**CASE 1) MINIMIZING SURFACE AREA: FIXED VOLUME, LOWEST SURFACE AREA**

**Problem:** Guy has 64 m3 of sand and wants to make a box to store it, using as little material as possible. Determine which box will have the **least surface area**?

*In the problem above, Guy is dealing with a situation where* ***volume*** *is fixed and he needs to create a box with the* ***lowest surface area*** *so that he will spend* ***the least*** *amount of money in material.*

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| The closer the box gets to being a \_\_\_\_\_\_\_\_\_\_\_\_\_, the smaller the **surface area** is for a given volume. |

**How to solve the problem above algebraically**

*We know that* ***cube*** *will provide the lowest surface area for a fixed volume of 64 m3 of sand. You need a calculator that has cube root button.*

**Tech Tip for 2 possible buttons**

$$\sqrt[x]{}$$

1) Type 3 for the root

2) Press $\sqrt[x]{}$

3) Type 64

$$\sqrt[3]{x}$$

1) Type 64

2) Press $\sqrt[3]{x}$



**TRY:** State the dimensions that will **minimize** (lowest) the surface area of a shadow box that has a volume of 35937 cm3.

**CASE 2 – MAXIMIZING VOLUME: FIXED SURFACE AREA, MAXIMUM VOLUME**

Dorsa has 24 m2 of wood to make a toy box. Determine which box will have the maximum volume.

*In the problem above, Dorsa has a fixed amount of material (surface area) and needs to create a box that will provide the largest volume to fit the most amount of toys.*

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| The closer the box gets to being a \_\_\_\_\_\_\_\_\_\_\_\_\_, the **larger** the volume is for a given surface area. |

**How to solve the problem above algebraically** *We know that cube will provide the largest volume.*

Determine the dimensions of a box that maximizes the volume and has a surface area of 54 cm2.

**Questions**

1. A magician has ordered a covered water tank for his next new act. He has enough money to pay for 150 m2 of building material. What is the largest volume of water that can be held in his water tank?

2. State the dimensions that will minimize the surface area of a shadow box that has a volume of 19683 cm3.

3. You have been asked to make a single shelf cabinet, with a volume of 1.125 m3. However, it can only be 0.5 m deep.

a) Determine the dimensions that will minimize the surface area.

b) Assuming that the front face of the shelf is open, what total surface area of wood is needed?