

**SUMMARY:**

**Optimization of Rectangles:**

- To maximize area for a given perimeter:
  - > The ideal shape when all four sides are enclosed = \_\_\_\_\_
    - side length =
  - > The ideal shape when only three sides are enclosed = \_\_\_\_\_
    - width = \_\_\_\_\_ & length = \_\_\_\_\_
- To minimize perimeter for a given area:
  - > The ideal shape = \_\_\_\_\_
    - side length =

**Optimization of Square-based Prisms:**

- To maximize volume for a given surface area:
  - > The ideal shape = \_\_\_\_\_
    - side length =
- To minimize surface area for a given volume:
  - > The ideal shape = \_\_\_\_\_
    - side length =

**Optimization of Cylinders:**

- To maximize volume for a surface area:
  - > The ideal cylinder occurs when \_\_\_\_\_
    - radius =
- To minimize surface area for a given volume:
  - > The ideal shape cylinder occurs when \_\_\_\_\_
    - radius =

**EX. 1.** Canned pineapple is an example of an ideal cylinder. The volume of a can of pineapple is 398 mL.

a) What are its dimensions in cm?

b) How much sheet metal is need to make the can?

**EX. 2.** The All Grow fertilizer company plans to sell a cylindrical bargain jug of concentrated liquid fertilizer.

a) Find the dimensions of the jug that would have a maximum volume if the company plans to construct it out of 1884 cm<sup>2</sup> of plastic.

b) What volume of fertilizer will the cylindrical jug hold?

**EX. 3.** A rectangular swimming pool is to be enclosed using 78 m of rope.

a) What are the dimensions of the rectangle with maximum area?

b) Suppose 39 barriers, each 2 m long, are used instead of rope. Can the same area be enclosed?

c) If your answer to b) is no, what are the new dimensions and what is the new area?

**EX. 4.** Sanjay has prepared a proposal for a client. The client is looking to fence off the largest area possible in his backyard. In the proposal, Sanjay reports how 40 m of fencing can be used to fence the enclosure...

a) with 4 sides.

b) with 3 sides, using a wall as one side.

**EX. 5.** A farmer is adding a rectangular corral to the side of his barn. The barn will form one side of the rectangle. The area of the corral is to be  $50 \text{ m}^2$ .

a) What dimensions use the minimum length of fencing to enclose the corral?

b) What is the minimum length of fencing that can be used to enclose the corral?

**EX. 6.** Cereal is packaged in a square-based prism box. The box contains  $5564 \text{ cm}^3$  of cereal.

a) What dimensions for the box require the least amount of cardboard? Round the dimensions to the nearest tenth of a centimetre.

b) Does cereal usually come in a box shaped like the one you found in part a)? Suggest reasons for this.

**EX. 7.** Dylan has a piece of plywood that measures 120 cm by 240 cm. He wants to construct a square-based prism box to hold his sports equipment in the garage. Dylan wants to maximize the volume of the box and to keep the waste of plywood to a minimum.

a) Determine the dimensions of the box with maximum volume, including a lid. Round to the nearest tenth of a centimetre if necessary.

b) Can Dylan construct the box you found in part a) from his piece of plywood? Why or why not?