SAMPLE CONTENT

PERFECT

MATHEMATICS
PART - II

BASED ON TEXTBOOK AND BOARD PAPER PATTERN

Application of Co-ordinate Geometry:
Slope of a line is used to determine the length of conveyor belt. If the slope of the belt is more, the material will slide down instead of being carried up.

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STD. X
(Eng. Med.)

Target Publications® Pvt. Ltd.

Based on the **Latest Paper Pattern** prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04

PERFECT Mathematics Part – II

STD. X

Salient Features

- Created as per the latest paper pattern
- Includes solutions to all Practice Sets and Problem Sets
- Includes additional problems, activities and MCQs
- Tentative marks allocation for all problems
- Chapter-wise assessment for every chapter
- Includes 'Challenging Questions'
- Smart Check for Answer verification
- Illustrative Examples at the beginning of Exercises
- Constructions drawn with accurate measurements
- Includes Important Theorems and Formulae at the end
- Model Question Paper in accordance with the latest paper pattern
- Inclusion of **QR Code** for students to access the 'Solution' for the Model Question Paper
- Includes Board questions till March 2022

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PREFACE

Creation of the **'Perfect Mathematics Part – II, Std. X'** book was a rollercoaster ride. We had a plethora of ideas, suggestions and decisions to ponder over. However, our basic premise was to keep this book in line with the new, improved syllabus and to provide students with updated material.

Mathematics Part **-** II covers several topics including Similarity of Triangles, Pythagoras Theorem, Circles, Geometric Constructions, Co-ordinate Geometry, Trigonometry and Mensuration. The study of these topics requires a deep and intrinsic understanding of concepts, terms and formulae. Hence, to ease this task, we present **'Std. X: Mathematics Part - II'** – a complete and thorough guide, extensively drafted to boost the confidence of students.

Before each Practice Set, short and easy explanation of different concepts with illustrations is provided. A detailed thinking process involved in solving problems is explained in stepwise manner in 'Illustrative Examples'. Detailed solution of the problems has been provided for the students understanding and is not expected in the examination. We have also included Solutions and Answers to Textual Questions and Examples in an extremely lucid manner.

Moreover, the inclusion of 'Smart Check' enables students to verify their answers.'Textual Activities' covers all the Textual Activities along with their answers. 'Additional Problems for Practice' include multiple unsolved problems for revision and in the process help the students to sharpen their problem solving skills. 'Solved Examples' from textbook are also a part of this book. Every chapter ends with a 'Chapter Assessment'. This test stands as a testimony to the fact that the child has understood the chapter thoroughly. 'Activities for Practice' includes additional activities along with their answers for students to practice. 'One Mark Questions' include '**Type A**: Multiple Choice Questions', '**Type B**: Solve the Following Questions' along with their answers.

'Challenging Questions' include questions that are not a part of the textbook, yet are core to the concerned subject. These questions would provide students enough practice to tackle Challenging Questions in their examination.

Questions from Board papers of March 2019, July 2019, March 2020, December 2020 and March 2022 have been included as that would help students to prepare better for board exam.

We have presented a tentative mark allocation for the problems in this book. However, marks mentioned are indicative and are subject to change as per the Maharashtra State Board's discretion.

'Model Question Paper' based on the pattern prescribed by the State Board is provided at the end to help the students prepare for their final examination.

We have provided **QR Code** for students to access 'Solutions' for the given Model Question Paper.

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Publisher

Edition: Third

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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KEY FEATURES

ILLUSTRATIVE EXAMPLE

Illustrative Example provides a detailed approach towards solving a problem.

SMART CHECK

Smart Check is a technique to verify the answers. This is our attempt to cross-check the accuracy of the answer. Smart check is indicated by ✓ symbol.

CHAPTER ASSESSMENT

Chapter Assessment covers questions from the chapter for self-evaluation purpose.
This is our attempt to offer students with revision and help them assess their knowledge of each chapter.

ONE MARK QUESTIONS

One Mark Questions
Type A - These are Multiple Choice Questions which either require short solutions or direct application of mathematical concepts.
Type B - These questions require very short solutions with direct application of mathematical concepts.

QR CODE

QR code provide Solution for Model Question Paper.

CHALLENGING QUESTIONS

With an increase in the weightage of these questions in board examination, we have created a separate section of **Challenging Questions for additional practice.**

ACTIVITIES FOR PRACTICE

Activities for Practice: In this section we have provided multiple activities for practice in accordance with the latest paper pattern.

IMPORTANT FORMULAE

Important Formulae given at the end of the book includes all the key formulae in the chapter.
It offers students a handy tool to solve problems and ace the last minute revision.

ADDITIONAL PROBLEMS FOR PRACTICE

In this section we have provided ample practice problems for students. Solved examples from textbook are indicated by "+".

QUESTION PAPER

Model Question Paper is provided for the students to know about the types of questions that are asked in the Board Examinations.

Evaluation Scheme

Academic year 2019 - 2020 and onwards

Mathematics - Part I	40 Marks	Written Examination	Time: 2 hours
Mathematics - Part II	40 Marks	Written Examination	Time: 2 hours
Internal Evaluation	20 Marks		
Total	**100 Marks**		

The scheme of internal evaluation will be as follows:

- 2 Homework assignments [one based on Mathematics Part – I and one based on Mathematics Part – II (5 Marks each) – 10 Marks]
- Practical Exam / MCQ Test (Part I – 10 Marks and Part II – 10 Marks) - These 20 marks are to be converted into 10 Marks.

PAPER PATTERN

Question No.	Type of Questions	Total Marks	Marks with option
1.	(A) Solve 4 out of 4 MCQ (1 mark each)	04	04
	(B) Solve 4 out of 4 subquestions (1 mark each)	04	04
2.	(A) Solve 2 activity based subquestions out of 3 (2 marks each)	04	06
	(B) Solve any 4 out of 5 subquestions (2 marks each)	08	10
3.	(A) Solve 1 activity based subquestion out of 2 (3 marks each)	03	06
	(B) Solve any 2 out of 4 subquestions (3 marks each)	06	12
4.	Solve any 2 out of 3 subquestions (4 marks each) [Out of textbook]	08	12
5.	Solve any 1 out of 2 subquestions (3 marks each)	03	06
	Total Marks	**40**	**60**

The division of marks in question papers as per objectives will be as follows:

Distribution of Marks	
Easy Questions	40%
Medium Questions	40%
Difficult Questions	20%

Objectives	Maths – II
Knowledge	20%
Understanding	30%
Application	40%
Skill	10%

[Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04]

Topic-wise weightage of marks

S. No.	Topic Name	Marks with option
1	Similarity	10
2	Pythagoras Theorem	07
3	Circle	12
4	Geometric Constructions	07
5	Co-ordinate Geometry	07
6	Trigonometry	07
7	Mensuration	10
	Total	**60**

Note: In the topic-wise weightage of marks given in the above table, flexibility of maximum 2 marks is permissible.

CONTENTS

Note: Solved examples from textbook are indicated by "+".
Smart check is indicated by ✓ symbol.

Note: *Steps of construction are provided in Chapters for the students' understanding.*

6 Trigonometry

Let's Study

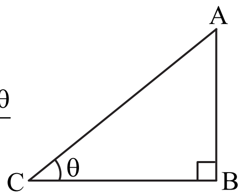
- Trigonometric ratios
- Trigonometric identities
- Angle of elevation and Angle of depression
- Problems based on heights and distances

Let's Recall

Trigonometric ratios:

i. $\sin\theta = \dfrac{\text{Opposite side of } \angle\theta}{\text{Hypotenuse}}$

$= \dfrac{AB}{AC}$



ii. $\cos\theta = \dfrac{\text{Adjacent side of } \angle\theta}{\text{Hypotenuse}}$

$= \dfrac{BC}{AC}$

iii. $\tan\theta = \dfrac{\text{Opposite side of } \angle\theta}{\text{Adjacent side of } \angle\theta}$

$= \dfrac{AB}{BC}$

Relation among trigonometric ratios:

i. $\sin\theta = \cos(90 - \theta)$

ii. $\cos\theta = \sin(90 - \theta)$

iii. $\tan\theta \times \tan(90 - \theta) = 1$

iv. $\dfrac{\sin\theta}{\cos\theta} = \tan\theta$

Basic trigonometric identity:

$\sin^2\theta + \cos^2\theta = 1$

Examples:

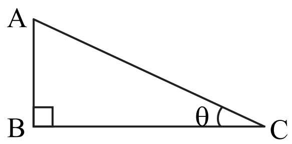
1. Fill in the blanks with reference to the figure given below.

(Textbook pg. no. 124)

i. $\sin\theta = \dfrac{\boxed{AB}}{\boxed{AC}}$

ii. $\cos\theta = \dfrac{\boxed{BC}}{\boxed{AC}}$

iii. $\tan\theta = \dfrac{\boxed{AB}}{\boxed{BC}}$



2. Complete the relations in ratios given below.

(Textbook pg. no. 124)

i. $\dfrac{\sin\theta}{\cos\theta} = \boxed{\tan\theta}$

ii. $\sin\theta = \cos\left(90 - \boxed{\theta}\right)$

iii. $\cos\theta = \sin\left(90 - \boxed{\theta}\right)$

iv. $\tan\theta \times \tan(90 - \theta) = \boxed{1}$

3. Complete the equation.

(Textbook pg. no. 124)

i. $\sin^2\theta + \cos^2\theta = \boxed{1}$

4. Write the values of the following trigonometric ratios. (Textbook pg. no. 124)

i. $\sin 30° = \dfrac{1}{\boxed{2}}$

ii. $\cos 30° = \dfrac{\boxed{\sqrt{3}}}{\boxed{2}}$

iii. $\tan 30° = \dfrac{\boxed{1}}{\boxed{\sqrt{3}}}$

iv. $\sin 60° = \dfrac{\boxed{\sqrt{3}}}{\boxed{2}}$

v. $\cos 45° = \dfrac{\boxed{1}}{\boxed{\sqrt{2}}}$

vi. $\tan 45° = \boxed{1}$

Let's Learn

cosec, sec and cot ratios

Cosecant ratio:

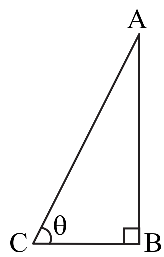
Multiplicative inverse or the reciprocal of sine ratio is called cosecant ratio.

It is written as cosec.

$\text{cosec}\,\theta = \dfrac{1}{\sin\theta}$

In ΔABC, $\angle B = 90°$, $\angle C = \theta$

$\therefore \quad \sin\theta = \dfrac{AB}{AC}$



Now, cosec θ $= \dfrac{1}{\sin\theta} = \dfrac{1}{\frac{AB}{AC}}$

$\therefore$ cosec θ $= \dfrac{AC}{AB}$

i.e. **cosec θ = $\dfrac{\textbf{Hypotenuse}}{\textbf{Opposite side of } \angle\theta}$**

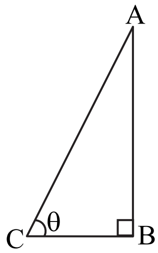
Secant ratio:

Multiplicative inverse or the reciprocal of cosine ratio is called secant ratio.

It is written as sec.

sec θ $= \dfrac{1}{\cos\theta}$

In ΔABC, ∠B = 90°, ∠C = θ



$\therefore$ cos θ $= \dfrac{BC}{AC}$

Now, sec θ $= \dfrac{1}{\cos\theta} = \dfrac{1}{\frac{BC}{AC}}$

$\therefore$ sec θ $= \dfrac{AC}{BC}$

i.e. **sec θ = $\dfrac{\textbf{Hypotenuse}}{\textbf{Adjacent side of } \angle\theta}$**

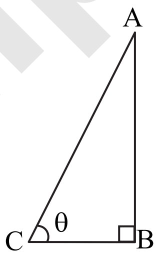
Cotangent ratio:

Multiplicative inverse or the reciprocal of tangent ratio is called cotangent ratio.

It is written as cot.

cot θ $= \dfrac{1}{\tan\theta}$

In ΔABC, ∠B = 90°, ∠C = θ



$\therefore$ tan θ $= \dfrac{AB}{BC}$

Now, cot θ $= \dfrac{1}{\tan\theta} = \dfrac{1}{\frac{AB}{BC}}$

$\therefore$ cot θ $= \dfrac{BC}{AC}$

i.e. **cot θ = $\dfrac{\textbf{Adjacent side of } \angle\theta}{\textbf{Opposite side of } \angle\theta}$**

We know that, tan θ $= \dfrac{\sin\theta}{\cos\theta}$

$\therefore$ cot θ $= \dfrac{1}{\tan\theta}$

$= \dfrac{1}{\frac{\sin\theta}{\cos\theta}}$

$\therefore$ **cot θ = $\dfrac{\cos\theta}{\sin\theta}$**

Relation between the trigonometric ratios:

i. cosec θ $= \dfrac{1}{\sin\theta}$

$\therefore$ **sin θ × cosec θ = 1**

ii. sec θ $= \dfrac{1}{\cos\theta}$

$\therefore$ **cos θ × sec θ = 1**

iii. cot θ $= \dfrac{1}{\tan\theta}$

$\therefore$ **tan θ × cot θ = 1**

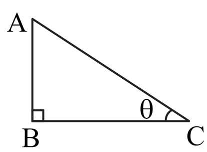
Trigonometric ratios of 0°, 30°, 45°, 60° and 90° angles.

Trigonometric ratio	Angle (θ)				
	0°	30°	45°	60°	90°
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec θ = $\frac{1}{\sin\theta}$	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec θ = $\frac{1}{\cos\theta}$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot θ = $\frac{1}{\tan\theta}$	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Let's Learn

Trigonometric identities

i. In ΔABC, ∠B = 90°, ∠C = θ



$\therefore$ $AB^2 + BC^2 = AC^2$

...[Pythagoras theorem]

$\therefore$ $\dfrac{AB^2}{AC^2} + \dfrac{BC^2}{AC^2} = \dfrac{AC^2}{AC^2}$

...[Dividing both sides by AC^2]

$\therefore$ $\left(\dfrac{AB}{AC}\right)^2 + \left(\dfrac{BC}{AC}\right)^2 = 1$

$\therefore$ $(\sin\theta)^2 + (\cos\theta)^2 = 1$

...$\left[\because \dfrac{AB}{AC} = \sin\theta \text{ and } \dfrac{BC}{AC} = \cos\theta\right]$

$\therefore$ **$\sin^2\theta + \cos^2\theta = 1$**

ii. $\sin^2\theta + \cos^2\theta = 1$

$\therefore \quad \dfrac{\sin^2\theta}{\sin^2\theta} + \dfrac{\cos^2\theta}{\sin^2\theta} = \dfrac{1}{\sin^2\theta}$

... [Dividing both sides by $\sin^2\theta$]

$\therefore \quad 1 + \left(\dfrac{\cos\theta}{\sin\theta}\right)^2 = \left(\dfrac{1}{\sin\theta}\right)^2$

$\therefore \quad 1 + (\cot\theta)^2 = (\text{cosec}\,\theta)^2$

...$\left[\because \dfrac{\cos\theta}{\sin\theta} = \cot\theta \text{ and } \dfrac{1}{\sin\theta} = \text{cosec}\,\theta\right]$

$\therefore \quad \mathbf{1 + \cot^2\theta = cosec^2\theta}$

iii. $\sin^2\theta + \cos^2\theta = 1$

$\therefore \quad \dfrac{\sin^2\theta}{\cos^2\theta} + \dfrac{\cos^2\theta}{\cos^2\theta} = \dfrac{1}{\cos^2\theta}$

...[Dividing both sides by $\cos^2\theta$]

$\therefore \quad \left(\dfrac{\sin\theta}{\cos\theta}\right)^2 + 1 = \left(\dfrac{1}{\cos\theta}\right)^2$

$\therefore \quad (\tan\theta)^2 + 1 = (\sec\theta)^2$

...$\left[\because \dfrac{\sin\theta}{\cos\theta} = \tan\theta \text{ and } \dfrac{1}{\cos\theta} = \sec\theta\right]$

$\therefore \quad \mathbf{1 + \tan^2\theta = sec^2\theta}$

Note: $(\sin\theta)^2$ is written as $\sin^2\theta$, $(\cos\theta)^2$ as $\cos^2\theta$ and so on.

Remember This

Trigonometric identities:

i. $\sin^2\theta + \cos^2\theta = 1$
$1 - \sin^2\theta = \cos^2\theta$
$1 - \cos^2\theta = \sin^2\theta$

ii. $1 + \tan^2\theta = \sec^2\theta$
$\sec^2\theta - 1 = \tan^2\theta$
$\sec^2\theta - \tan^2\theta = 1$

iii. $1 + \cot^2\theta = \text{cosec}^2\theta$
$\text{cosec}^2\theta - 1 = \cot^2\theta$
$\text{cosec}^2\theta - \cot^2\theta = 1$

Illustrative Example

If $\cos\theta = \dfrac{40}{41}$, find the values of $\sin\theta$ and $\cot\theta$.

Solution:

Step 1: Read the given things carefully and try to understand which identity can be used

$\cos\theta = \dfrac{40}{41}$ ...[Given]

Step 2: Use the necessary trigonometric identity to get one of the required trigonometric ratio.

$\sin^2\theta + \cos^2\theta = 1$ ...[Formula]

$\therefore \quad \sin^2\theta = 1 - \cos^2\theta$

$= 1 - \left(\dfrac{40}{41}\right)^2$

$= 1 - \dfrac{1600}{1681} = \dfrac{1681 - 1600}{1681}$

$\therefore \quad \sin^2\theta = \dfrac{81}{1681}$

$\therefore \quad \sin\theta = \dfrac{9}{41}$

...[Taking square root of both side]

Step 3: Use the appropriate formula to get the remaining trigonometric ratios.
Here, we need to find the value of $\cot\theta$.

Since, $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$

$\therefore \quad \cot\theta = \dfrac{\frac{40}{41}}{\frac{9}{41}}$

$\therefore \quad \cot\theta = \dfrac{40}{9}$

Step 4: Write the required solution.

$\therefore \quad \mathbf{\sin\theta = \dfrac{9}{41}, \ \cot\theta = \dfrac{40}{9}}$

Practice Set 6.1

1. If $\sin\theta = \dfrac{7}{25}$, find the values of $\cos\theta$ and $\tan\theta$. [2 Marks]

Solution:

$\sin\theta = \dfrac{7}{25}$ ...[Given]

We know that,

$\sin^2\theta + \cos^2\theta = 1$

$\therefore \quad \left(\dfrac{7}{25}\right)^2 + \cos^2\theta = 1$

$\therefore \quad \dfrac{49}{625} + \cos^2\theta = 1$

$\therefore \quad \cos^2\theta = 1 - \dfrac{49}{625}$

$\therefore \quad \cos^2\theta = \dfrac{625 - 49}{625}$

$\therefore \quad \cos^2\theta = \dfrac{576}{625}$

$\therefore \quad \cos\theta = \dfrac{24}{25}$ ...[Taking square root of both sides]

Now, $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$

$= \dfrac{\left(\dfrac{7}{25}\right)}{\left(\dfrac{24}{25}\right)}$

$= \dfrac{7}{25} \div \dfrac{24}{25}$

$= \dfrac{7}{25} \times \dfrac{25}{24}$

$\therefore$ $\tan\theta = \dfrac{7}{24}$

$\therefore$ **$\cos\theta = \dfrac{24}{25}$ and $\tan\theta = \dfrac{7}{24}$**

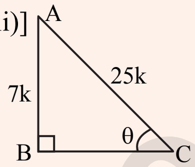
Smart Check or Alternate Method

$\sin\theta = \dfrac{7}{25}$ …(i) [Given]

Consider ΔABC, where $\angle ABC = 90°$ and $\angle ACB = \theta$.

$\sin\theta = \dfrac{AB}{AC}$ …(ii) [By definition]

$\therefore$ $\dfrac{AB}{AC} = \dfrac{7}{25}$ …[From (i) and (ii)]



Let AB = 7k and AC = 25k

In ΔABC, $\angle B = 90°$

$\therefore$ $AB^2 + BC^2 = AC^2$ ...[Pythagoras theorem]

$\therefore$ $(7k)^2 + BC^2 = (25k)^2$

$\therefore$ $49k^2 + BC^2 = 625k^2$

$\therefore$ $BC^2 = 625k^2 - 49k^2$

$\therefore$ $BC^2 = 576k^2$

$\therefore$ $BC = 24k$

...[Taking square root of both sides]

Now, $\cos\theta = \dfrac{BC}{AC}$ …[By definition]

$= \dfrac{24k}{25k}$

$\therefore$ $\cos\theta = \dfrac{24}{25}$

Also, $\tan\theta = \dfrac{AB}{BC}$ …[By definition]

$= \dfrac{7k}{24k}$

$\therefore$ $\tan\theta = \dfrac{7}{24}$

$\therefore$ **$\cos\theta = \dfrac{24}{25}$ and $\tan\theta = \dfrac{7}{24}$**

2. If $\tan\theta = \dfrac{3}{4}$, find the values of $\sec\theta$ and $\cos\theta$. **[2 Marks]**

Solution:

$\tan\theta = \dfrac{3}{4}$ …[Given]

We know that,

$1 + \tan^2\theta = \sec^2\theta$

$\therefore$ $1 + \left(\dfrac{3}{4}\right)^2 = \sec^2\theta$

$\therefore$ $1 + \dfrac{9}{16} = \sec^2\theta$

$\therefore$ $\dfrac{16+9}{16} = \sec^2\theta$

$\therefore$ $\sec^2\theta = \dfrac{25}{16}$

$\therefore$ $\sec\theta = \dfrac{5}{4}$

...[Taking square root of both sides]

Now, $\cos\theta = \dfrac{1}{\sec\theta}$

$= \dfrac{1}{\left(\dfrac{5}{4}\right)}$

$\therefore$ $\cos\theta = \dfrac{4}{5}$

$\therefore$ **$\sec\theta = \dfrac{5}{4}$ and $\cos\theta = \dfrac{4}{5}$**

3. If $\cot\theta = \dfrac{40}{9}$, find the values of $\operatorname{cosec}\theta$ and $\sin\theta$. **[2 Marks]**

Solution:

$\cot\theta = \dfrac{40}{9}$ …[Given]

We know that,

$1 + \cot^2\theta = \operatorname{cosec}^2\theta$

$\therefore$ $1 + \left(\dfrac{40}{9}\right)^2 = \operatorname{cosec}^2\theta$

$\therefore$ $1 + \dfrac{1600}{81} = \operatorname{cosec}^2\theta$

$\therefore$ $\dfrac{81+1600}{81} = \operatorname{cosec}^2\theta$

$\therefore$ $\operatorname{cosec}^2\theta = \dfrac{1681}{81}$

$\therefore$ $\operatorname{cosec}\theta = \dfrac{41}{9}$ ...[Taking square root of both sides]

Now, $\sin\theta = \dfrac{1}{\operatorname{cosec}\theta} = \dfrac{1}{\left(\dfrac{41}{9}\right)}$

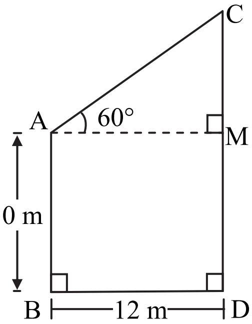
$\therefore$ $\sin\theta = \dfrac{9}{41}$

$\therefore$ **$\operatorname{cosec}\theta = \dfrac{41}{9}$ and $\sin\theta = \dfrac{9}{41}$**

3. Two buildings are facing each other on a road of width 12 metre. From the top of the first building, which is 10 metre high, the angle of elevation of the top of the second is found to be 60°. What is the height of the second building? [3 Marks]

Solution:

Let AB and CD represent the heights of the two buildings, and BD represent the width of the road.



Draw seg AM ⊥ seg CD.

Angle of elevation = $\angle CAM = 60°$

AB = 10 m

BD = 12 m

In □ABDM,

$\angle B = \angle D = 90°$

$\angle M = 90°$ … [seg AM ⊥ seg CD]

∴ $\angle A = 90°$ …[Remaining angle of □ABDM]

∴ □ABDM is a rectangle. …[Each angle is 90°]

∴ AM = BD = 12 m, DM = AB = 10 m } …[Opposite sides of a rectangle]

In right angled ΔAMC,

$\tan 60° = \dfrac{CM}{AM}$ …[By definition]

∴ $\sqrt{3} = \dfrac{CM}{12}$

∴ $CM = 12\sqrt{3}$ m

Now, CD = DM + CM …[C–M–D]

∴ $CD = (10 + 12\sqrt{3})$ m

$= 10 + 12 \times 1.73$

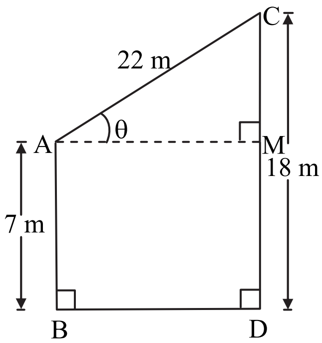
$= 10 + 20.76 = 30.76$

∴ **The height of the second building is $(10 + 12\sqrt{3})$ m i.e. 30.76 m.**

4. Two poles of heights 18 metre and 7 metre are erected on a ground. The length of the wire fastened at their tops is 22 metre. Find the angle made by the wire with the horizontal. [3 Marks]

Solution:

Let AB and CD represent the heights of two poles, and AC represent the length of the wire.



Draw seg AM ⊥ seg CD.

Angle of elevation = $\angle CAM = \theta$

AB = 7 m

CD = 18 m

AC = 22 m

In □ABDM,

$\angle B = \angle D = 90°$

$\angle M = 90°$ ...[seg AM ⊥ seg CD]

∴ $\angle A = 90°$ …[Remaining angle of □ABDM]

∴ □ABDM is a rectangle. …[Each angle is 90°]

∴ DM = AB = 7 m …[Opposite sides of a rectangle]

Now, CD = CM + DM …[C–M–D]

∴ 18 = CM + 7

∴ CM = 18 − 7 = 11 m

In right angled ΔAMC,

$\sin \theta = \dfrac{CM}{AC}$ …[By definition]

∴ $\sin \theta = \dfrac{11}{22} = \dfrac{1}{2}$

But, $\sin 30° = \dfrac{1}{2}$

∴ $\theta = 30°$

∴ $\angle CAM = 30°$

∴ **The angle made by the wire with the horizontal is 30°.**

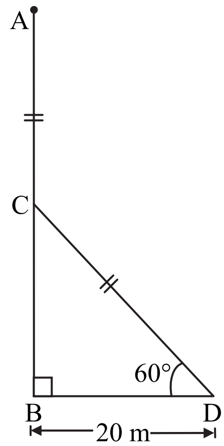
5. A storm broke a tree and the treetop rested 20 m from the base of the tree, making an angle of 60° with the horizontal. Find the height of the tree. [3 Marks]

Solution:

Let AB represent the height of the tree.

Suppose the tree broke at point C and its top touches the ground at D.

AC is the broken part of the tree which takes position CD such that $\angle CDB = 60°$



∴ AC = CD …(i)

BD = 20 m

In right angled ΔCBD,

$\tan 60° = \dfrac{BC}{BD}$ …[By definition]

∴ $\sqrt{3} = \dfrac{BC}{20}$

∴ $BC = 20\sqrt{3}$ m

Also, $\cos 60° = \frac{BD}{CD}$ …[By definition]

$\therefore \quad \frac{1}{2} = \frac{20}{CD}$

$\therefore \quad CD = 20 \times 2 = 40$ m

$\therefore \quad AC = 40$ m …[From (i)]

Now, AB = AC + BC ...[A–C–B]

$= 40 + 20\sqrt{3}$

$= 40 + 20 \times 1.73$

$= 40 + 34.6$

$= 74.6$

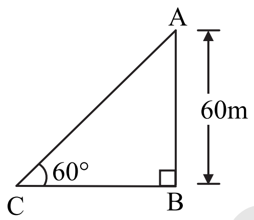
$\therefore$ **The height of the tree is $(40 + 20\sqrt{3})$ m i.e. 74.6 m.**

---

6. A kite is flying at a height of 60 m above the ground. The string attached to the kite is tied at the ground. It makes an angle of 60° with the ground. Assuming that the string is straight, find the length of the string.
($\sqrt{3} = 1.73$) **[3 Marks]**

Solution:

Let AB represent the height at which kite is flying and point C represent the point where the string is tied at the ground.



$\angle ACB$ is the angle made by the string with the ground.

$\angle ACB = 60°$

AB = 60 m

In right angled ΔABC,

$\sin 60° = \frac{AB}{AC}$ …[By definition]

$\therefore \quad \frac{\sqrt{3}}{2} = \frac{60}{AC}$

$\therefore \quad AC = \frac{60 \times 2}{\sqrt{3}}$

$= \frac{120}{\sqrt{3}}$

$= \frac{120}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ …[On rationalising the denominator]

$= \frac{120\sqrt{3}}{3}$

$\therefore \quad AC = 40\sqrt{3}$

$= 40 \times 1.73 = 69.20$ m

$\therefore$ **The length of the string is 69.20 m.**

Problem Set – 6

1. Choose the correct alternative answer for the following questions. **[1 Mark each]**

i. $\sin \theta . \text{cosec } \theta = ?$ **[July 19]**

(A) 1 (B) 0
(C) $\frac{1}{2}$ (D) $\sqrt{2}$

ii. cosec 45° = ?

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$
(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{2}{\sqrt{3}}$

iii. $1 + \tan^2 \theta = ?$ **[Mar 19]**

(A) $\cot^2 \theta$ (B) $\text{cosec}^2 \theta$
(C) $\sec^2 \theta$ (D) $\tan^2 \theta$

iv. When we see at a higher level, from the horizontal line, angle formed is _______.

(A) angle of elevation.
(B) angle of depression.
(C) 0
(D) straight angle.

Answers:

i. (A) ii. (B)
iii. (C) iv. (A)

---

2. If $\sin \theta = \frac{11}{61}$, find the value of $\cos \theta$ using trigonometric identity. **[Mar 22] [2 Marks]**

Solution:

$\sin \theta = \frac{11}{61}$ …[Given]

We know that,

$\sin^2 \theta + \cos^2 \theta = 1$

$\therefore \quad \left(\frac{11}{61}\right)^2 + \cos^2 \theta = 1$

$\therefore \quad \frac{121}{3721} + \cos^2 \theta = 1$

$\therefore \quad \cos^2 \theta = 1 - \frac{121}{3721}$

$\therefore \quad \cos^2 \theta = \frac{3721 - 121}{3721}$

$\therefore \quad \cos^2 \theta = \frac{3600}{3721}$

$\therefore \quad \mathbf{\cos \theta = \frac{60}{61}}$

...[Taking square root of both sides]

Page no. **13** to **16** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**

$\therefore$ $\square$ACDE is a rectangle. …[Each angle is 90°]

$\therefore$ CD = AE = 2 m …[Opposite sides of a rectangle]

Now, BD = BC + CD …[B–C–D]

= 18.80 + 2

= 20.80 m

$\therefore$ **The maximum height from the ground upto which the ladder can reach is 20.80 metres.**

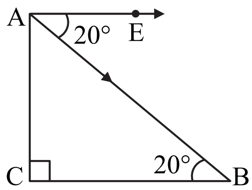
10. While landing at an airport, a pilot made an angle of depression of 20°. Average speed of the plane was 200 km/hr. The plane reached the ground after 54 seconds. Find the height at which the plane was when it started landing. (sin 20° = 0.342) [4 Marks]

Solution:

Let AC represent the initial height and point A represent the initial position of the plane.

Let point B represent the position where plane lands.

Angle of depression = $\angle$EAB = 20°



Now, seg AE $\parallel$ seg BC

$\therefore$ $\angle ABC = \angle EAB$ …[Alternate angles]

$\therefore$ $\angle ABC = 20°$

Speed of the plane

= 200 km/hr

$= 200 \times \frac{1000}{3600}$ m/sec

$= \frac{500}{9}$ m/sec

$\therefore$ Distance travelled in 54 sec

= speed × time

$= \frac{500}{9} \times 54$

= 3000 m

$\therefore$ AB = 3000 m

In right angled ΔABC,

$\sin 20° = \frac{AC}{AB}$ …[By definition]

$\therefore$ $0.342 = \frac{AC}{3000}$

$\therefore$ AC = 0.342 × 3000

= 1026 m

$\therefore$ **The plane was at a height of 1026 m when it started landing.**

Activities for Practice

1. If $\sec\theta = \frac{25}{7}$, find the value of $\tan\theta$.

[Mar 20][2 Marks]

$1 + \tan^2\theta = \sec^2\theta$

$\therefore$ $1 + \tan^2\theta = \left(\frac{25}{7}\right)^{\square}$

$\therefore$ $\tan^2\theta = \frac{625}{49} - \square$

$= \frac{625 - 49}{49}$

$= \frac{\square}{49}$

$\therefore$ $\tan\theta = \frac{\square}{7}$ …[By taking square roots]

2. A person is standing at a distance of 50 m from a church looking at its top. The angle of elevation is of 60°. Find the height of the church. **[2 Marks]**

Let AB represents the height of the church and point C represents the position of the person.

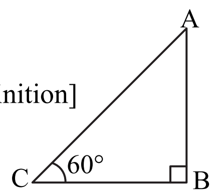
BC = $\square$

Angle of elevation = $\square$ = 60°

In right angled ΔABC,

$\tan 60° = \frac{\square}{\square}$ …[By definition]

$\therefore$ AB = $\square$



3. Complete the following activity to prove: $\cot\theta + \tan\theta = \mathrm{cosec}\,\theta \times \sec\theta$

[Mar 22][2 Marks]

Activity:

L.H.S. = $\cot\theta + \tan\theta$

$= \frac{\cos\theta}{\sin\theta} + \frac{\square}{\cos\theta} = \frac{\square + \sin^2\theta}{\sin\theta \times \cos\theta}$

$= \frac{1}{\sin\theta \times \cos\theta}$ ….$\because$ $\square$

$= \frac{1}{\sin\theta} \times \frac{1}{\cos\theta}$

$= \square \times \sec\theta$

$\therefore$ L.H.S. = R.H.S.

4. If $\sin\theta = \frac{9}{41}$, find the values of $\cos\theta$ and $\tan\theta$.

[3 Marks]

$\sin\theta = \frac{9}{41}$ ...[Given]

we know that,

$\sin^2\theta + \cos^2\theta = \boxed{\quad}$

$\therefore \left(\frac{9}{41}\right)^2 + \cos^2\theta = 1$

$\therefore \cos^2\theta = 1 - \frac{81}{\boxed{\quad}}$

$\therefore \cos\theta = \boxed{\frac{\quad}{\quad}}$

...[Taking square root of both sides]

Now, $\tan\theta = \frac{\boxed{\quad}}{\cos\theta}$

$= \frac{\left(\frac{9}{41}\right)}{\boxed{\frac{\quad}{\quad}}}$

$\therefore \tan\theta = \boxed{\frac{\quad}{\quad}}$

5. Prove that : $\frac{\cot\theta}{\operatorname{cosec}\theta - 1} = \frac{\cot\theta + \operatorname{cosec}\theta + 1}{\cot\theta + \operatorname{cosec}\theta - 1}$

[3 Marks]

L. H. S. $= \frac{\cot\theta}{\operatorname{cosec}\theta - 1}$

$= \frac{\boxed{\quad}}{\operatorname{cosec}\theta - 1} \times \frac{\operatorname{cosec}\theta + 1}{\boxed{\quad}}$

...[On rationalising the denominator]

$= \frac{\cot\theta(\operatorname{cosec}\theta + 1)}{\boxed{\quad}}$

$= \frac{\cot\theta(\operatorname{cosec}\theta + 1)}{\boxed{\quad}}$

$= \frac{\operatorname{cosec}\theta + 1}{\cot\theta}$

$\therefore \frac{\cot\theta}{\operatorname{cosec}\theta - 1} = \frac{\operatorname{cosec}\theta + 1}{\cot\theta}$

$\therefore$ By theorem on equal ratios,

$\frac{\cot\theta}{\operatorname{cosec}\theta - 1} = \frac{\operatorname{cosec}\theta + 1}{\boxed{\quad}}$

$= \frac{\cot\theta + (\operatorname{cosec}\theta + 1)}{\operatorname{cosec}\theta - 1 + (\cot\theta)}$

$= \boxed{\frac{\quad}{\quad}}$

$\therefore \frac{\cot\theta}{\operatorname{cosec}\theta - 1} = \frac{\cot\theta + (\operatorname{cosec}\theta + 1)}{\operatorname{cosec}\theta - 1 + (\cot\theta)}$ = R.H.S

One Mark Questions

Type A: Multiple Choice Questions

1. $\cos\theta.\sec\theta =$

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) $\sqrt{2}$

2. $\tan\theta.\tan(90° - \theta) =$

(A) 0 (B) $\frac{1}{\sqrt{3}}$ (C) 1 (D) $\sqrt{3}$

3. If $\cos\theta = \frac{4}{5}$, then $\tan\theta =$

(A) $\frac{3}{5}$ (B) $\frac{3}{4}$ (C) $\frac{4}{3}$ (D) $\frac{5}{3}$

4. If $\cot\theta = \frac{7}{8}$, then $\tan^2\theta =$

(A) $\frac{7}{8}$ (B) $\frac{8}{7}$

(C) $\frac{49}{64}$ (D) $\frac{64}{49}$

5. If $\tan\theta = \frac{4}{3}$, then $3\sin\theta - 4\cos\theta =$

(A) 0 (B) 1 (C) $\frac{4}{5}$ (D) $\frac{3}{5}$

6. Which of the following is the value of $\sec 30°$?

(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$

(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{2}{\sqrt{3}}$

7. The value of $2\tan 45° - 2\sin 30°$ is________.

[Mar 22]

(A) 2 (B) 1

(C) $\frac{1}{2}$ (D) $\frac{3}{4}$

8. $\frac{1 - \cot^2 45°}{1 + \cot^2 45°} =$

(A) $\cos 90°$ (B) $\sin 90°$

(C) $\sin 45°$ (D) $\cos 45°$

9. $1 + \cot^2\theta =$
(A) $\sec^2\theta$ (B) $\cos^2\theta$
(C) $\text{cosec}^2\theta$ (D) $\tan^2\theta$

10. $\tan^2(90° - \theta) - \text{cosec}^2\theta =$
(A) 0 (B) 1 (C) –1 (D) 2

11. If $\cos\theta = \frac{24}{25}$, then the value of $\sin\theta$ is
(A) $\frac{7}{24}$ (B) $\frac{7}{25}$ (C) $\frac{25}{7}$ (D) $\frac{24}{7}$

12. If $\tan\theta = \frac{3}{4}$, then $\cos^2\theta - \sin^2\theta =$
(A) $\frac{3}{25}$ (B) $\frac{4}{25}$ (C) $\frac{7}{25}$ (D) $\frac{9}{25}$

13. If $\cot\theta = \frac{3}{4}$, then $\frac{\sin\theta - \cos\theta}{\sin\theta + \cos\theta} =$
(A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{1}{4}$ (D) $\frac{3}{4}$

14. $\frac{1 + \tan^2\theta}{1 + \cot^2\theta} =$
(A) $\sec^2\theta$ (B) $\cos^2\theta$
(C) $\tan^2\theta$ (D) $\cot^2\theta$

15. $(1 - \cos^2\theta)\cot^2\theta =$
(A) $\sec^2\theta$ (B) $\cos^2\theta$
(C) $\text{cosec}^2\theta$ (D) $\sin^2\theta$

16. $\sec^2\theta - \frac{1}{\text{cosec}^2\theta - 1} =$
(A) 0 (B) 1
(C) $2\sec^2\theta$ (D) $2\,\text{cosec}^2\theta$

17. $\text{cosec}^2\theta\,(1 + \cos\theta)(1 - \cos\theta) =$
(A) 0 (B) 1
(C) $\sec^2\theta$ (D) $\sin^2\theta$

18. $\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta} =$
(A) 5 (B) $\frac{1}{5}$ (C) –5 (D) $-\frac{1}{5}$

19. $\frac{\sin\theta}{1 + \cos\theta} =$
(A) $\frac{\cos\theta}{1 - \sin\theta}$ (B) $\frac{1 - \cos\theta}{\sin\theta}$
(C) $\frac{1 - \sin\theta}{\cos\theta}$ (D) $\frac{1 - \cos\theta}{1 + \cos\theta}$

20. If $\text{cosec}\,\theta - \cot\theta = \frac{1}{3}$, then $\text{cosec}\,\theta + \cot\theta =$
(A) 1 (B) 2 (C) 3 (D) 4

21. If $\sin\theta + \sin^2\theta = 1$, then $\cos^2\theta + \cos^4\theta =$
(A) 0 (B) 1 (C) –1 (D) 2

22. If $\sin\theta + \cos\theta = m$ and $\sin\theta - \cos\theta = n$, then
(A) $m^2 + n^2 = 1$ (B) $m^2 - n^2 = 1$
(C) $m^2 + n^2 = 2$ (D) $m^2 - n^2 = 2$

23. When we see below the horizontal line, then the angle formed is _______ .
(A) a zero degree angle
(B) the angle of depression
(C) the angle of elevation
(D) a straight angle

24. If a vertical pole 12m high casts a shadow $4\sqrt{3}$ m long on the ground, then the angle of elevation of the sun at that time is
(A) 30° (B) 45° (C) 60° (D) 90°

25. A kite is flying at a height 80 m above the ground. The string of the kite which is temporarily attached to the ground makes an angle 45° with the ground. If there is no slack in the string, then the length of the string is
(A) 40 m (B) $40\sqrt{2}$ m
(C) 80 m (D) $80\sqrt{2}$ m

26. The angle of elevation of top of the tower from a point P on the ground is 30°. If the point is 45 m away from the foot of the tower, then the height of the tower is
(A) 45 m (B) 15 m
(C) $15\sqrt{3}$ m (D) $20\sqrt{3}$ m

27. The angle of depression of a ship as observed from the top of a lighthouse is 45°. If the height of the lighthouse is 200 m, then what is the distance of the ship from the foot of the lighthouse?
(A) 200 m (B) 400 m
(C) 100 m (D) $200\sqrt{3}$ m

Type B: Solve the Following Questions

1. Find the value of $\sin\theta \cdot \text{cosec}\theta$.
2. Find the value of $1 + \cot^2\theta$.
3. If $\tan\theta = \frac{8}{15}$ then $\cot\theta = ?$
4. If $3\sin\theta = 4\cos\theta$, then find the value of $\tan\theta$. **[Dec 20]**
5. Write any two identities.
6. $16\,\text{cosec}^2A - 16\cot^2A = ?$
7. What is $\text{cosec}(90 - \theta) = ?$
8. If $\cot\theta = 6$, where θ is an acute angle, find $\text{cosec}\theta$ using the identity.
9. If $\sin\theta = \cos\theta$, then what will be the measure of angle θ ? **[Mar 22]**

Additional Problems for Practice

Based on Practice Set 6.1

+1. If $\sin\theta = \frac{20}{29}$, then find the value of $\cos\theta$. **[2 Marks]**

2. If $\sin\theta = \frac{8}{17}$, when θ is an acute angle, then find the value of $\cos\theta$ by using identities. **[July 17] [2 Marks]**

3. If $\cos\theta = \frac{3}{5}$, where θ is an acute angle, find the value of $\sin\theta$. **[Mar 18] [2 Marks]**

+4. If $\sec\theta = \frac{25}{7}$, then find the value of $\tan\theta$. **[2 Marks]**

5. If $\cos\theta = \frac{5}{13}$, then find $\sin\theta$. **[July 19] [2 Marks]**

6. If $\sin\theta = \frac{5}{13}$, where θ is an acute angle, find the values of other trigonometric ratios using identities. **[Mar 12; Oct 12] [3 Marks]**

7. If $\tan\theta = \frac{20}{21}$, then find the values of other trigonometric ratios. **[3 Marks]**

+8. If $5\sin\theta - 12\cos\theta = 0$, find the values of $\sec\theta$ and $\operatorname{cosec}\theta$. **[2 Marks]**

9. If $3\sin\theta - 4\cos\theta = 0$, then find the values of $\tan\theta$, $\sec\theta$ and $\operatorname{cosec}\theta$. **[3 Marks]**

+10. If $\cos\theta = \frac{\sqrt{3}}{2}$, then find the value of $\frac{1-\sec\theta}{1+\operatorname{cosec}\theta}$. **[3 Marks]**

11. If $\sin\theta = \frac{4}{5}$, then find the value of $\frac{4\tan\theta - 5\cos\theta}{\sec\theta + 4\cot\theta}$. **[3 Marks]**

12. Prove the following:

i. $\frac{\sin\theta}{1-\cos\theta} = \operatorname{cosec}\theta + \cot\theta$ **[2 Marks]**

ii. $\tan\theta - \cot\theta = \frac{2\sin^2\theta - 1}{\sin\theta\cos\theta}$ **[2 Marks]**

iii. $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \operatorname{cosec}\theta + \cot\theta$ **[Oct 14] [3 Marks]**

iv. $\sqrt{\frac{1-\cos A}{1+\cos A}} = \operatorname{cosec}A - \cot A$ **[Oct 12; July 16] [3 Marks]**

+v. $\sec x + \tan x = \sqrt{\frac{1+\sin x}{1-\sin x}}$ **[3 Marks]**

vi. $\sec^2\theta - \cos^2\theta = \sin^2\theta(\sec^2\theta + 1)$ **[3 Marks]**

vii. $\cos^4\theta - \cos^2\theta = \sin^4\theta - \sin^2\theta$ **[2 Marks]**

viii. $\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta$ **[Mar 15] [3 Marks]**

ix. $\sin^4\theta + \cos^4\theta = 1 - 2\cos^2\theta + 2\cos^4\theta$ **[2 Marks]**

x. $\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} = 2\sec\theta$ **[3 Marks]**

xi. $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\operatorname{cosec}\theta$ **[4 Marks]**

xii. $\frac{\tan\theta}{\sec\theta - 1} + \frac{\tan\theta}{\sec\theta + 1} = 2\operatorname{cosec}\theta$ **[3 Marks]**

xiii. $\frac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1} = \frac{1+\cos\theta}{\sin\theta}$ **[3 Marks]**

13. Eliminate α, if $x = r\cos\alpha$, $y = r\sin\alpha$. **[Mar 13] [2 Marks]**

14. Eliminate θ from the following equations.

i. $x = a\sec\theta$, $y = b\tan\theta$ **[Mar 12] [2 Marks]**

+ii. $x = a\cot\theta - b\operatorname{cosec}\theta$, $y = a\cot\theta + b\operatorname{cosec}\theta$ **[3 Marks]**

Based on Practice Set 6.2

+1. An observer at a distance of 10 m from a tree looks at the top of the tree, the angle of elevation is 60°. What is the height of the tree? ($\sqrt{3} = 1.73$) **[2 Marks]**

+2. From the top of a building, an observer is looking at a scooter parked at some distance away, makes an angle of depression of 30°. If the height of the building is 40 m, find how far the scooter is from the building. ($\sqrt{3} = 1.73$) **[3 Marks]**

3. From the top of the lighthouse, an observer looks at a ship and finds the angle of depression to be 60°. If the height of the lighthouse is 84 metres, then find how far is the ship from the lighthouse? ($\sqrt{3} = 1.73$) **[Mar 17] [3 Marks]**

4. A person observed the angle of elevation of the top of a tower as 30°. He walked 50 m towards the foot of the tower along level ground and found the angle of elevation of the top of the tower as 60°. Find the height of the tower. ($\sqrt{3} = 1.73$) **[4 Marks]**

5. A person standing on the bank of a river observes that the angle of elevation of the top of a tree standing on the opposite bank is 60°. When he moves 40 m away from the bank, he finds the angle of elevation to be 30°. Find the height of the tree and the width of the river. ($\sqrt{3}$=1.73) **[Mar 16; July 16, 17] [4 Marks]**

+6. To find the width of the river, a man observes the top of a tower on the opposite bank making an angle of elevation of 61°. When he moves 50 m backward from bank and observes the same top of the tower, his line of vision makes an angle of elevation of 35°. Find the height of the tower and width of the river. (tan 61° = 1.8, tan 35° = 0.7) **[4 Marks]**

7. Two buildings are in front of each other on either side of a road of width 10 metres. From the top of the first building which is 30 metres high, the angle of elevation of the top of the second is 45°. What is the height of the second building? **[Mar 15] [3 Marks]**

8. The horizontal distance between two poles is 15 m. The angle of depression of the top of the first pole as seen from the top of the second pole is 30°. If the height of the second pole is 24 m, find the height of the first pole. ($\sqrt{3} = 1.73$) **[4 Marks]**

+9. Roshani saw an eagle on the top of a tree at an angle of elevation of 61°, while she was standing at the door of her house. She went on the terrace of the house so that she could see it clearly. The terrace was at a height of 4 m. While observing the eagle from there the angle of elevation was 52°. At what height from the ground was the eagle?
(Find the answer correct upto nearest integer)
(tan 61° = 1.80, tan 52° = 1.28, tan 29° = 0.55, tan 38° = 0.78) **[4 Marks]**

10. From the top of a 60 m high building, the angles of depression of the top and the bottom of a tower are 30° and 60° respectively. Find the height of the tower. ($\sqrt{3} = 1.73$) **[4 Marks]**

11. A ship of height 24 m is sighted from a lighthouse. From the top of the lighthouse, the angles of depression to the top of the mast and base of the ship are 30° and 45° respectively. How far is the ship from the lighthouse? ($\sqrt{3}$=1.73) **[July 15] [4 Marks]**

+12. A tree was broken due to storm. Its broken upper part was so inclined that its top touched the ground making an angle of 30° with the ground. The distance from the foot of the tree and the point where the top touched the ground was 10 metre. What was the height of the tree?

13. A tree is broken by the wind. The top of that tree struck the ground at an angle of 30° and at a distance of 30 m from the root. Find the height of the whole tree. ($\sqrt{3} = 1.73$) **[Oct 14; Mar 18] [3 Marks]**

Chapter Assessment

Total Marks: 25

Q.1. A. Choose the correct alternative. **[4]**

i. cot 60° =
(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

ii. tan θ.cot θ =
(A) 0 (B) $\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) 1

iii. When we see at a lower level, from the horizontal line, angle formed is _______.
(A) angle of elevation. (B) angle of depression.
(C) 0 (D) straight angle.

iv. $9 \sec^2 A - 9 \tan^2 A$ =
(A) 0 (B) 3 (C) –9 (D) 9

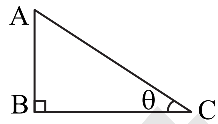
Q.1. B. Solve the following questions. **[2]**

i. If $\tan\theta = \frac{1}{\sqrt{3}}$, then find the value of θ.

ii. If cosec $\theta = \frac{13}{12}$, then find the value of sin θ.

Q.2. A. Complete the following activities. (Any one) **[2]**

i. Prove the identity $\sin^2\theta + \cos^2\theta = 1$ with the help of given figure.



Proof:

In ΔABC,

$\angle B = 90°$, $\angle C = \theta$

$\therefore \quad \boxed{} = AC^2$ ...[Pythagoras theorem]

$\therefore \quad \frac{AB^2}{AC^2} + \frac{BC^2}{AC^2} = \frac{AC^2}{AC^2}$ ...[Dividing both sides by AC^2]

$\therefore \quad \left(\frac{AB}{AC}\right)^2 + \left(\frac{BC}{AC}\right)^2 = 1$

$\therefore \quad \boxed{} + (\cos\theta)^2 = 1$ ...$\left[\because \boxed{\frac{}{}} = \sin\theta \text{ and } \boxed{\frac{}{}} = \cos\theta\right]$

$\therefore \quad \sin^2\theta + \cos^2\theta = 1$

ii. Prove that, $\frac{\tan^3\theta - 1}{\tan\theta - 1} = \sec^2\theta + \tan\theta$

L.H.S $= \frac{\tan^3\theta - 1}{\tan\theta - 1}$

$= \frac{(\tan\theta - 1)\boxed{}}{\tan\theta - 1}$ ...$\left[\because a^3 - b^3 = (a - b)\boxed{}\right]$

$= \boxed{}$

$= \boxed{} + \tan\theta$

$= \sec^2\theta + \tan\theta$

= R.H.S

Q.2. B. Solve the following questions. (Any two) **[4]**

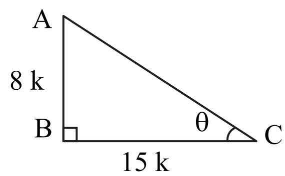
i. A person standing at a distance of 90 m from a church observes the angle of elevation of its top to be 45°. Find the height of the church.

ii. Prove that $\frac{\tan\theta + \sin\theta}{\tan\theta - \sin\theta} = \frac{\sec\theta + 1}{\sec\theta - 1}$

iii. If $\cos\theta + \frac{1}{\cos\theta} = 4$, then prove that $\cos^2\theta + \frac{1}{\cos^2\theta} = 14$.

Q.3. A Complete the following activities (Any one) **[3]**

i. If $\tan\theta = \frac{8}{15}$, find the values of secθ and cosθ.



$\tan\theta = \frac{8}{15}$ ...(i)[Given]

Consider ΔABC, where $\angle ABC = 90°$ and $\angle ACB = \theta$

$\tan\theta = \boxed{\frac{}{}}$ ...(ii)[By definition]

$\therefore \quad \boxed{\frac{}{}} = \frac{8}{15}$ ...[From (i) and (ii)]

Let AB = 8k and BC = 15k

In ΔABC, $\angle$B = 90°

$\therefore$ $AB^2 + BC^2 = AC^2$ …[Pythagoras theorem]

$\therefore$ AC = $\boxed{}$

Now, $\sec\theta = \dfrac{AC}{BC}$ …[By definition]

$\therefore$ $\sec\theta = \boxed{\dfrac{}{}}$

Also, $\cos\theta = \boxed{\dfrac{}{}}$ …[By definition]

$\therefore$ $\cos\theta = \boxed{\dfrac{}{}}$

ii. If $\sec\theta = \dfrac{2}{\sqrt{3}}$, then find the value of $\dfrac{1-\operatorname{cosec}\theta}{1+\operatorname{cosec}\theta}$

$\sec\theta = \boxed{\dfrac{}{}}$ …[Given]

$\therefore$ $\cos\theta = \dfrac{1}{\sec\theta} = \boxed{\dfrac{}{}}$

we know that, $\sin^2\theta + \cos^2\theta = \boxed{}$

$\therefore$ $\sin^2\theta + \boxed{\dfrac{}{}}^2 = 1$

$\therefore$ $\sin^2\theta + \dfrac{3}{4} = 1$

$\therefore$ $\sin^2\theta = 1 - \dfrac{3}{4}$

$\therefore$ $\sin\theta = \boxed{\dfrac{}{}}$ …[Taking square root of both sides]

Now, $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta} = \dfrac{1}{\frac{1}{2}} = 2$

$\therefore$ $\dfrac{1-\operatorname{cosec}\theta}{1+\operatorname{cosec}\theta} = \boxed{\dfrac{}{}}$

Q.3. B. Solve the following questions. (Any one) **[3]**

i. Prove that: $\sec^6 x - \tan^6 x = 1 + 3\sec^2 x \times \tan^2 x$

ii. A tree breaks due to storm and the broken part bends, so that the top of the tree touches the ground making an angle of 60° with the ground. The distance from the foot of the tree to the point where the top touches the ground is 5 metres. Find the height of the tree. $(\sqrt{3} = 1.73)$

Q.4. Solve the following questions. (Any one) **[4]**

i. A straight highway leads to the foot of the tower. A man standing at the top of the tower observes a car at an angle of depression of 30°, which is approaching the foot of the tower with uniform speed. Six seconds later, the angle of depression of the car is found to be 60°. Find the time taken by the car to reach the foot of the tower from this point.

ii. If $\sec\theta + \tan\theta = p$, show that $\dfrac{p^2-1}{p^2+1} = \sin\theta$.

Q.5. Solve the following questions. (Any one) **[3]**

i. If $3\tan^2\theta - 4\sqrt{3}\tan\theta + 3 = 0$, find the acute angle θ.

ii. Eliminate θ from the following equations.
$x = a\cot\theta - b\,\text{cosec}\,\theta$,
$y = a\cot\theta + b\,\text{cosec}\,\theta$

Answers

Activities for Practice

1. i. 2 ii. 1 iii. 576 iv. 24
2. i. 50 m ii. $\angle ACB$ iii. $\frac{AB}{BC}$ iv. $50\sqrt{3}$ m
3. i. $\sin\theta$ ii. $\cos^2\theta$ iii. $\sin^2\theta + \cos^2\theta = 1$ iv. $\text{cosec}\,\theta$
4. i. 1 ii. 1681 iii. $\frac{40}{41}$ iv. $\sin\theta$
   v. $\frac{40}{41}$ vi. $\frac{9}{40}$
5. i. $\cot\theta$ ii. $\text{cosec}\theta + 1$ iii. $\text{cosec}^2\theta - 1$ iv. $\cot^2\theta$
   v. $\cot\theta$ vi. $\frac{\cot\theta + \text{cosec}\theta + 1}{\cot\theta + \text{cosec}\theta - 1}$

One Mark Questions

Type A: Multiple Choice Questions

1. (C)	2. (C)	3. (B)	4. (D)	5. (A)	6. (D)	7. (B)	8. (A)	9. (C)	10. (C)
11. (B)	12. (C)	13. (A)	14. (C)	15. (B)	16. (B)	17. (B)	18. (C)	19. (B)	20. (C)
21. (B)	22. (C)	23. (B)	24. (C)	25. (D)	26. (C)	27. (A)			

Type B: Solve the Following Questions

1. 1
2. $\text{cosec}^2\theta$
3. $\frac{15}{8}$
4. $\frac{4}{3}$
5. $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$
6. 16
7. $\sec\theta$
8. $\sqrt{37}$
9. $45°$

Additional Problems for Practice

Based on Practice Set 6.1

1. $\frac{21}{29}$
2. $\frac{15}{17}$
3. $\frac{4}{5}$
4. $\frac{24}{7}$
5. $\frac{12}{13}$
6. $\cos\theta = \frac{12}{13}$, $\tan\theta = \frac{5}{12}$, $\cot\theta = \frac{12}{5}$,
   $\sec\theta = \frac{13}{12}$, $\text{cosec}\,\theta = \frac{13}{5}$
7. $\sin\theta = \frac{20}{29}$, $\cos\theta = \frac{21}{29}$, $\cot\theta = \frac{21}{20}$,
   $\sec\theta = \frac{29}{21}$, $\text{cosec}\,\theta = \frac{29}{20}$
8. $\sec\theta = \frac{13}{5}$, $\text{cosec}\,\theta = \frac{13}{12}$
9. $\tan\theta = \frac{4}{3}$, $\sec\theta = \frac{5}{3}$, $\text{cosec}\,\theta = \frac{5}{4}$
10. $\frac{\sqrt{3} - 2}{3\sqrt{3}}$

11. $\frac{1}{2}$

13. $x^2 + y^2 = r^2$

14. i. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

ii. $\left(\frac{y-x}{b}\right)^2 - \left(\frac{y+x}{a}\right)^2 = 4$

Based on Practice Set 6.2

1. 17.3 m
2. 69.20 m
3. 48.44 m
4. 43.25 m
5. Width of river = 20 m,
   Height of tree = 34.60 m
6. Width of river = 31.82 m,
   Height of tower = 57.28 m
7. 40 m
8. 15.35 m
9. 14 m
10. 40 m
11. 56.88 m
12. $10\sqrt{3}$ m
13. 51.90 m

Scan the given Q. R. Code in *Quill - The Padhai App* to view the answers of the Chapter Assessment.

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