# Best Design of Prisms & Cylinders

## MAXIMIZING THE VOLUME OF A CYLINDER

**Recall:**        Formula for Volume of a Cylinder: _____

A cylinder with a fixed surface area will have the **maximum (largest) volume** when _____.
Rewrite the formula for Volume of a Cylinder with the change to the height above:

So…the formula for the **maximized volume of a cylinder** is _____

## MINIMIZING THE SURFACE AREA OF A CYLINDER

**Recall:**        Formula for Surface Area of a Cylinder: _____

A cylinder with a fixed volume will have the **minimum (smallest) surface area** when _____.
Rewrite the formula for Surface Area of a Cylinder with the change to the height above:

So…the formula for the **minimized surface area of a cylinder** is _____

**Examples:**

1. A cylinder is to be made with 3000 cm$^2$ of sheet metal. Determine the dimensions (r and h) that would give the maximum volume for this cylinder.

2. Sara is a design engineer and must design a cylindrical portion of a regularly used tool. This tool must be able to contain 500mL of oil (hint: 1mL = 1cm$^3$). Find the dimensions of the cylinder that will use the least amount of metal (have the least surface area).

**MAXIMIZING THE VOLUME OF A RECTANGULAR PRISM**

**Recall:**       Formula for Volume of a Rectangular Prism: _____

A rectangular prism with a fixed surface area will have the **maximum** (largest)
**volume** when _____.
Rewrite the formula for Volume of a Rectangular Prism with the change to the
height above:

So…the formula for the **maximized volume of a rectangular prism** is _____

**MINIMIZING THE SURFACE AREA OF A RECTANGULAR PRISM**

**Recall:**       Formula for Surface Area of a Rectangular Prism: _____

A rectangular prism with a fixed volume will have the **minimum** (smallest) **surface
area** when _____.
Rewrite the formula for Surface Area of a Rectangular Prism with the change to
the height above:

So…the formula for the **minimized surface area of a rectangular prism** is _____

**Examples:**
1. Determine the dimensions of a rectangular prism with a maximum volume if its surface area must be 375
cm$^2$.

2. A rectangular prism must have a volume of 125 m$^3$. What is the smallest surface area that is needed to
create this box and what are its dimensions?

**BEST DESIGN SUMMARY**

Based on the investigations we have done around optimization, let's summarize our findings.

| Rectangle | | |
|---|---|---|
| **Minimum Perimeter** | **Occurs when** | **Formula** |
| **Maximum Area** | **Occurs when** | **Formula** |

| | Cylinder | Rectangular Prism |
|---|---|---|
| **Maximum Volume** | **Occurs when** | **Occurs when** |
| | **Formula** | **Formula** |
| **Minimum Surface Area** | **Occurs when** | **Occurs when** |
| | **Formula** | **Formula** |