

Direct Instruction Lesson Plan: Squares and Square Roots

Component 1: Preplanning Tasks

- A. *Connection Analysis:* TEKS 7.1C – Students will represent squares and square roots using geometric models. TEKS 7.13D – Students will select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- B. *Content Analysis:*
 - 1. Identify the square of a number and show the relationship between that and the square root.
 - 2. Prerequisite skills: multiplication, division, exponents, and math involving decimals
 - 3. Key Terms: square, square number, square root, exponent
- C. *Objective:* Students will be given direct instruction involving the relationship between square and square roots. Students will demonstrate how to find the square and square roots of pairs of numbers using geo-boards and record their answers in a chart provided for them.
- D. *Objective Rationale:* Allowing the use of the geo-boards helps students visualize what a perfect square is and work the math out using easily identifiable numbers so they can connect the relationships with perfect square numbers, square roots, and perimeter and area.
- E. *Materials:* 10 X 10 Geo-boards, Rubber Bands, Introduction Transparency, Recording Chart (one for each student). Non-Squares and Greeks (1 per student)
- F. *Room Arrangement:* Desks are in groups of 2 and all students will be able to see the board.

Component 2: Lesson Set-Up

- A. *Gain Attention:* Teacher should say “Class” with the understanding that students will respond with “Yes” and stay quiet to await for instructions. Pass out the geo-boards and let students have time to play with them by asking questions such as, can you make a square? A triangle? How many pegs around is the square you’ve made? When we measure around a square what is that called? How can we find the area of a square?
- B. *Behavior Expectations:* Students stay on task with working with their board and answering questions out loud. Students experiment with the board on their own, but focus remains on the board and its relation to math.

Component 3: Lesson Opening

- A. *Activate Background Knowledge:* Ask students what they know about exponents. What is another way to say 3 to the power of 2? Can you recall any perfectly square objects? (Think Rubics cube, dice, etc.) If a square has an area of 16, what must be the length and the width?
- B. *Statement of Objective:* “Today we are going to learn about squaring numbers and finding the square roots of numbers.”
- C. *Pre-Teach Vocabulary:* “Who remembers what an exponent is?” (Draw and model what the students give you as feedback, correct as necessary.) “How do you solve an exponent problem? The number you get when you multiply a base number by the power of two is called a square number. The exponent two is also called “the square”. Is 64 a square number? Is 21 a square number? Who can name other square numbers? The base number of an exponent can also be called the root number. So if we are looking for the “square root” of a number, what do you think we are looking for?” (Students should be able to respond appropriately, if not guide students.)
- D. *Restatement of objective purpose:* “Now that we know what the vocabulary is, who can tell me what we are going to learn today?”
 - 1. “Today we are going to learn about squaring numbers and finding the square roots of numbers.”

Component 4: Lesson Body

- A. *Explanation:*
 - 1. Show introduction transparency.
 - 2. Go through each question as listed on transparency.
 - 3. Ask students if 729 is a perfect square? (*yes) If a student answers correctly, have them share with the class how they got the answer.
 - 4. Show students how to find out if a number is a perfect square. No perfect square can end with 2, 3, 7, or 8. Does our number? (*no)
 - 5. The rest is just work. The easiest thing to do is find the number that when multiplied together is 729, and that involves estimating and guess and check. For instance we know that 10×10 is 100 and that 100×100 is 10,000 therefore we know we are looking for a number between 10 and 100. What is 20×20 ? 400. What is 30×30 ? 900. So now we know we are looking for a number between 20 and 30. I like to work by two’s at this point. $22 \times 22 = 484$. Still too small. What is 24×24 ? 576. We are getting closer. What is 26×26 ? 676. Closer. $28 \times 28 = 784$. Oops we’ve gone too far. We know it wasn’t 26, and now we know it’s not 28. What is in between? (*27) So let’s check. What is 27×27 ? 729. So 729 is a perfect square.
 - 6. We now also know the square root of 729. It is 27. When we are looking for the square root, we are looking for a number when multiplied by itself will equal what is under the square root sign.

B. Demonstration:

1. Try another problem. What is 12^2 ? (144). So what is the square root of 144? (12.)
2. Try another problem. What is the square root of 289? (17.) Have students work the problem the same way you did (*see 5) - AP

C. Supervised Practice:

1. Hand out the "Recording Chart" Have students complete the chart with their partner utilizing the geo-board.
2. Give instructions to the students. "You will complete the Square and Square Root chart by filling in the missing blanks. You have 3 columns on your paper. One column shows Exponent form. One column shows square form, and the last column shows square root form.

Example: 3^2	9	3
?	16	?

3. Monitor and assess student pairs as they are completing the sheets.

Component 5: Lesson Closing

- A. When first bell rings signal for students attention.
- B. Have students stack their supplies on their desk and begin getting ready for their next class quietly. During this time review what they've learned. - CFU
- C. How do you find the square a number? How do you find the square root of a number? Does every number have a perfect square?

Component 6: Extended Practice

- A. Pass out Non Squares and Greeks C-Scope lesson for homework.

Component 7: Evaluation

- A. Throughout the day there will be assessment and monitoring. Independent evaluation will occur when the homework is graded.