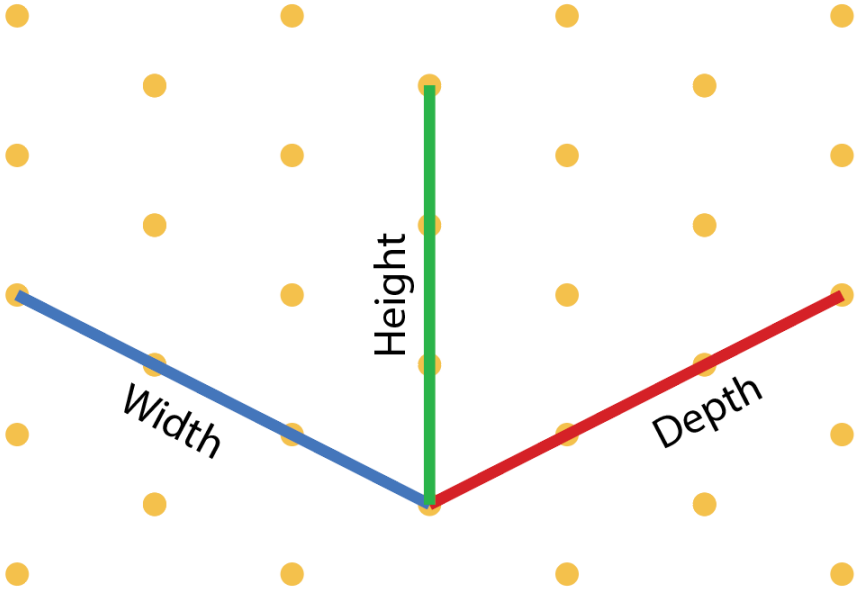
Making Math

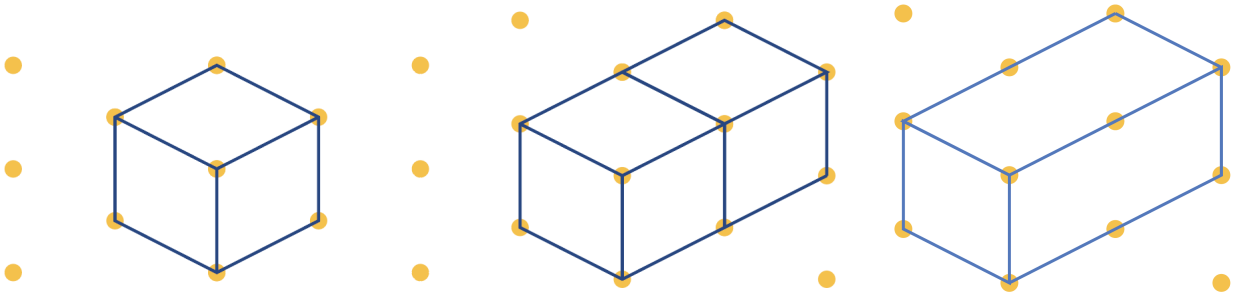
Developing Student Mathematicians

Isometric Drawings

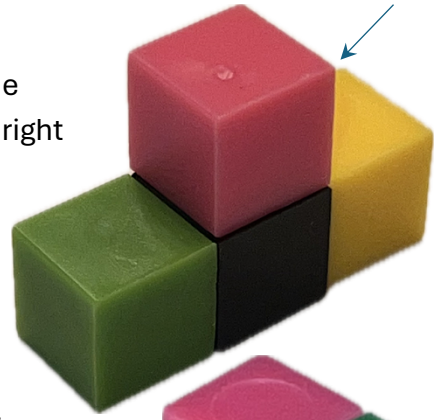
An *isometric drawing* is a way to represent three-dimensional objects with a two-dimensional picture. Edges in each of the three dimensions (think of the blue, red, and green segments below as the *x*, *y*, and *z* axes) meet at 60° or 120° so that all are symmetrically represented. This symmetry is what makes the drawings iso-metric, meaning "same measure." All directions are treated equally. Distance and scale and direction are all preserved. Isometric paper has a hexagonal grid of dots or lines to facilitate drawing parallel lines at the proper angle.



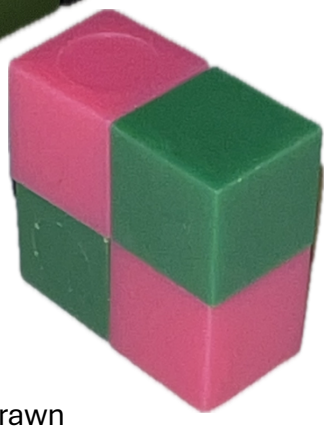
In the leftmost isometric drawing below is a cube. The view is as if we are above the shape looking diagonally at a corner with the front view to the left, a side view to the right, and the view from above at the top. The next two drawings show two adjacent cubes and a rectangular solid of the same size as the two cubes.



Note that when drawing multiple cubes, it is easiest to start with the one closest to the viewer (you) and then add ones that are partly obscured by that first cube. It is easier to picture which edges of the cube should be omitted that way.

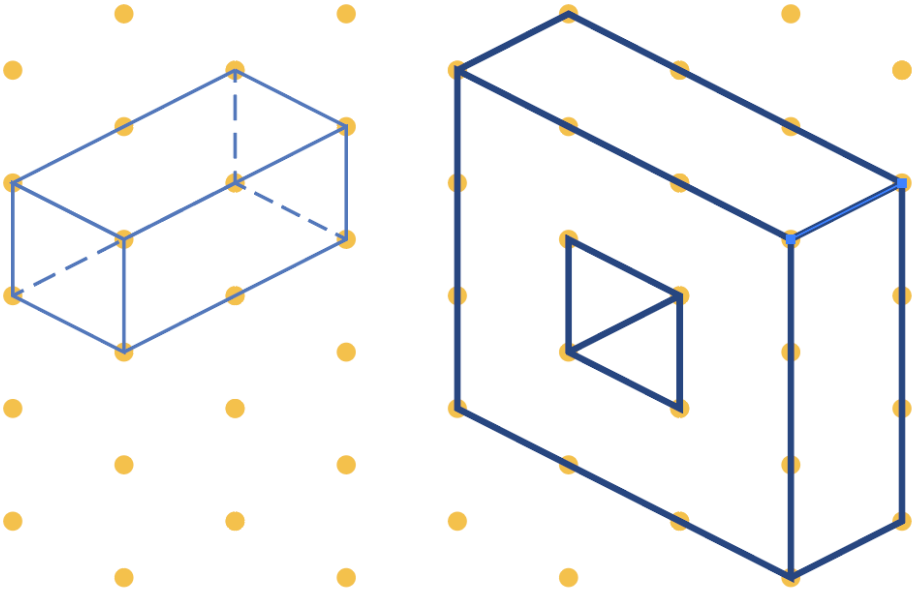


Corners that don't even touch may line up. See, for example, in the picture at right, the back corner of the yellow cube and the upper right corner of the red cube. From this perspective, the two corners, indicated by the arrow, seem to coincide and so those two points will be drawn in the same place in the isometric drawing (we are basically projecting all edges and corners onto a plane behind the shape).

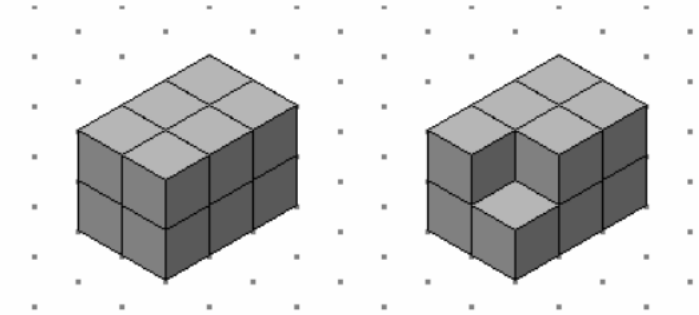


Using isometric paper, draw each of the two shapes at right. Start with a square that is not obscured by any other square (such as the upper green one in the second image).

Sometimes students will want to represent hidden edges. This is done with dashed lines as in the isometric drawing below to the left. We can also show more complicated shapes with holes. The key to which line within the hole is still visible is to imagine the missing direction (up/down, left/right, front/back) for the segments at each vertex of the hole that can actually be drawn within the hole. The second video Ms. Cooper's Art Class videos on isometric drawing techniques demonstrates this rule well. Students who want to explore these drawings further will enjoy her other videos on how to do more elaborate shapes such as buildings and circles.



Isometric drawings may be ambiguous. We don't know if the two shapes pictured here are the same or not, because we can't see if the left image has a missing corner hidden in the back (imagine rotating the righthand figure up and over).



See the Student Handouts document for some practice activities. It is really helpful to have centimeter cubes for students to use making simple shapes they can attempt to draw. You can make the above point about ambiguity by having students practice drawing the same shapes with different corners facing the viewer. They can move their chair or rotate the structure made of cubes.

Lastly, just a note that because we can connect the dots on isometric paper doesn't mean we get a 3-D object that is possible: