

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--

SUMMARY SHEET		
Learner Previous Knowledge	Concept of square roots in numbers	
Target Knowledge for this Topic	Square numbers - Patterns and Properties including the pythagorean triplets Finding square roots using long divisions for big numbers and prime factorisation for small numbers. Estimating square roots of non-perfect square numbers using long division method and method of approximation Verifying whether a number is a perfect square or perfect cube or not by using prime factorisation method.	
Learning Goals		Taxonomy Level
<i>More Complex Learning Goal- Students will be able to generalize and verify the patterns and properties related to square roots.</i>		Generalizing
<i>Target Learning Goal- Students will be able to find square roots using different methods; Estimate square roots of non-perfect square and check their estimation; perform properties and patterns in square and numbers including the Pythagorean triplets</i>		Executing
<i>Simpler Learning Goal- Students will be able to describe the properties of square roots.</i>		Recalling
Period No.	Lesson Objectives	Teaching Learning Materials Required
1, 2 and 3 <i>Note: this lesson requires 3 days.</i>	- Understand patterns and Properties of Square numbers - Research about the Pythagorean triplets - Finding square roots using long divisions for big numbers and prime factorization for small numbers.	<u>Research Work: Worksheet-1</u> <u>Discussion:</u> Grade 8 NCERT book (1 for teacher's reference) <u>Pythagorean Triplets: Worksheet-2</u> (1 per student); <u>Methods to find out square root:</u>
4 and 5 <i>Note: this lesson requires 2 days.</i>	- Understand what are perfect and imperfect squares - Find the squares of perfect & imperfect square numbers. - Use the methods to find the square roots. - Estimating Square roots	<u>Find if the number is a perfect square or not: Worksheet-3</u> (1 per student); <u>Worksheet-4</u> (1 per student)

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--

Period 1, 2 and 3

Lesson Objectives

At the end of this lesson students will be able to:

- Understand patterns and Properties of Square numbers
- Research about the Pythagorean triplets
- Finding square roots using long divisions for big numbers and prime factorization for small numbers.

Teaching Learning Materials required

- **Research Work: Worksheet-1** (1 per student of the group);
- **Discussion:** Grade 8 NCERT book (1 for teachers reference)
- **Pythagorean Triplets: Worksheet-2** (1 per student);

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 to 6 at computer lab

Lesson Beginning <u>Time:</u> 40mins <u>Purpose:</u> Activate prior knowledge Generate interest to the topic Introduce the concept Develop conceptual understanding	<u>Research/Groups</u> • Inform students that this class will be about researching the square numbers that we see around & its patterns. • Distribute research Worksheets-1 to each student to record the findings. <i>Note: Provide the students with grade 8 Mathematic book of NCERT for research purpose. Though students will be recording responses individually, they will be working in groups to research and find information.</i> <u>Discussion/Groups</u> • Project Worksheet-1 • Call groups one by one to share their research data with others. • Ask groups to share their responses and explain their observations. • Discuss the research findings in support of square numbers. • Build a consensus on conclusions drawn from the table. • Discuss the various patterns followed by the square numbers. • To build consensus for conclusion regarding properties and patterns, ask others if they agree or not. • If they disagree, ask them to justify the disagreement. • Encourage students to add more information. • Use the NCERT book for reference in case of doubts.
---	--

Note: Students may come up with different or incorrect conclusions. In this case, ask other students who may have the correct analysis to explain and justify. It is important to build consensus on all properties & patterns – this will help eradicate any errors. Also the intent here is to understand square numbers and their properties. Discuss all the conclusions drawn from the patterns and table & build consensus on all the conclusions. Student can give different examples but the conclusion drawn should be same

- Ask students to finish up and come up with any queries that they may have regarding their research findings.

Home Assignment:

- Tell students to practice questions on Pg 96-Exercise 6.1 of NCERT Textbook.

Lesson Middle

Time: 40 min

Purpose: Introduce the topic

Develop the conceptual understanding

Pythagorean Triplets

- Write “Pythagorean triplets” on the board.
- Ask, do they know anything related to this word?
- Give few students a chance to share their views.
- Tell them today they are going to work in groups in order to know about Pythagorean triplets and how Pythagoras theorem can be used to find out square roots.
- Distribute **Worksheet-2**, to each student.
- Instruct them to find out the answers of the questions through discussion or research work.
- Give them time to research about the Pythagorean triplets and to use Pythagoras theorem to find square roots.

Discussion/Whole class

- Project Worksheet-2 and held up a discussion.
- Ask the following questions:
 - What do they mean by Pythagorean triplets?
 - How did they find them?
 - How did they find when one of the member is given?
 - What is Pythagoras theorem?
 - How can it be used to find the square roots and under what conditions you can use this theorem?

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--

	- Through discussion build consensus on the questions. <i>Note. It is important to build consensus on all answers – this will help eradicate any errors. Also the intent here is to build consensus on the conclusion that we can write Pythagorean Triplets with given numbers.(Use the NCERT book for reference)</i> <u>Home Assignment:</u> - Tell students to practice questions on Pg 98-Exercise 6.2 of NCERT Textbook.
Lesson End <u>Time:</u> 40 min <u>Purpose:</u> Introduce the concept Develop conceptual understanding Consolidate students learning	<u>Methods to find out square root/Groups</u> - Bring into their notice that they have discovered how to use Pythagoras theorem to find out the square roots. - It's time to discover other ways which are used to find the square roots. <i>Note: Though students are working in groups but they will record the findings in their individual sheets.</i> <u>Discussion/Whole class</u> - Ask the following questions: - What do they understand by square roots? - It is denoted by which symbol? - What are the ways which are used to find the square roots? - How the ways are different from each other? - If given an opportunity which method or way will you prefer and why? - Through discussion build consensus on all the questions. <i>Note. It is important to build consensus on all answers – this will help eradicate any errors. In case students came up with incorrect answers, ask other students who may have the correct answers to explain and justify. In case of doubts refer the NCERT textbook.</i> <u>Home Assignment:</u> - Tell students to practice questions on Pg 102-Exercise 6.3 of NCERT Textbook.

Name: _____

Worksheet-1

Skill: Logical Reasoning

Research Work:

Direction: Research and find answers!

1. What do you understand by squaring a number? Give an example to explain.

2. Research about the square numbers that we see around or use in mathematical formulas. Like Area of a square etc,

3. Observe the numbers:

1, 4, 9, 16, 25, 36.....

What is the pattern that you can find in the sequence of numbers given above? Is there any name that is used to describe these numbers?

4. Write the first 10 numbers of the pattern. Now, observe the ending digits, what can you conclude from it?

5. Find the square of the numbers & complete the table. What can you conclude from the table?

Number	Square
1	1
9	81

11	
19	
21	

6. Find the square of the numbers & complete the table. What can you conclude from the table?

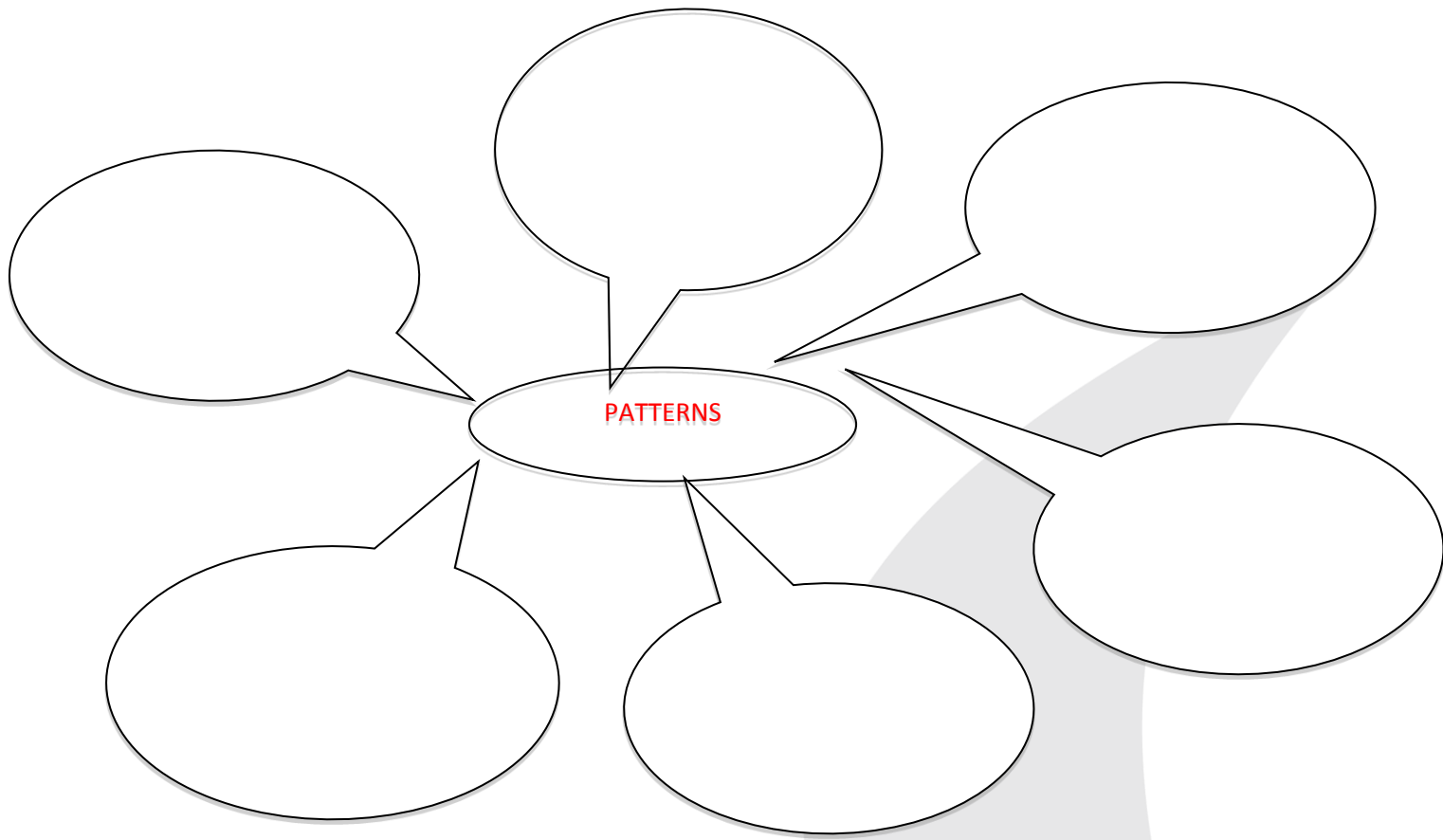
Number	Square
4	16
6	36
14	
16	

7. Find the square of the numbers & complete the table. What can you conclude from the table?

Number	Square
10	100
20	400
40	
100	
500	
800	



8. Research & complete the web by writing the name of different patterns of square numbers.



9. Explain all the patterns by giving examples.

Write the conclusion for each pattern on square numbers.

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--



Name:_____

Worksheet-2

Skill: Logical Reasoning

Pythagorean Triplets:

Direction: Discuss and find answers!

Q1. Explain about Pythagorean triplet by observing the given sequence.

$$3^2 + 4^2 = 9 + 16 = 25 = 5^2$$

Q2. Give one more example of Pythagorean triplet

Q3. Try to represent the Pythagorean triplets in general form. (Take for any natural number $m > 1$)

Q4. Use the general form derived in the above question; and tries to write a Pythagorean triplet whose one number is 14.

Q5. Why do you think a certain set of numbers is known as Pythagorean triplets?

Q6. Find out square roots used in Pythagoras theorem

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--

Period 4 and 5

Lesson Objectives

At the end of this lesson students will be able to:

- Understand what are perfect and imperfect squares
- Find the squares of perfect & imperfect square numbers.
- Use the methods to find the square roots.
- Estimating Square roots

Teaching Learning Materials required

- **Find if the number is a perfect square or not: Worksheet-3** (1 per student);
- **Worksheet-4** (1 per student)

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 to 6

Lesson Beginning <u>Time:</u> 20 min <u>Purpose:</u> Activate the prior knowledge Introduce the topic Develop conceptual understanding	<u>Find if the number is a perfect square or not /groups</u> • Distribute Worksheet-3 to each student. • Ask them to read & attempt the worksheet by discussing with their group members <i>Note: The students can discuss with their group members but work in their individual sheets.</i> • Discuss with groups and build a consensus on the use of properties to find if a number is a perfect square or not. <i>Note- The intent here is to understand what are perfect and imperfect square numbers</i>
Lesson Middle <u>Time:</u> 30 min <u>Purpose:</u> Develop the conceptual understanding	<u>Discussion/Whole class</u> • Tell the students to consider the following situations: ○ <i>Mohini has a square piece of cloth of area 125 cm^2. She wants to know whether she can make a handkerchief of side 15 cm. If that is not possible she wants to know what is the maximum length of the side of a handkerchief that can be made from this piece.</i>

Rita and Sita played a game. One told a number and other gave its square root. Rita started first. She said 25 and Sita answered quickly as 5. Then Sita said 81 and Rita answered 9. It went on, till at one point Rita gave the number 250. And Sita could not answer. Then Rita asked Sita if she could at least tell a number whose square is closer to 250.

- Ask, how do they find the answer of the shared situations?
- Is there any easy way out?
- Let them think and respond
- Through the discussion build the consensus on the estimation of square roots to find the answer of the shared situations.
- Make sure they will come up with the following explanations:
 - In all such cases we need to *estimate* the square root.
 - We know that $100 < 250 < 400$ and $100 = 10^2$ and $400 = 20^2$.
 - So $10 < 250 < 20$
 - But still we are not very close to the square number.
 - We know that $15^2 = 225$ and $16^2 = 256$
 - Therefore, $15 < 250 < 16$ and 256 is much closer to 250 than 225.

So, 250 is approximately 16.

Lesson End

Time: 20 mins

Purpose:

Consolidate students learning

Worksheet/Individual

- Distribute the **Worksheet-4** to each student of the group.
- Tell them to discuss and find the answer of the given questions in pairs.

Note: The students can discuss with their pair but work in their individual sheets.

- Project Worksheet-4 and held up a discussion.
- Ask the following questions:
 - How did they find the answer of the questions?
 - Which method did they use and why?
- Through discussion build consensus on all the questions.

Note. It is important to build consensus on all answers – this will help eradicate any errors. In case students came up with incorrect answers, ask other students who may have the correct answers to explain and justify. The intent here is to make them, use the methods of finding square roots, which they discovered in yesterday's class.

Class: 8	Subject: Mathematics	Topic: Squares and Square Roots
-----------------	-----------------------------	--



	<u>Home Assignment</u> Tell the students to practice questions on Pg 107-Exercise 6.4 of NCERT Textbook
--	--

Name: _____

Worksheet-3

Skill: Problem Solving

Directions- Find whether the given numbers are perfect square or not and justify it.

361

625

122

64000

89722

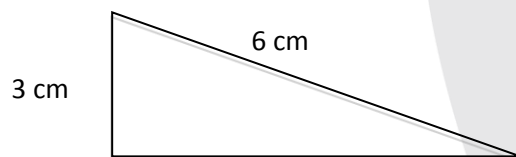
Name: _____

Worksheet-4**Skill: Problem Solving**

Study the following situations

A) Area of a square is 169 sq cm. What could be the side of the square?

B) Find the length of the side of the right triangle.

(Hint- apply Pythagoras theorem, $AB^2 + BC^2 = AC^2$)

c) In the above cases, we need to find a number whose square is known.

Find the name for the term where the square of the number is given and we have to find the square. What is the symbol used for it.

b) 6400

c) Find, If 2352 is a perfect square? Why or why not? If not, find the smallest multiple of 2352, which is a perfect square. Find the square root of the new number.

Estimate the value to the nearest whole number.

a) $\sqrt{80}$

b) $\sqrt{1000}$

c) $\sqrt{350}$

d) $\sqrt{500}$

Class: 8

Subject: Mathematics

**Topic: Squares and
Square Roots**

