5.1 Exploring Nets

GOAL

Build 3-D objects from nets.

1. Match each object to its net.

   a) ___ [cylinder - horizontal]

   b) ___ [triangular prism]

   c) ___ [rectangular prism]

   d) ___ [cylinder - vertical]

   e) ___ [triangular prism]

   f) ___ [rectangular box]
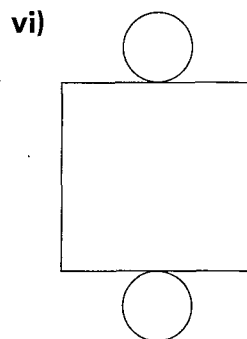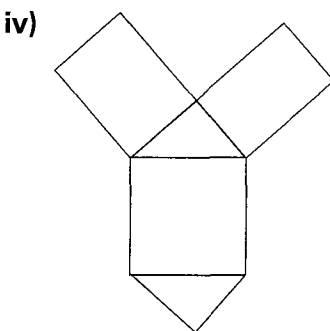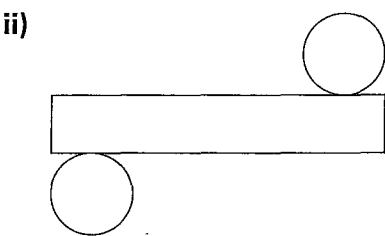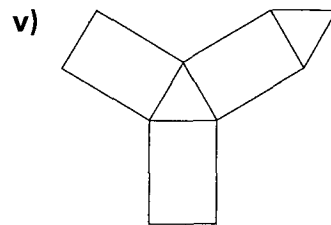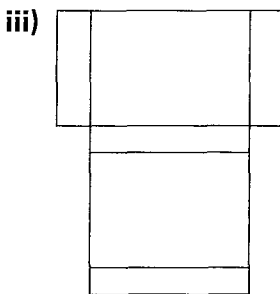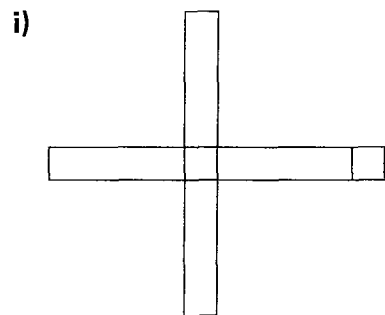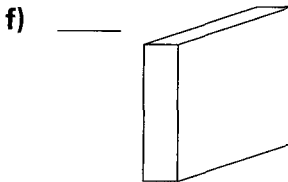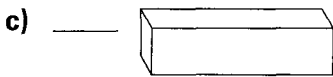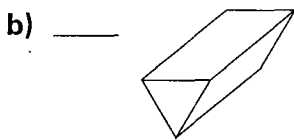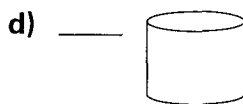
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A net is a 2-D pattern that you can fold to create a 3-D object.

For example, this is a net for a cube.

   i) [cross-shaped net]

   ii) [rectangle with two circles]

   iii) [net with rectangles]

   iv) [net with squares and triangle]

   v) [three rectangles meeting]

   vi) [square with two circles]

5.2 Drawing the Nets of Prisms and Cylinders

Draw nets of prisms and cylinders.

1. **a)** I am a rectangle with a circle attached at each end.
       What net am I?

    b) I am three rectangles attached at the longer sides.
       I have a triangle attached at each of the short ends of
       the middle rectangle. What net am I?
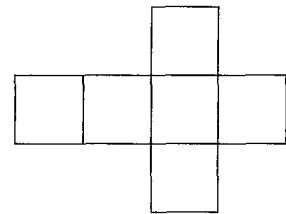
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When you draw a net, make sure
that each edge will meet another
edge and that no sides overlap.

2. Draw a net for this rectangular prism.

    4.0 cm
    5.5 cm   3.0 cm
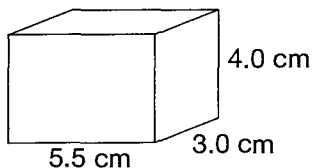
3. Draw a net for this triangular prism.

    47 mm
    22 mm
    30 mm

4. Draw a net for this cylinder.

    5.1 cm
    8.2 cm

5.3 Determining the Surface Area of Prisms
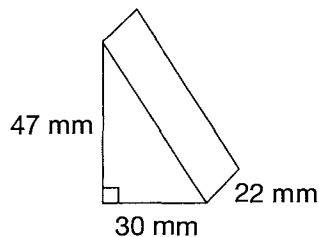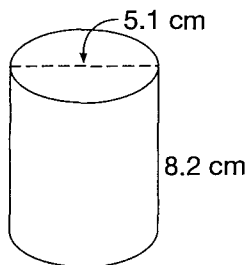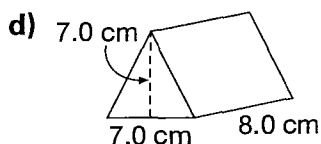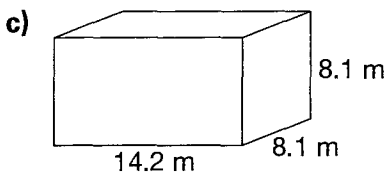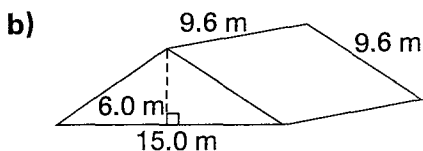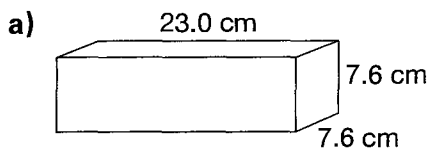
Develop strategies to calculate the surface area of prisms.

1. Calculate the surface area of each prism.

   a)
   23.0 cm
   7.6 cm
   7.6 cm

   b)
   9.6 m
   9.6 m
   6.0 m
   15.0 m

   c)
   8.1 m
   14.2 m
   8.1 m

   d)
   7.0 cm
   7.0 cm
   8.0 cm

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To determine the surface area of a prism:
- Calculate the area of each side.
- Add the areas.

height
4 cm
8 cm   3 cm   width
length
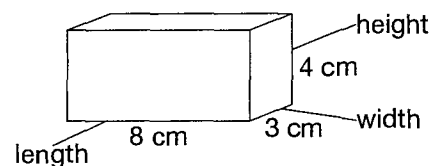
$SA = 2 \times (8 \text{ cm} \times 4 \text{ cm})$
$\qquad + 2 \times (8 \text{ cm} \times 3 \text{ cm})$
$\qquad + 2 \times (3 \text{ cm} \times 4 \text{ cm})$
$\qquad = 64 \text{ cm}^2 + 48 \text{ cm}^2 + 24 \text{ cm}^2$
$\qquad = 136 \text{ cm}^2$

4.0 cm   5.0 cm
base height   12.0 cm
6.0 cm   length
base width

$SA = 2 \times (5.0 \text{ cm} \times 6.0 \text{ cm})$
$\qquad + 6.0 \text{ cm} \times 12.0 \text{ cm}$
$\qquad + 2 \times (\frac{1}{2} \times 6.0 \text{ cm} \times 4.0 \text{ cm})$
$\qquad = 60.0 \text{ cm}^2 + 72.0 \text{ cm}^2$
$\qquad \quad + 24.0 \text{ cm}^2$
$\qquad = 156.0 \text{ cm}^2$

5.4 Determining the Surface Area of Cylinders

Develop strategies to calculate the surface area of a cylinder.

1. Calculate the surface area of each cylinder.

   a) 5.0 cm   10.0 cm

   b) 2.0 cm   6.0 cm

2. Determine the surface area of a cylinder with each radius and height:

   a) radius 4.0 cm, height 12.0 cm

   b) radius 4.0 cm, height 10.5 cm

   c) radius 4.0 cm, height 14.5 cm

3. A company will construct metal oil drums for local refineries. Each drum is 1.0 m in diameter and 1.5 m high. Determine the area of the metal needed to construct an oil drum.
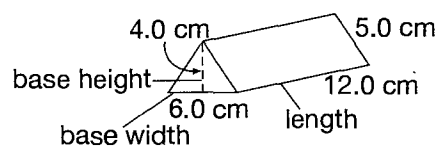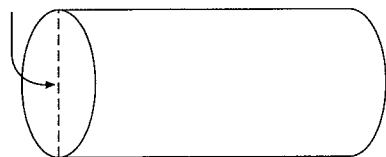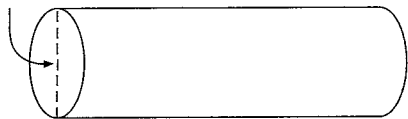

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To determine the surface area of a cylinder:
- Calculate the area of the curved side.
- Calculate the area of the top and the base.
- Add the areas.

Area of top and base:

$A = 2 \times \pi \times r \times r$

Area of curved surface:

$A = C \times h \text{ or } A = \pi \times d \times h$
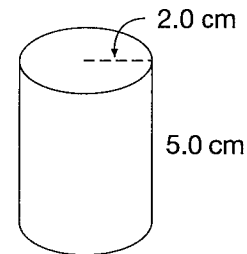
2.0 cm

5.0 cm

$SA = 2 \times \pi \times 2.0 \text{ cm} \times 2.0 \text{ cm}$
$\quad + \pi \times 4.0 \text{ cm} \times 5.0 \text{ cm}$
$\quad \doteq 25.1 \text{ cm}^2 + 62.8 \text{ cm}^2$
$\quad \doteq 87.9 \text{ cm}^2$

5.5 Determining the Volume of Prisms

GOAL

Develop and apply formulas for the volume of prisms.

1. Calculate the volume of each prism.

   a)

   5.0 cm
   3.0 cm
   6.5 cm

   b)

   13.0 cm
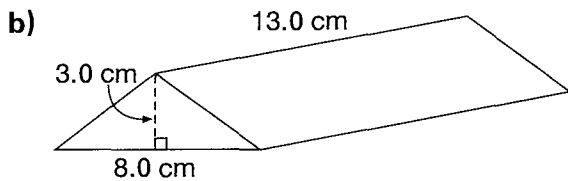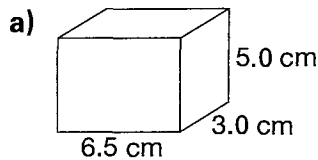   3.0 cm
   8.0 cm

2. A rectangular prism is 4.0 cm in length, 8.0 cm in height, and 64.0 cm³ in volume. Calculate the width of the prism.

3. A triangular prism is 4.0 cm in length. Its base is 6.0 cm wide and the volume is 2000.0 cm³. Calculate the height of the prism's base.

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To determine the volume of a prism, multiply the area of the base by the height of the prism:
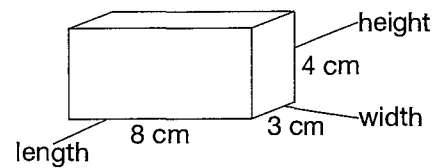
$V = b \times h$

The b in this formula refers to the base of the prism.

Area of a rectangle: $A = l \times w$

Area of a triangle: $A = \frac{1}{2} b \times h$

The b in this formula refers to the base of the triangle.

height
4 cm
8 cm   3 cm   width
length

$V = 8 \text{ cm} \times 3 \text{ cm} \times 4 \text{ cm}$
$ = 96 \text{ cm}^3$

4.0 cm   5.0 cm
base height
12.0 cm
6.0 cm   length
base width
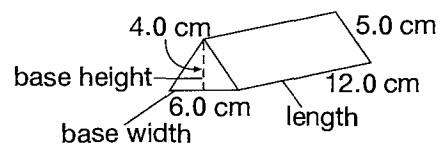
$V = (\frac{1}{2} \times 6.0 \text{ cm} \times 4.0 \text{ cm})$
$ \times 12.0 \text{ cm}$
$ = 144 \text{ cm}^3$

5.6 Determining the Volume of Cylinders

Develop a formula for the volume of a cylinder.

1. Calculate the volume of each cylinder.

   a) 6.0 cm   10.0 cm

   b) 1.0 cm   6.0 cm

To calculate the volume of a cylinder, multiply the area of the base by the height of the cylinder:
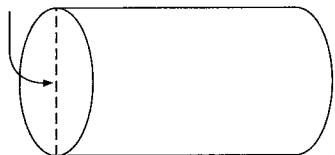
$V = \pi \times r \times r \times h$

2.0 cm

5.0 cm

$V = \pi \times 2.0 \text{ cm} \times 2.0 \text{ cm} \times 5.0 \text{ cm}$
$\doteq 62.8 \text{ cm}^3$

Volume is the amount of space that an object occupies. Capacity is the amount that an object can hold.
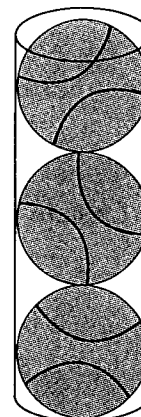
2. Which cylinder would hold more water?
   Explain your answer.
   Cylinder A: height 7.0 cm, diameter 5.0 cm
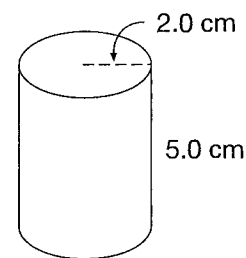   Cylinder B: height 5.0 cm, diameter 7.0 cm

_____

_____

_____

3. A tennis ball is about 6.0 cm in diameter. Determine the capacity of a cylindrical canister that could just fit 3 tennis balls as shown.
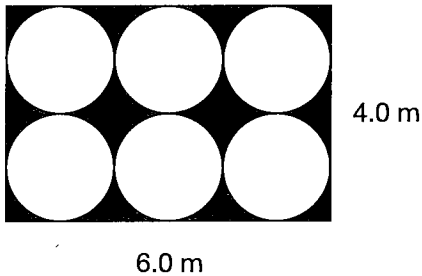
5.7 Solve Problems Using Models

Use models to solve measurement problems.

1. Determine the surface area of the shaded region.

4.0 m

6.0 m

2. A pizza box measuring 25 cm by 25 cm by 4 cm contains a pizza 20 cm in diameter and 3 cm high. What percent of the box is occupied by the pizza and what percent is not?

3. A tortilla chip container is in the shape of a triangular prism with a base area of 36 cm^2 and a volume of 540 cm^3. The base is a right isosceles triangle. The containers are shipped in a box with a capacity of 38 880 cm^3.

a) How many containers fit in one box? Explain.

b) Model two different boxes that would hold the packages. Explain which box you would use.

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When solving problems using models, the following steps will help you:

1. **Understand the Problem**

   Search the question for information necessary to solve the problem.

2. **Make a Plan**

   Translate the information into a working diagram so you can determine how to solve the problem.

3. **Carry Out the Plan**

   Answer the problem using the information in the question and the formulas needed to solve for the measurements.
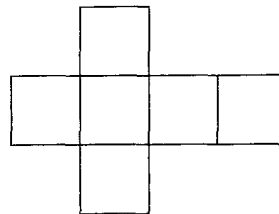
4. **Look Back**

   Review your work to determine if your calculations are correct and whether the answer makes sense.
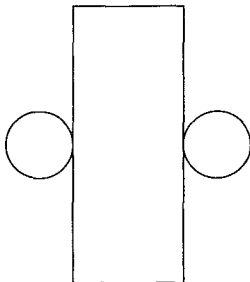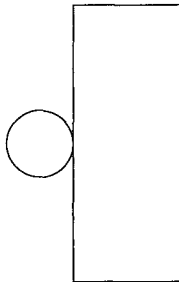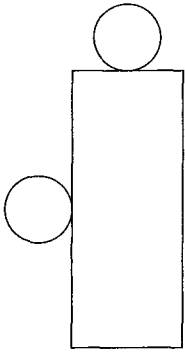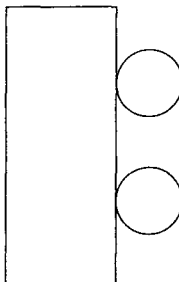
Circle the letter of the correct answer.

1. This is a net of which 3-D object?

    A. a triangular prism   **B.** a cylinder

    C. a cube   **D.** a square pyramid

2. Which diagram is the net of a cylinder?

    A.   **B.**

    C.   **D.**

3. What is the surface area of a rectangular prism 6 cm by 8 cm by 7 cm?

    A. 266 m²   **B.** 336 cm²   **C.** 292 cm²   **D.** 252 cm²

4. A triangular prism has a base in the shape of an equilateral triangle. The base is 5.0 m wide and 4.3 m high. The prism is 4.0 m in length. What is the surface area of the triangular prism?

    A. 71.5 m²   **B.** 81.5 m²   **C.** 86.5 m²   **D.** 96.5 m²

5. What is the surface area of a cylinder 10.0 cm in height and with a radius of 8.0 cm?

    A. 706.3 cm²   **B.** 804.2 cm²   **C.** 904.8 cm²   **D.** 1005.3 cm²

6. What is the volume of a rectangular prism 6 m by 2 m by 10 m?

   A. 60 cm³   **B.** 80 cm³   **C.** 40 cm³   **D.** 120 cm³

7. A triangular prism has a base 9.0 cm wide and 3.0 cm high. The prism is 5.0 cm in length. What is the volume of the triangular prism?

   A. 67.5 cm³   **B.** 87.5 cm³   **C.** 97.5 cm³   **D.** 107.5 cm³

8. What is the volume of a cylinder 12.0 cm high and with a diameter of 6.0 cm?

   A. 282.7 cm³   **B.** 339.3 cm³   **C.** 238.2 cm³   **D.** 187.5 cm³

9. What is the height of a rectangular prism with a base area of 99 m² and a volume of 396 m³?

   A. 1 m   **B.** 2 m   **C.** 3 m   **D.** 4 m

10. What is the height of a triangular prism with a base area of 45 cm² and a volume of 270 cm³?

    A. 3 cm   **B.** 4 cm   **C.** 6 cm   **D.** 10 cm

11. What is the height of a cylinder with a base area of 201 m² and a volume of 603 m³?

    A. 3 m   **B.** 6 m   **C.** 8 m   **D.** 9 m

12. Which object has the greatest surface area?

    A. a rectangular prism 6 cm by 3.5 cm by 2.0 cm

    B. a triangular prism with base width 5 cm, base height 5 cm, and length 5 cm

    C. a cylinder with height 5 cm and radius 2 cm

    D. a rectangular prism 4 cm by 4 cm by 4 cm

13. Which prism has the greatest volume?

    A. a rectangular prism 4.5 cm by 4.5 cm by 7.0 cm

    B. a triangular prism with base width 9 cm, base height 5 cm, and length 7 cm

    C. a rectangular prism 7 cm by 3 cm by 7 cm

    D. a triangular prism with base width 7.5 cm, base height 4.5 cm, and length 9.5 cm
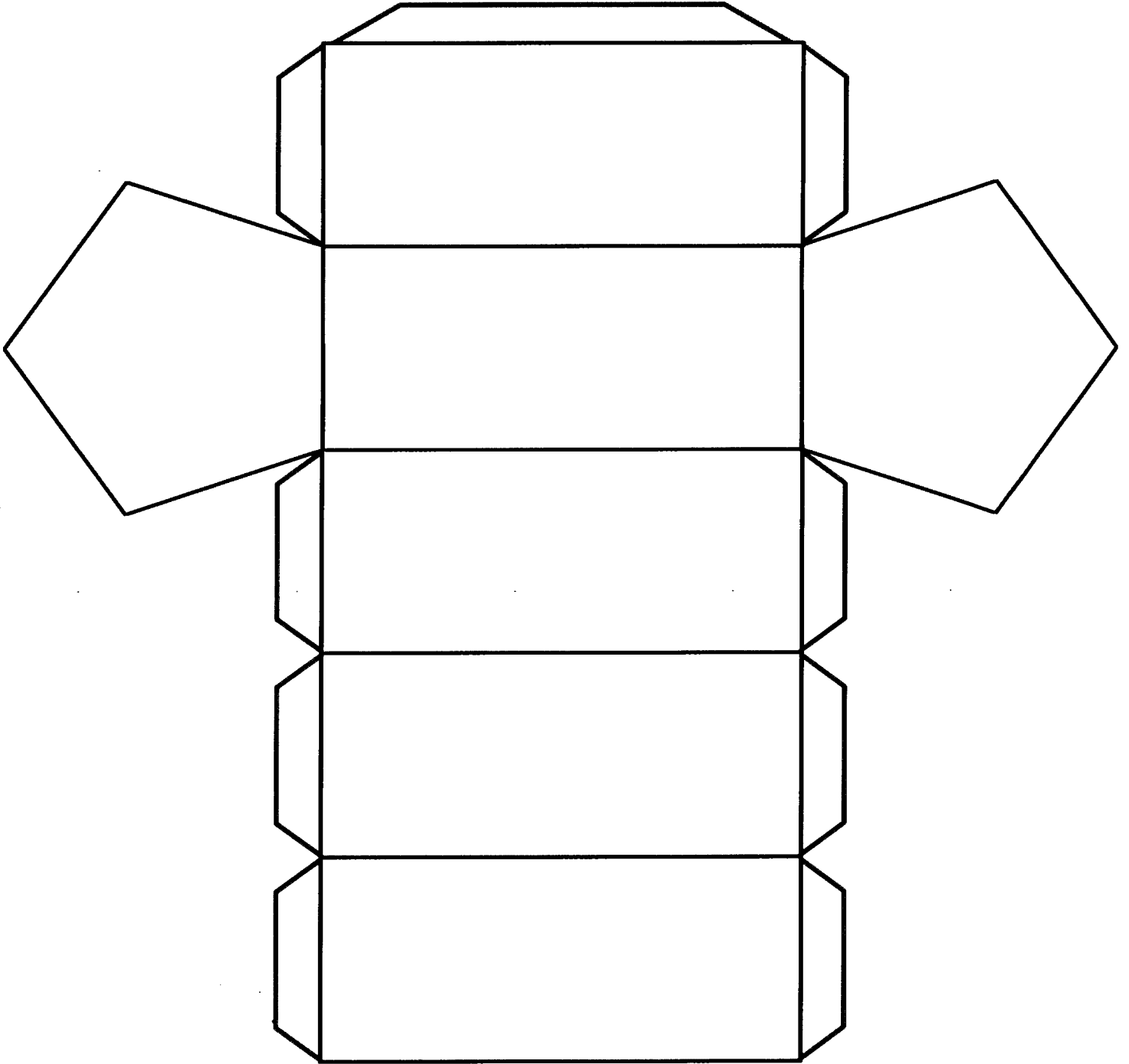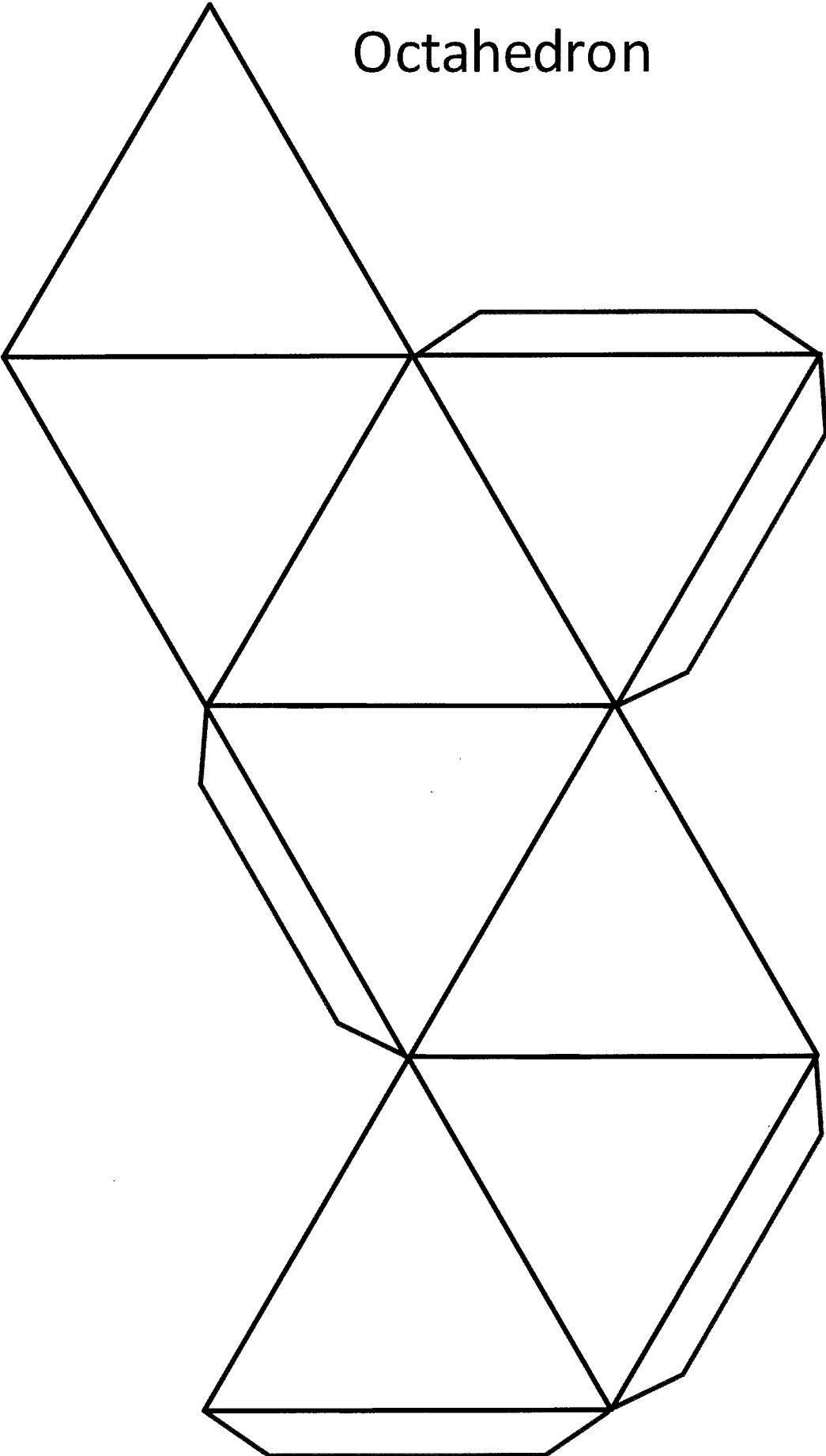
Triangular Prism
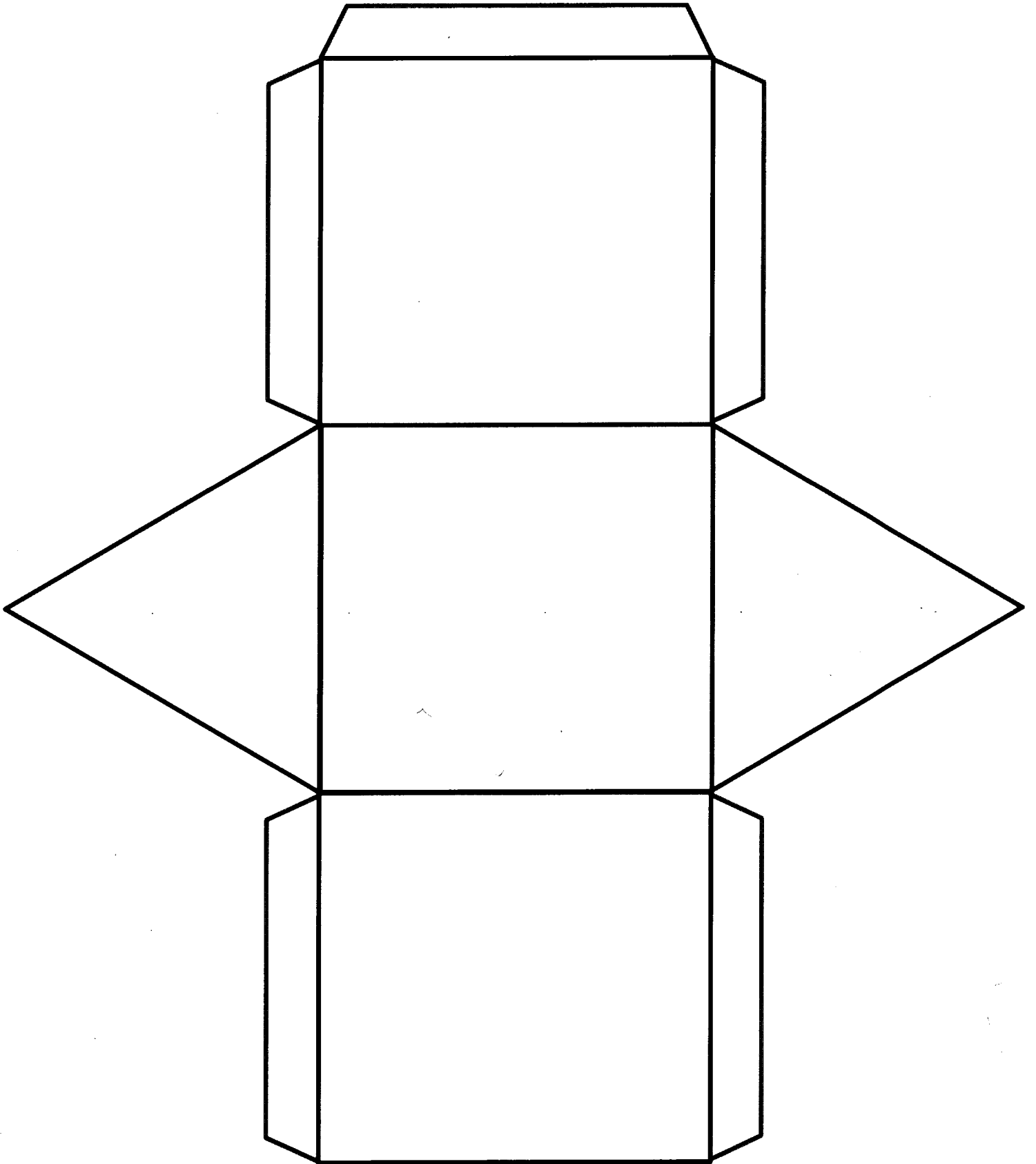
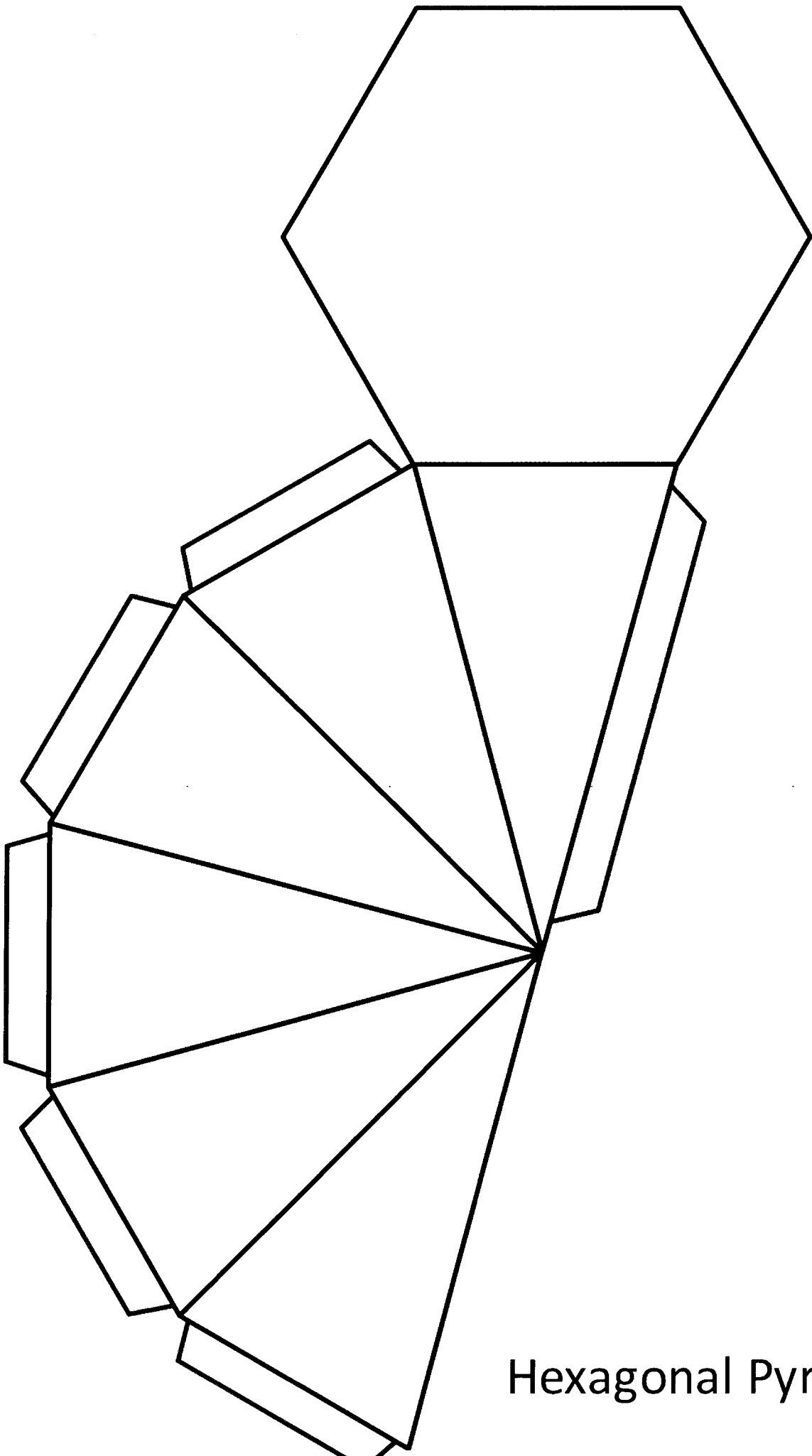Cut out... fold the black lines...
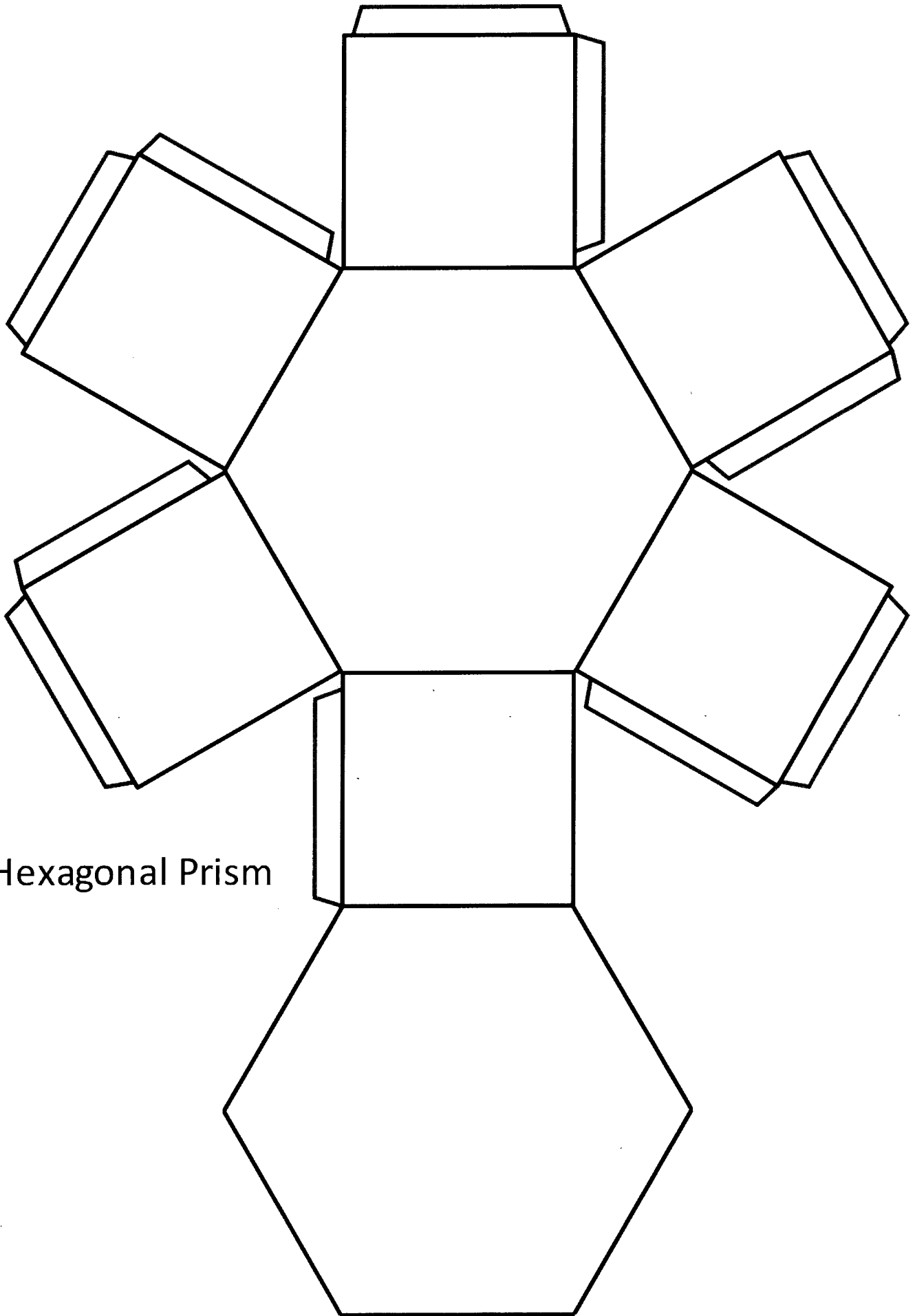
Hexagonal Prism

Pentagonal Prism

Octahedron

Hexagonal Pyramid

Icosahedron

Pyramid

Tetrahedron