Name: Key Date:________ Period:______

SECTION 7.4 SQUARE ROOTS AND SCIENTIFIC NOTATION

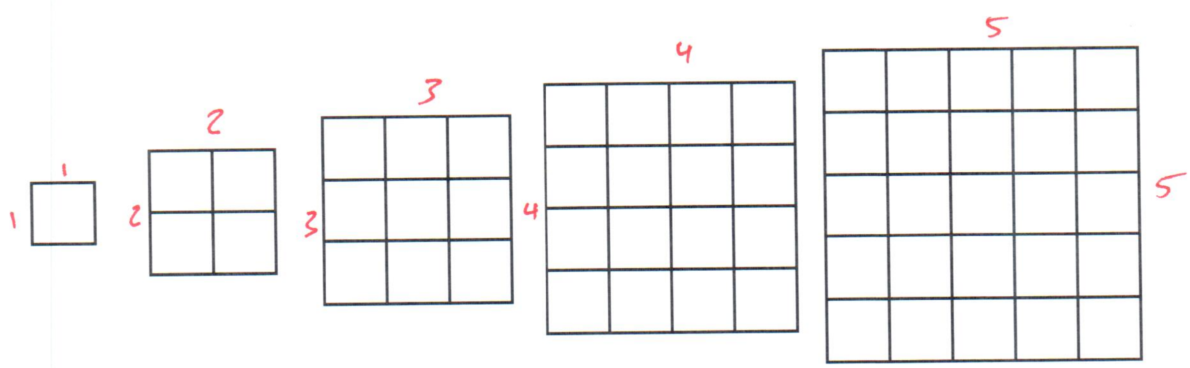
VOCABULARY

DEFINITION	EXAMPLE
Square numbers (Perfect Squares): whole number that can be written as the square of a whole number	$25 = 5^2$
Square roots: a number that is squared to get a whole number.	5 is the square root of 25.
Radical notation: $\sqrt{}$	$\sqrt{25} = 5$
Scientific notation: A number written as a number between 1 and 10 (excluding 10) times 10^n	3500 $= 3.5 \times 10^3$
Standard notation: A number written out without exponents or powers of 10	3500

Big Idea: How are square numbers and square roots related? How are exponents used in scientific notation?

EXPLORATION 1

Identify the dimensions of each figure and their corresponding areas.



Area: 1 4 9 16 25

1 x 1 square has area = 1^2 = 1 square unit.

2 x 2 square has area = 2^2 = 4 square units.

3 x 3 square has area = 3^2 = 9 square units.

4 x 4 square has area = 4^2 = 16 square units.

5 x 5 square has area = 5^2 = 25 square units.

Write the perfect squares associated to squares with dimensions of 1 x 1 to 25 x 25 in the table below.

1 x 1= 1	2 x 2= 4	3 x 3= 9	4 x 4= 16	5 x 5= 25
6 x 6= 36	7 x 7= 49	8 x 8= 64	9 x 9= 81	10 x 10= 100
11 x 11= 121	12 x 12= 144	13 x 13= 169	14 x 14= 196	15 x 15= 225
16 x 16= 256	17 x 17= 289	18 x 18= 324	19 x 19= 361	20 x 20= 400
21 x 21= 441	22 x 22= 484	23 x 23= 529	24 x 24= 576	25 x 25= 625

Given a number n, we can ask, "Is there a number b so that $b^2 = n$? If $b^2 = n$, then we say b the square root of n and denote it by $\sqrt{n}$.

Square roots correspond to square numbers, such that $\sqrt{n}$ = b, or $b^2 = n$.

Find all the square roots of numbers less than or equal to 100 that are whole numbers.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$\sqrt{1}$ $\sqrt{4}$ $\sqrt{9}$ $\sqrt{16}$ $\sqrt{25}$ $\sqrt{36}$ $\sqrt{49}$ $\sqrt{64}$ $\sqrt{81}$ $\sqrt{100}$

For example, $\sqrt{16} = 4$ and $\sqrt{25} = 5$.

What patterns do you observe about square numbers, the square roots or numbers, and square numbers and their corresponding square roots? Answers will vary.

Odd square numbers have odd square roots.

Even square numbers have even square roots.

The difference between two consecutive square numbers is odd.

PROBLEM 1

a. Is there a number b, such that $b^2 = 144$? In other words, what is $\sqrt{144}$? 12

b. What is $\sqrt{625}$? 25

c. What is $\sqrt{289}$? 17

SCIENTIFIC NOTATION

In studying the real world, we often have to use large numbers. For example, the earth's circumference is 40,000,000 meters. There are even larger numbers that play an important role in understanding the world we live in. The earth's mass is approximately 5,973,600,000,000,000,000,000 metric tons. We can use exponents to help us write and compare such large numbers without writing so many zeros. For example, we can write the following numbers in equivalent ways:

$3{,}500 = 3.5 \times 1000 = 3.5 \times 10^3$

$35{,}000 = 3.5 \times 10{,}000 = 3.5 \times 10^4$

$35{,}000{,}000 = 3.5 \times 10^7$

We call writing numbers in this form scientific notation. What does the exponent in each of these represent? How do you determine the exponent for each of these numbers? Notice that the first part of a number written in scientific notation is always greater than or equal to 1 and less than 10. The advantage of converting a number in standard notation to scientific notation is apparent in converting the earth's mass from standard notation to scientific notation: 5.9736 x 1021 metric tons.

PROBLEM 2

Use scientific notation to write the distances between each of the following planets to the sun.

Planet	Distance from sun in kilometers (using standard notation)	Distance from sun in kilometers (using scientific notation)
Mercury	57,900,000 km.	5.79×10^7
Venus	108,200,000 km.	1.082×10^8
Earth	149,600,000 km.	1.496×10^8
Mars	227,900,000 km.	2.279×10^8
Jupiter	778,300,000 km.	7.783×10^8
Saturn	1,427,000,000 km.	1.427×10^9
Uranus	2,871,000,000 km.	2.871×10^9
Neptune	4,497,100,000 km.	4.4971×10^9

PROBLEM 3

Fill in the chart by converting the numbers to scientific notation or standard notation.

Standard Notation	Scientific Notation
0.00000378	3.78×10^{-6}
0.00000000024	2.4×10^{-10}
0.00004973	4.973×10^{-5}
0.009831	9.831×10^{-3}

PRACTICE EXERCISES

1. Draw a square with the following side lengths. Write the dimensions as whole numbers and also indicate the area.

a. $\sqrt{36}$

$\sqrt{36} = 6$

6, A=36

6 by 6

b. $\sqrt{196}$

$\sqrt{196} = 14$

14, A=196

14 by 14

c. $\sqrt{529}$

23 by 23

$\sqrt{529} = 23$

23, A = 529

2. Lucy needs to set up 225 chairs for a book reading at the public library. If the chairs are placed in a square arrangement, how many should be in each row?

$\sqrt{225} = 15$

15 rows & 15 columns

3. Write the following numbers using scientific notation.

a. 367,100 b. 694,000,000,000 c. 0.00000002

a. 3.671×10^5

b. 6.94×10^{11}

c. 2×10^{-8}

4. Convert the following numbers from scientific notation to standard notation.

a. 8.639×10^3 b. 1.75×10^{12} c. 5.9872×10^{-8}

a. 8,639

c. 0.000000059872

b. 1,750,000,000,000

SUMMARY (What I learned today)