

Solids and Their Nets

Name: _____

Date: _____

Concepts

- Constructing the Net of Prisms
- Constructing the Nets of Pyramids
- Constructing the Nets of Solids
- Decomposable and Truncated Solids
- Euler's Theorem
- Prisms
- Pyramids
- Solids (theory)
- Solids with Curved Surfaces
- Tetrahedrons
- The Area and the Volume of Solids - Secondary 1 and 2
- The Area of Prisms

Constructing the Net of Prisms

1. A confectioner in Rimouski packs a chocolate log in a box shaped like a prism. Its two bases are equilateral triangles with sides of 6 cm, and the box is 20 cm long.

- a) How many pieces would you cut out to make the net of this box, and what shape is each one?
- b) Give the dimensions of every rectangle in the net.
- c) Find the total area of the rectangular pieces only.

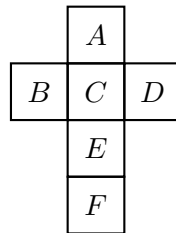
Constructing the Nets of Pyramids

2. A park in Sherbrooke has a monument shaped like a pyramid with a square base. The base measures 10 m on each side, and each triangular face has a height of 12 m measured from the middle of a base edge up to the top of the monument.

- a) Describe the net of this pyramid: how many pieces, and what shape and size is each one?
- b) The four triangular faces are to be covered in copper. What area of copper is needed?

Constructing the Nets of Solids

3. The net below is made of six identical squares and folds up into a cube.



- a) When the net is folded, which face ends up opposite face *A*? Opposite face *B*? Opposite face *C*?
- b) How many edges of the cube are already joined in the net (the fold lines), and how many still have to be taped shut?

Decomposable and Truncated Solids

4. A bird feeder is built by gluing a pyramid with a square base on top of a rectangular prism. The prism is $20\text{ cm} \times 20\text{ cm}$ at the base and 30 cm tall; the pyramid's square base is $20\text{ cm} \times 20\text{ cm}$ and matches the top of the prism exactly.

- a) Name the two solids the feeder decomposes into, and say which faces of them disappear inside the glued join.
- b) How many faces does the finished feeder show on the outside?
- c) The tip of the pyramid is then sliced off with a horizontal cut, making a truncated pyramid. What shape is the new face created by the cut?

Euler's Theorem

5. For each solid below, count its vertices V , its edges E and its faces F , then work out $V - E + F$. Copy and complete the table.

Solid	V	E	F	$V - E + F$
Prism with a triangular base				
Pyramid with a square base				
Cube				

What do you notice about the last column?

Prisms

6. A shop displays its candles in three prism-shaped boxes: box 1 has a rectangular base, box 2 has a base that is a regular hexagon, and box 3 has a triangular base.

- a) Name each prism.
- b) For each one, give the number of faces, vertices and edges.
- c) What do all three boxes have in common that makes them prisms rather than pyramids?

Pyramids

7. A garden lamp is shaped like a pyramid whose base is a regular octagon (8 sides).

- a) How many faces, vertices and edges does the lamp have?
- b) What shape is each lateral face?
- c) Of these three solids, which are pyramids: (i) a solid with one pentagonal face and five triangles meeting at a point; (ii) a solid with two identical triangular faces and three rectangles; (iii) a solid with four triangular faces?

Solids

8. Six objects are on a table: a Rubik's cube, a soup can, a beach ball, a party hat, a die shaped like a triangular pyramid, and a chocolate box shaped like a triangular prism.

- a) Name the solid each object represents.
- b) Sort the six into polyhedrons and solids that are not polyhedrons.
- c) Write the rule you used to sort them, in one sentence.

Solids with Curved Surfaces

9.

- a) For each of the cylinder, the cone and the sphere, say how many flat faces and how many curved surfaces it has.
- b) Which of the three has a net made of two circles and a rectangle?
- c) A can of maple syrup is a cylinder with a diameter of 10 cm and a height of 14 cm. Its label is a rectangle that wraps exactly once around the can, with no overlap. Give the dimensions of the label, to the nearest tenth of a centimetre. (Use $\pi \approx 3.14$.)

Tetrahedrons

- 10.** Jade folds a paper decoration in the shape of a tetrahedron whose six edges all measure 5 cm.
- a) How many faces, vertices and edges does it have, and what shape is each face?
 - b) What is the total length of all its edges?
 - c) Her net is a single piece made of four triangles joined along three fold lines. When she folds it up, how many edges still have to be taped, and what total length of tape is that?

The Area and the Volume of Solids - Secondary 1 and 2

- 11.** A moving company uses a cardboard box shaped like a rectangular prism, measuring 30 cm long, 20 cm wide and 15 cm high.
- a) Find the total area of cardboard in the closed box.
 - b) Find the volume of the box.
 - c) Say in one sentence what each of the two answers tells the company.

The Area of Prisms

12. A ramp at a skatepark is a prism lying on its side. Its two bases are right triangles with sides of 6 m, 8 m and 10 m, and the ramp is 15 m long.

- a) Find the lateral area of the prism (the three rectangles).
- b) Find the area of the two triangular bases.
- c) Find the total area of the prism.

Synthesis — drawing on several sheets in this topic

13. A gift box is a prism whose two bases are identical triangles with sides of 5 cm, 5 cm and 6 cm. The height of each triangle, measured onto the 6 cm side, is 4 cm. The box is 12 cm long.

- a) Describe the net of the box: how many pieces, and the dimensions of each.
- b) Find the total area of the net.
- c) Find the volume of the box.

Want the harder problems and the worked solutions?

The *Challenge Problems* set and the *Answer Keys* for Solids and Their Nets — with the reasoning written out in full — are available at tutorinmontreal.ca.