NAME _____ DATE _____

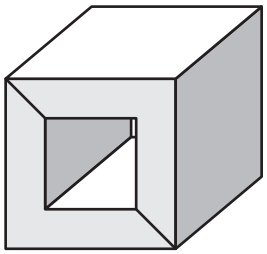
Challenge: Skills and Applications

For use with pages 719–726

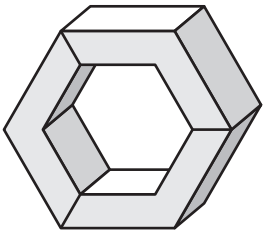
Euler's Theorem can be extended to polyhedrons with "holes." For a polyhedron with F faces, V vertices, E edges, and n "holes," the equation is $F + V - E = 2 - 2n$. The number $2 - 2n$ is the *Euler characteristic* of the polyhedron. In Exercise 4 below, $n = 3$, so the Euler characteristic is -4.

In Exercises 1–9, count the number of faces, vertices, and edges of the polyhedron. (Assume that the back of the polyhedron matches the front.) Find the Euler characteristic. Check your answers by verifying that $F + V - E = 2 - 2n$.

1.



2.



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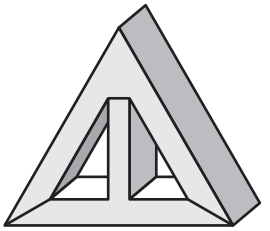
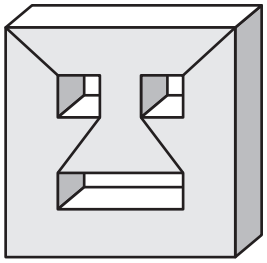
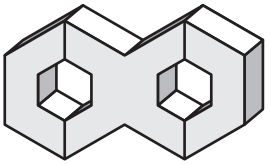


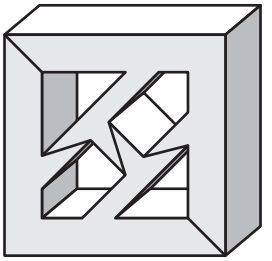
4.



5.



6.



7. A polyhedron has 12 faces, 29 edges, and 1 "hole." How many vertices does it have?

8. A polyhedron has 23 faces, 49 edges, and 4 "holes." How many vertices does it have?

9. A polyhedron has 18 vertices, 36 edges, and 2 "holes." How many faces does it have?

10. A polyhedron has 21 faces, 35 vertices, and 3 "holes." How many edges does it have?

11. A polyhedron has 26 faces, 43 vertices, and 75 edges. How many "holes" does it have?

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