Isometric Drawing

A project in spatial visualization, volume, and surface area

To help my students get their minds around the concepts of volume and surface area, and to foster spatial visualization skills, I had them practice making three-dimensional drawings on isometric paper. This paper has a system of triangular lines running diagonally in two directions and vertically. There are no horizontal lines. It is important to orient the paper to the sideways or landscape position before beginning. They began by sketching a single cube on their paper (Figure 1). Students should have a model such as a multi-link cube for this purpose. Another option is to project the cube onto a television by close-focusing a video camera onto the cube and feeding a cable from the camera to the TV. This insures that every student has the same view of the cube. They could see that its volume was one cube, and they knew its surface area was six square units. However, on the isometric paper, you could see exactly half of the surfaces. You could see the top, but not the bottom; the front, but not the back; and one side, but not the other. They realized that one of the advantages of an isometric view is that it shows you exactly half of the surface area.

Then we snapped several cubes together and tried to sketch more advanced buildings (Figure 2). While some students found this challenging, others showed a natural talent for this skill. For those students, I asked them to try to sketch how the structure would look from the back without actually turning it around. Whether students were already proficient at isometric drawing or whether it was a struggle for them, they all improved quickly and dramatically. Even the students who initially said the assignment was difficult were genuinely engaged in the activity within a few minutes.

Our next step was to try to sketch block letters (Figure 3). Some letters are simple while others are more complex (Figure 4). In general, students seemed to prefer the more advanced styles. In each case, students were asked to find the volume and surface area of each letter.

Students then made isometric drawings of their names and found the volume and surface area of each letter and of their total name. These were then traced onto blank paper so the isometric lines no longer showed. While students were only asked to do their first name, some, such as Derek Turner, went well beyond my expectations creating incredible designs that contained optical illusions reminiscent of M.C. Eshcer's art. Though some of Derek's letters would be physically impossible to build, he has used the isometric paper to correctly find the volume and surface area of these imaginary letters. This project engaged not only my high mathematical thinkers, but many of my more reluctant learners as well. When visitors enter my room, these fine projects engage them as well and draw many "Oohs" and "Aahs"!

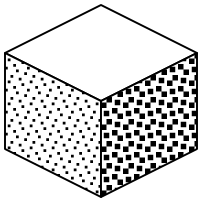


Figure 1

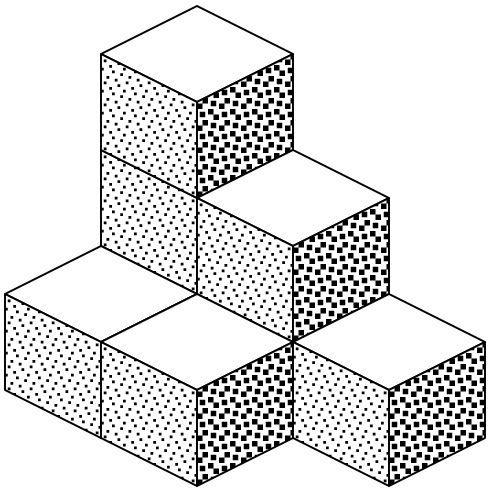


Figure 2

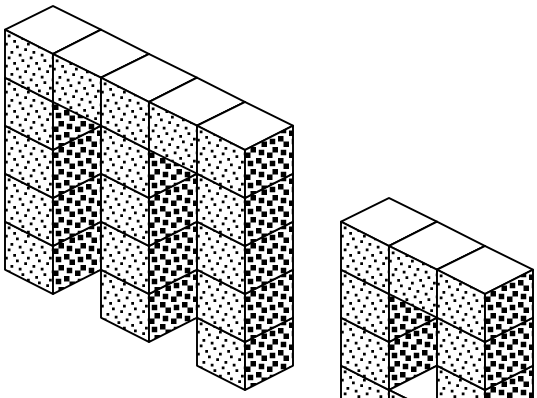


Figure 3

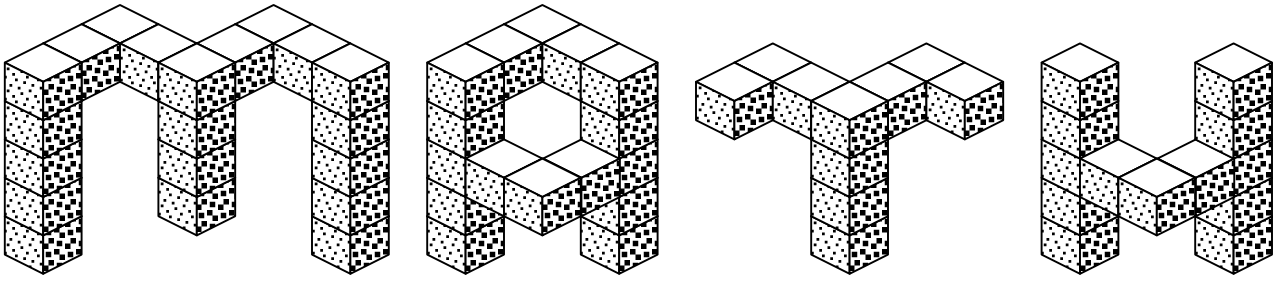
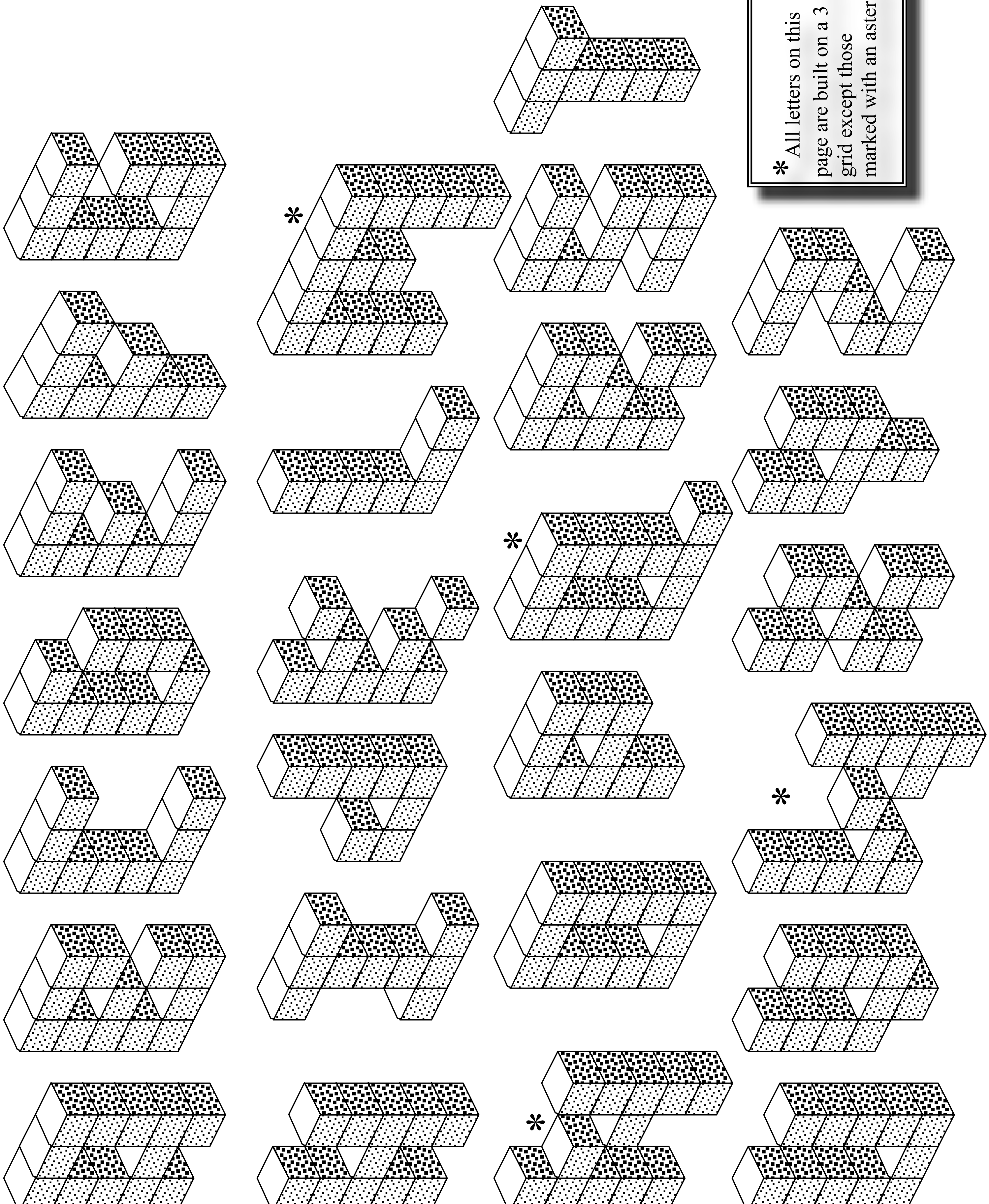
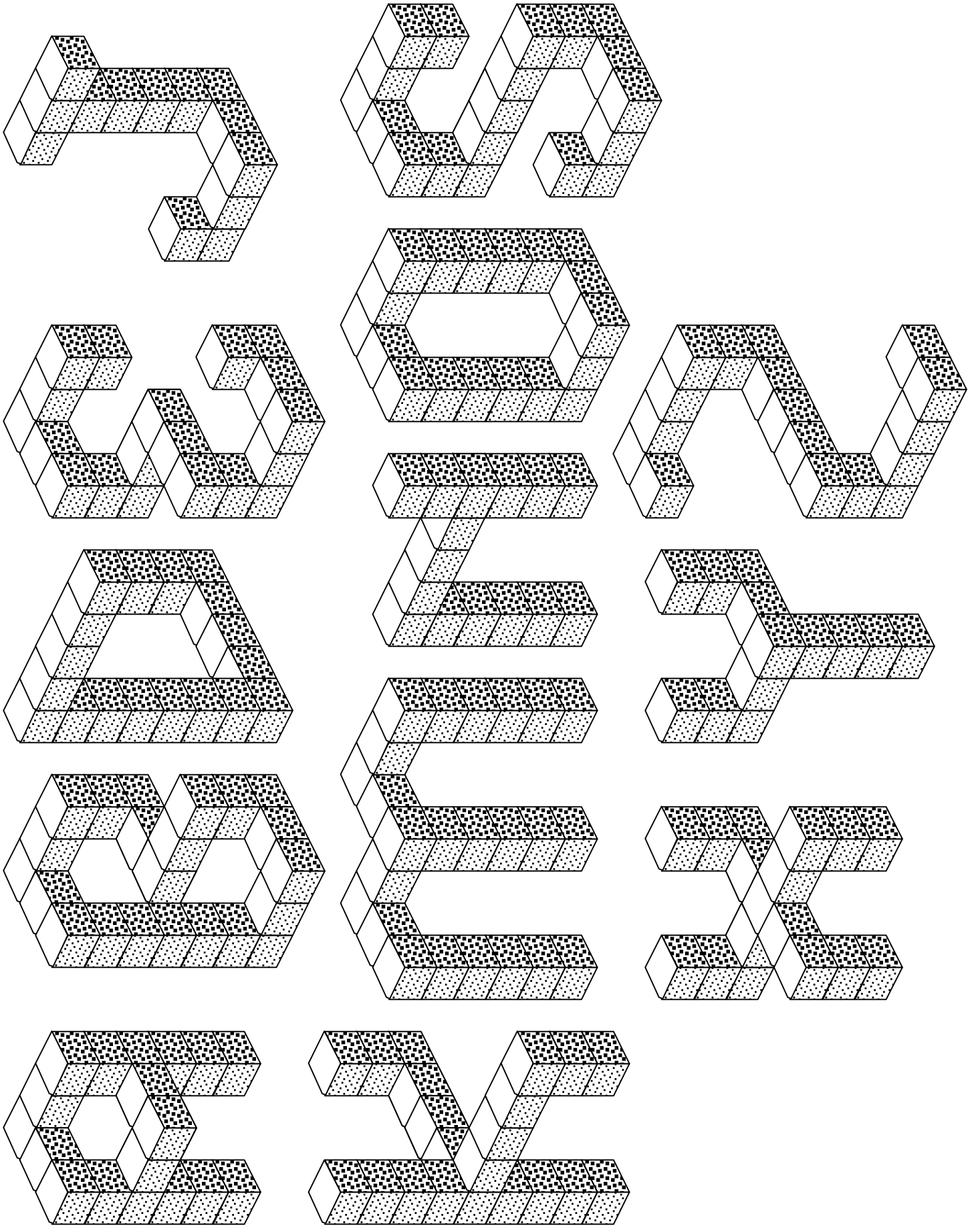


Figure 4

* All letters on this page are built on a 3 x 5 grid except those marked with an asterisk.





ISOMETRIC DRAWING PAPER

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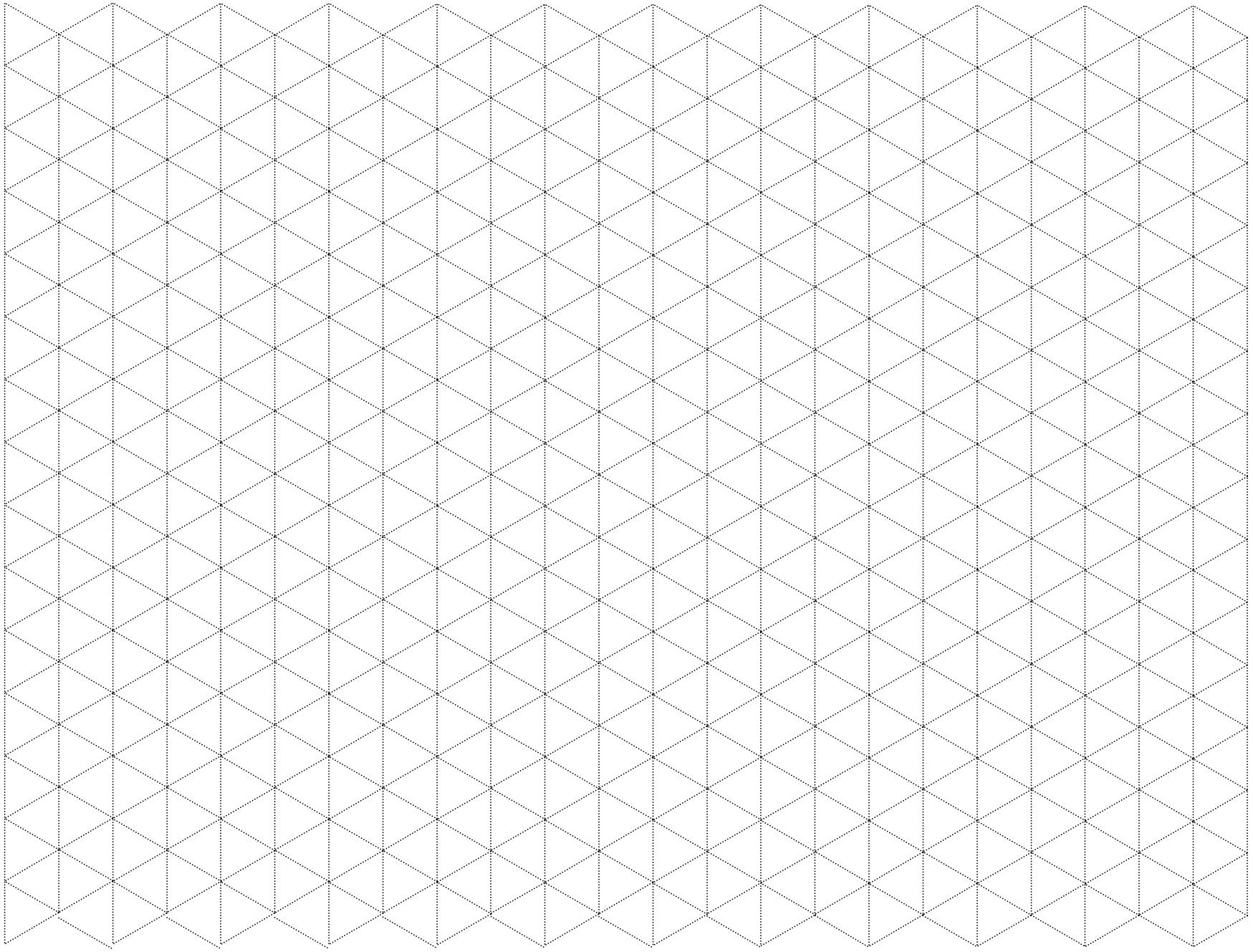
Name_____



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