3D geometry: cubes & beyond

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1. Draw a cube.

2. Draw two cubes sharing a face.

3. How many ways can three cubes be arranged so that each shares at least one face with another cube? Draw these different "tricubes".

4. If each edge of the cubes you drew above is $1cm$ long, can you arrange 9 of the tricubes to make a cube with edges $3cm$ long? Can you do it using at least one of each kind of tricube?

5. Draw a picture of a cube with one corner cut off. What shape is the face where you cut?

6. Pick a corner of this cube. Mark the middle of each of the three edges that touch this corner. Draw a picture with the corner cut off by a slice going through all three marks. Do this for each corner. How many faces does the shape have now? What are they? This shape is called a *cuboctahedron*.

7. Color one corner of this cube red. There are three faces at this corner. Color the opposite corner of each of these three squares red also. Now draw straight lines connecting these red corners. How many edges did you draw? How many faces does this shape have? This shape is called a *tetrahedron*.
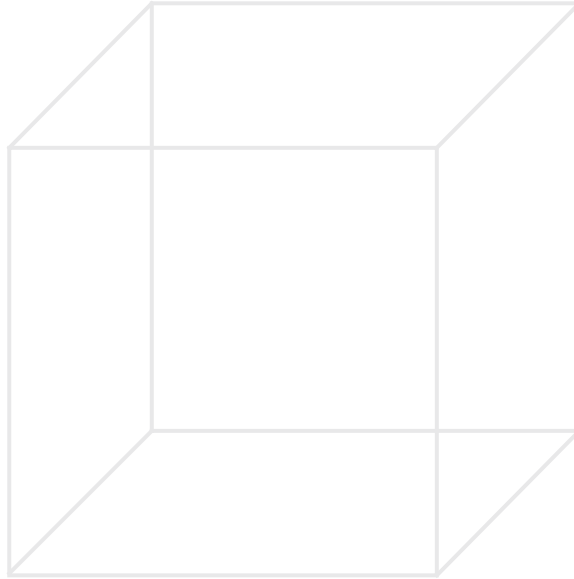
8. Redraw your picture from problem 7. Now color the *other* 4 corners of the cube blue and connect them by edges, making another tetrahedron. Part of the red tetrahedron is inside the blue tetrahedron. Color the edges of this shape green. How many edges are there? How many faces does this shape have? This shape is called an *octahedron*.

9. Draw a cube. Put a dot in the middle of each face. Connect each dot to the closest 4 other dots. How many edges did you draw? What shape do they make?

10. Draw a tetrahedron. Put a dot in the middle of each face. Connect each dot to the other 3 dots. How many edges did you draw? What shape do they make?

11. Draw an octahedron. Put a dot in the middle of each face. Connect each dot to the nearest 3 dots. How many edges did you draw? What shape do they make?

12. "octahedron" comes from Greek: $\overset{\backprime}{o}\kappa\tau\overset{\prime}{\omega}$ (eight) + $\overset{\prime}{\epsilon}\delta\rho\alpha$ (seat).
    "tetrahedron" comes from Greek: $\tau\epsilon\tau\rho\acute{\alpha}\varsigma$ (four) + $\overset{\prime}{\epsilon}\delta\rho\alpha$ (seat).
    What is another word for "cube"? Hint: The Greek word for six is $\overset{\prime}{\epsilon}\xi$ [hex].