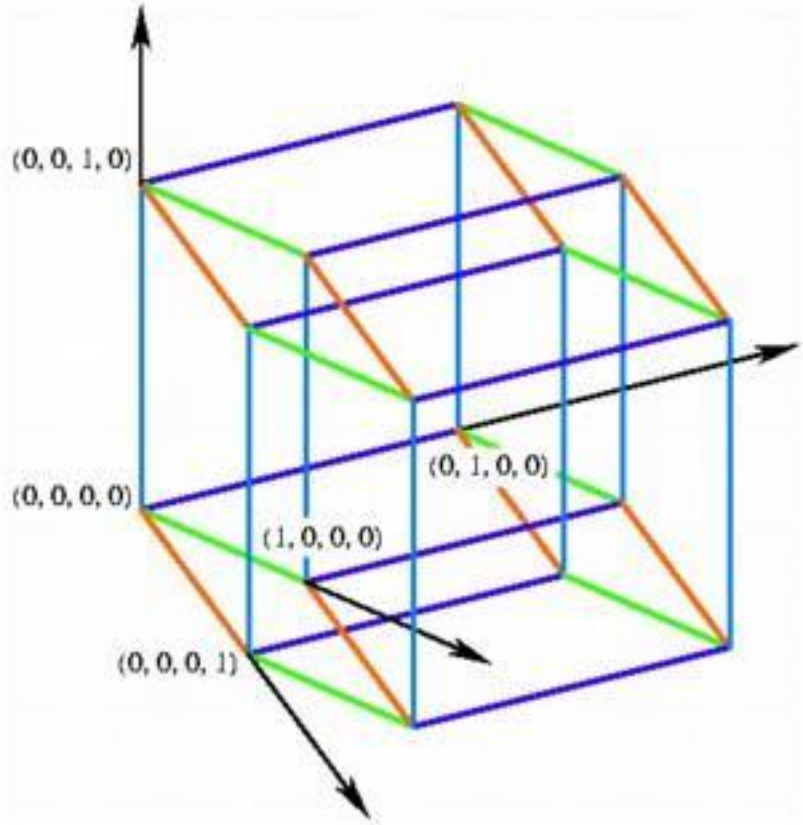
NAME:

TEAMMATES:

EXERCISE:

Label all the vertices of the hypercube.



bog | glers | BY SCOTT KIM

Hyperspace: Up, Out and Away

Looking at the world through 4-D glasses

TESSERACT: CUBE TO THE FOURTH

Hyperspace—space beyond three dimensions—is one of the most mind-expanding ideas in modern science. For neophytes, the classic introduction to higher dimensional spaces is Edwin A. Abbott's 1884 novel *Flatland*, the tale of a square who lives in a two-dimensional world. Mr. A. Square can't imagine a third direction perpendicular to his world—up but not north—until he dreams of Lineland, a one-dimensional world. Thinking about the jump from line to square, he makes the leap from square to cube.

As a 3-D creature, you may have trouble picturing a fourth direction perpendicular to our three—out but not north or up. But, like Mr. A. Square, you can make the leap from cube to hypercube by first thinking about the jump from square to cube. Try filling in the blanks in the paragraphs at right.

→ To build a three-dimensional cube, make two copies of a two-dimensional square. Lay one of the squares flat on the ground and raise the other in the third dimension the distance of one side length. This doubles the four corners of the original square for a total of eight corners. Connect each corner of the bottom square to the corresponding corner of the top square, for a total of 12 edges. The completed cube has six square faces: one each top and bottom and four around the sides. If the edge length is one foot, then the farthest distance from one corner to another is ___ feet.

→ To build a four-dimensional hypercube, called a tesseract, make two copies of a three-dimensional cube. Lay one three-dimensional cube flat on the ground and raise the other in the fourth dimension the distance of one side length. This doubles the ___ corners of the original cube for a total of ___ corners. Connect each corner of the bottom cube to the corresponding corner of the top cube, for a total of ___ edges. The completed hypercube has ___ cubical hyperfaces: one each top and bottom and ___ around the sides. If the edge length is one foot, then the farthest distance from one corner to another is ___ feet.