

**Modeling Data in Excel**

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Section 4

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**Introduction**

• **Motivation:**

Having a sense of the flexibility and importance of a spreadsheet program as Excel to be able to create our own spreadsheets.

• **Objectives:**

1) Calculating the different values of the volume and the area of cones using Excel.

2) Viewing the obtained results in the form of a graph.

3) Write the cone equations using MathType.

• **Overview:**

In this report, we are interested in one particular geometric shape: the cone. We wish to calculate different values of volume and area of a cone depending on its radius and height. Thus, we need to use a simple tool that allows us to change those input values and give an output value depending on the inputs. This can easily be done using a spreadsheet.

 **•Outline:**

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 **Work Description**

• **Background:**

“A **cone** is an *‪n*‬-[dimensional](http://en.wikipedia.org/wiki/Dimension) [geometric shape](http://en.wikipedia.org/wiki/Geometric_shape) that tapers smoothly from a **base** (usually flat and circular) to a point called the **apex** or **vertex**. Formally, it is the solid figure formed by the [locus](http://en.wikipedia.org/wiki/Locus_%28mathematics%29) of all straight-line segments that join the apex to the base. The term "cone" is sometimes used to refer to the surface or the lateral surface of this solid figure (the lateral surface of a cone is equal to the surface minus the base). The **axis** of a cone is the straight line (if any), passing through the apex, about which the base has symmetry. In common usage in elementary [geometry](http://en.wikipedia.org/wiki/Geometry), cones are assumed to be **right circular**, where *right* means that the axis passes through the centre of the base (suitably defined) [at right angles](http://en.wikipedia.org/wiki/Perpendicular) to its plane, and *circular* means that the base is a [circle](http://en.wikipedia.org/wiki/Circle).”

Below is a figure of a right circular cone.

 

• **Modeling Process:**

 ⇒ Development of the model:

The spreadsheet should be well organized so that anyone who reads it understands it. Thus, we will reserve each side, column and row of the spreadsheet for a purpose. First, reserve the left-hand side to enter the title of the project and the input variables (Height and Radius of the cone). The spreadsheet should look something like this one below:

Second, insert the name of the author and the output variables (Volume and Area of the cone) one the right-hand side of the sheet.

We then enter the formulas of the volume and the area of the cone. In order to view the formulas in the output cells instead of the values, go to the “Formulas” tab and click on “Show Formulas”. The sheet should look like this:

Changing the input values of the height and radius should give different output values of the volume and area.

 ⇒ Cone Equations:

 •**Tools:**

\* Since the input values are variable, there should be an easier way than to enter a different value every time. In fact, a simple way is using relative and absolute addresses.

The relative addresses feature of Excel will allow Excel to enter the appropriate equations in the cells below. For example, if we wish to expand the equation “B1= A1 + A2” using the “fill handle” then, by default, B2 will be “B2= A2 + A3” and “B3= A3+ A4”.

The Absolute addresses feature is useful in case you want to keep the value of a certain cell unchanged with the expansion of the formula. In this case, the name of this particular cell should be surrounded by dollar signs. For example, if you want to keep the value of cell B4, the element B4 in the formula should become “$B$4” (excluding quotations).

After updating the equations, you should obtain the following sheet:

\* Another useful tool in excel is that of charts. We are interested in plotting the volume and the area as a function of the incremented radius. To do this, select “Insert” → “Scatter” → “Scatter with smooth lines and Markers”. Then click on “select data” and select the data you wish to plot.

**• Results:**

After following the steps stated above, the chart should look similar to this one:

And the final spreadsheet should resemble this one below:

We can see that the chart reveals that the volume and area of the cone are in exponential growth. Moreover, the chart shows the height and radius in which the volume and area of the cone are equal (intersection of both lines). Finally, the graph is important since it gives us the ability to approximate graphically the volume or surface area at any radius without any computation.

 **Conclusion**

Overall, we have seen how the use of a Microsoft Excel spreadsheet can simplify the computation and organization of a certain problem. The insertion of charts and tables can definitely help viewing the problem in a simpler way thus allowing us to resolve it.

It would be interesting, as a computer engineering major, to learn how to such problems by programming.

 **Appendix**

The “Microsoft Office help” button can help you get more familiar with excel and its features.