diagonals

Work with 1 or 2 other students, and choose one of your group as the recorder. The recorder should keep a written record of his/her group's discussion of the problem below, and may use this to write up the problem-solving process.

There are hints on the back, but you shouldn't look at them until you have engaged with the problem for 10–20 minutes.

- Understand the problem.

- Devise a plan.

- Carry out the plan.

- Look back.

- Acknowledge when, and how, you're stuck.

Here's the problem. You have a rectangular grid made up of m rows and n columns (the symbols n and m represent positive whole numbers). Draw a line from the upper left to the lower right corner (the diagonal). How many of the grid squares will the line pass through the interior of? If you are told m and n, can you calculate how many squares the diagonal will meet? Can you derive a formula? Can you justify your formula.

What about a rectangular parallelepiped that is m rows by n columns by o layers?

You should begin by trying out some examples. Start with small examples, possibly limiting m (the number of rows) to some simple, small number. Since the examples need to be drawn fairly accurately, you might want to use some paper that's already divided up into squares.

Here's an example where $m = 4$ and $n = 6$:
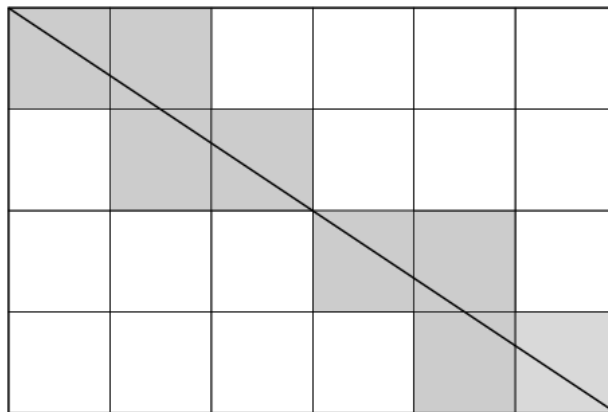
Explore this, and other, problems on my problem-solving wiki:
https://wwwcgi.cdf.toronto.edu/~heap/cgi-bin/Solvent/wiki.pl?Problem_Solving_Home_Page/DiagonalCount
user: **sleuth**   password: **eureka**

Hints:

1. What happens in special cases, such as $n = m + 1$, or when m and n are both even?

2. Are there cases where the problem scales down to some smaller rectangle?