contact]

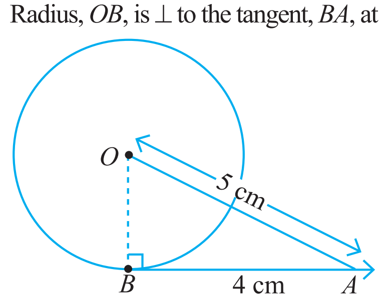
$\Rightarrow \angle OAT = 90°$ *(½ M)*

Now, in ΔOAT, $\cos 30° = \frac{AT}{OT}$ *(½ M)*

$\Rightarrow AT = \cos 30° \times OT = \frac{\sqrt{3}}{2} \times 4 = 2\sqrt{3}$ cm *(½ M)*

4. The length of a tangent from a point *A* at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle. ***(An)* (NCERT Intext)**

Sol. $\because$ Radius, *OB*, is $\perp$ to the tangent, *BA*, at the point of contact *B*.



(½ M)

So, $\angle OBA = 90°$ *(½ M)*

Now, by Pythagoras Theorem,

$OB = \sqrt{OA^2 - BA^2}$ *(½ M)*

$= \sqrt{5^2 - 4^2} = \sqrt{25 - 16} = \sqrt{9} = 3$

$\therefore$ Radius, $OB = 3$ cm *(½ M)*

5. Two tangents *PQ* and *PR* are drawn from an external point to a circle with centre *O*. Prove that *QORP* is a cyclic quadrilateral. **(*Cr*) (NCERT Exemplar)**

Sol. Since, Radius ⊥ Tangent

So, $OR \perp PR$

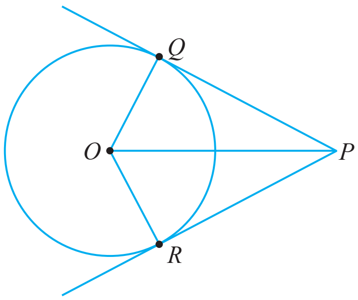
Therefore, $\angle ORP = 90°$ *(½ M)*

Similarily,

Since, Radius ⊥ Tangent

So, $OQ \perp PQ$

Therefore, $\angle OQP = 90°$ *(½ M)*



Now, in quadrilateral *ORPQ*,

Sum of all interior angles = 360º

$\angle ORP + \angle RPQ + \angle PQO + \angle QOR = 360º$ *(1 M)*

$\Rightarrow 90º + \angle RPQ + 90º + \angle QOR = 360º$

So, $\angle QOR + \angle RPQ = 180º$ *(½ M)*

Since sum of opposite angles in the quadrilateral is 180º

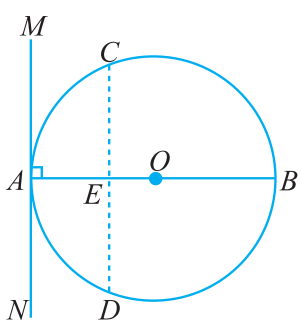
So, *PROQ* is a cyclic quadrilateral. *(½ M)*

6. Prove that a diameter *AB* of a circle bisects all those chords which are parallel to the tangent at the point *A*.

(*An*) (NCERT Exemplar)

Sol. Let *AB* be the a diameter of the circle.

Draw a tangent *MN* at point *A*.



Draw a chord *CD* parallel to the tangent *MN*.

Therefore, *CD* is a chord of the circle and *OA* is radius of the circle. *(1 M)*

Now,

$\angle MAO = 90°$ [Since tangent at any point of a circle is perpendicular to the radius through the point of contact]

(½ M)

Also, $\angle CEO = \angle MAO$ [Corresponding angles]

Therefore, $\angle CEO = 90°$ *(½ M)*

Since, a perpendicular line drawn through the centre of the circle to a chord bisects the chord.

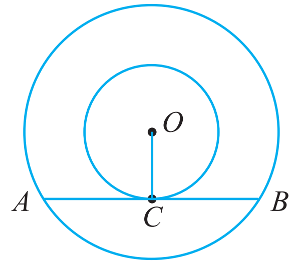
So, *OE* bisects *CD* or *AB* bisects *CD*.

Hence, diameter *AB* bisects all chords which are parallel to the tangent at the point *A*. *(1 M)*

7. Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle, is bisected at the point of contact. **(*Re*)**

Sol. Given: Two concentric circles with centre *O* and let *AB* is a chord of the larger circle touching the smaller circle at *C*.

To Prove: $AC = BC$.



(1 M)

Construction: Join *OC*.

Proof: *AB* is a tangent to the smaller circle at the point *C* and *OC* is the radius through the point of contact *C*.

$\therefore OC \perp AB$. *(1 M)*

But, the perpendicular drawn from the centre of a circle to a chord bisects the chord and *AB* is the chord of the larger circle.

So, *OC* bisects *AB* *(½ M)*

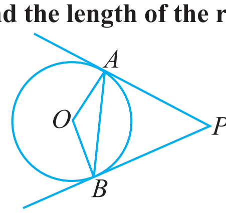
Hence, $AC = BC$. *(½ M)*

Key Takeaways

In two concentric circles, the chord of the larger circle that touches the smaller circle is bisected at the point of contact.

8. *PA* and *PB* are tangents drawn to a circle of centre *O* from an external point *P*. Chord *AB* makes an angle of 30° with the radius at the point of contact.

If length of the chord is 6 cm, find the length of the tangent *PA* and the length of the radius *OA*. **(*Un*)**



Sol. $\angle OAB = 30°$

$\angle OAP = 90°$ [Angle between the tangent and the radius at the point of contact]

$\angle PAB = 90° - 30° = 60°$ *(½ M)*

$AP = BP$ [Tangents to a circle from an external point]

$\angle PAB = \angle PBA$ [Angles opposite to equal sides of a triangle]

(½ M)

In ΔABP, $\angle PAB + \angle PBA + \angle APB = 180°$ [Angle Sum Property]

$60° + 60° + \angle APB = 180°$

$\angle APB = 60°$ *(½ M)*

$\therefore \Delta ABP$ is an equilateral triangle, where $AP = BP = AB$.

$PA = 6$ cm *(½ M)*

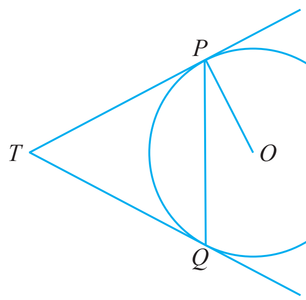
In Right ΔOAP, $\angle OPA = 30°$

$\tan 30° = \frac{OA}{PA}$

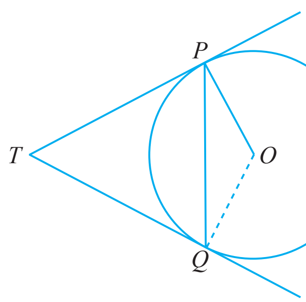
$\frac{1}{\sqrt{3}} = \frac{OA}{6}$ *(½ M)*

$OA = \frac{6}{\sqrt{3}} = 2\sqrt{3}$ cm *(½ M)*

9. **In the figure, two tangents *TP* and *TQ* are drawn to a circle with centre *O* from an external point *T*. Prove that $\angle PTQ = 2\angle OPQ$.** ***(Cr)***



Sol. Join OQ.



In ΔPOQ,

$\angle POQ + \angle OQP + \angle OPQ = 180°$

[Sum of all angles of triangle = 180°]

$\because PO = QO$ [Radii of circle]

$\Rightarrow \angle OPQ = \angle OQP$ *(½ M)*

$\therefore \angle POQ + 2\angle OPQ = 180°$ ... (*i*) *(½ M)*

In quadrilateral, $TPOQ$

$\angle PTQ + \angle TQO + \angle QOP + 2\angle OPQ + \angle TPO = 360°$ ...(*ii*)

(Using Angle sum property)

$TP \perp OP$ & $TQ \perp OQ$ [$\because$ Tangent $\perp$ Radius] *(½ M)*

$\Rightarrow \angle TPO = \angle TQO = 90°$

$\therefore$ from (*ii*)

$\angle PTQ + \angle QOP = 360° - 90° - 90° = 180°$ ...(*iii*) *(½ M)*

From (*i*) and (*iii*)

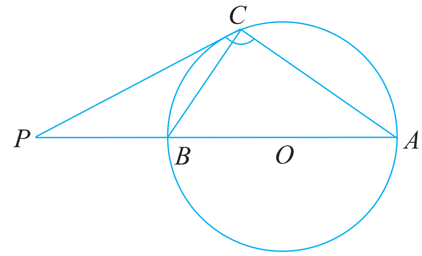
$\angle PTQ + \angle POQ = \angle POQ + 2\angle OPQ$

$\Rightarrow \angle PTQ = 2\angle OPQ$ *(1 M)*

Hence, proved

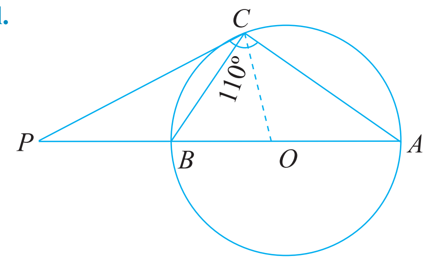
Long Answer Type Questions (4 or 5 M)

1. **The tangent at a point *C* of a circle and a diameter *AB* when extended intersect at *P*. If $\angle PCA = 110°$, find $\angle CBA$**



[Hint: Join *C* with centre *O*.] **(*(Cr)* (NCERT Exemplar))**

Sol.



Join C with centre O. *(½ M)*

In this, OC is the radius.

Since the tangent at any point of a circle is perpendicular to the radius through the point of contact.

Therefore, OC perpendicular to PC

$\Rightarrow \angle PCO = 90°$ *(½ M)*

Now, $\angle PCA = 110°$ [Given]

$\Rightarrow \angle PCO + \angle OCA = 110°$ *(½ M)*

$\Rightarrow 90° + \angle OCA = 110°$ *(½ M)*

$\Rightarrow \angle OCA = 20°$ *(½ M)*

Also, $OC = OA$ [Radii of the circle]

Therefore, $\angle OCA = \angle OAC = 20°$ *(½ M)*

[angles opposite to equal sides are equal]

Now, since the angle in a semicircle is 90°.

So, $\angle BCA = 90°$ *(½ M)*

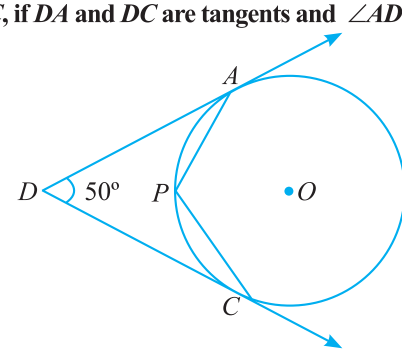
In ΔBCA,

$\angle BCA + \angle CAB + \angle CBA = 180°$ *(½ M)*

$\Rightarrow 90° + 20° + \angle CBA = 180°$ [Since, $\angle OAC = CAB$] *(½ M)*

$\Rightarrow \angle CBA = 180° - 110° = 70°$ *(½ M)*

2. **In the given figure, *O* is the center of the circle. Determine $\angle APC$, if *DA* and *DC* are tangents and $\angle ADC = 50°$.** ***(Re)***



Sol. Join OA and OC.

Since, the tangent drawn to a circle is perpendicular to the radius at the point of contact.

MOCK TEST PAPER-2

Time allowed : 3 hours **Maximum Marks : 80**

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and follow them:

(i) *This question paper contains **38** questions. **All** questions are compulsory.*

(ii) *Question Paper is divided into 5 Sections-**Section A, B, C, D and E.***

(iii) *In **Section A question number 1 to 18 are** Multiple Choice Questions **(MCQs)** and question number **19 & 20** are Assertion-Reason based **questions of 1 mark each.***

(iv) *In **Section-B question number 21 to 25 are** Very Short Answer (VSA) type **questions of 2 marks each.***

(v) *In **Section-C question number 26 to 31 are** Short Answer (SA) type **questions carrying 3 marks each.***

(vi) *In **Section-D question number 32 to 35 are** Long Answer (LA) type **questions carrying 5 marks each.***

(vii) *In **Section-E question number 36 to 38 are** Case Study based questions **carrying 4 marks each. Internal choice is provided in 2 marks question in each case-study.***

(viii) ***There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.***

(ix) ***Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.***

(x) ***Use of calculators is NOT allowed.***

SECTION - A

Section - A consists of Multiple Choice type questions of 1 mark each.

1. The HCF and the LCM of 12, 21, 15 respectively are

(*a*) 3, 140 (*b*) 12, 420 (*c*) 3, 420 (*d*) 420, 3

2. If $p - 1$, $p + 1$ and $2p + 3$ are in A.P., then the value of p is

(*a*) –2 (*b*) 4 (*c*) 0 (*d*) 2

3. If α, β are zeroes of a polynomial $p(x) = 2x^2 - x - 1$ then $\alpha^2 + \beta^2$ is equal to

(*a*) $\frac{-3}{4}$ (*b*) $\frac{5}{4}$ (*c*) $\frac{1}{4}$ (*d*) $\frac{3}{4}$

4. The distance between the points $(0, 2\sqrt{5})$ and $(-2\sqrt{5}, 0)$ is

(*a*) $2\sqrt{10}$ units (*b*) $4\sqrt{10}$ units (*c*) $2\sqrt{20}$ units (*d*) 0

5. $A(5, 1)$, $B(1, 5)$ and $C(-3, -1)$ are the vertices of ΔABC. Then the length of median AD is

(*a*) $\sqrt{37}$ units (*b*) $\sqrt{17}$ units (*c*) $\sqrt{45}$ units (*d*) $\sqrt{27}$ units

SECTION - B

Section - B consists of Very Short Answer (VSA) type questions of 2 marks each.

21. If the HCF of 408 and 1032 is expressible in the form $1032 \times 2 + 408 \times p$, then find the value of p.

22. (*a*) The area of the base of a right circular cylinder is 154 cm^2 and its height is 15 cm. Find the C.S.A of the cylinder.

OR

(*b*) Find the height of a cylinder whose radius is 7 cm and the total surface area is 968 cm^2.

23. E is a point on the side AD produced of a parallelogram $ABCD$ and BE intersects CD at F. Show that $\Delta ABE \sim \Delta CFB$.

24. (*a*) If $\sin\theta + \sin^2\theta = 1$, then prove that $\cos^2\theta + \cos^4\theta = 1$

OR

(*b*) If $\sin\alpha = \frac{1}{\sqrt{2}}$ and $\cot\beta = \sqrt{3}$, then find the value of $\text{cosec}\alpha + \text{cosec}\beta$.

25. Find the mode of the following distribution:

Marks	0–10	10–20	20–30	30–40	40–50	50–60
Number of Students	4	6	7	12	5	6

SECTION - C

Section - C consists of Short Answer (SA) type questions of 3 marks each.

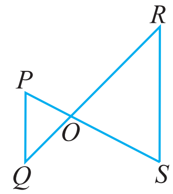
26. Prove that $\sqrt{3}$ is an irrational number.

27. Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$.

28. Find the roots of the quadratic equation $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$, by factorisation method.

29. Find the ratio in which the y-axis divides the line segment joining the points (6, –4) and (–2, –7). Also find the point of intersection.

30. (*a*) In the figure, if $PQ \parallel RS$, prove that & $\Delta POQ \sim \Delta SOR$



OR

(*b*) From an external point PA, tangents PA and PB are drawn to a circle with centre O. If $\angle PAB = 50°$, then find $\angle AOB$.

31. (*a*) Prove that $\frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1} = \frac{1 + \sin\theta}{\cos\theta}$

OR

(*b*) Prove that $(\text{cosec}A - \sin A)(\sec A - \cos A) = \frac{1}{\cot A + \tan A}$

SECTION - D

Section - D consists of Long Answer (LA) type questions of 5 Marks each.

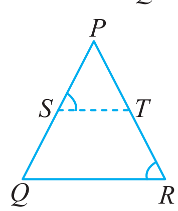
32. The sum of four consecutive numbers in an A.P is 32 and the ratio of the product of the first and the last term to the product of two middle terms is 7 : 15. Find the numbers.

33. Two taps running together can fill a tank in $3\frac{1}{13}$ hours. If one tap takes 3 hours more than the other to fill the tank, then how much time will each tap take to fill the tank?

34. (*a*) If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, prove that the other two sides are divided in the same ratio.

OR

(*b*) In the given figure, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Prove that PQR is an isosceles triangle.



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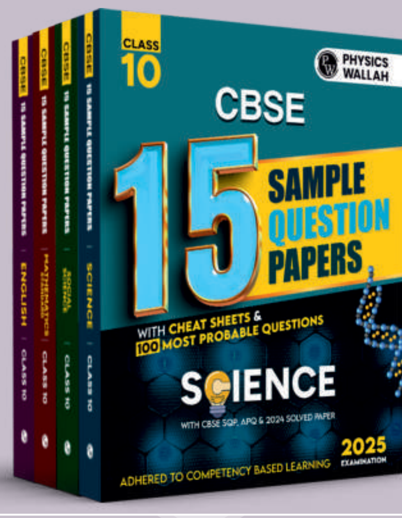

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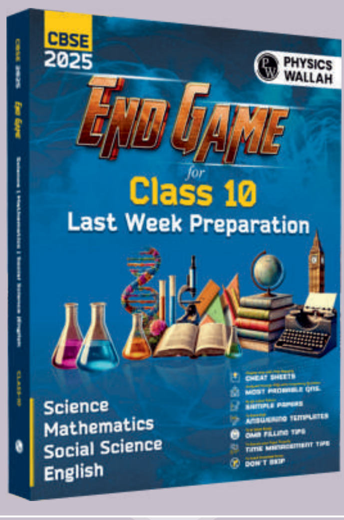

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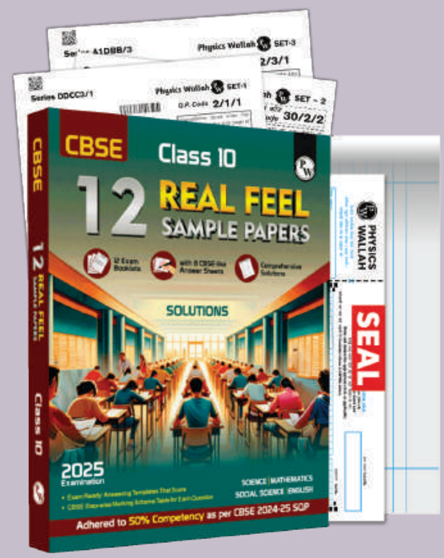

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