Important Concepts . . .

Preview Review

Mathematics Grade 9 TEACHER KEY

W1 - Lesson 5: Square Roots of Rational Numbers

Important Concepts of Grade 9 Mathematics

Materials Required

Paper
Pencil
Calculator

No Textbook Required

This is a stand-alone course.

Mathematics Grade 9
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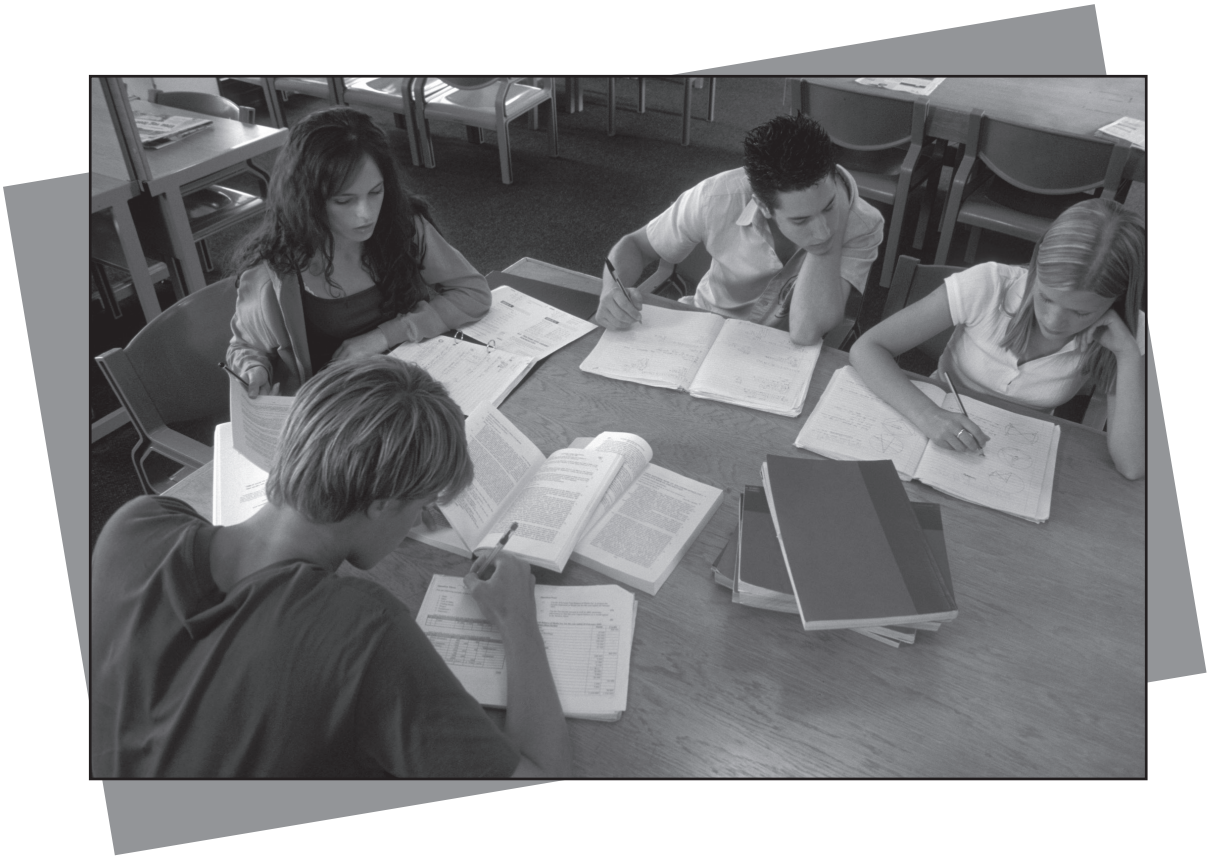
Preview/Review Concepts for Grade Nine Mathematics

Teacher Key



W1 – Lesson 5:

Square Roots of Rational Numbers

OBJECTIVES

By the end of this lesson, you will be able to:

- Determine the square root of a given positive rational number that is a perfect square.
- Estimate the square root of a given rational number that is not a perfect square, using the roots of perfect squares as benchmarks.
- Determine an approximate square root of a given rational number that is not a perfect square, using technology; e.g., a calculator, a computer.
- Identify a number with a square root that is between two given numbers.

GLOSSARY

Rational Number: Any number that can be written as a ratio of two integers. It can be positive, negative, a fraction or a decimal as long as we can write it as a fraction where the numerator and denominator are both integers.

Ex. $\frac{1}{2}$, 0.75 (can be written as $\frac{3}{4}$), –1 (can be written as $-\frac{1}{1}$), 0.988 (can be written as $\frac{988}{1000}$) . . .

Square Root: A number when multiplied by itself will result in a specific number. $\sqrt{}$ is the symbol for a square root.

Ex. $\sqrt{9}$ = 3 because 3 multiplied by itself yields 9.

Perfect square: A number that has a whole number as its square root.

Non-perfect square: A number that has a non-terminating and non-repeating decimal number as its square root.

W1 – Lesson 5: Square Roots of Rational Numbers

Materials required:

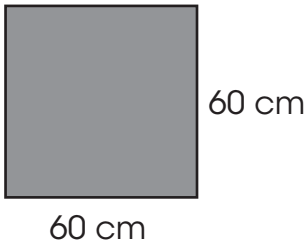
- Paper, Pencil, and Calculator

Part 1: Modelling Squares and Cubes

Square numbers are numbers that are multiplied by themselves.

$(x)(x)$ or x^2, where x = any rational number.

What is the area of this square bulletin board?



To find the area of the square, multiply the side of the square by the side of the square.

Or Area = $(s)(s) = s^2$

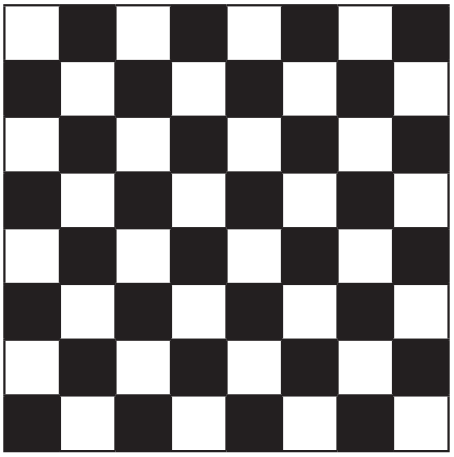
In this example: Area = 60×60 or Area = 60^2
Area = 3600 cm^2

Practice Questions

1. The formula for the area of a square is $A = s^2$

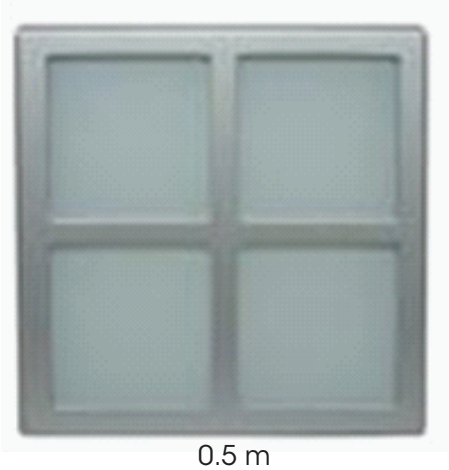
2. Find the area of the following squares.

a.



$A = s^2$
$A = 44 \times 44$
$A = 1936 \text{ cm}^2$

b.



$A = s^2$
$A = 0.5 \times 0.5$
$A = 0.25 \text{ m}^2$

3. Find the area of the following squares with side lengths of:

a. 15.5 cm

$A = s^2$
$A = 15.5 \times 15.5$
$A = 240.25 \text{ cm}^2$

b. 36.9 m

$A = s^2$
$A = 36.9 \times 36.9$
$A = 1361.61 \text{ cm}^2$

Part 2: Estimating Square Roots

A square root is the number being multiplied by itself that results in a specific number.

$\sqrt{\ }$ is the symbol that represents a square root.

Only perfect squares will have square roots that are whole numbers. Non-perfect squares will have square roots that are decimal numbers. The number 30 is a non-perfect square, because when you type $\sqrt{30}$ into a calculator, the following number will appear, 5.477225575 . . . . This decimal does not terminate or repeat. It will go on forever. In these cases, the answer must be approximated. A reasonable answer for the square root of 30 is 5.47. This decimal was rounded to the nearest hundredth.

Example 1

The square roots of non-perfect squares and rational numbers can be estimated.

What is the square root of 37.8? This is expressed mathematically as $\sqrt{37.8}$.

Mentally:

37.8 is closest to what perfect square number?
The answer is 36.

So, the square root must be close to 6, because the square root of 36 is 6.

The square root of 37.8 must be slightly greater than 6 because 37.8 > 36.

On a calculator, type $\sqrt{\ }$ 37.8

Note: Some calculators require the symbol to be entered after: 37.8 $\sqrt{\ }$

The screen will show an answer of 6.14817. . .

Practice Questions

1. Determine the square roots of the following numbers using a calculator. Round your answer to the nearest hundredth.

   a. $\sqrt{45} \doteq$ ***6.71***

   b. $\sqrt{24.5} \doteq$ ***4.95***

   c. $\sqrt{114.7} \doteq$ ***10.71***

   d. $\sqrt{86.3} \doteq$ ***9.29***

2. Determine the two numbers in which the square root of the following falls in between.

   a. $\sqrt{10}$ is between ***3*** and ***4***.

   b. $\sqrt{35.2}$ is between ***5*** and ***6***.

   c. $\sqrt{14.44}$ is between ***3*** and ***4***.

Part 3: Calculating Square Roots

The square root of a number can be calculated mentally by thinking: *"What number can be multiplied by itself to result in a product of a given number?"*

The square root of a number can be calculated with technology by using the Square Root key on a calculator: [√]

On a calculator, type [√] [42.5]

Note: Some calculators require the symbol to be entered after: [42.5] [√]

The screen will show an answer of 6.5192 . . .

Example 1

What is $\sqrt{9.61}$?

On a calculator, type [√] [9.61]

Note: Some calculators require the symbol to be entered after: [9.61] [√]

The screen will show and answer of 2.5709920 . . .

So $\sqrt{9.61} \doteq 2.57$.

Example 2

It is also possible to find the square root of fractions.

For example, $\sqrt{\frac{64}{225}}$.

Ask what is the square root of 64?

The answer is 8.

What is the square root of 225?

The answer is 15.

So $\sqrt{\frac{64}{225}} = \frac{8}{15}$.

Example 3

To evaluate expressions using square roots, break down the expression into smaller pieces.

$3^2 \times \sqrt{16} + 5^2 - \sqrt{49}$
$3^2 = 9$
$\sqrt{16} = 4$
$5^2 = 25$
$\sqrt{49} = 7$

So the expressions turn to $9 \times 4 + 25 - 7 = 36 + 25 - 7 = 54$.

Practice Questions

1. Find the value of the following square roots.

   a. $\sqrt{4.84}$ = ***2.2***

   b. $\sqrt{256}$ = ***16***

2. Evaluate the following.

   a. $\sqrt{\frac{121}{196}}$ = $\frac{\textbf{\textit{11}}}{\textbf{\textit{14}}}$

   b. $\sqrt{\frac{144}{225}}$ = $\frac{\textbf{\textit{12}}}{\textbf{\textit{15}}}$

3. Solve the following.

   a. $4^2 + \sqrt{729} \square \left(\sqrt{25} + 2^2\right) =$

   16 + 27 ÷ (5+4) = 16 + 3 = 19

   b. $\sqrt{q+r}$, if $q = 42$ and $r = 30$ =

   $= \sqrt{\textbf{\textit{42 + 30}}}$
   $= \sqrt{\textbf{\textit{72}}}$
   $= \textbf{\textit{8.49}}$

Lesson 5 Assignment

1. Select the correct value for $\square$.

   a. $\square^2 = 169$ ***13***

   b. $144 = \square^2$ ***12***

2. Determine the following. Round to the nearest hundredth when needed.

   a. $\sqrt{10} \doteq$ ***3.16***

   b. $\sqrt{35.2} \doteq$ ***5.93***

   c. $\sqrt{152} \doteq$ ***12.33***

   d. $\sqrt{279} \doteq$ ***16.70***

3. Determine the missing numbers.

   a. $\sqrt{196} = \sqrt{\square\square\square}$

   4 ***49***

   b. $\sqrt{\frac{16}{\square}} = \frac{\square}{7}$

   49 ***4***

   c. $\sqrt{\square} = 21$

   441

   d. $\sqrt{14.44} = \square$

   3.8


LEARNING
ANYTIME
ANYWHERE