



SAMPLE QUESTION PAPERS MATHEMATICS

Strictly according to the latest CBSE guidelines, syllabus & marking scheme 2015-16

BENEFITS

- ★ Ten Sample Question Papers covering important concepts strictly as per the latest syllabus (1-5 Solved and 6-10 for Self Assessment*)
- ★ Strict adherence to CBSE 'Question Paper Design' for exam oriented preparation.
- ★ Typology of Questions as per CBSE specifications.
- ★ Answers from the CBSE Marking Scheme with detailed explanations as per the word limit specified by Board.
- ★ 'On Tips Notes' for effective revision.



DESIGN OF THE QUESTION PAPER

Sr. No.	Typology of Questions	Very Short Ans (VSA)	Short Ans-I (SA-I)	Short Ans-II (SA-II)	Long Ans (LA)	Total Marks	Percentage (%) Weightage
		1 Mark	2 Marks	3 Marks	4 Marks		
01.	Remembering	1	2	2	3	23	26%
02.	Understanding	2	1	1	4	23	26%
03.	Application	1	2	3	2	22	24%
04.	High Order Thinking Skills	–	1	4	–	14	16%
05.	Creating, Evaluation and Multi-Disciplinary	–	–	–	2*	8	8%
	• TOTAL	4×1=4	6×2=12	10×3=30	11×4=44	90	100%

*Solutions for SQP 6 - 10 can be downloaded from www.oswaalbooks.com



Strictly Based on Latest Syllabus Issued by CBSE
for 2016 Examination

SAMPLE QUESTION PAPERS

MATHEMATICS



*Solutions for SQP 6-10 can be downloaded
from www.oswaalbooks.com

**March 2016
EXAMINATION**

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* **SOLUTIONS** for **Sample Question Paper 6 to 10** can be downloaded from www.OswaalBooks.com

PREFACE

The Albert Einstein said “Education is not the learning of facts, but the training of mind to think”. So to train the mind and strengthen the roots of students, the CBSE started Continuous & Comprehensive Evaluation (CCE). The term ‘Continuous’ in the CCE refers to the periodicity and regularity in assessment and the term ‘Comprehensive’ refers to overall assessment of the learner, in both curricular & co curricular scheme of things.

The CBSE initiated the change and to support it, Oswaal Publication started an exclusive series of books which comprises of Sample Question Papers along with other titles. The thought was to give students enough questions to solve rather than feeding them with answers to remember.

The Sample Question Papers strictly follow the CBSE guidelines, syllabus and marking scheme. This book has total 10 sample question papers. Out of which 5 question papers are solved, and the answers follow the word limit specified by the CBSE. The answers have been written in steps and each step specifies marks as per the CBSE marking scheme. In this way students can learn what to write, how much to write and time management which will reduce their stress during examination.

However as mentioned Oswaal Publication believes that students should do self-practice with enough number of questions, hence this book has 5 more sample papers which are unsolved and meant for self-assessment. After solving the unsolved sample question papers, students can download solutions from our website and can check their work. In this way students can take proactive measures for examinations by learning from their mistakes.

Each Sample Question Paper includes value based and HOTS questions (Higher Order Thinking Skills). Each and every single question covers all typologies specified by CBSE. Wherever required, well labelled and high quality figures/diagrams are given for easy and fast learning. One of the major attractions is “On Tips Notes” which will help students in revision of the whole syllabus very fast and effectively. Oswaal Publication believes in continuous improvement, hence this book is updated, reviewed every year with new questions and all the answers are checked twice.

At last we would like to thank our authors, editors, reviewers and specially students who regularly send us suggestions which helps in continuous improvement of this book and makes this book stand in the category of “One of the Best”. Wish you all Happy Learning.

—*Publisher*



SYLLABUS

COURSE STRUCTURE - 2015-16

CLASS X

Second Term

Marks : 90

UNITS	MARKS
II. ALGEBRA (Contd.)	23
III. GEOMETRY (Contd.)	17
IV. TRIGONOMETRY (Contd.)	08
V. PROBABILITY	08
VI. COORDINATE GEOMETRY	11
VII. MENSURATION	23
TOTAL	90

UNIT II : ALGEBRA (Contd.)

3. QUADRATIC EQUATIONS

15 Periods

Standard form of a quadratic equation $ax^2 + bx + c = 0$, ($a \neq 0$). Solution of the quadratic equations (only real roots) by factorization, by completing the square and by using quadratic formula. Relationship between discriminant and nature of roots.

Situational Problems based on quadratic equations related to day to day activities to be incorporated.

4. ARITHMETIC PROGRESSIONS

8 Periods

Motivation for studying Arithmetic Progression Derivation of the n^{th} term and sum of the first n terms of A.P. and their application in solving daily life problems.

UNIT III : GEOMETRY (Contd.)

2. CIRCLES

8 Periods

Tangents to a circle at a point.

- (i) (Prove) The tangent at any point of a circle is perpendicular to the radius through the point of contact.
- (ii) (Prove) The lengths of tangents drawn from an external point to circle are equal.

3. CONSTRUCTIONS**8 Periods**

- (i) Division of a line segment in a given ratio (internally).
- (ii) Tangent to a circle from a point outside it.
- (iii) Construction of a triangle similar to a given triangle.

UNIT IV : TRIGONOMETRY**3. HEIGHTS AND DISTANCES****8 Periods**

Simple problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation / depression should be only 30° , 45° , 60° .

UNIT V : STATISTICS AND PROBABILITY**2. PROBABILITY****10 Periods**

Classical definition of probability. Simple problems on single events (not using set notation).

UNIT VI : COORDINATE GEOMETRY**1. LINES (In two-dimensions)****14 Periods**

Review : Concepts of coordinate geometry, graphs of linear equations. Distance between two points and section formula (Internal Division). Area of a triangle.

UNIT VII : MENSURATION**1. AREAS RELATED TO CIRCLES****12 Periods**

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter / circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60° , 90° and 120° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

2. SURFACE AREAS AND VOLUMES**12 Periods**

- (i) Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones. Frustum of a cone.
- (ii) Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

PRESCRIBED BOOKS :

- 1. Mathematics - Textbook for class X - NCERT Publication
- 2. Guidelines for Mathematics Laboratory in Schools, class X - CBSE Publication
- 3. A Handbook for Designing Mathematics Laboratory in Schools - NCERT Publication
- 4. Laboratory Manual - Mathematics, secondary stage - NCERT Publication
- 5. Mathematics exemplar problems for class X, NCERT Publication.

QUESTIONS PAPER DESIGN 2015-16
CLASS-X

MATHEMATICS CODE NO. 041

Time-3 Hours

Marks-90

S. No.	Typology of Questions	Very Short Answer (VSA) (1 Mark)	Short Answer - I (SA) (2 Marks)	Short Answer - II (SA) (3 Marks)	Long Answer (LA) (4 Marks)	Total Marks	% Weightage
1.	Remembering - (Knowledge based Simple recall questions, to know specific facts, terms, concepts, principles, or theories; Identify, define, or recite, information)	1	2	2	3	23	26%
2.	Understanding- (Comprehension -to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	2	1	1	4	23	26%
3.	Application (Use abstract information in concrete situation, to apply knowledge to new situations; Use given content to interpret a situation, provide an example, or solve a problem)	1	2	3	2	22	24%
4.	High Order Thinking Skills (Analysis & Synthesis -Classify, compare, contrast, or differentiate between different pieces of information; Organize and/or integrate unique pieces of information from a variety of sources)	—	1	4	—	14	16%
5.	Creating, Evaluation and Multi Disciplinary (Generating new ideas, product or - ways of viewing things Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	—	—	—	2*	8	8%
	Total	4 × 1 = 4	6 × 2 = 12	10 × 3 = 30	11 × 4 = 44	90	100%

*One of the LA (4 marks) will be to assess the values inherent in the texts.

TIPS ON HOW TO SCORE HIGH IN YOUR EXAMINATIONS

1 BELIEVE IN YOURSELF

This is the foremost barrier to be crossed for scoring high marks in exams. One needs to believe in his/her ability to learn, memorise and reproduce what has been learnt. Exams are nothing but the test of our faith, confidence and knowledge.

2 FOLLOW A TIMETABLE

A well set time table allotting specific durations for studying, sleeping, playing, surfing the net and eating can help every student a lot. Every above quoted thing has to be done every day. A proper schedule can help a student beat examination stress.

3 SET EVERY DAY GOALS

Preparations should be done every day to excel on the day of exams without depending upon any miracle capsule to bail you out at the last moment. By setting every day targets and goals, one can achieve incredible results in terms of efficiency and performance.

4 STAY HEALTHY

Health is wealth. This adage never fails. Only a sound body and sound mind can work effectively towards achieving any objective. Thus a healthy body is a mandate for rigorous mental exercise that comes up during examinations.

5 PRACTICE DAILY

We eat daily, we sleep daily, so why not study daily? Regular practice in every subject will keep students close to a subject. If one avoids any subject for more than three days in a go, he/she is bound to lose interest in it.

6 PLAY GAMES

Playing games, both indoors and outdoors, help in inculcating a practical approach towards dealing with a problem along with beating the examination stress.

7 PRESENTATION

Till now we have discussed the pre-exam tips. This is a crucial tip while writing the examinations. A systematic and neat display of answers can boost your chances of scoring high.

8 TIME MANAGEMENT

You need to manage time not only during exam preparations, but also at the time of solving the question paper. Carrying a wrist watch during exams is an excellent way to manage time well. You should also try and save some time at the end of the paper to recheck the answers.

9 SLEEP WELL

A sound sleep at night before the exam helps us relax and rejuvenates our mind. The tired brain needs enough rest and we need to understand this. It is only then that we will be able to make the most of it during examinations.

10 RELAX YOURSELF

This is last but not the least. Relaxing is like meditating. When we are relaxed we are the most efficient in reproducing what we have learnt.

TIPS ON HOW TO GET THE OSWAAL ADVANTAGE

1 OSWAAL - YOUR ELIXIR OF POSITIVITY AND CONFIDENCE

Positivity and confidence can do wonders to your grades, far more than you think. By studying from Oswaal Sample Question Papers, you develop confidence in yourself which makes you positive and hence gives you the winners' advantage! A bunch of important questions along with their systematic presentation helps you tremendously in studying effectively.

OSWAAL - YOUR PLANNER FOR EXAMINATION PREPARATIONS

You must make a schedule for your studies followed by strict implementation of that schedule. Oswaal SQPs give you questions on important topics or topics that need more practice or time. Oswaal SQPs include last year exam questions as well as sample papers for the proper schedule of your study. You may also study with your friends and make the entire learning process fun!!

3 OSWAAL - YOUR CONFIDENCE BOOSTER JUST BEFORE THE EXAM

One should never try and read, study or cram anything new just before the exam. You can open your Oswaal SQPs and read through the answers highlighted by you a night before for the last time and then put away all your books. This gives you a new wave of confidence just before the commencement of your exam!

**Examination
PAPER**

**Summative Assessment -II
(2014 - 15)
Class-X**

**Mathematics
Code : UDICCY2**

Time allowed : 3 Hours

Max. Marks : 80

General Instructions :

- (i) All questions are compulsory.
- (ii) The question paper consists of 31 questions divided into four sections A, B, C and D. Section-A comprises of 4 questions of 1 mark each, Section-B comprises of 6 questions of 2 marks each, Section-C comprises of 10 questions of 3 marks each and Section-D comprises of 11 questions of 4 marks each.
- (iii) There is no overall choice.
- (iv) Use of calculator is not permitted.

SECTION-A

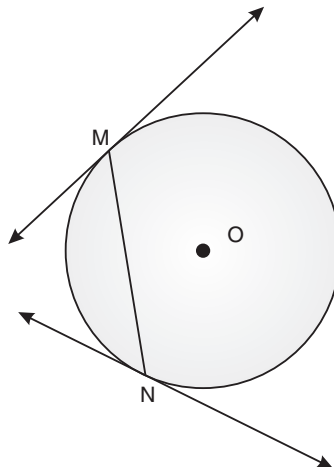
Question numbers 1 to 4 carry one mark each.

- 1. Find the positive root of $\sqrt{3x^2 + 6} = 9$. 1
- 2. The ratio of the length of a rod and its shadow is $1 : \frac{1}{\sqrt{3}}$. What is the angle of elevation of the source of light ? 1
- 3. What is the probability that a non leap year has 53 Mondays ? 1
- 4. Find the area of the triangle with vertices (0, 0), (6, 0) and (0, 5). 1

SECTION-B

Question numbers 5 to 10 carry two marks each.

- 5. The seventeenth term of an A.P exceeds its 10th term by 7. Find the common difference. 2
- 6. In a cricket match, Harbhajan took three wickets less than twice the number of wickets taken by Zaheer. The product of the number of wickets taken by these two is 20. Represent the above situation in the form of a quadratic equation. 2
- 7. Prove that tangents drawn at the ends of a chord of a circle make equal angles with the chord. 2



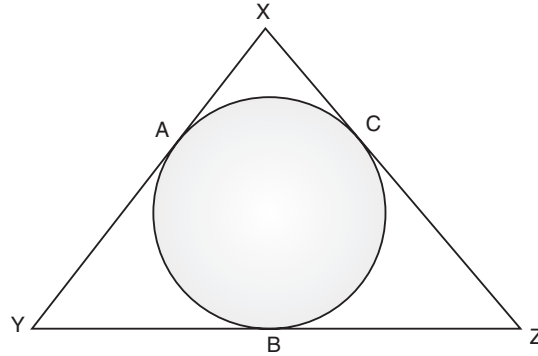
- 8. Draw a line segment of length 7 cm. Find a point P on it which divides it in the ratio 3 : 5. 2

9. Draw tangents to a circle of radius 6 cm from a point P at a distance of 10 cm from its centre. 2
10. Find the area of the square that can be inscribed in a circle of radius 8 cm. 2

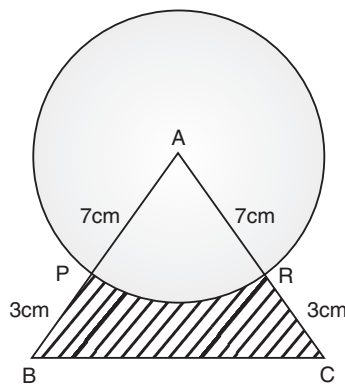
SECTION-C

Question numbers 11 to 20 carry 3 marks each.

11. Determine an AP whose third term is 9 and when fifth term is subtracted from 8th term, we get 6. 3
12. Find the values of k for which the quadratic equation $(k - 2)x^2 + 2(2k - 3)x + (5k - 6) = 0$ has equal roots. 3
13. ΔXYZ is circumscribing a circle, touching the circle at A, B and C as shown in the figure. If $AX = 4$ cm, $AY = 6$ cm and $XZ = 12$ cm, find the length of YZ . 3



14. The horizontal distance between two towers is 60 m. The angle of elevation of the top of the taller tower as seen from the top of the shorter one is 30° . If the height of the taller tower is 150 m, then find the height of the shorter tower. 3
15. A number x is chosen from $-5, -4, -3, -2, -1, 0, 1, 2, 3$.
Find the probability that $|x| < 3$. 3
16. If the distance of $P(x, y)$ from $A(6, 2)$ and $B(-2, 6)$ are equal, prove that $y = 2x$. 3
17. If $(5, 2), (-3, 4)$ and (x, y) are collinear, show that $x + 4y - 13 = 0$. 3
18. In a cylinder of base radius 10 cm, liquid is filled to the height of 9 cm. A metal cube of diagonal $8\sqrt{3}$ cm is immersed completely in the liquid. Find the height by which the water will rise in the cylinder. 3
19. A momento is made as shown in the figure. Its base PBCR is silver plated from the front side. Find the area which is silver plated. (Use $\pi = \frac{22}{7}$) 3

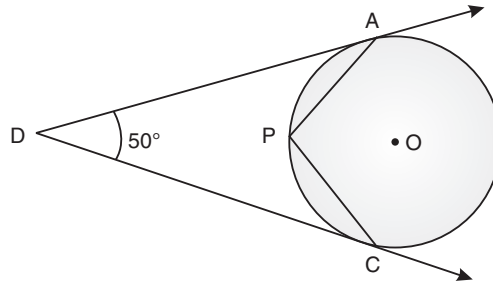


20. A glass is in the shape of a cylinder of radius 7 cm and height 10 cm. Find the volume of juice in litres required to fill 6 such glasses. (Use $\pi = \frac{22}{7}$) 3

SECTION-D

Question numbers 21 to 31 carry 4 marks each.

21. Find the value of a , b and c such that the numbers a , 7 , b , 23 and c are in A.P. 4
22. Find the roots of the quadratic equation $4x^2 + 4bx - (a^2 - b^2)50$ by the method of completing the square. 4
23. Find :
 $\left(4 - \frac{1}{n}\right) + \left(7 - \frac{2}{n}\right) + \left(10 - \frac{3}{n}\right) \dots$ upto n terms. 4
24. In the given figure, O is the centre of the circle. Determine $\angle APC$, if DA and DC are tangents and $\angle ADC = 50^\circ$. 4



25. Draw $\triangle ABC$ such that $BC = 5$ cm, $\angle ABC = 60^\circ$ and $\angle ACB = 30^\circ$. Now construct $\triangle A'BC' \sim \triangle ABC$ with $A'B : AB = 3 : 2$. 4
26. Two posts are k metres apart and the height of one is double that of the other. If from the mid-point of the line segment joining their feet, an observer finds the angles of elevation of their tops to be complementary, then find the height of the shorter post. 4
27. A bag contains 15 balls of which x are blue and remaining red. If the number of red balls are increased by 5, the probability of drawing the red ball doubles. Find 4
- (i) P (red ball)
- (ii) P (blue ball)
- (iii) P (blue ball if 5 extra red balls are actually added)
28. $(1, -1)$, $(0, 4)$ and $(-5, 3)$ are vertices of a triangle. Check whether it is a scalene triangle, isosceles triangle or an equilateral triangle. Also, find the length of its median joining the vertex $(1, -1)$ to the mid-point of the opposite side. 4
29. A solid is consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm. It is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm. 4
30. Two circular beads of different sizes are joined together such that the distance between their centres is 14 cm. The sum of their areas is 130π cm². Find the radius each bead. 4
31. A child prepares a poster on "save water" on a square sheet whose each side measures 50 cm. At each corner of the sheet, she draws a quadrant of radius 15 cm in which she shows the ways to save water. At the centre, she draws a circle of diameter 21 cm and writes a slogan save water in it. Find the area of the remaining sheet. Write the value depicted. 4

ON TIPS NOTES

Note making is a skill that we use in many walks of life: at school, university and in the world of work. However, accurate note making requires a thorough understanding of concepts. We, at Oswaal, have tried to encapsulate all the chapters from the given syllabus into the following ON TIPS NOTES. These notes will not only facilitate better understanding of concepts, but will also ensure that each and every concept is taken up and every chapter is covered in totality. So go ahead and use these to your advantage... go get the OSWAAL ADVANTAGE!!

CHAPTER 1 : Quadratic Equations

➤ Fundamentals :

- General form of quadratic equation is : $ax^2 + bx + c = 0$, Where $a \neq 0$.
- a is coefficient of x^2 , b is coefficient of x , c is called constant term.
- Equation of the form $ax^2 + c = 0$ is called pure quadratic equation.
- The value of variable satisfying equation is called root.
- Quadratic equation has two roots.

➤ Methods of Solving Quadratic Equation :

- Factorisation Method (splitting the middle term)
- Completing the Square Method
- Quadratic Formula Method (Sridharacharya Formula)

➤ Factorisation Method :

Step 1 : Resolve the equation in factor using splitting the middle term methods,
i. e. : $ax^2 + bx + c = (Ax+B)(Cx + D)$

Step 2 : Put both factors equal to zero,
 $Ax + B = 0$ and $Cx + D = 0$

Therefore : $x = -\frac{B}{A}$ and $x = -\frac{D}{C}$ are two roots.

➤ Completing The Square Method :

Step 1 : Let the equation be : $ax^2 + bx + c = 0$

Step 2 : Make the coefficient of x^2 unity by dividing whole equation by it, you will get :

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

Step 3 : Shift the constant term on RHS, you will get :

$$x^2 + \frac{bx}{a} = -\frac{c}{a}$$

Step 4 : Add the square of half of the coefficient of x . On the both sides of the equation :

$$x^2 + 2\left[\frac{b}{2a}\right]x + \left[\frac{b}{2a}\right]^2 = -\frac{c}{a} + \left[\frac{b}{2a}\right]^2$$

Step 5 : Write LHS as the perfect square and simplify RHS :

$$\left[x + \frac{b}{2a} \right]^2 = \frac{b^2 - 4ac}{4a^2}$$

Step 6 : Take square root on both sides :

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

Step 7 : Evaluate the values of x by shifting the constant term on RHS.

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

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

➤ **Quadratic Formula Method :**

Direct formula to calculate the roots is given as :

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

Proof : Use steps given in completing the square method.

Discriminant : It is denoted by ' D ' and given by :

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

➤ **Nature of Roots of Quadratic equation :**

First of all find D .

- If $D > 0$, roots are real and unequal.
- If $D = 0$, roots are real and equal.
- If $D < 0$, roots are imaginary.

CHAPTER 2 : Arithmetic Progressions

Sequence : An arrangement of numbers which has a pattern, which can suggest the successor of every number in the arrangement. *e.g.:*

1. Arithmetic Progressions

3, 5, 7, 9, 11.....

- 8, - 5, - 2, 1, 4, 7.....

6, 1, - 4, - 9, - 14.....

$\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32}$ Yes it is AP, because it can be written as below :

$\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, 5\sqrt{2}$

$3 + \sqrt{2}, 3 + 2\sqrt{2}, 3 + 3\sqrt{2}, 3 + 4\sqrt{2}, 3 + 5\sqrt{2}$

2. Geometric Progressions (not in course)

3, 9, 27, 81.....

6, 18, - 54, 162, - 486.....

$\sqrt{2}, 2, 2\sqrt{2}, 4, 4\sqrt{2}, 8$

An Arithmetic Progression (AP) : is a list of numbers in which each term is obtained by adding a fixed number to the preceding term except the first term.

This fixed number is called common difference, denoted by ' d '. It can be +ve, - ve or zero.

So general form of an AP is given by :

$$a, a + d, a + 2d, a + 3d, a + 4d, \dots, a + (n - 1)d.$$

where a = first term, d = common difference and $a + (n - 1)d = n^{\text{th}}$ term.

Here $t_2 - t_1 = d$
 $t_3 - t_2 = d$
 $t_4 - t_3 = d$ so on.....

Hence : It can be written :

$$t_2 - t_1 = t_3 - t_2$$

$$2t_2 = t_1 + t_3$$

Conclusion : If three numbers a, b and c are in AP then :

$$2b = a + c.$$

➤ **Important Formulae :**

n^{th} term of an AP $T_n = a + (n - 1)d$

Sum of the n terms of an AP is : $S_n = \frac{n}{2} [2a + (n - 1) d]$

Also : $S_n = \frac{n}{2} (a + l)$

Where, $l =$ last term, *i.e.*, $l = a + (n - 1)d$.

➤ **Tips :**

- To an AP if we (i) add (ii) subtract (iii) multiply or (iv) divide each term by the same number, the resulting sequence would always be an AP.
- If three numbers a, b and c are in AP then :
 $2b = a + c$
- Whenever you be asked to take three numbers which are in AP, always take :
 $a - d, a, a + d$.

➤ **Proof Of "Sum of n terms of an AP"**

We know that general form of an AP is given by :

$$a, a + d, a + 2d, a + 3d, a + 4d, \dots, a + (n - 1)d.$$

$$\Rightarrow S_n = a + (a + d) + (a + 2d) + (a + 3d) + \dots + [a + (n - 2)d] + [a + (n - 1)d] \quad \dots(i)$$

Now write the above equation in reverse order :

$$\Rightarrow S_n = [a + (n - 1)d] + [a + (n - 2)d] + \dots + (a + 3d) + (a + 2d) + (a + d) + a \quad \dots(ii)$$

Adding the corresponding terms of eq (i) & (ii), we get

$$\Rightarrow 2S_n = [2a + (n - 1)d] + [2a + (n - 1) d] + [2a + (n - 1) d] \dots [2a + (n - 1) d]$$

$$\Rightarrow 2S_n = n[2a + (n - 1) d]$$

$$\Rightarrow S_n = \frac{n}{2} [2a + (n - 1)d]$$

Also, it can be written as : $S_n = \frac{n}{2} [a + a + (n - 1)d]$ [(where, last term, $l = a + (n - 1)d$]

$$\Rightarrow S_n = \frac{n}{2} [a + l] \quad \text{Hence Proved.}$$

➤ **Some important key points :**

- We know $a_n = a + (n - 1)d$
 $a_n = a + nd - d$
 $a_n = (a - d) + nd$

i.e. Linear equation denotes general term where

- coefficient of n is common difference ' d '
- constant term is $(a - d)$.

2. We know $S_n = \frac{n}{2} [2a + (n - 1)d]$

$$S_n = na + \frac{n}{2}(n - 1)d$$

$$S_n = na + n^2 \frac{d}{2} - n \frac{d}{2}$$

$$S_n = n \left(a - \frac{d}{2} \right) + n^2 \frac{d}{2}$$

i.e., Quadratic equation denotes sum to n terms where

(i) Coefficient of n^2 is : $\frac{d}{2}$

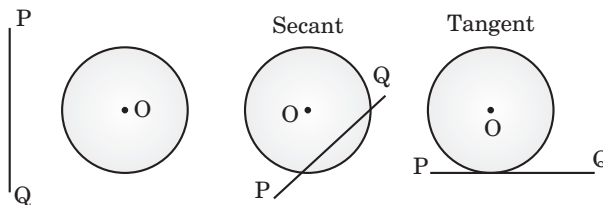
(ii) Coefficient of n is $\left[a - \frac{d}{2} \right]$

CHAPTER 3 : Circles (Tangents to a Circle)

➤ **Fundamentals :**

1. Consider a circle $C(O, r)$ and a line PQ . There can be three possibilities given below :

- (i) Non intersecting line w.r.t circle
- (ii) A line intersects circle in two distinct points, this line is called a **Secant**.
- (iii) A line which intersects circle exactly at one point is called a **Tangent**.



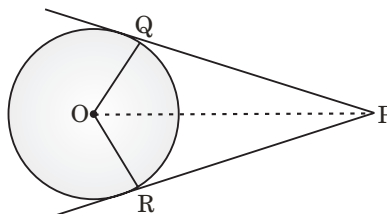
- 2. From a point P inside a circle, the number of tangents drawn to the circle = 0.
- 3. From a point P on a circle, the number of tangents drawn to the circle = 1.
- 4. From a point P outside the circle, the number of tangents drawn to the circle = 2.
- 5. The distance between two parallel tangents drawn is equal to the diameter of the circle.

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 two tangents from an external point to a circle are equal.

Given : A circle $C(O, r)$ and two tangents say PQ and PR from an external point P .

To prove : $PQ = PR$.



Construction : Join OQ , OR and OP .

Proof : In ΔOQP and ΔORP

$OQ = OR$ (radii of the same circle)

$OP = OP$ (Common)

$\angle Q = \angle R = \text{each } 90^\circ$ (The tangent at any point of a circle is perpendicular to the radius through the point of contact)

Hence $\Delta OQP \cong \Delta ORP$ (By RHS Criterion)

$\therefore PQ = PR$ (By CPCT)

Hence Proved.

CHAPTER 4 : Constructions

- To divide a line segment internally in a given ratio $m : n$, where both m and n are positive integers.

Steps Of Construction :

Step 1. Draw a line segment AB of given length by using a ruler.

Step 2. Draw any ray AX making an acute angle with AB .

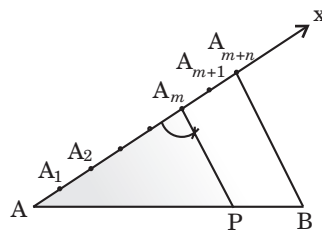
Step 3. Along AX mark off $(m + n)$ points $A_1, A_2, \dots, A_m, A_{m+1}, \dots, A_{m+n}$ such that $AA_1 = A_1A_2 = A_{m+n-1}A_{m+n}$.

Step 4. Join BA_{m+n} .

Step 5. Through the point A_m draw a line parallel to $A_{m+n}B$ by making an angle equal to $\angle A_{m+n}BA$ at A_m .

Suppose this line meets AB at point P .

The point P so obtained is the required point which divides AB internally in the ratio $m : n$.



- **Construction of triangles similar to a given triangle :**

(a) **Steps of Construction : when $m < n$,**

Step 1. Construct the given triangle ABC by using the given data.

Step 2. Take any one of the three sides of the given triangle as base. Let AB be the base of the given triangle

Step 3. At one end, say A , of base AB , Construct an acute $\angle BAX$ below the base AB .

Step 4. Along AX mark off n points $A_1, A_2, A_3, \dots, A_n$ such that

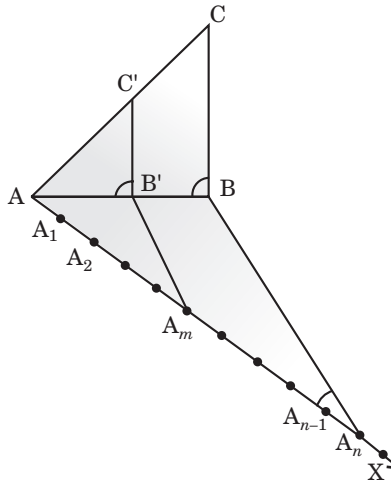
$$AA_1 = A_1A_2 = \dots = A_{n-1}A_n$$

Step 5. Join A_nB .

Step 6. Draw A_mB parallel to A_nB which meets AB at B' .

Step 7. From B' draw $B'C' \parallel CB$ meeting AC at C' .

Triangle $AB'C'$ is the required triangle each of whose sides is $\left(\frac{m}{n}\right)^{\text{th}}$ of the corresponding side of ΔABC .



(b) Steps of Construction : when $m > n$,

Step 1. Construct the given triangle by using the given data.

Step 2. Take any one of the three sides of the given triangle and consider it as the base.

Let AB be the base of the given triangle.

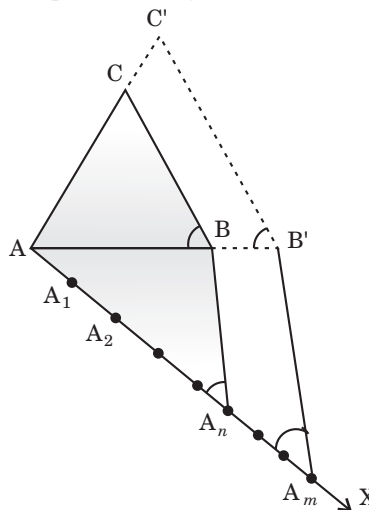
Step 3. At one end, say A , of base AB , construct an acute angle $\angle BAX$ below base AB i.e., on the opposite side of the vertex C .

Step 4. Along AX mark off m (larger of m and n) points $A_1, A_2, A_3, \dots, A_m$ such that $AA_1 = A_1A_2 = \dots = A_{m-1}A_m$.

Step 5. Join A_nB to B and draw a line through A_m parallel to A_nB , intersecting the extended line segment AB at B' ,

Step 6. Draw a line through B' parallel to BC intersecting the extended line segment AC at C' .

Step 7. $\triangle AB'C'$ so obtained is the required triangle.



➤ To draw the tangent to a circle at a given point on it, when the centre of the circle is known.

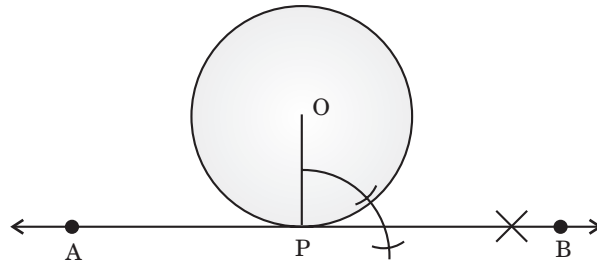
Given : A circle with center O and a point P on it.

Required : To draw the tangent to the circle at P .

Steps of construction :

(i) Join OP ,

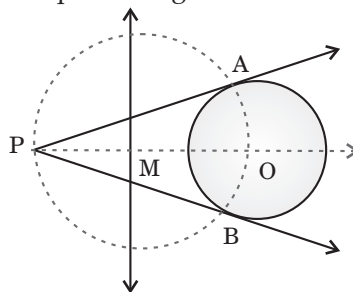
(ii) Draw a line AB perpendicular to OP at the point P , APB is the required tangent at P ,



- **To draw the tangent to a circle from a point outside it (external point) when its center is known.**
Given : A circle with center O and a point P outside it.
Required : To construct the tangents to the circle from P .

Steps of construction :

- (i) Join OP and bisect it. Let M be the mid point of OP .
- (ii) Taking M as centre and MO as radius, draw a circle to intersect $C(O, r)$ in two points, say A and B ,
- (iii) Join PA and PB . These are the required tangents from P to $C(O, r)$.



CHAPTER 5 : Areas Related to Circles

Fundamentals :

- Circle is defined set of all those points which are at constant distance from fixed point. The fixed point is called **centre**.
- The constant distance is called **radius**.
- The longest chord passing through centre and whose end point lies on circle is called **diameter**.
- Circles with same centers are called Concentric Circles.
- **Circumference** : In simple words we can say perimeter of circle is called circumference. But actually :

π is defined as the ratio of circumference and diameter of circle.

$$\pi = \frac{\text{Circumference}}{\text{Diameter}}$$

Therefore, Circumference = $\pi \times \text{Diameter}$

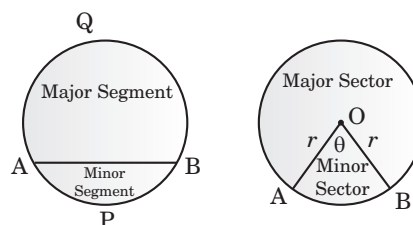
i.e.,

Circumference = $2\pi r$

Area of the Circle = πr^2

[where, r is the radius of circle]

Arc, Chord, Segment, Sector of a Circle



Arc : Any portion of circumference. *i.g.*, : APB is minor arc while AQB is major arc.

Chord : The line joining any two points on the circle. *i.g.* : AB .

Segment : In figure chord AB divides the circle in two segments *i. e.*, $APBA$ (minor segment) and $AQBA$ (major segment).

Sector : The region bounded by the two radii AO and BO and arc AB is called sector of the circle.

Let $\angle AOB = \theta$, where θ is called central angle.

Length of Arc : When sector angle $\angle AOB = \theta$.

We know that length of arc when sector angle ($\angle AOB = 360^\circ$) is $2\pi r$

length of arc when sector angle ($\angle AOB = 1^\circ$) is $\frac{2\pi r}{360^\circ}$

Length of arc when sector angle ($\angle AOB = \theta$) is $\frac{2\pi r \times \theta}{360^\circ}$

$$\text{Length of arc } AB = 2\pi r \times \frac{\theta}{360^\circ}$$

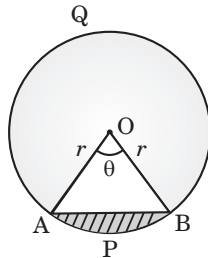
Area of Sector : When sector angle $\angle AOB = \theta$

We know that area of circle when sector angle ($\angle AOB = 360^\circ$) is πr^2

Area of arc when sector angle ($\angle AOB = 1^\circ$) is $\frac{\pi r^2}{360^\circ}$

Area of arc when sector angle ($\angle AOB = \theta$) is $\frac{\pi r^2}{360^\circ} \times \theta$

$$\text{Area of Sector} = \pi r^2 \times \frac{\theta}{360^\circ}$$



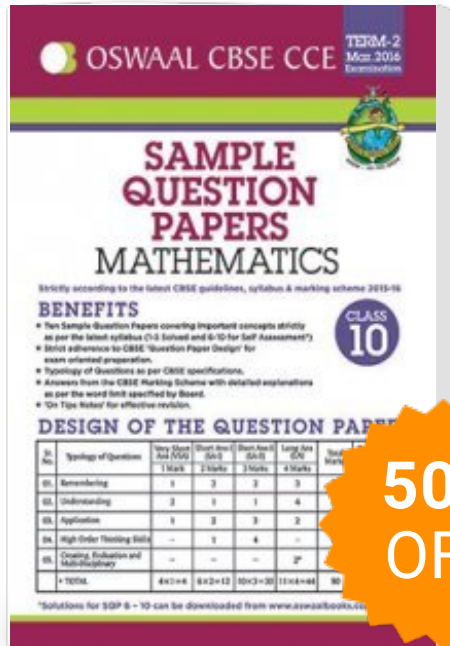
Area of Segment (shaded) of A Circle : Area of Sector AOB – Area of triangle AOB

<p>We can use formula given below when $\theta \geq 90^\circ$</p> <p>Area of segment = $\frac{\pi r^2 \theta}{360^\circ} - r^2 \sin \frac{\theta}{2} \cos \frac{\theta}{2}$</p>	<p>We can use formula given below when $\theta = 90^\circ$</p> <p>Area of segment = $\frac{\pi r^2 \theta}{360^\circ} - \frac{1}{2} r^2 \sin \theta$</p>
---	--

Perimeter Of Segment (shaded) Of A Circle : $AB + \text{arc}(APB)$

$$\text{Perimeter of Segment} = \frac{2\pi r \theta}{360^\circ} - 2r \sin \frac{\theta}{2}$$

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