MINISTRY OF AGRARIAN POLICY AND FOOD OF UKRAINE

Kharkiv Petro Vasylenko National Technical University of Agriculture

Methodological guidelines

Using Microsoft Word 2016

Part 4

for individual work and laboratory work of disciplines «Informatics»,
«Informatics and information technologies»,
«Information systems and technologies»,
for students with learning in a foreign language

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Methodological guidelines are intended to assist students in studying Informatics in English, both in the classroom and individually.

Laboratory Work 4

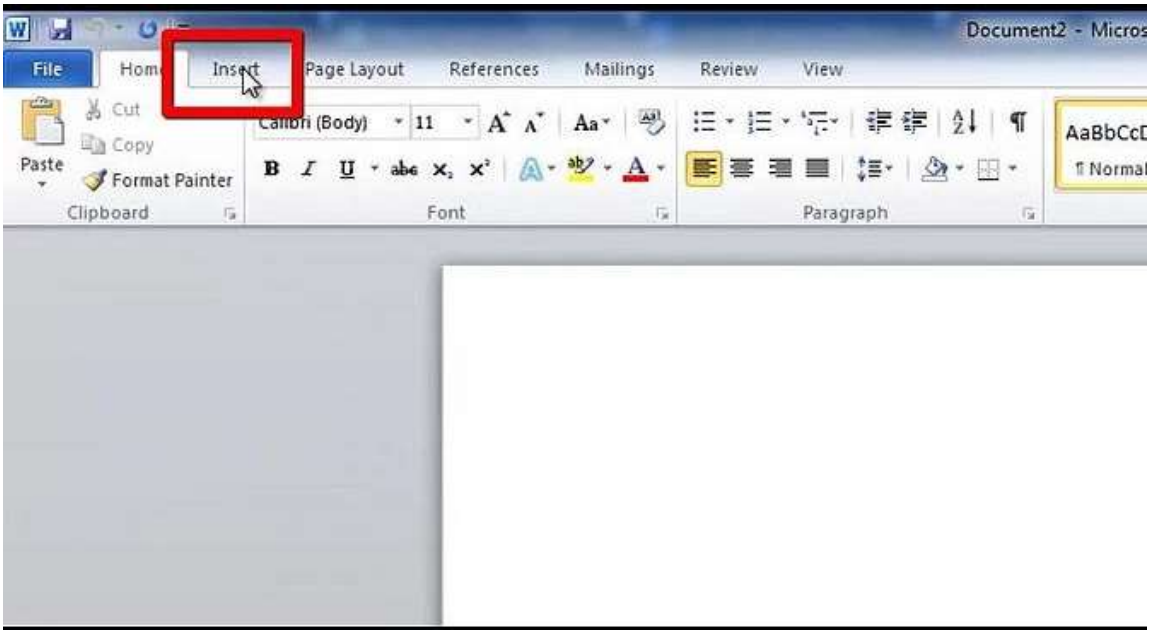
Objective: obtain skills in creating equations in Microsoft Word.

I. How to perform the laboratory work

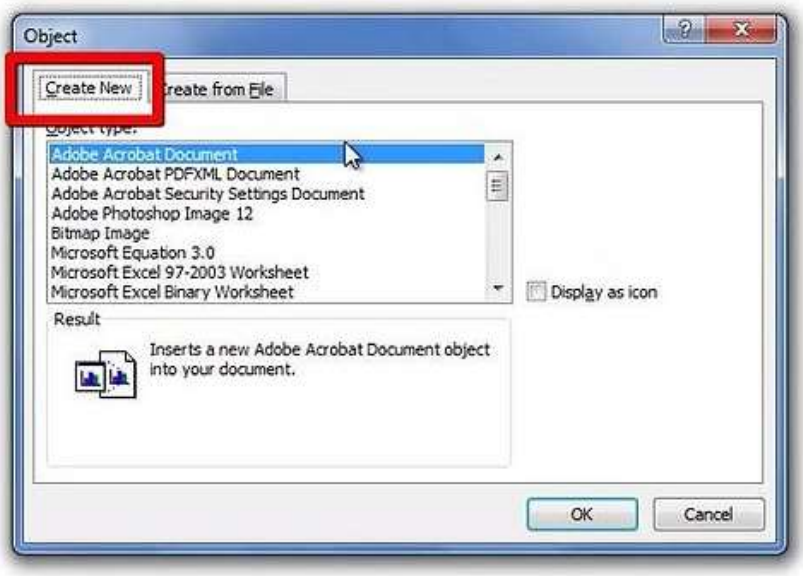
To insert equations in Microsoft Word may to use two different formula's editors: Microsoft Equation or MathType.

Method 1

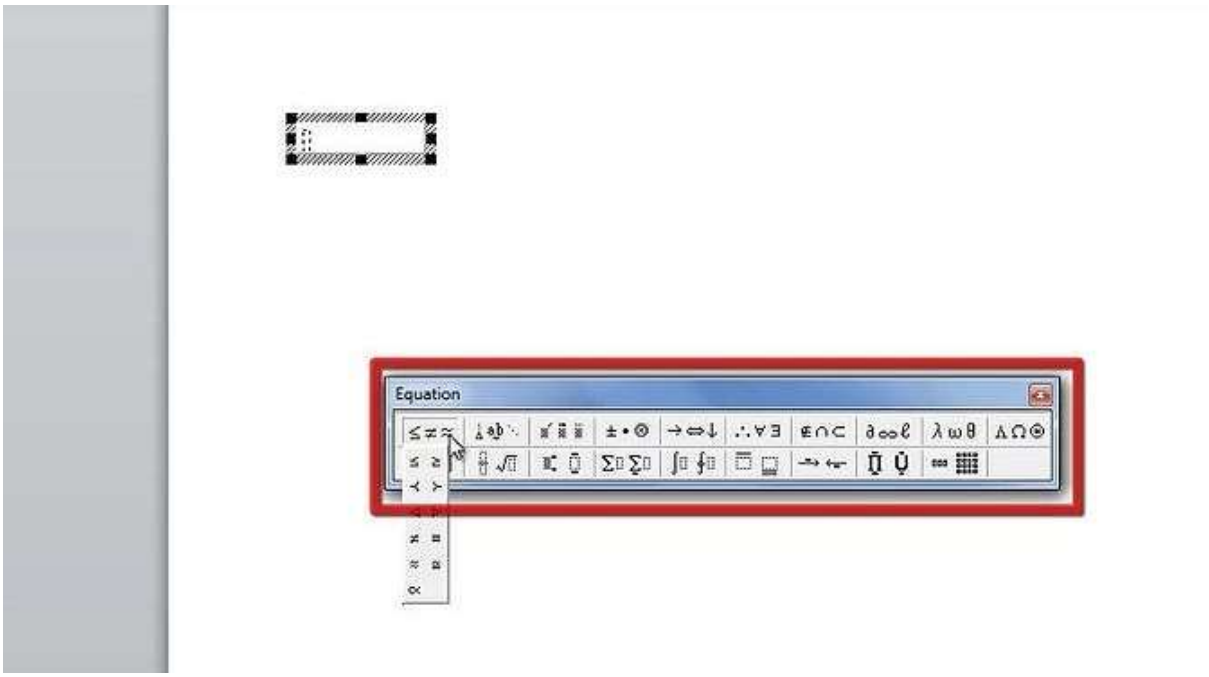
1. Select the Insert ribbon bar.



2. Go to Insert > Object



3. On the "Create New" tab select Microsoft Equation 3.0

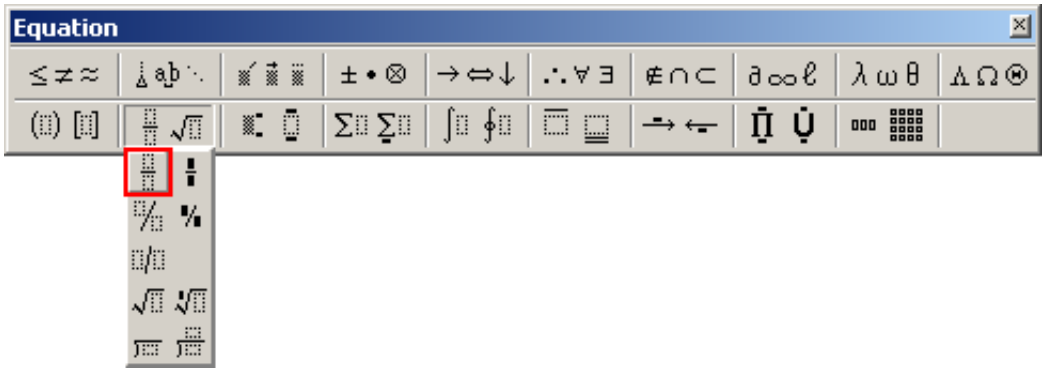


4. Start building your equation using the equation toolbar.

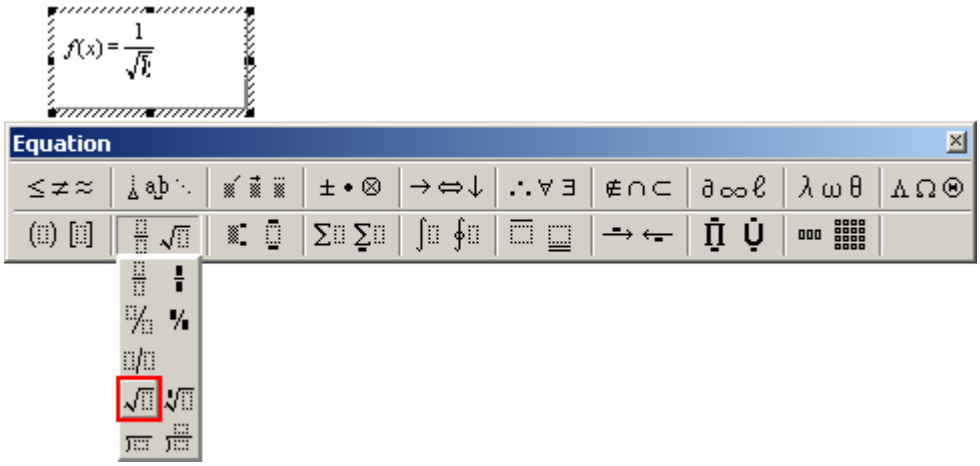
How to insert an equation with fractions, square roots and exponents

This tip display how to insert an equation for example, the normal, or Gaussian distribution

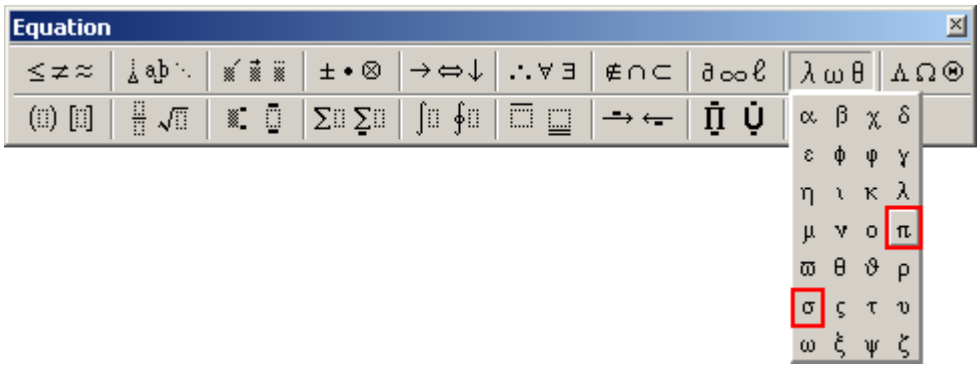
1. In **the Equation Editor** enter ***f(x)=*** and then select **Full-size vertical fraction** in the**Fraction and radical templates** group on the **Equation** toolbar:



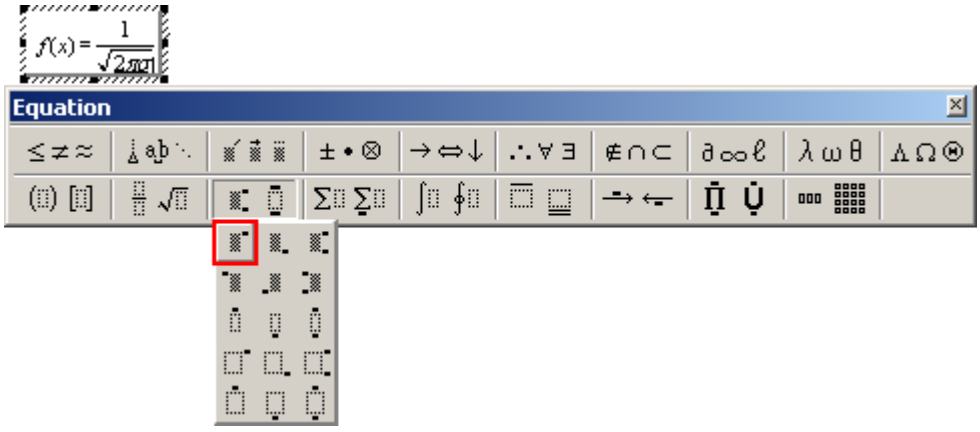
2. Enter ***1*** in the top of this template and in the bottom choose **Square root** in the **Fraction and radical templates** group on the **Equation** toolbar:



3. Enter ***2*** and then choose $\pi\sigma$ in the **Greek characters (lowercase)** group on the**Equation** toolbar:



4. Select **Superscript** in the **Subscript and superscript templates** group on the**Equation** toolbar:



Enter ***2*** in the **Superscript** field.

5. In the left of your formula enter ***e***, choose **Superscript** and then enter "**-**" and choose again **Full-size vertical fraction** and **Superscript** to finish your equation:

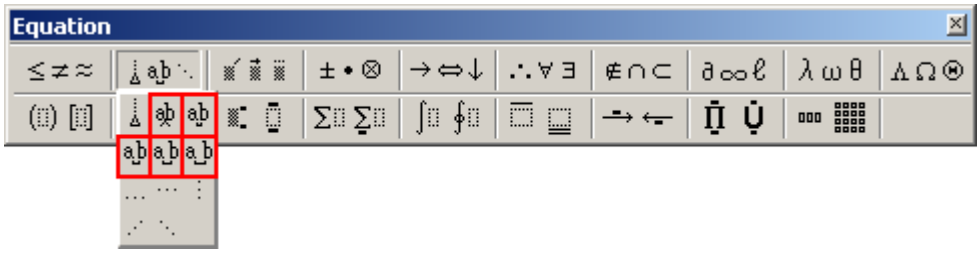
$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}},$$

Adjusting spacing and alignment in an equation

*The **Equation Editor** automatically handles formatting, nonetheless, you can manually adjust the spacing and alignment of equations.*

Word 2003 proposes three ways to adjust the spacing and alignment of equations:

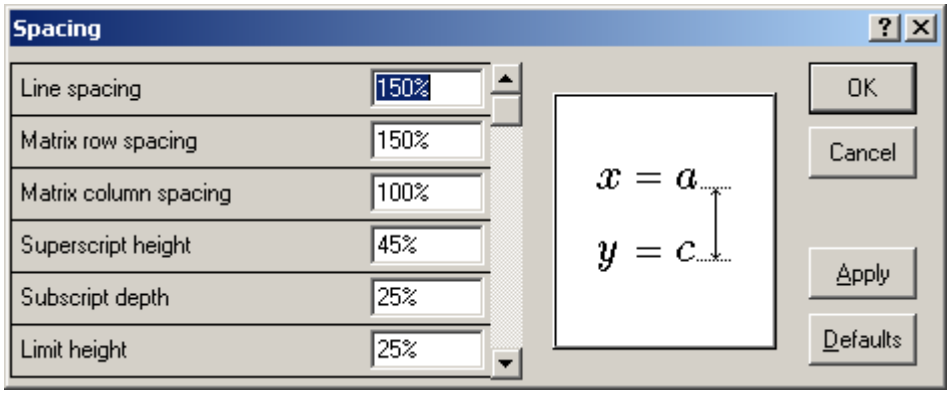
- Use the **Spaces and ellipses** button on the **Equation** toolbar:



  With this button, you can include spaces that act like characters, taking up room from zero length to the equivalent of a quad space:

  - Zero space - **Shift+Spacebar**
  - 1-point space - **Ctrl+Alt+Spacebar**
  - Thin space (one-sixth em) - **Ctrl+Spacebar**
  - Thick space (one-third em) - **Ctrl+Shift+Spacebar**
  - Em space (quad) - no shortcut key

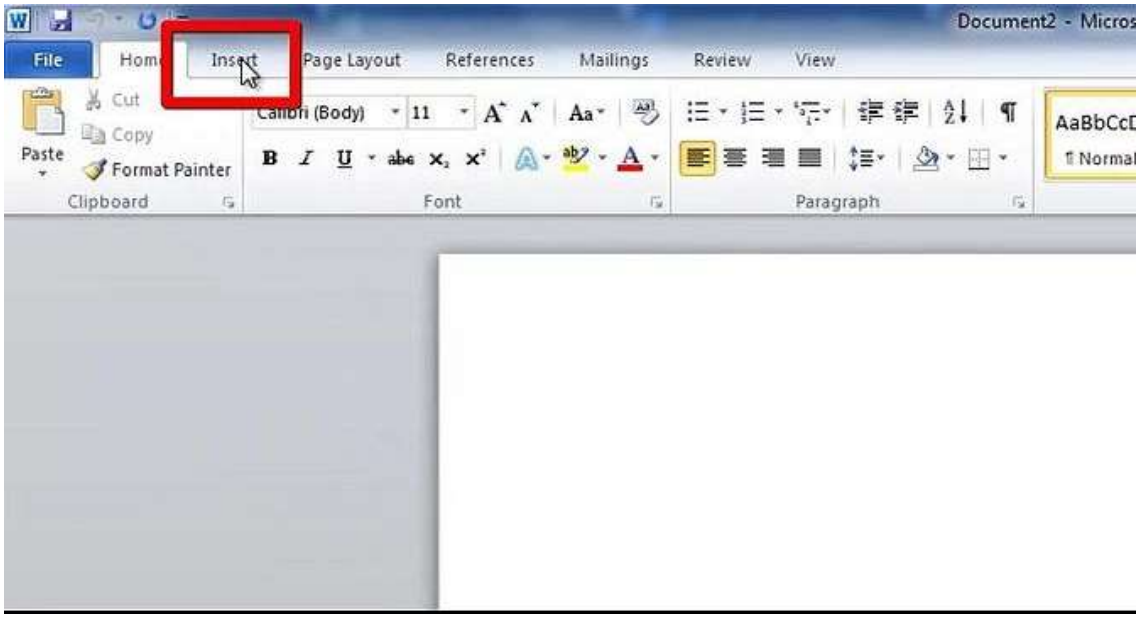
- When **Equation Editor** is open, you can choose **Format -> Spacing** to display the**Spacing...** dialog box:



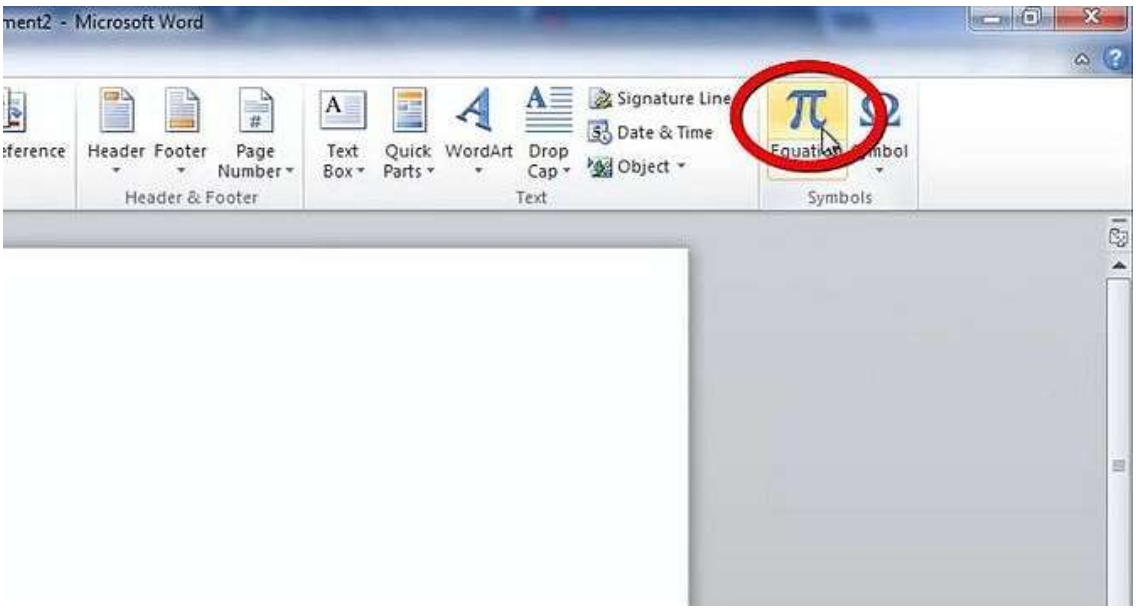
With this dialog box, you can adjust line, matrix, subscript, and superscript spacing.

- The final method, called *nudging*, is more precise. Select the item that you want to adjust, hold down the **Ctrl** key, and then click the arrow pointing in the direction that you want the item to move. The selected item moves one pixel per click.

Method 2



1. Select the **Insert ribbon bar.**



2. On the very right hand side, either select the "Equation" button or pull it down for more options.

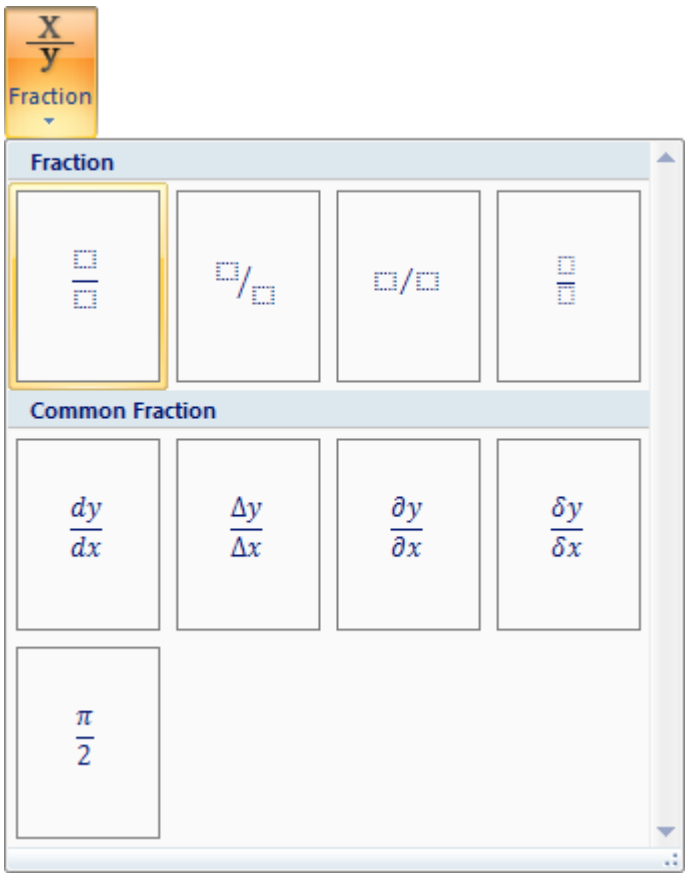
To insert, for example, the normal, or Gaussian distribution, do the following:

In the ***Professional*** present:

1. In your own equation enter ***f(x)=***.

2. On the **Equation Tools Design** tab, in the **Structures** group, click the **Fraction** button:

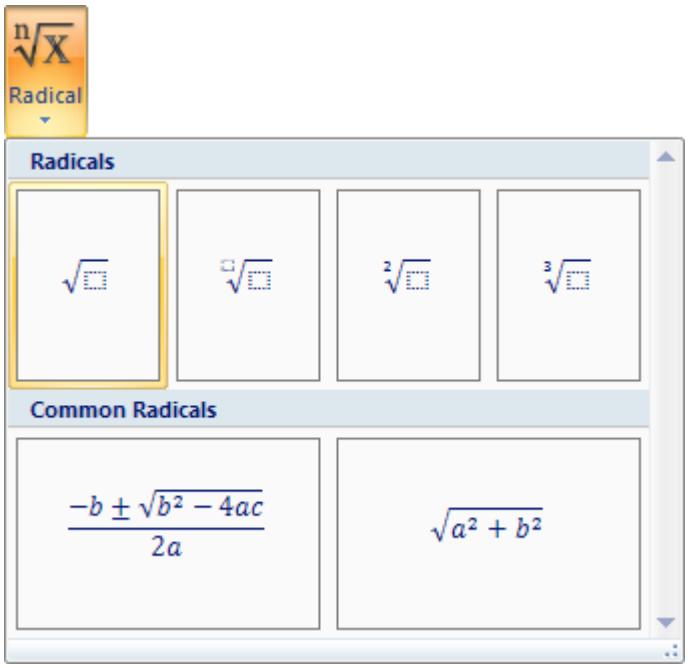
In the **Fraction** list choose **Stacked Fraction**:



3. Enter ***1*** in the top of your fraction.

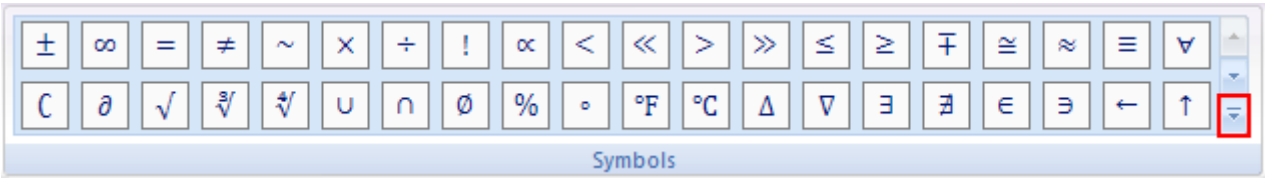
4. In the bottom of your fraction, do the following:

4.1. On the **Equation Tools Design** tab, in the **Structures** group, click the **Radical** button. In the **Radical** list choose **Square root**:

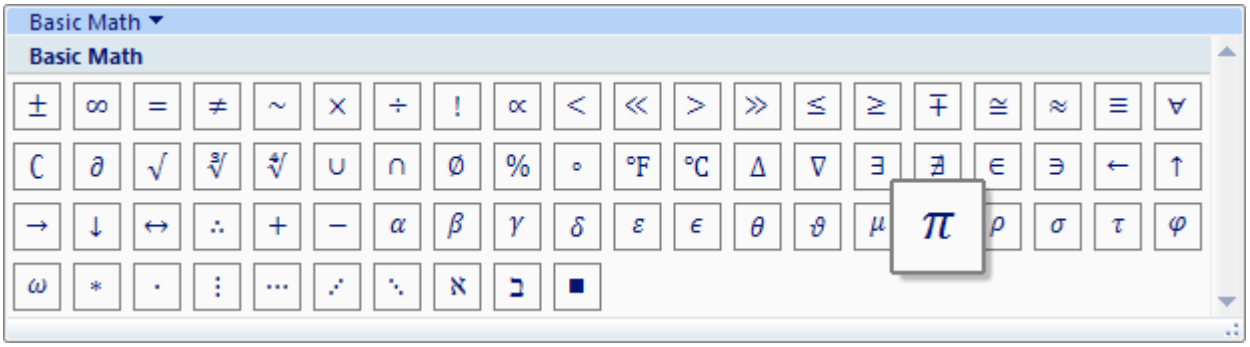


4.2. Enter ***2***.

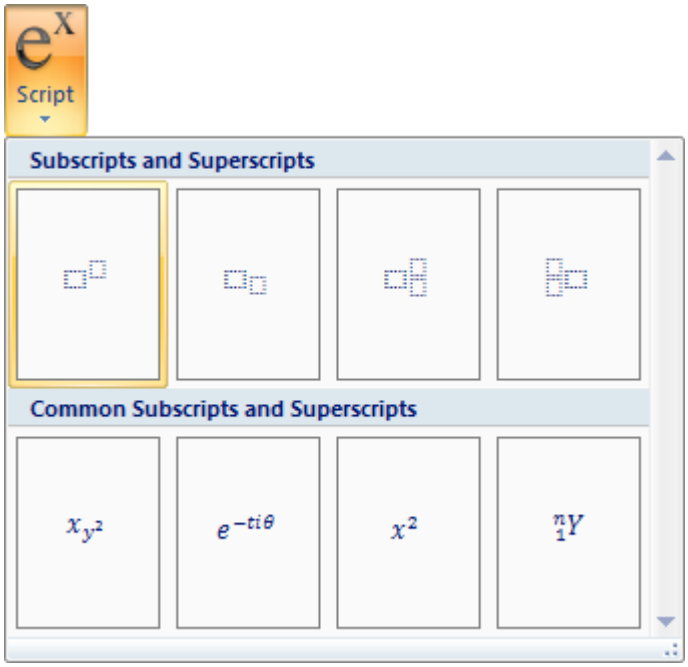
4.3. On the **Equation Tools Design** tab, in the **Simbols** group, click the **More** button:



In the list of symbols choose:



4.4. On the **Equation Tools Design** tab, in the **Structures** group, click the **Script** button. In the **Script** list choose **Superscript**:



4.5. In the base box of script choose σ.

4.6. In the upper right box of script enter ***2***.

5. In the left of your formula choose **Script** again to enter ***e*** in the base box, in the upper right box enter **-** and choose again **Fraction** etc.:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

In the ***Linear*** present:

1. In your own equation enter ***f(x)=1/***.

2. On the **Equation Tools Design** tab, in the **Simbols** group, choose $\sqrt{}$ or simply***sqrt***.

3. In the brakets enter ***2*** π (or ***pi***), σ (or ***sigma***) and ^***2***:

$$f(x) = 1/\sqrt{(2\pi\sigma^2)}$$

Then you enter a space key, this linear formula transformed to the professional format:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}}$$

4. Enter ***e^(-(x-*** μ (or ***mu**), ***)^2/(2,*** σ (or ***sigma***) and then ^***2))***:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e\text{^}(-\frac{(x-\mu)^2}{2\sigma^2})$$

Then you enter a space key, second part of your linear formula transformed to the professional format:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

II. Tasks to perform.

1. Open Microsoft Word.
2. Create the new document.
3. Create the equations at the bottom, using methods 1 and 2.

$$\sum_{k=0}^{n} kr^k = \sum_{k=0}^{n} k(r)r^{k-1}$$

$$= r\sum_{k=0}^{n} kr^{k-1}$$

$$= r\frac{d}{dr}\sum_{k=0}^{n} r^k$$

$$= r\frac{d}{dr}\frac{(1-r^{n+1})}{1-r}$$

$$= r\frac{(n+1)r^n(1-r)-(1-r^{n+1})}{(1-r)^2}$$

$$= r\frac{(n+1)r^n}{1-r} - r\frac{1-r^{n+1}}{(1-r)^2}$$

$$\frac{5}{9}(F-32) \quad \frac{2Z^3+1}{3Z^2} \quad \sqrt{\frac{L}{2G}} \quad \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \quad \frac{|A-B|}{|A|+|B|} \quad A\left(\frac{1-R^N}{1-R}\right) \quad P\left(1+\frac{R}{12}\right)^{12N}$$

$$\frac{-B+\sqrt{B^2-4AC}}{2A} \quad \sqrt{(X_1-X_2)^2+(Y_1-Y_2)^2} \quad e^{-N}N^N\sqrt{2N\pi}$$

$$\sqrt{\frac{1}{LC}-\left(\frac{R}{2L}\right)^2} \quad \frac{2A_1\left(\sqrt{H_1}-\sqrt{H_2}\right)}{CA_0\sqrt{2G}} \quad A\left[1+\sqrt{1-B\left(\frac{D}{LF}\right)^2}\right]$$

$$MM' = \begin{pmatrix} \det(M) & m_{1,2} & m_{1,3} & \dots & m_{1,k-1} & 0 & \\ 0 & m_{2,2} & m_{2,3} & \dots & m_{2,k-1} & 0 & \\ 0 & m_{3,2} & m_{3,3} & \dots & m_{3,k-1} & 0 & \\ \vdots & \vdots & \vdots & & \vdots & \vdots & \vdots \\ 0 & m_{k-1,2} & m_{k-1,3} & \dots & m_{k-1,k-1} & 0 & \\ 0 & m_{k,2} & m_{k,3} & \dots & m_{k,k-1} & \det(M) & \end{pmatrix}$$

Inverse of a matrix:

If $|A| \neq 0$, then $A^{-1} = \frac{1}{|A|} \times (adj)A$

$$AA^{-1} = A^{-1}A = 1$$

$$\left(A^{-1}\right)^{-1} = A$$

$$(AB)^{-1} = B^{-1}A^{-1}$$

$$(A_1 \ldots A_n)^{-1} = A_n^{-1} \ldots A_2^{-1} A_1^{-1}$$

$$\left(A^1\right)^{-1} = \left(A^{-1}\right).$$

$$(kA)^{-1} = \frac{1}{k} A^{-1} \; if \; k \neq 0$$

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $|A| \neq 0$, then A^{-1}

$$= \begin{bmatrix} \frac{d}{ad-bc} & \frac{-b}{ad-bc} \\ \frac{-c}{ad-bc} & \frac{a}{ad-bc} \end{bmatrix}$$

$$\int_0^\infty \mathrm{d}x_1 \, x_1 \int \mathrm{d}y_1 n_{\mathrm{qu}}^{(2)\mathrm{T}}(\mathbf{r}_1, \mathbf{r}_2) = [1 - \exp(-2x_2^2/\lambda^2)] \exp(-2x_2^2)$$

$$\times \left\{ -n^2\sqrt{2} \int_0^\infty \mathrm{d}t \left[\frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2} + \sqrt{\pi}\, t \frac{\exp(-t^2 + t x_2 2\sqrt{2})}{1+\Phi(t)} \right] \right.$$

$$+ \lambda^2 n^2 \sqrt{2} \int_0^\infty \mathrm{d}t \, \frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2}$$

$$- \lambda n^3 2\sqrt{2}\pi \int_0^\infty \mathrm{d}t \left[\frac{\exp(-3t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^3} + \sqrt{\pi}\, t \frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2} \right]$$

$$- \lambda^2 n^4 3\sqrt{2}\pi^2 \int_0^\infty \mathrm{d}t \left[\frac{\exp(-4t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^4} + \sqrt{\pi}\, t \frac{\exp(-3t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^3} \right]$$

$$\left. - \lambda^2 n^3 \frac{2}{3}\sqrt{2\pi} \int_0^\infty \mathrm{d}t \, t \left[\frac{\exp(-3t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^3} + \sqrt{\pi}\, t \frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2} \right] \right\}$$

$$- \lambda^2 n^2 \frac{\sqrt{2}}{6} \exp(-2x_2^2) \int_0^\infty \mathrm{d}t \, \frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2}$$

$$+ \left\{ -\lambda^2 n^2 \frac{\sqrt{2}}{24} \frac{\partial^2}{\partial x_2^2} - n^2\sqrt{2} \exp(-2x_2^2/\lambda^2) x_2 \frac{\partial}{\partial x_2} \right\}$$

$$\times \left\{ \exp(-2x_2^2) \int_0^\infty \mathrm{d}t \left[\frac{\exp(-2t^2 + t x_2 2\sqrt{2})}{[1+\Phi(t)]^2} \right.\right.$$

$$\left.\left. + \sqrt{\pi}\, t \frac{\exp(-t^2 + t x_2 2\sqrt{2})}{1+\Phi(t)} \right] \right\} + \ldots .$$

$$\begin{aligned}
\sigma_{X_1X_1} &= EX_1^2 - \mu_1^2 \quad \text{with} \\
EX_1^2 &= \int_0^1 \int_0^1 x_1^2 \left(\frac{1}{2}x_1 + \frac{3}{2}x_2\right) dx_1 dx_2 = \frac{1}{2}\left[\frac{x_1^4}{4}\right]_0^1 + \frac{3}{4}\left[\frac{x_1^3}{3}\right]_0^1 = \frac{3}{8}
\end{aligned}$$

$$\begin{aligned}
\sigma_{X_2X_2} &= EX_2^2 - \mu_2^2 \quad \text{with} \\
EX_2^2 &= \int_0^1 \int_0^1 x_2^2 \left(\frac{1}{2}x_1 + \frac{3}{2}x_2\right) dx_1 dx_2 = \frac{1}{4}\left[\frac{x_2^3}{3}\right]_0^1 + \frac{3}{2}\left[\frac{x_2^4}{4}\right]_0^1 = \frac{11}{24}
\end{aligned}$$

$$\begin{aligned}
\sigma_{X_1X_2} &= E(X_1X_2) - \mu_1\mu_2 \quad \text{with} \\
E(X_1X_2) &= \int_0^1 \int_0^1 x_1x_2 \left(\frac{1}{2}x_1 + \frac{3}{2}x_2\right) dx_1 dx_2 = \int_0^1 \left(\frac{1}{6}x_2 + \frac{3}{4}x_2^2\right) dx_2 \\
&= \frac{1}{6}\left[\frac{x_2^2}{2}\right]_0^1 + \frac{3}{4}\left[\frac{x_2^3}{3}\right]_0^1 = \frac{1}{3}.
\end{aligned}$$

4. Save document in your work folder.
5. Close document.
6. Close Microsoft Word.

III. Checklist

1. How to launch the Microsoft Equations?
2. How to insert an equation with fractions, square roots and exponents in Microsoft Equations and MathType?
3. How to adjust spacing and alignment in an equation?
4. How to return in main document from Microsoft Equations?
5. How to launch the MathType?
6. How to insert the Greek symbols in formulas?
7. What is the main difference between inserting formulas by Microsoft Equations and by MathType?

Educational edition

METHODOLOGICAL GUIDELINES

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Part 4

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