Dividing Up the Area
ID: 12354

Time required
45 minutes

Activity Overview
In this activity, students investigate the relationship between the area of quadrilaterals and triangles using the Geoboard application. As an extension, students will find the area of a complex figure.

Topic: Geometry
- *Apply appropriate techniques, tools, and formulas to determine measurements*

- *Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes*

Teacher Preparation and Notes
- *The Geoboard app needs to be loaded on all calculators.*

- *Before beginning the activity, make sure students are be able to draw figures and find the area of those figures using the Geoboard app. Instructions for each are given on the following pages.*

- *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 file, go to education.ti.com/exchange and enter "12354" in the quick search box.***

Associated Materials
- *MGAct17_DividingArea_worksheet_TI73.doc*

- *MGAct17_DividingArea_Nav_TI73.act*

Suggested Related Activities
To download the activity listed, go to <u>education.ti.com/exchange</u> and enter the number in the quick search box.

- *Geoboard and Area (TI-73 Explorer) — 6690*

- *Surround and be Found! (TI-73 Explorer) — 4651*

- *Area Formulas App (TI-73 Explorer) — 6814*

Problem 1 – Area of Squares and Triangles

Students are to start the Geoboard app by pressing [APPS], scroll down until **GEOBOARD** is highlighted and press [ENTER]. Then press any key to go to its home menu. Students are instructed to choose an 8 × 8 board, however you can have them select any size board appropriate for the class.
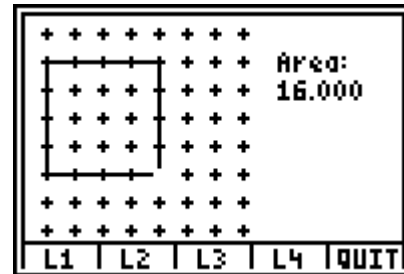
To draw a figure:

- Press [Y=] to select **DRAW**.

- When the cursor is on the first vertex of the figure, press [Y=] for **ADD**. (Use the arrow keys to move the cursor.)

- Move the cursor to the next vertex and select **ADD**, and so on for the other vertices.

- On the last vertex, press [TRACE] for **DONE**.

- Selecting **QUIT** ([GRAPH]) will return to the previous menu.
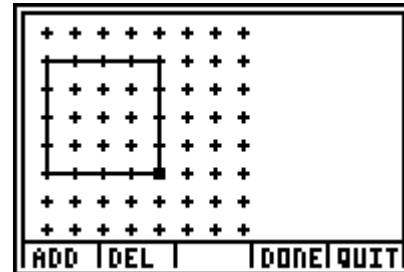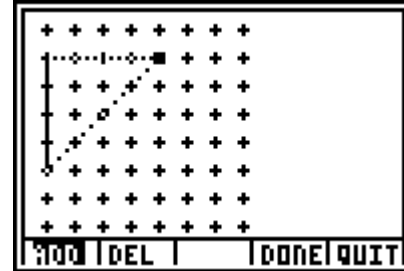
To find the area of a figure:

- Press [TRACE] to select **MEAS**.

- Then select **AREA** (option 2) from the measurement menu.

- When the cursor is on a vertex or side of the figure, press [ENTER].

  Note: If there is more than one figure on the board (and they share a vertex) press the [▲] to select the figure to measure. The object selected will appear with dotted sides.

Students are to draw a square and a triangle that cuts the square in half. Then they should find the area of each figure. The screenshot of the 8 × 8 grid in each problem on the worksheet allows students to sketch the figures drawn using Geoboard.

They should see that the area of the triangle is half of the area of the square.
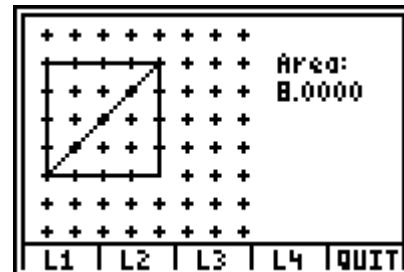
Problem 2 – Area of Rectangles and Triangles

Students first need to clear the drawings from Problem 1 by selecting **Erase Board** from the OPTN menu and the select **Yes** to confirm the deletion. This will return students to the 8 × 8 board.

Using the same method as Problem 1, students will draw a rectangle and a triangle that cuts the rectangle in half. They should see that the area of the triangle is half of the area of the rectangle.
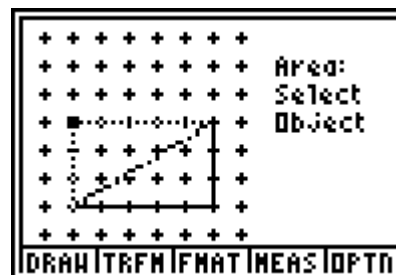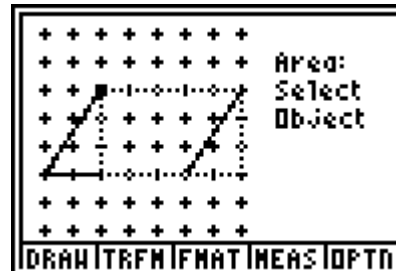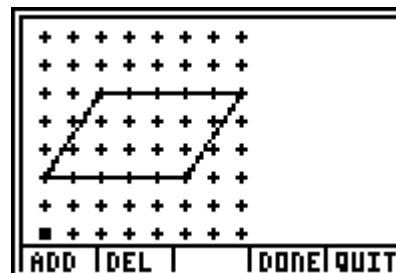
Problem 3 – Area of Parallelograms and Rectangles

This problem is different from the first two problems. Students are to draw a parallelogram like the one shown on the worksheet. Then they need to draw a rectangle that has the same area as the parallelogram, which means they will need to find the area of the parallelogram before drawing the rectangle.

Guide students to place the rectangle so that it shares two vertices (shown at the right). They should see that the triangle formed outside of the rectangle matches the triangle formed inside the rectangle on the opposite side. If desired, students could draw the triangles and compare the areas to see that they are to same.

This should lead students to the conclusion that a rectangle and a parallelogram have similar formulas.

**Problem 4 – Area of Parallelograms and Triangles**

In the last problem, students will compare the areas of a parallelogram and a triangle that cuts it in half. They should see, like the previous problems, the area of a triangle is half of the area of a parallelogram.

In general, students should see that the areas of a right, obtuse, and acute triangles were half of rectangles, squares, and parallelograms, which have a general formula of **height × base**, so the formula for a triangle is $A = \frac{1}{2}bh$.
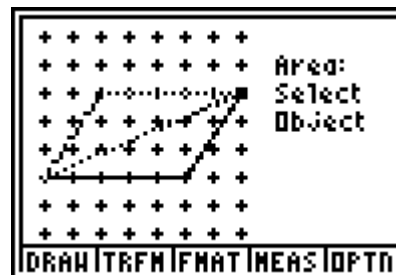
Extension – Area of Complex Figures

Students can use what they've learned in the activity to find the area of the complex figures given on the worksheet. For students that have difficulty with this concept, have them draw the lines to separate the figure into simpler polygons.
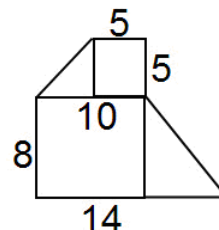
Extension – TI-Navigator^{TM}

1. To begin the lesson, load the activity settings file *MGWeek17_DividingArea_Nav_TI73.act* into Activity center. Discuss the meaning of area. Area is often defined as the number of square units a figure covers. Ask students for the area of the square shown and use **Quick Poll** (with **Open Response**) to collect their answers.

2. Prompt individual students to challenge the class by drawing a figure in **GeoBoard** for which they think other students will have difficulty finding the area. Take a screen capture of that student's device, making sure they do not have the area revealed on their screen. Right click on the screen capture and save it to the computer desktop.

    Load the saved image into **Activity Center** as a background image and have a contest to see which student can come closest to the actual area of the figure. Have the student who drew the image find the actual area and use **Quick Poll** to collect the other students' guesses.