Square Numbers
ID: 13410

Time required
45 minutes

Activity Overview

In this activity, students will make a variety of squares using square tiles and the Table feature of the calculator to discover patterns and make predictions off those patterns.

Topic: Algebraic Thinking

- *Develop understanding of square numbers*

- *Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules*

Teacher Preparation and Notes

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*

- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter "13410" in the quick search box.***

Associated Materials

- *MG_SqNumbers_worksheet_TI73.doc*

- *MG_SqNumbers_Nav01_TI73.act*

- *MG_SqNumbers_Nav02_TI73.act*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *How Totally Square! (TI-73 Explorer) — 4454*

- *How Totally Square! Part 2 (TI-73 Explorer) — 4455*

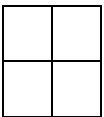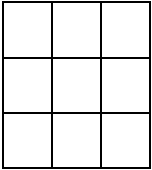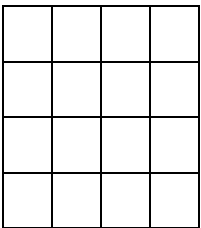- *Perfect Squares Practice (TI-73 Explorer & TI-Navigator) — 11680*

Problem 1 – Planning a Party

In this problem, students will use square tiles to create perfect squares. Describe the following scenario to students. They are planning an end-of-year banquet and need to plan for seating. The tables will be made from student desks which each take up 1 square yard. Desks are put together to form square tables.

Questions 1–3

If each group has 50 tiles, they can create up to a 7 × 7 table.

Discuss with students patterns they are seeing in the table they are creating. Explain to students that the number of desks on each side is also the side length because each desk has a side length of 1 yard. (1 yard × 1 yard = 1 square yard) The total number of desks is the total number of tiles that they used to create the table.

Number of Desks on Each Side	Total Number of Desks	
1	1	
2	4	
3	9	
4	16	

Questions 4–5

Discuss square numbers with students. Point out that all of the shapes built for this activity were squares because the length and width used to build the tables were the same number.

Guide students to write the pattern using *x* and *y*.

If the side length is *x* and the total number of tiles is *y*, how could the pattern be written using these variables?

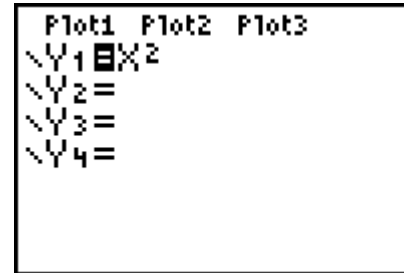$$x \cdot x = y \quad \text{or} \quad x^2 = y$$

Problem 2 – Square Number Tables

<u>Questions 6–7</u>

Show students how to create a table. They first have to enter the agreed upon function in the Y= editor. Press $\boxed{\text{Y=}}$ $\boxed{\text{CLEAR}}$ $\boxed{x}$ $\boxed{x^2}$ $\boxed{\text{ENTER}}$. Pressing $\boxed{\text{CLEAR}}$ is necessary if there is a previous equation beside **Y₁**.

Note: If any of the **Plots** are highlighted, students can move the cursor up to each Plot number and press $\boxed{\text{ENTER}}$ to turn that plot off. This is only necessary if you want to show the graph as well.

After the equation is entered, the next step is to set up the table format. Students will press $\boxed{\text{2nd}}$ $\boxed{\text{WINDOW}}$ and change the settings as shown at the right. Once the table is set, press $\boxed{\text{2nd}}$ $\boxed{\text{GRAPH}}$.

<u>Questions 8-12</u>

To explore the table generated, students need to use the $\boxed{\blacktriangledown}$ and $\boxed{\blacktriangle}$ keys. If desired, the table set up can be changed at any point by returning to the TABLE SETUP menu. Use the table to help students explore and answer the questions on the worksheet.

Extension

Use the triangular pieces from pattern blocks and investigate triangular numbers and their patterns.

Extension – TI-Navigator™

1. To visually show different size squares, use the following TI-Navigator activity with Question 1. Load the activity settings file ***MGAct08_SqNumbers_Nav01_TI73.act*** into Activity center. Start the activity and have students enter the length of 1 side into **L₁** and the length of the other side into **L₂**. Since these are both the same, it does not matter which side goes into which list.

    As students **Submit** their points, you will see the **State Plot** appear. The grid is turned on so the "squares" show up. The number of squares between the student's point and the *x*-axis and *y*-axis should match the number of tiles used.

2. Use **Screen Capture** or **Quick Poll** to monitor student activity throughout the lesson.

3. As an extension to Problem 2, you can use ***MGAct08_SqNumbers_Nav01_TI73.act***. The activity center is set up to plot the side of a square and the square of that number. This would lead into a discussion around parabolas and non-linear functions. After points are obtained, you can click the **Graph-Equation** tab and **Show** the equation that has been entered.

Solutions – student worksheet

Problem 1

1.

Number of Desks on Each Side	Total Number of Tiles
1	1
2	4
3	9
4	16
5	25
6	36
7	49

2. Answers will vary. The number of blocks is going up. Students may begin to see that the number is the side times the side.

3. Answers will vary. Students should start to see a pattern. Side times side is the pattern.

4. $x \cdot x = y$ or $x^2 = y$

5. Check students' answers. They should begin to see that these numbers are "square numbers" because they create a perfect geometric square.

Problem 2

8. 64

9. 11

10. No, because there will be lots of chairs in the middle of the square and no one can sit at them.

11. Check students' answers.

12. The numbers provided should be squares.