"Square Up"

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Objectives

- Student will be able to recall the perfect squares through 144 and the square roots of these perfect squares, given either a number to a power (i.e.: $5^2 = ?$) or the square root of a number (i.e.: $\sqrt{25} = ?$).

- Student will analyze and investigate the relationship between a number that is a perfect square and the square roots of these numbers.

- Student will create a spreadsheet comparing a number, its square root, and its square.

Grade Level and Subject

This lesson is intended for completion by 8th grade mathematics students.

Research Model Focus

This lesson plan was created using the Big 6 research model.

Georgia Performance Standards (GPS) Alignment

- M8N1a: Find square roots of perfect squares.

- M8N1d: Recognize that the square root of 0 is 0 and that every positive number has two square roots that are opposite in sign.

- M8N1e: Recognize and use the radical symbol to denote the positive square root of a positive number.

- M8N1f: Estimate square roots of positive numbers.

Prerequisites/Prior Knowledge

The student will have completed *Classworks* Unit 4230: "Exploring Squares and Square Roots." They will, therefore, already understand the basis behind square roots. In addition, they will know how to calculate the square roots of numbers, including simplifying the square roots of non-perfect squares.

Materials/Tools/Resources

- Computer lab, with *Classworks* and *Microsoft Office Excel* installed on each computer

- Each student will need the appropriate *Classworks* lesson(s) – Unit 4230 – assigned to him/her.

- Paper and pencil

- Possible modification: depending on resources, "Square Up" can be completed in partners.

Steps/Procedures

1. The teacher will assign *Classworks* unit 4230 to each student before the students go to the computer lab.

2. The students will enter the lab and log-in to *Classworks* and go to the assigned activity.

3. The students will complete *Classworks* unit 4230. f needed, they may redo lessons/activities with scores less than 75%.

4. After completion of the *Classworks* lessons, the teacher will discuss the project with the students and outline the requirements and expectations.

5. The teacher will work with the students to create the headings for each column: "positive integer", "integer squared", "estimated square root of integer", "calculated square root of integer" and "exact square root of integer". The language might be different, but the results for each column should be the same. The headings should appear as follows and each column should include the following information:

Positive Integer	Integer Squared	Estimated Square Root of Integer	Calculated Square Root of Integer	Exact Square Root of Integer
This column will contain the integers 1 – 12.	This column will contain the squares of these numbers.	This column will contain an estimated (to the tenth) square root of the integer.	This column will contain a decimal (to the hundredth) equivalency of the square root of the integer.	This column will contain the exact square root, either as a simplified square root or whole number.

6. The teacher will then review how to create an equation/formula in *Excel* so that the math is consistent throughout the spreadsheet. Note: no formula should be used for the estimated square root.

7. The students should complete the table on paper first, to encourage the thought processes. Rather than merely having the student use *Excel* to complete the math, the students will need to do the math on their own. The student will not complete the fourth column (Calculated square root) on their own notebook paper.

8. (This step will be started as students complete their own tables on notebook paper.) Once these preliminary discussions have taken place and the initial table completed, the students can begin their investigations of the numbers 1 – 12. They will turn in this notebook paper (unchanged) with the spreadsheet. Through completion of the spreadsheet, the students can check their answers for columns 2 and 5 and see how close their estimations were.

9. After students have completed their numerical investigations, the teacher should encourage them to incorporate boarders, colors, font choice, etc. to enhance the appearance of the spreadsheet.

Assessment Strategy

The following rubric will be used to assess the project:

Rubric – "Square Up"				
	1	2	3	
Student has completed their table for the numbers 1 – 12 on both the notebook paper and spreadsheet.	The student has completed all rows for less than 8 integers. OR The student has left 2 or more rows incomplete.	The student has completed all rows for 9 – 11 integers. OR The student has left 1 row incomplete.	The student has completed all rows for all 12 integers.	x 3 = _____
Student information is accurate.	Student has more than 5 errors in their finished spreadsheet.	Student has 1 – 4 errors in the finished spreadsheet.	Student has 0 errors in the finished spreadsheet.	x 3 = _____
Student estimates are reasonable on notebook paper.	Student estimate is unreasonable for more than 2 square roots.	Student estimate is unreasonable for 1 – 2 square roots.	All estimates are reasonable.	x 2 = _____
Student has utilized appropriate formulas in spreadsheet.	Student has errors in more than 1 error.	Student has errors in 1 formula.	All formulas are correctly used.	x 2 = _____
Total Score (out of 30):				

Outcomes

The student will produce a table on notebook paper with their initial ideas of the numbers.

They will also produce a spreadsheet of information that should contain the following

information, understanding that the estimation column may vary *slightly*:

Positive Integer	Integer Squared	Estimated Square Root of Integer	Calculated Square Root of Integer	Exact Square Root of Integer
1	1	1	1	1
2	4	1.3	1.41	$\sqrt{2}$
3	9	1.8	1.73	$\sqrt{3}$
4	16	2	2	2
5	25	2.1	2.24	$\sqrt{5}$
6	36	2.4	2.45	$\sqrt{6}$
7	49	2.6	2.65	$\sqrt{7}$
8	64	2.9	2.83	$2\sqrt{2}$
9	81	3	3	3
10	100	3.2	3.16	$\sqrt{10}$
11	121	3.3	3.32	$\sqrt{11}$
12	144	3.4	3.47	$2\sqrt{3}$