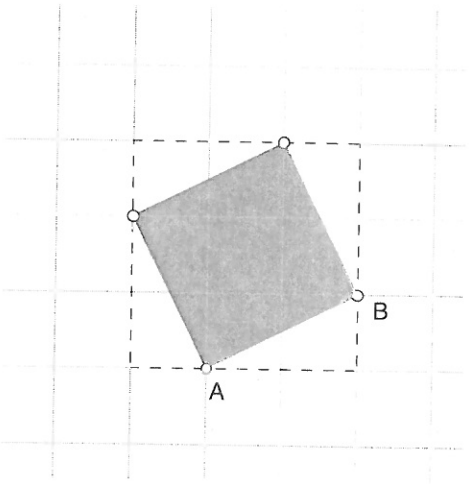
Square Areas on a Grid

Name(s): _____

In this activity, you'll find areas of squares on a square grid, including "tilted" squares. The strategy you develop for finding these tilted square areas can be applied to one proof of the Pythagorean theorem.

Sketch and Investigate

1. Open the sketch **Squarefinder.gsp.**
2. Drag point *A* or *B* to get a feel for how the corners of the square snap to the grid.



Note that when the yellow square is tilted on the grid, a larger square with dashed sides surrounds it. Pay attention to when the measure of $\overline{AB}$ is a whole number and when it is not.

Q1 A perfect square is a number whose square root is a whole number. In this sketch, the yellow square has whole-number side lengths when its sides are horizontal or vertical (that is, when the square is not tilted). In these nontilted squares, the area is a perfect square. Sketch six different perfect squares on a piece of graph paper and label each square with its side length and area.

3. Now drag point *A* or point *B* to make a tilted square whose area you think is 5 square units. When you're pretty sure you have the right square (and not before!), press the *Show Area Yellow Square* button to check yourself. If you were wrong, press the *Hide Area Yellow Square* button and try again.

The square with area 5 has a side length of the square root of 5. The measure in the sketch is a decimal approximation.

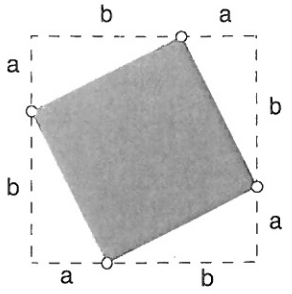
Q2 Sketch the square with area 5 on your graph paper. Label it with its area and its side length expressed as a square root and a decimal approximation, that is, $\sqrt{5} \approx 2.24$.

Q3 Make five more tilted squares. For each, figure out the area, check yourself with the Show button, then sketch the square on your graph paper. Label each with the area and the side length.

Q4 Explain your strategy for finding the areas of tilted squares.

Explore More

1. Write an expression for the tilted square shown at right in terms of a and b. Call the side length of the tilted square c, and write an equation relating a, b, and c. Simplify the equation as much as you can. Does this equation apply even if the square is not on a grid?



2. Some tilted squares on the grid have whole number side lengths. Find as many of these as you can.
3. Is it possible to make a tilted square on the grid with area 3? Explain.
4. Is it possible to make a square on the grid whose area is not a whole number? Explain.