


# EXCEL \* TUTORIAL

## Chemistry C2407

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\* Compatible with Excel 98, Excel 2001, Excel X (2002) for Macintosh and Excel 97, 2000, XP (2002) for Windows.

**Note for Excel users on Windows:** All features of Excel for Macintosh are available in Excel for Windows, with a few differences. Instead of the Apple command key (  ) the **ctrl** key is used for keyboard shortcuts. Instead of the **return** key, the **enter** key is used. In addition, there are contextual menus that can be accessed by clicking the right mouse button. This menu brings up a list of functions that relate to the area that the mouse cursor is over.

- I. What is Excel?
- II. Basic Excel definitions / features
- III. Graphing
- IV. Formulas and Functions

### I. What is Excel?

Microsoft Excel is a spreadsheet program, a table of rows and columns where data can be entered. Data can be of many types, numeric, strings, or alphanumeric. Data can be manipulated and analyzed in Excel, quickly and efficiently. Part of the analytic arsenal of Excel is database, statistical, graphical, and other mathematical functions.

### II. Basic Excel definitions / features

When you open Excel, a blank Excel sheet opens. On top are the various menu bars. Below the menu is the sheet. It is divided up into referenced **columns** and **rows**. **Columns** are arranged horizontally across the sheet and are indexed by capital letters, as seen on the top of the sheet. One column is one vertical section of a sheet. **Rows** are arranged vertically down the sheet and are indexed by numbers, as seen on the left-hand side of the sheet. One row is a horizontal section of a sheet.

The intersection of a column and row is defined as a **cell**. **Cells** are where one inputs data, usually one data value per cell. Valid data inputs can consist of characters, strings, numbers, dates, currency, or formulas. (Formulas will be discussed later.) A column letter and a row number reference one cell. For example, the first cell found at the intersection of the first column, denoted **A**, and the first row, **1**, is referenced as A1. When referencing cells, it does not matter whether the letter is capitalized, *i.e.* cell a1 is the same as cell A1. When referencing a block of cells (or **range** of cells), colons separate the beginning and the end cells for the range. For example, A3:A10 refers to the column of each cell from A3 to A10. B3:D6 refers to the block of cells which starts at B3 as the upper left-hand cell and ends with D6 as the lower right-hand cell.

### Inputting / Editing cells

Navigating around the cells can be done with the arrow keys, unless a cell is in edit mode. In edit mode, data can be entered, and it can be distinguished from other modes because a blinking cursor can be seen.

After data is entered, pressing the **Return** key enters the data into one cell, and moves the highlighted cell down 1 row. To edit a cell that already contains data, double-click on the cell, or select the cell and press the **F2** key.

## Chemistry C2407, Fall 2003

### Outline of Course content

Instructor: George Flynn

Meeting Time: TTh, 1:10 p.m.

All information contained in this handout can be found at the C2407 course website:

<http://www.columbia.edu/itc/chemistry/chem-c2407/>

#### I) Kinetic Theory of Gases

- 1) An Observation about gases
- 2) Review of physics of kinematics
- 3) A simplified Kinetic Theory Model
- 4) Kinetic energy and absolute temperature
- 5) Typical molecular speeds
- 6) Effusion
- 7) Heat Capacity
- 8) Definition of work at constant pressure
- 9) Collisions between molecules
- 10) Mean free path
- 11) Boltzmann speed distribution
- 12) Various definitions of average speeds

#### II) Binary Collision Model for Chemical Reactions

- 1) Reactions occur during collisions
- 2) Collision frequency/kinetic rate constant
- 3) Relative speed
- 4) Energy requirements/reaction

barriers

- 5) All or nothing activated state model
- 6) Arrhenius reaction model
- 7) Temperature Dependence of rate constant
- 8) Orientation effect

#### III) Chemical Kinetics

- 1) Definitions: reaction rate and reaction order
- 2) First order kinetics
- 3) Half time for first order reaction
- 4) Second order kinetics
- 5) Half life for second order reaction
- 6) Initial rates method
- 7) Mechanisms and elementary reactions
- 8) Unimolecular decompositions
  - a) The Lindemann Mechanism
  - b) The steady state approximation
  - c) Results for limiting cases
- 9) Catalysis
  - a) Enzyme kinetics
  - b) Michaelis-Menten Model

## Chemistry C2407, Fall 2003: Recitations

**Teaching Assistants: Jennifer Inghrim, and Sean Moran**

**Meeting Time: M, 3-5, 6-8; T, 3-5; W, 4-6; F, 10-12, 2-4**

All information contained in this handout can be found at the C2407 course website:

<http://www.columbia.edu/itc/chemistry/chem-c2407/>

You must sign up for one of the 6 possible recitation sections of Chemistry C2407 ; times listed above. You can do this in the usual manner via the telephone registration system. (The recitations have been given the course number C2409.) Not all the recitations are required, but some are. Following is a list of the required and other recitation data for the term. The teaching assistants will review material for exams or answer your specific questions at those recitations that are not required. (Of the 14 weeks in the term, 7 required recitations, 4 have no recitation and 3 have non-required recitation review exams.) All of the non-required recitations (held during the week before exams) are open to all students, regardless of the day that you sign up for required recitations. If for any reason you cannot make your assigned required recitation day due to an emergency that may arise during the term, please speak to one of the teaching assistants about joining one of the other required recitations for that week.

Required recitations are largely computer based . Computer (required) recitation sections will be held in room 211 Havemeyer Hall. Rooms for non-required recitations will be announced at the first computer recitation section. Note that the first recitation section starts during the first week of classes, on Wednesday, September 3, 2003.

### Recitations

- 1) September 3-9: Excel tutorial (**Required**)
- 2) September 10-16: Boltzmann distribution exercise (**Required**)
- 3) September 17-23: Review material for Exam 1 to be held 9/25/03
- 4) September 24-26: Exam week, no recitation

**Instructor: George Flynn**

**MC 3109 Havemeyer Hall, 3000 Broadway**

**212 854 4162**

**Fall Semester 2003                      Expected Enrollment 85**

**Chemistry C2407x, Intensive General Chemistry**

All information on this course can be found at the C2407 course website:

<http://www.columbia.edu/itc/chemistry/chem-c2407/>

### **Reserve List for Chemistry Library**

Principles of Modern Chemistry 5th Ed., by Oxtoby, Gillis, and Nachtrieb, Brooks/Cole•Thor  
2002.

Principles of Modern Chemistry 4th Ed., by Oxtoby, Gillis, and Nachtrieb, Saunders, 1999.

University Chemistry, 3rd Ed. by B. H. Mahan, Addison Wesley, 1969.

Solids and Surfaces: A Chemist's View of Bonding in Extended Structures by Roald Hoffmar  
Publishers, 1988, New York.

Bonds: An Introduction to Atomic and Molecular Structure by Harry B. Gray, Benjamin/Cum  
Publishing Co. 1973

Student Solutions Manual (to Principles of Modern Chemistry, 5<sup>th</sup> Edition) by Wade A.  
Freeman, Brooks/Cole•Thomson, 2002.

Study Guide and Student Solutions Manual (to Principles of Modern Chemistry) by Wade A.  
Freeman, Saunders, 1999.

George Flynn

SOME IMPORTANT INFORMATION

Chemistry C2407X

TTh

George Flynn

1:10 p.m.

All information contained in this handout can be found at the C2407 course website:

<http://www.columbia.edu/itc/chemistry/chem-c2407/>

PLEASE NOTE:

FOR STUDENTS IN FU-SEAS:

THE LAST DAY TO DROP THIS COURSE IS NOVEMBER 13, 2003

FOR STUDENTS IN COLUMBIA COLLEGE:

THE LAST DAY TO DROP THIS COURSE IS OCTOBER 7, 2003

- (1) Exams: Three (3) "hour" exams (75 minutes, 1 class period) will be given on the following
- Thursday, September 25, 2003 (covers material through lecture of 9/18/03)
  - Thursday, October 23, 2003 (covers material through lecture of 10/16/03)
  - Tuesday, November 25, 2003 (covers material through lecture of 11/18/03)

Note that there is generally a week between the end of the lecture material and each exam. I will actually announce in class the cut off for lecture material for each exam. The above is, however, approximately correct. The timing of the exam given during Thanksgiving week is a compromise among bad choices driven by a change (by one week) in the scheduling of the Thanksgiving Holiday by the U.S. Congress.

- (2) Recitations: There will be a recitation, Monday, 3-5 or 6-8 p.m., or Tuesday, 3-5 p.m., or Wednesday, 4-6 p.m., or Friday, 10 a.m.-12 noon or 2-4 p.m. These will be run by our graduate teaching assistants, Jennifer Inghrim (854-4964) ([jai2002@columbia.edu](mailto:jai2002@columbia.edu)), and Sean Moran (8468) ([sdm2007@columbia.edu](mailto:sdm2007@columbia.edu)). Use the phone registration system to sign up for these recitations. The course number for the recitations is C2409. Seven of these recitations are required and used to review for the class period exams described above. The other 4 weeks of the term, the

Chemistry C2407x  
Some Free Formulas for Exams

### Kinetic Theory of Gases

$$\text{Impacts/sec} = (1/6) (N/V) A c \quad \{ \text{Impacts/sec} = (1/4) (N/V) A c \}$$

$$\text{Force} = [2mc] [(1/6) (N/V) A c] = (1/3) (N/V) m c^2 A$$

$$\text{Pressure} = \text{Force}/A = (1/3) (N/V) m c^2 = [(2/3)] [(1/2) m c^2] [N/V]$$

$$pV = nRT = (N/N_0)RT = (N/N_0)(N_0 k)T = NkT$$

$$m/k = M/R$$

$$[(1/2) m c^2] = (3/2) kT \quad [(1/2) M c^2] = (3/2) RT$$

$$c_{\text{rms}} = (3kT/m)^{1/2} = (3RT/M)^{1/2} \quad c_{\text{ave}} = (8kT/\pi m)^{1/2} = (8RT/\pi M)^{1/2}$$

$$c_{\text{mp}} = (2kT/m)^{1/2} = (2RT/M)^{1/2}$$

$$c_{\text{rms}} = 1.37 \times 10^5 \text{ cm/sec} = 1.37 \times 10^3 \text{ meter/sec (for He at 300 K)}$$

$$\text{Effusion Rate: } R = (1/6) (N/V) A c \quad \{ R = (1/4) (N/V) A c \}$$

$$dw = -pdV \quad dE = dQ + dw$$

$$C_p = (dQ/dT)_p \quad C_v = (dQ/dT)_v$$

$$C_v = (3/2)R \quad C_p = (3/2)R + R \quad (\text{Atoms})$$

$$C_v = (5/2)R \quad C_p = (5/2)R + R \quad (\text{Linear molecules})$$

$$z = \pi \rho^2 c (N/V) \quad \{ z = (2)^{1/2} \pi \rho^2 c_{\text{ave}} (N/V) \}$$

$$\lambda = c/z = [\pi \rho^2 (N/V)]^{-1} = [\pi \rho^2 (pN_0/RT)]^{-1}$$

$$\{ \lambda = c_{\text{ave}}/z = [(2)^{1/2} \pi \rho^2 (N/V)]^{-1} = [(2)^{1/2} \pi \rho^2 (pN_0/RT)]^{-1} \}$$

$$\Delta N/N = (4\pi)(m/2\pi kT)^{3/2} c^2 \exp[-mc^2/2kT] \Delta c$$

### Binary Collision Model

$$\langle u_{\text{rel}} \rangle = (8kT/\pi\mu)^{1/2}, \quad \mu = m_a m_b / (m_a + m_b)$$

**Values of some physical constants**

Quantity	Symbol	Value
Avogadro's number	$N_o$	$6.0222 \times 10^{23}$
Planck constant	$h$	$6.6262 \times 10^{-27}$ erg-sec
	$h/2\pi$	$1.0546 \times 10^{-27}$ erg-sec
Boltzmann constant	$k$	$1.3806 \times 10^{-16}$ erg/molecu
gas constant	$R$	$8.3143 \times 10^7$ ergs/mole-de $1.9872$ cal/mole-deg K
speed of light	$c$	$2.9979 \times 10^{10}$ cm/sec
proton charge	$e$	$4.8032 \times 10^{-10}$ esu
electron mass	$m_e$	$9.1096 \times 10^{-28}$ g
atomic mass unit	$amu$	$1.6605 \times 10^{-24}$ g
Bohr magneton	$m_B$	$9.2741 \times 10^{-21}$ erg/gauss
nuclear magneton	$m_N$	$5.0509 \times 10^{-24}$ erg/gauss

**Source:** B. N. Taylor, W. H. Parker, and D. N. Langenberg, *Rev. Mod. Phys.*, **41**, p. 375, 1969

**Energy conversion factors**

	ergs	eV	cm <sup>-1</sup>	°K	kcal	kcal/
1 erg	1	$6.2420 \times 10^{11}$	$5.0348 \times 10^{15}$	$7.2441 \times 10^{15}$	$2.3901 \times 10^{-11}$	1.435
1 eV	$1.6021 \times 10^{-12}$	1	$8.0657 \times 10^3$	$1.1605 \times 10^4$	$3.8390 \times 10^{-23}$	2.311
1cm <sup>-1</sup>	$1.9862 \times 10^{-16}$	$1.2398 \times 10^{-4}$	1	1.4388	$4.7471 \times 10^{-27}$	2.858
1°K	$1.3804 \times 10^{-16}$	$8.6167 \times 10^{-5}$	$6.9502 \times 10^{-1}$	1	$3.2993 \times 10^{-27}$	1.986
1 kcal	$4.1840 \times 10^{10}$	$2.6116 \times 10^{22}$	$2.1066 \times 10^{26}$	$3.3009 \times 10^{26}$	1	6.022
1 kcal/mole	$6.9446 \times 10^{-14}$	$4.3348 \times 10^{-2}$	$3.4964 \times 10^2$	$5.0307 \times 10^2$	$1.6598 \times 10^{-24}$	1
1 atomic unit	$4.360 \times 10^{-11}$	27.21	$2.195 \times 10^5$	$3.158 \times 10^5$	$1.042 \times 10^{-21}$	6.275

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Department of Chemistry

212-854-4162

Chemistry C2407x, Fall 2003

3109 Havemeyer Hall

George Flynn

## Homework Assignment 1

### Kinetic Theory of Gases

Note that assignments are provided for both the 4<sup>th</sup> and 5<sup>th</sup> editions of the required text by Oxtoby. Where the editions differ, citations for the 4<sup>th</sup> edition appear in square brackets.

Required reading, no lectures: Oxtoby section 4.2, pp 96-98, [101-103] (pressure units), problems 4.5, 4.6, 4.9, 4.10; and section 4.3, pp 103-105, [108-110] (units for R)

Lectures cover pages 108-116, [113-123] in Oxtoby (Sections 4.5, 4.6), and pages 198-205, [206-214] (Sections 7.2, 7.3)

Do Oxtoby Chapter 4 Problems: 4.41-4.43; 4.48, 4.49 and 4.52, 4.53. In problems 4.52, 4.53 you may ignore the part of the question having to do with diffusion. Also do Oxtoby Chapter 7 Problems: 7.1, 7.2.

In addition calculate the collision frequency for:

- (a) a sample of oxygen at 1.00 atm. Pressure and 25<sup>0</sup> C
- (b) a molecule of hydrogen in a region of interstellar space where the number density is  $1.0 \times 10^{10}$  molecules per cubic meter and the temperature is 30 K.

[Take the diameter of oxygen to be  $2.92 \times 10^{-10}$  meter and that of hydrogen to be  $2.34 \times 10^{-10}$  meter.]

You must hand in solutions to Problems 4.6, 4.10, 4.42, 4.48, 4.52, 7.2 and the collision frequency problem above, on or before class on 9/18/03. Be sure to make a copy of your solutions from which to study.

### Binary Collision Model

Lectures cover pages 456-457, [472-473] in Oxtoby (Section 13.6), and pages 452-456, [468-472] (Section 13.5)

Do Oxtoby Chapter 13 Problems: 13.43, 13.44

EXC



# EL\* TUTORIAL

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The intersection of a column and row is defined as a **cell**. **Cells** are where one inputs data, usually one data value per cell. Valid data inputs can consist of characters, strings, numbers, dates, currency, or formulas. (Formulas will be discussed later.) A column letter and a row number reference one cell. For example, the first cell found at the intersection of the first column, denoted **A**, and the first row, **1**, is referenced as A1. When referencing cells, it does not matter whether the letter is capitalized, *i.e.* cell a1 is the same as cell A1. When referencing a block of cells (or **range** of cells), colons separate the beginning and the end cells for the range. For example, A3:A10 refers to the column of each cell from A3 to A10. B3:D6 refers to the block of cells which starts at B3 as the upper left-hand cell and ends with D6 as the lower right-hand cell.

### Inputting / Editing cells

Navigating around the cells can be done with the arrow keys, unless a cell is in edit mode. In edit mode, data can be entered, and it can be distinguished from other modes because a blinking cursor can be seen.

After data is entered, pressing the **Return** key enters the data into one cell, and moves the highlighted cell down 1 row. To edit a cell that already contains data, double-click on the cell, or select the cell and press the **F2** key.

The mouse is very important in Excel, as it is used to select a cell or range of cells. One click over a cell highlights it, while double-clicking allows editing of the cell. One click on a row or column index selects the whole row or column, respectively. If one holds down the mouse button and drags the mouse, a whole range of cells, rows, or columns can be selected.

Be wary of the cursor as it moves across the screen. While over the sheet, the cursor changes from an arrow to a crosshair. While over a line separating the column or row indices, the cursor changes to a line with 2 perpendicular arrows. Holding the mouse button while the cursor is in this form will change the column or row spacing and not select columns or rows.

*Example 1*

Try entering some data values into the sheet. Input **x** into cell A1, **y** into cell B1. Cells A1 and B1 will serve as axis labels in a graph for a later example. Fill cells A2:A6 with the values **1, 2, 3, 4, and 5** with one number per cell. Fill cells B2:B6 with the values **2, 4, 6, 8, and 10**, with one number per cell.

Excel has some features that allow for manipulation of data around the sheet. These features include **clear, copy, cut, paste, insert column/row, delete column/sheet, redo**, and **undo**. All these functions can be accessed under the **Edit** menu, with the exception of **insert** functions, which can be accessed under the **Insert** menu. Most functions also have keyboard shortcuts, a combination of keystrokes that accomplishes the same task. Shortcuts allow for more efficient data manipulation. Shortcuts are included, where applicable, after the function name below:

- **Clear contents (Del):** The clear menu has many options, but the one of interest is clear content, which clears the contents of the selected cells.
- **Copy (command-C):** The copy command copies the selected cells.
- **Cut (command-X):** The cut command copies the selected cells, and clears the contents of the cells at the same time. The cut command is used to move data.
- **Paste (command-V):** The paste command pastes copied or cut cells into the selected region. Be sure that the area you select as the target of the paste contains the same number of columns and rows as the original copied area. There are a couple of neat tricks that can be done with paste that will be explained later.
- **Insert:** The insert menu has the option to insert a column or row. When inserting either, it inserts a column or row before the selected area. If you select a column C, the new column appears to the left. If you are selecting a row 4, the new row appears above. You can insert multiple columns or rows by selecting an appropriate number of columns or rows before insertion. The new columns or rows also appear before the selected area.
- **Delete:** When deleting columns or rows, the column or row must be selected in entirety by clicking on the respective index. Unlike clear, delete removes the entire row or column.
- **Redo (command-Y):** Redo repeats the previous step or undoes the last undo.
- **Undo (command-Z):** Undo erases mistakes by removing the last changes on the sheet.

**Example 2**

Using the previous example, select the range of cells A1:B6. Press **Del** to clear content and **command-Z** to undo. Press **command-C** to copy the contents. Select the range C7:D12 and press **command-V**. A duplicate of the cells are seen. Select column B and under the **Insert** menu, select the **Columns** option. A new blank column B is there and the column of y values previously labeled B, is now labeled C. Select column B and under the **Edit** menu, select **Delete**. Select row 3 and under the **Insert** menu, select the **Rows** option. A new blank row 3 appears, and the column that was row 3 is now row 4. Select range A4:B7 and press **command-X**. Select A3:B6 and paste by pressing **command-V**.

Now try out other things.

Within one Excel file, one can have multiple sheets. When Excel opens, there are several blank sheets that are open. Tabs at the bottom differentiate them as Sheet1, Sheet2, and Sheet3, by default.

**File / Print functions**

Under the **File** menu, there are several items of interest:

- **New (command-N)**: Creates a new spreadsheet file.
- **Open (command-O)**: Opens an Excel file.
- **Save (command-S)**: Saves an Excel file, in Excel 98 format. There are two additional save features in Excel 98, **Save As...** and **Save as HTML.... Save As...** allows one to save an Excel file in another format, such as an earlier version of Excel, or as a plain text file. **Save as HTML...** allows one to save an Excel file as an HTML table readable web browsers.

**Note:** *Formatting may be lost upon conversion to other formats, including HTML. Also note that Excel 97 and Excel 98 can read the same files without loss of formatting.*

- **Print Preview**: Before printing your file, this function allows one to preview the printed file, to see it exactly as it will be printed. This is an important function because it allows one to check for proper pagination of the spreadsheet.
- **Print (command-P)**: Sends the selected print area to the printer. This will print all sheets in one file.

**Example 3**

Save your file to a floppy disk. Press **command-S** and save the file as *lines*.

Note: If you desire to use your disk in both Macintosh and Windows computers, save the file as *lines.xls*.

**III. Graphing****Creating XY (scatter) graphs**

1. From the **Insert** menu, select **Chart**. You should now see a chart wizard.

2. Under the **Standard Types** tab, select **XY (Scatter)**. From Chart Sub-Type, select either unconnected points (top) or points connected with straight (not smooth) lines (bottom left.) Press **Next**.
3. Under the **Data Range** tab, in the **Data Range:** field, click on the button to the right. Select all your data points to be included in the graph, including any axis labels. Under the **Series** tab, (if the data is not preselected for you) select the name of your y axis under Name. Do this by clicking on the button to the right of the name field, then click on the cell. Do the same for your X and Y values. Use the **Add** and **Remove** buttons to add or remove additional data series, or sets of y-axis data points. This allows one to plot multiple series that use the same x-axis. Press **Next**.
4. Add a chart title and axis titles, then press **Finish**.
5. Clicking on different areas of the graph highlight different components. The format of different components can be changed by selecting the first menu item under the **Format** menu. For example, highlight the data series by clicking on one of the data points. The first item under the **Format** menu is **Selected Data Series**, which brings up a menu appropriate for the data series.
6. Clicking on the chart also changes the menu item **Data** into **Chart**. The menu items under **Chart** open the same menus seen in the chart wizard. In addition, there is the option to **Add Trendline**, which allows one to calculate a linear or exponential fit.

#### *Example 4*

Using the data from the previous exercises, and the graphing instructions, construct a line graph using the column A as the x-axis data and column B as the y-axis data. Use row 1 as the axis labels.

Note when you place the mouse over a point in the graph, the coordinates of the point appear in a box over the point after a second. Using the graph from *Example 4*, the point (1,2) would show up in a small pop-up label when the cursor is over the first point.

To change the set of x or y values, either to remove or extend them, use the **Source Data...** option under the **Chart** menu. Under the **Series** tab, X and Y values can be modified.

### **Advanced functions (optional)**

#### Linear fit of graphs

To add a best-fit line, click a point on the graph to highlight all of them. From the menu, select **Chart**, then **Add Trendline**. Select Linear as your Type, then select the Options tab. In here, select Display Equation on Chart. Press OK. Now you should see a best-fit line, along with the equation.

## **IV. Formulas and Functions**

### **Formulas**

Formulas, specifically numeric formulas, are algebraic expressions consisting of numbers, cell references, mathematical symbols (+, -, \*, /, %) and functions. For example, a formula for a straight line could be  $2*x - 2$ , where  $x$  is a cell reference like A4, resulting in the formula,  $2*A4 - 2$ . Inputting formulas into Excel is the same as inputting cells, except an equal sign (=) precedes the formula. Inputting the formula  $2*A4 - 2$  will result in the string " $2*A4 - 2$ " rather than the intended result  $=2*A4 - 2$ , which causes Excel to calculate the formula using the

variable number located in the cell A4. When inputting formulas, it is important to remember the precedence of operations. Parentheses become extremely important!

Functions are similar to formulas, but compute a value that a normal algebraic expression cannot express, or express easily, such as the natural logarithm of a number. Functions are used in formulas just like another term. To compute 10 times the natural log of 6.03, the natural log function **LN(x)** is used, where **x** is a number or cell reference. The complete formula is **=10\*LN(6.03)**. The terms inside the parenthesis are function arguments, and can be numbers, strings, or cell ranges, depending on the function.

### SOME MATHEMATICAL EXCEL FUNCTIONS

EXP(x)	LN(x)	POWER(x,y)	LOG10(x)
Calculates $e^x$	Calculates $\ln(x)$	Calculates $x^y$	Calculates $\log(x)$

PI()	SQRT(x)	SUM(a <sub>1</sub> , a <sub>2</sub> , a <sub>3</sub> , a <sub>4</sub> ...) or SUM(a <sub>z</sub> , a <sub>y</sub> )
Calculates $\pi$	Calculates square root of $x$	Calculates sum over cell range, like A3:A7

**REMINDER: All formulas entered must be preceded by an equal sign =**

#### Filling Data Ranges

Many times in Excel, duplicate data has to be copied into other cells. Other times, a column must be filled with data of fixed intervals. These two actions can be done using the **Fill** option located under the **Edit** menu. Click and hold down the mouse button on the cell containing the value to be copied, and select the cells that will contain the duplicate data. After blocking out the area, go to the **Edit** menu, select **Fill**, and then the appropriate fill direction, which starts from the first cell selected. If you want to fill across two directions, like down and then right, the **Fill** option must be used again, but in the other direction.

You can also use copy and paste to duplicate data. Copy one cell value, then select any number of cells to copy to (it need not be contiguous with the original data), and then paste.

To fill a data series using an initial value and a constant interval, select the cell with the initial value. Go to the **Edit** menu, select **Fill**, and then **Series....** Under **Series in**, select **Columns**. Input a **Step value** and the **Stop value**. Press **OK**.

#### Copying and Pasting Formulas

When copying and pasting formulas, keep in mind that cell references are relative. This is useful for entering formulas. The y values in table 1, shown below, are obtained by using the formula  $x^2$ . To do this, the entry for cell B2 is **=A2\*A2**.

Copy cell B2 and paste it into cells B3 through B6. Note that the values in column B do correspond to  $x^2$  (i.e., B3 is A3\*A3, etc.) Keep this relative cell references in mind when pasting formulas.

	A	B	C
1	x	y	formula
2	1	1	A2*A2
3	2		
4	3		
5	4		
6	5		

Table 1

	A	B	C
1	x	y	formula
2	1	1	A2*A2
3	2	4	A3*A3
4	3	9	A4*A4
5	4	16	A5*A5
6	5	25	A6*A6

Table 2

*Example 5*

Using the data from the previous exercises, start to fill the rest of column A, in intervals of 1, to 100. Leaving the column label in B1, clear the data from column B. Type in cell B2,  $=2*A2+2$ . Copy this formula into cells B3:B101. Extend the graph to include these new x and y points.

Pick 2 points at random from the graph and calculate the slope. Does it match the formula?

**Defining names for absolute cell reference**

There are situations where cell references in formulas must be absolute, and not relative, so that cells references are constant upon pasting. This is done by defining a name for a particular cell. Defining names allows one to refer to the contents of a cell as a constant, and names can be used in place of cell references. Alternatively, one can use named cells as variables whereby changing its value can affect all cells that contain formulas with the variable. Let's give the cell C1 a value of 8.314. Select the cell and from the **Insert** menu, go to **Name** and **Define....** Under **Names in workbook:** type in the name for the cell, for example **gasconst**. Now a reference can be made to cell in any formula by typing the name out, like  $1.5*gasconst*A3$ . Upon copying this cell, the cell reference to column A changes relatively, but the gasconst term does not change even if the cell position changes.

**Getting help**

With Excel 98, there is a help system, which can be accessed by pressing the **F1** key or selecting **Microsoft Excel Help** under the **Help** menu. By typing in a question or term, you get information on the term or instructions on how to implement a function.