Lab partners:
Lab#1 Presentation of lab reports

The first thing we do is to **create page headers**.
In Word 2007 do the following: ***Insert***, in *header and footer* click on *page number*, *top of page*, scroll down to *page x of y*, *bold numbers*, *right* and click. Next, click on home, center paragraph, add the text: "Dr. Fritz Wilhelm, physics 120", "Lab 1: Use of Word and Excel", then go to the next line. Type **your own name**, and then **Phys120** and the **section number**. Last: *insert date*.

Type your last name and first name into the header. Then a space and the name of the lab: **Lab 1, Presentation of lab reports**. Then type Page # and click on the page sign on the menu bar. Then type of and click on number of pages.
Place the mouse symbol in the second row of the header and then click on the <u>date icon</u> in the **header menu**. This header will now show up on every page of your report. Evidently you have to change it every week with a new name for the lab. Everything else will remain the same.)

Save your work on disk.

In order to include proper Greek symbols we click on the **symbol icon**. Inside the symbol menu you find all symbols necessary. In order to work faster in the future, I suggest you assign a key to each common symbol. A good key is to choose Ctrl with the corresponding alphabetical letter:
Try it out. Create the following list of letters and assign the proper key to them.
α (alpha) Ctrl-a
β (beta) Ctrl-b
γ (gamma) Ctrl-g
ρ (rho) Ctrl-r (in physics used for density)
π (pie) Ctrl-p
Δ (delta) Ctrl-d (difference, uncertainty, Δx uncertainty in x, or change in x)

When it comes to typing formulas, we use the ***equation editor* *or Mathtype***

If any particular icon is not on your toolbar, click on ***help***, and choose equation editor. There you can find out how to put it on the toolbar. Here are the procedures: <u>Tools, customize, commands, insert:</u> now choose from the examples which one you want to use. Drag it to the toolbar to a space where a vertical line shows up.

As today's practice with Mathtype (equation editor) create the following formulas:

$$\sin\alpha = \frac{opposite\ side}{hypotenuse} = \frac{a}{c}$$

$$\cos\alpha = \frac{adjacent\ side}{hypotenuse} = \frac{b}{c} \quad \tan\alpha = \frac{\sin\alpha}{\cos\alpha} = \frac{a}{b}$$

Then try the following formulas, first in the regular Word editor:

The circumference of a circle C=2πr
The area of a circle A=πr^2

The power symbol here is a superscript. If it is not on the tool bar as $\underline{x}^2$ click on customize, then choose toolbars, format, scroll down until superscript appears and drag the icon to the toolbar, do the same with subscript.

Mathtype uses different fonts for formulas and regular text; here are the rules:
 Ctrl-shft-e will put you in text mode, Ctrl+ will put you in math mode.

volume of a sphere with radius r or diameter d: $V_s = \dfrac{4\pi}{3}r^3 = \dfrac{\pi d^3}{6}$

volume of a cylinder with radius r, height h, diameter d: $V_c = \pi r^2 h = \dfrac{\pi d^2 h}{4}$

When you leave Mathtype by clicking on the exit "x" (upper right corner) the text will appear in your Word file. **To edit a formula in Word, just double-click on the Mathtype formula.**

In physics we have the kinematic equations which describe the motion of an object under constant acceleration a. For example, the constant acceleration due to the attractive force of the earth is called g, and has the value of 9.80 m/s^2 =32 feet/ s^2. Whenever you want to drag (**move**) a formula from one part of the report to another, select it by double-clicking on a word, or by passing the mouse cursor over it (click and hold down). Then let go, click again and drag the object where you want it to be. If you want to **copy** the object, which means you want to leave it where it is, but create another similar object somewhere else, you drag while holding down the ctrl key. This is useful for copying complicated formulas.
Some of the kinematic formulas are:
$x(t) = \dfrac{1}{2}at^2$ the location of a point particle at the time t is given by this formula, which we read as

"x of t equals one half a t squared."
Now, type Heisenberg's uncertainty relationship:

$\Delta x \cdot \Delta p \geq \dfrac{\hbar}{2}$

Let us use subscripts:
$\Delta x = x_2 - x_1$

We have our own computer room (110) in which you can work from 9 to 6 every day. There are printers inside, so you can also print your reports.

Use of Excel

Many times we also use **Excel to do our calculations**. Excel is a **spreadsheet**, which performs its calculations in cells named like A1, C5 etc, where the letter corresponds to the column, and the integer to the row.

1. **Entering data:**

C5 is the cell located at the intersection of the fifth row with column C.

Open Excel and see for yourself. It may be a good idea to have both your Word and your Excel file open side by side. Locate cell C3 in your spreadsheet and type in <u>Numbers</u>. In C4 we want to put the number 1, in C5 3, in C6 5, and so on, that is, we add the number 2 to every previous number in the column. The elegant way to do this is by putting your mouse pointer into C5, then click = and enter c4+2, click enter and the number 3 appears in C5. Now we need to **copy the formula in cell C5** all the way down to C25. Select C5 by double clicking on it.

A	B	C	D	E
1				
2		1		
3		3		
4		5		
5		7		
6		9		
7		11		
8		13		
9		15		
10		17		
11		19		
12		21		
13		23		
14		25		
15				
16				

2. **Copying Data (Ctrl-c, ctrl-v)**

When a **little cross appear at the lower right end of the cell**, just drag it all the way down to cell C25 while holding down the ctrl-key, and let go. The last number in C25 should be 45. You can achieve the same thing by selecting cell C5, then copying the cell content into memory by ***Ctrl-c***. Then highlight all the cells from C6 to C25 by sweeping over it with the mouse pointer, holding down the left key. Then paste by clicking ***Ctrl-V***. Both copying and pasting could also be done by using the ***Edit*** key on the tool bar. ***Click on Edit.***

If you get a message saying Macro disabled, follow the suggestions of MS, or restart Word and check on "enable macros." If this does not work either use Edit/copy and Edit/paste on the Menu bar.

3. **Copy, paste, paste special**

When you open the Edit icon, you find that there is also a ***paste special*** key, which allows you to **paste formulas, values, formatting separately**.

You would paste **values only** for example if you don't want to copy the formula.

4. Using data in a column (like C) and create new data in (D)

Now let us take the square root of the numbers in column C. For that, first type Square root into cell D3. The word will probably not fit. Move the mouse cursor all the way up into the gray top bar with the letters A, B, C in them.

When you move the mouse cursor over a vertical dividing line a double sided arrow appears. Hold down the left key and drag the dividing line to the right until the column has the right size.

Now go to D4 and select the cell by left-clicking on it. Type **=sqrt(c4)**. *(If your data are in a different cell-location use that correct reference!)* Instead of typing "c4" you can also click on c4. Then copy this formula **=sqrt(c4)** all the way down to D25 by any of the methods we just learnt. Excel automatically fills in the correct cell row-number. Once you are done, all the square roots appear. You can double check that the square root of 25 is 5, as expected.

5. Useful and important stuff:

Excel interprets the following symbols as follows:

+ plus, - minus,

 * multiply, / divide,

^5 raise to the power of 5,

pi() number π

E-6 is 10^{-6}

Excel will interpret letters as functions only if they are preceded by an = sign.

=sqrt(5) or =sqrt(c10) which will result in the calculation of the square-root of the number in c10.

A function must contain the argument or reference enclosed in parentheses (…).

Once you open the first parenthesis, you can insert the cell by clicking on it.

Many mathematical functions have their intuitive names, but can always be found in the tool bar, by clicking on the icon **f$_x$**

If you want to open a **new work sheet**, click on *INSERT* in the toolbar, and then click on *Worksheet*. You can rename your worksheets by right-clicking on their label at the bottom of the page.

6. Correct number of significant figures:

The results may show 7 or eight significant figures. If the number does not fit into your cell, move the mouse cursor to the upper boundary between column D and E. A horizontal double arrow appears by means of which you can expand the width of the column to the desired value.

We generally do not want more than 3 or four significant figures.

Now, let us reduce the number of decimals in the square root column to 3 significant figures.

Select cells D4 to D25. Click on *format, cells, number, scientific, decimal places, 2.* All values now show up in scientific notation with three significant figures. An important note on significant figures: If not otherwise specified, use three significant figures for your calculations by *formatting the cells to scientific notation with two significant*

figures.   To format them with one significant figure, use scientific notation with 0 decimals.

Sometimes, when you put a fraction into a cell like1/60 Excel interprets this as a date. In that case, select the column, click on *format, cells, number, scientific, decimal places, 2*. This will format the numbers in the selected area correctly. You can also choose *format, cells, number, fraction.* Reenter your number 1/60 etc. and you will see the expected number displayed in Excel.

7. Other formatting

Let us now make the header columns a bit nicer. Move the mouse cursor to the left-most gray column with the number 3 in it. Click, and an arrow pointing to the whole right row 3 appears. We want to format this row. Click on Format, then cells., font, size 14, color red, or which ever formatting style you like.

8. Moving stuff between Excel and Word

Let us call the values in column C, **x**. Type an x into the top cell, click on **B** for bold in the toolbar, then **increase the font to 14**, then **center the cell**.

If we want to create a formula for use in Excel, like $\sqrt{x}$, type the formula in Word, using Mathtype (or equation editor) and copy (Ctrl-c) from Word, and paste (Ctrl-V) in Excel. Have both programs open and move between them by *Alt-tab*.

Alternative method: In Excel click on *Insert, Object, equation editor.*

Now, let us move the whole area C3 to D25 from Excel into Word.

Select that area with your mouse cursor (click in the upper left corner, sweep to the lower right corner while holding down the button; let go and the whole area now shows with a selected frame around it), type Ctrl-c, move to Word by *Alt-tab*, position the cursor where you want the table to appear and click ctrl-v. Alternatively, you can choose *edit* on the toolbar. Under *paste special* choose *paste as Excel spreadsheet*. Option available only under Office XP.

To tell word how to position the picture or spreadsheet, right-click on a general area and then click on **table properties**. You can tell Word to allow text to show on any side of the table. You need to experiment with these options.

9. Graphing a function

To graph a function, select two or more columns. Select one column, then hold down the ctrl key and select the other column(s).

The x-values, which will appear on the horizontal axis, should be in the left column. The function f(x)=y is the column(s) to the right. (You can plot several graphs simultaneously, if they have the same x values. To graph the linear function, I have inserted the x-values in the column to the left of the function values. Select both columns and click on the *graphing icon* on the toolbar. Select *scatter plot, first option*. **Check that the x values appear on the horizontal axis**. If not you must tell Excel. If the x and

y columns are not adjacent to each other, hold down the ctrl-key why selecting the y column(s).

x	$\sqrt{x}$	X^2	y=2x+5
1	1.00E+00	1	7.00E+00
3	1.73E+00	9	
5	2.24E+00	25	
7	2.65E+00	49	
9	3.00E+00	81	
11	3.32E+00	121	
13	3.61E+00	169	
15	3.87E+00	225	
17	4.12E+00	289	
19	4.36E+00	361	
21	4.58E+00	441	
23	4.80E+00	529	
25	5.00E+00	625	

Then assign the labels for the graph and the axes. After that choose **_add trend-line_**. Make sure you choose <u>linear</u>, or <u>polynomial</u>, depending on what you expect. In our first case choose linear (first option). Under the **option** key select **_print equation on graph, and R^2_**

You can make a graph larger or smaller by clicking on a general area in the graph and dragging the corner points diagonally. If you right click on the graph, a formatting menu will appear. Below you see a graph for the squared function above. You must tell Excel where the data points are. Select the x column data points (without the letter x cell!!!!!) by mousing over them, then **hold down the CTRL key and select the data in the square column**. When you release the mouse key, both columns must be designated. Click on the graph icon on the tool bar, choose scatter plot, first option, and proceed.

Squared function

$y = x^2$

$R^2 = 1$

◆ Series1

— Poly. (Series1)

y

x
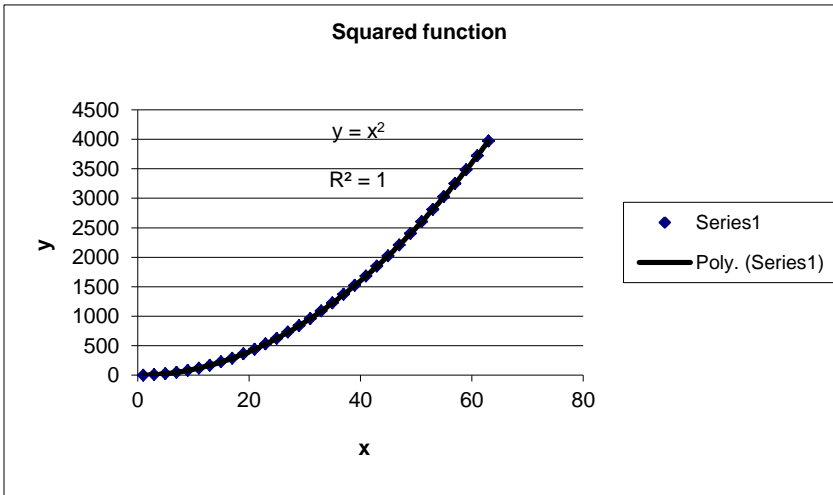
If you want to modify your graph layout, labels, formats, go **back to Excel** and **right-click on the general graph area**. If you want to add a trend-line **right-click on a graph data point**, and follow the instructions.

To repeat: To insert a graph or column from Excel into Word use copy (Ctrl-c) and paste (Ctrl-v). It is helpful to have both files open. You can move from one file to the other by using the key **_Alt-tab_**.

x-values   y-values

x-values	y-values
2.478E+01	3.231E+00
2.541E+01	4.479E+00
2.573E+01	5.128E+00
2.615E+01	5.969E+00
2.738E+01	8.425E+00
2.799E+01	9.641E+00
2.869E+01	1.104E+01
2.913E+01	1.194E+01
2.941E+01	1.248E+01

The **lab report for next week** consists in creating a report with the correct header as indicated at the beginning of the class. It must contain data and graphs for the following x-values: from 0 to 20 with 0.5 increments: linear graph y=2.7x+1, quadratic: y=1.5x^2+2x-3, and the **graph for the 9 data points above**. (Four graphs altogether.) Each graph must include a **trend-line, the and the equation of the graph**. The lab number is 1a. Its title is: **Creating a graph with Excel.**
In addition, copy this current file to your disk, Print it out to keep as a reference.

Optional: Using drawing tools for pictures etc.:
Click on Tools, Customize, Toolbars and choose select standard, plus format, plus drawing.
Let us now draw a triangle:

Right triangle.

β

c

a

α

b

γ
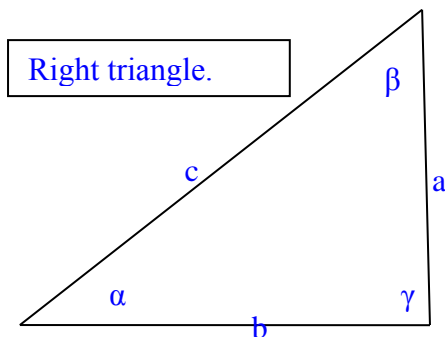
Click on the triangle and on format drawing canvas. Under the advanced icon, click on word wrap, and pick your choice. I have chosen largest side, left justify.

Next we want to add text boxes to the drawing. On the drawing menu, click on the text box. Move your cursor inside the text box and type something. Like right triangle. In order to include angle symbols you must create a text box for each one of the angles, and insert the proper symbol. After that we reformat the text box to no fill color, and no lines.