## Storage Capacity of a Silo

Tony is building a new silo to store corn as animal feed. It will be a cylinder topped with a half-sphere, and must store 21 000 t of corn. The entire silo can be filled with corn. Tony wants to minimize the surface area of the silo to reduce materials and paint costs. He has the following information:

- 1 m³ of corn has a mass of 700 kg.
- Building costs are $8/m², taxes included.
- Paint comes in 3.8 L cans. Each can covers 40 m² and costs $35, taxes included.
- Corn costs $140 per tonne ($140/t), taxes included. Recall that 1 t = 1000 kg.

**?** **What is the total cost to build, paint, and fill a silo with the least surface area?**

**A.** Sketch the silo. Label any measurements you will need.

**B.** Calculate the volume of the silo using the mass of feed it must hold.

**C.** Create a table listing possible dimensions for the silo.

**D.** Graph the surface area versus base radius.

**E.** Determine the minimum surface area.

**F.** Calculate the silo's building cost (before painting).

**G.** Calculate the silo's paint cost.

**H.** Calculate the cost to fill the silo with corn.

**I.** Determine the total cost.

**J.** Prepare a written report that shows your calculations and explains your thinking.

Task | **Checklist**

✔ Did you label all your table values and calculate entries correctly?

✔ Did you draw your sketch and label your graph accurately?

✔ Did you support your choice of surface area?

✔ Did you explain your thinking clearly?

## Investigation

### Mystery of the Pyramids

**22.** Jeremy is creating a piece of art for an exhibit. He starts with a square-based right pyramid, as shown. He makes a cut parallel to the base through the midpoints of the lateral edges. Then, he removes the top of the pyramid.
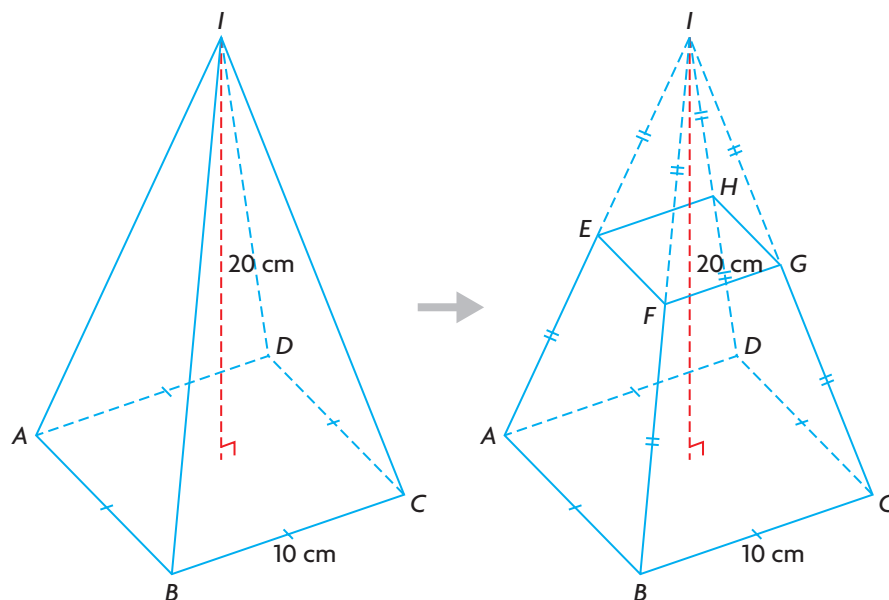


**a)** Determine the volume of the original pyramid.
**b)** Determine what volume of the pyramid was removed.
**c)** In terms of volume, what fraction of the original pyramid was removed?
**d)** Investigate whether this fraction would be the same if the original pyramid had a rectangular base.