

Inside a Solid Shape

Count faces, edges, vertices, and face angles

GRADE 4 • 4.MG.6.b

4.MG.6.b "Identify and describe solid figures (cube, rectangular prism, square pyramid, and sphere) according to their characteristics (number of angles, vertices, edges, and by the number and shape of faces)."

NAME _____

DATE _____

LOOK CLOSELY, THEN EXPLAIN

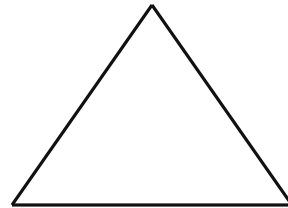
A face is a flat surface; an edge is where two flat faces meet; a vertex is a corner where edges meet. Dashed straight lines are hidden edges. Count hidden edges and vertices too; count each vertex once. Count face angles one face at a time: a triangle has 3 and a rectangle or square has 4. A shared vertex may be counted on several faces. A sphere has one curved surface and no flat faces.

WORKED EXAMPLE

This triangle could be one face of a solid. How many face angles does it have?

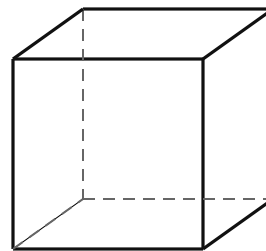
1. Follow the triangle's boundary and count three corners.
2. Each corner is an angle on this one flat face.

Answer: This one triangular face has 3 angles; this does not count all vertices or angles of the whole solid.

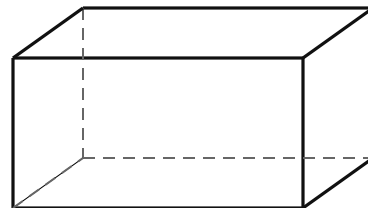


PRACTICE 4 problems

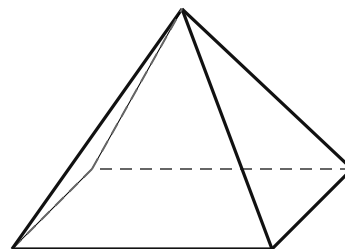
- 1** This drawing represents a cube. Describe its face shapes and give the numbers of faces, edges, and vertices. How many right angles are on each face? How many face angles altogether?



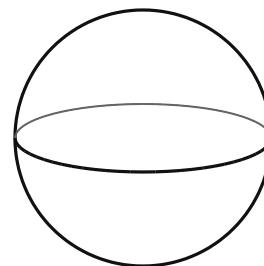
- 2** This drawing represents a rectangular prism. Describe its face shapes and count its faces, edges, and vertices. Count the angles on one face, then all face angles.



- 3** This is a square pyramid. Describe its face shapes and count its faces, edges, and vertices. Add the angles on its square face and four triangular faces.



- 4** Name this solid. Does it have any flat faces, edges, vertices, or face angles? Describe its surface. The curved line across the picture only helps show roundness; it is not an edge.



APPLY IT Show your work

- 1** Choose cube, rectangular prism, square pyramid, or sphere. A solid has 5 vertices and a square face. Name it, then describe all its other faces and its number of edges.

2

A solid has 6 faces, 12 edges, and 8 vertices. Can you decide whether it is a cube or a rectangular prism that is not a cube? Explain what additional face information would settle it.

CHALLENGE One step up

Mia says a square pyramid has 16 vertices because its faces have 16 angles altogether. Explain her mistake and give the correct number of vertices. Use the square pyramid in Practice 3 to describe a shared corner.

Face angles means the sum of the corner angles on all flat faces, not the count of distinct 3-D vertices. Cube/prism: 24; square pyramid: 16; sphere: 0. Accept cube as a special rectangular prism. Sphere's curved guide is not an edge. The drawings have no radius or altitude construction segments.

PRACTICE 1

6 square faces, 12 edges, 8 vertices. Each face has 4 right angles; $6 \times 4 = 24$ face angles altogether.

PRACTICE 2

6 rectangular faces, 12 edges, 8 vertices. Each face has 4 right angles; $6 \times 4 = 24$ face angles altogether. A square is a special rectangle.

PRACTICE 3

5 faces: 1 square and 4 triangles. 8 edges and 5 vertices. The square has 4 right angles and the triangles have 3 angles each; $4 + 4 \times 3 = 16$ face angles.

PRACTICE 4

A sphere. It has 0 flat faces, 0 edges, 0 vertices, and 0 face angles. It has one continuous curved surface.

APPLY IT 1

Square pyramid; its other 4 faces are triangles, and it has 8 edges.
Accept equivalent correct reasoning supported by the stated measurements or geometric properties.

APPLY IT 2

No; both have those counts. If all six faces are squares, it is a cube. If at least one face is a rectangle that is not a square, it is not a cube.
Accept equivalent correct reasoning supported by the stated measurements or geometric properties.

CHALLENGE

It has 5 distinct vertices. Counting face angles counts shared vertices more than once. For example, the top vertex belongs to 4 triangular faces, so it contributes 4 face angles but is only 1 vertex.