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Electronic-Math-Documents

This website provides Information for Creating Electronic Documents, with High Quality Mathematical Notation, Text, and Graphics: Created by David Alderoty © 2012. To contact the author use this e-mail address: David@TechForText.com, or left click on the link below for a website communication form.

Link for a Website Communication Form

This website is a 19,000 word e-book, and it was primarily written for individuals that create electronic documents with mathematics, such as developers that create: websites, e-books, or computer programs that have mathematical notation. The book might also be useful for students, and it is provided free of charge on this website, as well as in the alternative downloadable file formats listed below:

The files can take several minutes or longer to download.

1) If you want a PDF version of this e-book left click here.

2) If you want a XPF version of this e-book left click here.

3) If you want this e-book in the Microsoft Word 2007-2010 file format (with the file extension .DOCX left click here.

4) If you want this e-book, with the same layout used for the main website, in the Word DOCX file format, left click here.

5) If you want to view this e-book with the older versions of Microsoft Word (in the .DOC file format) left click here.

6) If you want a zipped folder, with a number of versions of this e-book, including all of the above, left click here. Files must be removed from the folder before they are used.

This e-book contains the same information as the main website, (www.TechForText.com/Electronic-Math-Documents) but some of the graphics are slightly different in this e-book.

The main website is not printer friendly, but the downloadable versions of this e-book, presented above, can be printed, (with the exception of the fourth and sixth item on the list). However, keep in mind that this is a 19,000 word e-book that contains a large number of colorful graphics, and mathematical expressions.

In addition, the primary focus of this e-book is lost in a printed copy, because it contains hyperlinks to computer programs, and resources on the Internet, which are not functional in hardcopy. However, most of the graphics are in Chapter 5, and all of the computer programs linked to this e-book are in Chapter 6. Most of the remaining material can be comprehended in a hardcopy format.

This e-book is on one long page. Thus, you can scroll down or up with the arrow keys or the mouse to go from one section of the book to another. Alternatively, you can use the hyperlinked table of contents of this e-book, by left clicking on a chapter, section, or subsection that you want to read. The hyperlinked table of contents is on the bottom of the page.

**If you want to go directly to the hyperlink
Table of Contents left click on these words.**

It is recommended that you view this e-book with a wide screen setting, usually listed as: Page Width, Fit Width, Fit to Screen Width. The above is the default setting, and you probably will not have to make any readjustments. If you find that the print is too large, try the other settings on your software, which might be listed as: Fit Height, One Page, Fit to Page Height, or Zoom.

Chapter 1) Creating High-Quality Electronic Math Documents and Related Concepts

Section 1) This Website Will Help with the Challenges Of Creating High-Quality Electronic Math Documents

The information in this e-book is presented in a series of chapters, sections, and subsections, which are listed in a hyperlinked table of contents. Each section is written more or less as an independent article. Thus, in most cases you will probably understand the material even if you read the sections out of sequence, or just read one section.

This e-book contains hyperlinks to other electronic documents that I created. This includes HTML webpages, with embedded computer programs that I devised for algebra, calculus, trigonometry, and other calculations. This e-book also contains hyperlinks to instructional videos and articles created by other authors, to provide a diverse perspective on the subject, and to reinforce and supplement the material I wrote. All the hyperlinks to my work are highlighted in , such as www.TechForText.com/Integral, and these links are in Chapter 6.

The material that I present in this e-book deals with various strategies and techniques that can be used for creating electronic documents with mathematics and text. I present a number of problems and related solutions, especially in regards to creating webpages with math and text. I discuss the utility of several highly efficient software devices, and present mathematical notation produced with each device.

With only a few exceptions, I do not provide step-by-step instructions in this e-book, on how to use software to create electronic math documents, because this material is widely available, and it would require hundreds of pages of additional writing. However, I provide website links to articles, and instructional videos, created by other authors, which includes step-by-step instructions for the software used to create electronic math documents.

Section 2) What Are Electronic Math Documents?

As the terminology is used in this text, *Electronic Math Documents* are documents with mathematics that were created for viewing on an electronic screen. Documents of this nature are very often websites with mathematical notation and text. However, e-books that contain math, as well as computer programs that perform calculations, and display the results on a computer screen are also electronic math documents, based on the way the terminology is used in this e-book.

This website is an example of an electronic math document, and it contains many mathematical expressions, as well as two and three dimensional graphs. (Examples and illustrations of mathematical notation starts after the introductory sections, and the graphs are in chapter six.)

Electronic math documents are quite versatile, and they can contain explanations, descriptions, illustrations, and instructions in the form of: text, mathematical notation, diagrams, sound recordings, and videos. The material in these documents can be reinforced or supplemented with hyperlinks to Internet resources, such as videos, articles, e-books, and software downloads.

Section 3) Styles and Aesthetic Forms For Electronic Math Documents

There are essentially a limitless number of configurations and styles that can be used to display mathematics in the electronic format, because electronic documents do not have the limitations of hardcopy. That is the computer, and modern equation editors, and word processor software, used to create math documents, provide an extreme level of versatility. Thus, with the electronic format you can display mathematics and text in a layout and style that is optimized for the specific situation, such as publisher requirements, or to meet the precise needs of the potential or actual readers of the document.

Scientific and mathematical journals, as well as college and graduate school instructors, often have specific style requirements. Some of these style requirements may preclude some of the techniques, and aesthetic concepts that are presented on this website. This applies especially to some of the unconventional aesthetic formats I use to present mathematics in this e-book. The unconventional formats are presented for the purpose of displaying the great versatility of the electronic format, and not to suggest that they are universally preferable or acceptable for creating documents.

However, many of the aesthetic configurations I used to present math and graphs in this e-book are quite colorful, and some convey artistic concepts, which is not the typical way of presenting mathematics. This material is presented with the hope that it stimulates your creative thinking, and may be useful in situations where you are not restricted by conventional style requirements.

Nevertheless, there is an advantage to the simplest styles, even when you have the freedom to be creative. Creating a complex document, such as this e-book, with multicolor graphics can be excessively time-consuming, especially when it involves HTML webpages, or the PDF format. Graphics tend to move out of place when they are converted for display on the Internet. The computer programs used to create documents of this nature are usually taxed to their limits, and bugs and software malfunctions are often encountered. This is especially the case when the document is lengthy. Thus, unless you are an expert, it is probably best to focus on creating documents that are easy to read, and **easy to create,** from the perspective of time and effort. This generally involves a simple black-and-white format.

Section 4) Writing Electronic Math Documents, That Are Easy to Read, and Understand

The previous section raises the questions: What is the best design and layout for electronic documents with mathematics? Is there an ideal design or style for electronic math documents? What is the best layout for documents that have both mathematics and text? In this regard, writers including students, often focus on a specific style, for laying out the text, graphics and mathematical notation. Similarly they may devise the wording in their documents based on a specific style. For example, technical documents, with the without mathematics, are often written in the passive voice, with little or no color, and with a minimum of graphics. This often is coupled with small fonts, and technical jargon that confuses a significant percentage of the readers. (Note: There is nothing wrong with technical jargon, if it does not confuse the readers, and does not make the text unnecessarily difficult to comprehend.)

In general, creating documents based on a specific style can result in text that is less than optimal, from the point of view of the reader. Styles can interfere with readability and comprehension, but in many cases they can have the opposite effect. **Specifically, certain ideas can be explained most effectively in the passive voice, but in many situations the active voice is the most effective way of presenting information.** Sometimes, the best way to explain certain ideas, especially instructions, is to use the word ***you***. Sometimes ideas can be explained most efficiently with unconventional wording, or even slang language. **When writing styles, prohibit any of the above, the resulting document might be more difficult to comprehend.**

The concept presented above, also applies to styles that are involve with the structure and layout of a document. For example, it is sometimes best to present certain types of information in the form of a list, but usually, it is best to use a conventional paragraph structure. Sometimes the most effective way of presenting information is to use an unconventional layout, such as a hybrid between a list and conventional paragraph structure.

Sometimes, it is best to present certain ideas, in italics or bold type. It is often best to present very important information, such as warnings that relate to safety, in extra-large wording. Sometimes, it is useful to use red or highlighted type, for ideas that maybe overlooked or ignored by the reader. **When a style prohibits any of the above, the resulting document may be less than optimal, from the perspective of conveying information to the reader.**

However, in many situations styles are required by publishers and instructors based on custom or tradition. When this is not the case, the best strategy is to focus on optimizing the readability and overall quality of the document, which is the primary focus of this section. This generally involves clearly written text and mathematics, with relatively large fonts, with an overall layout that is orderly and aesthetically pleasing.

IDEALLY, experimental evaluations comparing several documents written with different wording, layouts, and styles, should be carried out, with a representative sample of the readers, to determine what is the best layout and structure to use for an electronic math document. **The evaluations should be focused on determining the AVERAGE TIME that it takes readers to comprehend the same information presented with different wording, layouts and styles.** This is especially important if you are creating electronic math documents for students.

The above is an ideal that is usually NOT feasible, but it sometimes can be carried out in a simpler and less formal way. This can involve asking friends, colleagues, or students to evaluate or compare two or more documents that present the same information, with different wording and styles. When this is done, it is necessary to emphasize that the goal is to determine which document requires less time and/or effort to read and comprehend.

Even the simpler method described above may not be feasible, if you are writing documents or e-books for an unknown group of readers. This situation is encountered when you are writing for mass publication, especially if it involves the Internet. In such a case, the best strategy is to put yourself in place of your readers. That is while you are writing your document, periodically stop and evaluate your work, by imagining the ***difficulties** that a less than ideal reader will encounter, with the material you wrote. Then try to modify or improve the text and mathematical notation to prevent the difficulties from occurring.

***Keep in mind the difficulties that I am talking about are relative to the potential readers of a document. Difficulties of this nature cannot be identified with a computerized grammar and style checker, and even a professional editor, with years of experience, may not be able to spot these problems, unless he or she was familiar with your readers. However, asking yourself the following questions, while keeping the less than ideal reader in mind, can help you spot and eliminate most, if not all of the difficulties and potential problems in your document.**

1) What are all the possible ways that this text or mathematics can be misunderstood, and what modifications can I make to prevent these problems? This is a general question, which I usually keep in mind, when I am writing. I found it useful in spotting potential problems, which I eliminate, usually by rewording the text, or by providing additional explanations.

2) Will examples make it easier for the readers to understand the material I am presenting? Examples can often eliminate confusion or ambiguity, especially when explaining how to solve a math problem, or how to apply a theory or technique. Using examples is especially important if you are writing for students.

3) Can I break up the information that I want to write about, into a series of smaller units of information, and place each unit in separate paragraphs, or under separate headings or subheadings. This is a very important technique, for improving and simplifying writing. The idea here is to break up the information you are presenting into units that can fit into one paragraph when possible. When more than one paragraph is required for each unit of information provide a heading.

When this technique is used, you must check your writing to be certain that you are connecting the small units of information into the larger concept or idea that you want to present to your readers. When this technique is used poorly, readers may understand the individual units of information, but they may not comprehend the connection between individual units, and the main idea that you are trying to convey.

4) Can I break up this information into a series of steps? This is similar to the above, but steps usually represent information that can be expressed in a few words, or in one sentence. Presenting instructions in a series of steps is especially useful for computer instruction, and to show how to solve math problems. In addition, logical concepts, and cause and effect dynamics, can usually be explained well with a series of steps.

5) When you are creating documents that are very lengthy, such as E-BOOKS, ask yourself can the readers locate and understand specific sections of this document, without reading all of the material. The above can be achieved by breaking up the information you want to present into chapters, and/or sections, with headings. The headings must be worded to clearly indicate the information that is provided under each heading. The information under each heading ideally should be more or less written as an independent article. **All of the headings should be listed in a hyperlinked table of contents.**

6) Is the mathematical notation clear, and not confusing? It is usually best to use conventional mathematical notation, especially if you are writing for students.

7) Will written explanations increase the comprehensibility of my mathematical expressions? Explaining mathematics with written language can sometimes make the material easier to understand, especially for students. This of course can be coupled with conventional mathematical notation, and mathematical proofs. Mathematical proofs can often be clarified with simplified examples presented in written language.

8) What is the best font size for this document? When creating electronic documents, especially for the Internet, keep in mind that there are a great variation in screen sizes and screen resolution settings that are commonly used. For example, fonts which appear relatively large on a screen with 1024 X 768, maybe difficult to see if viewed on a screen with a resolution setting of 1600 X 900. In addition, some people place their computer screen 4 feet from their eyes, and there are also many individuals with poor eyesight. It is usually best to use larger size fonts, then is customary, to circumvent these potential difficulties.

Note) When I am creating an electronic document, for the Internet, I use two computer screens with the resolution setting shown above, to evaluate the appearance of my document. I also used several Internet browsers to evaluate my work, because webpages sometimes look significantly different in each browser.

9) **Are my sentences and paragraphs the optimum size?** For the electronic format, especially for the Internet, it is usually best to keep the sentences and paragraphs as short as feasible. It is probably best to make paragraphs in the electronic format **MUCH** shorter than you would for hardcopy, especially if you are going to display your work on a website.

10) **Are there any questions that you can add to this list that will help you with the type of writing you do?** You should add your own questions to this list. You should create questions that will remind you to check and correct various aspects of your writing and mathematics that relate to your specific needs.

Subsection) Additional Information In Regard To the Above, From Other Authors

If you want more information, and a **different perspective**, in regard to the information I presented above, see the following websites from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words in Google's search engine at www.Google.com.

(PDF) Words on website: **A Guide to Writing Mathematics**

Words on website: **Using Writing In Mathematics**

Words on website: **HOW TO WRITE MATHEMATICS**

Chapter 2) Techniques for Displaying Mathematics In Electronic Documents, And Related Concepts

Section 5) Integrating Mathematics Directly into the Text

Integrating mathematics directly into the text is a technique that involves aligning the mathematical notation with the sentence structure as shown in the following example:

Example 1) Math integrated into the text, to explain a formula: Einstein's equation $\mathbf{E} = \mathbf{mc^2}$ is often displayed, in popular publications as if it was a symbol or icon, representing modern technology. However, it was not created as a symbol, and the terms have precise mathematical meaning. $\mathbf{E} = \mathbf{Energy}$, $\mathbf{m} = \mathbf{Mass}$, and $\boldsymbol{c} = \mathbf{The\ speed\ of\ light}$.

The alternative technique, involves presenting the mathematics separately from the main text, as shown in example 2, presented below:

Example 2) Mathematics placed below the paragraph: Einstein's equation is often displayed, in popular publications as if it was a symbol or icon, representing modern technology. However, it was not created as a symbol, and the terms have precise mathematical meaning as shown below:

$$\boldsymbol{E = mc^2}$$

$$\boldsymbol{E} = \mathbf{Energy}$$

$$\mathbf{m} = \mathbf{Mass}$$

$$\boldsymbol{c} = \mathbf{Speed\ of\ light}$$

Integrating mathematics directly into the text can be especially useful when the document contains significantly more text than mathematics, and when the focus of the document is to explain a theory, concept, or technique. It is also useful when the primary focus of a document is not mathematics, and there are only a few formulas used as examples.

The alternative technique, shown in example 2 above, is probably more useful when the primary focus of the document is mathematical. This is especially the case, when the document is written for instructional purposes, such as to explain how to solve a mathematics problem.

In some situations, using the above techniques in a creative way might be the best strategy. This can involve using both of the techniques in the same document, or variations of the techniques. In general, there is almost a limitless number of ways of arranging mathematics and text, with the electronic format, which will become more apparent with the following examples:

Example 3) **Mathematics integrated into the text, to explain how to solve a simple quadratic equation:** If $\boldsymbol{X^2 - 6X + 8 = 0}$, than by factoring we obtain: $\boldsymbol{(X - 2)(X - 4) = 0}$ Now if we divide the left and right sides of the equation by $\boldsymbol{(X - 2)}$, the result is $\boldsymbol{(X - 4) = 0}$ We can easily solve this for $\boldsymbol{X}$, by adding $\boldsymbol{+4}$ to the left and right side of the equation, which results in $\boldsymbol{X = 4}$ Now, we will return to the equation, and solve for a second value of $\boldsymbol{X}$: $\boldsymbol{(X - 2)(X - 4) = 0}$, To calculate the second value $\boldsymbol{X}$ we divide both sides of the equation by $\boldsymbol{(X - 4)}$, which results in $\boldsymbol{(X - 2) = 0}$. If we solve this for $\boldsymbol{X}$, by adding $\boldsymbol{+2}$ to both sides of the equation, we obtain another value for $\boldsymbol{X}$, which is $\boldsymbol{X = 2}$. Thus, both $\boldsymbol{X = 2 \; and \; X = 4}$ satisfy this equation.

The next example, involves the SAME problem as above, with the mathematical notation integrated into the text, but the instructions on how to solve the equation is broken up into a series of five steps. The following layout is probably superior to example 3, if you are writing for students:

Example 4) read the following paragraphs.**to solve a simple quadratic equation, with the mathematical notation integrated into the text:** How to solve a quadratic equation that can be factored, using the following equation as an illustration: $X^2 - 6X + 8 = 0$

Step 1) By factoring $\mathbf{X^2 - 6X + 8 = 0}$ we obtain: $\mathbf{(X - 2)(X - 4) = 0}$

Step 2) divide the left and right sides of the equation by $\mathbf{(X - 2)}$, which result is $\mathbf{(X - 4) = 0}$

Step 3) Solve $\mathbf{(X - 4) = 0}$ for X, by adding +4 to the left and right side of the equation, which results in $\mathbf{X = 4}$

Step 4) Now, return to the $\mathbf{(X - 2)(X - 4) = 0}$, and divide both sides of the equation by $\mathbf{(X - 4)}$, which results in $\mathbf{(X - 2) = 0}$

Step 5) Solve $\mathbf{(X - 2) = 0}$ for X, by adding +2 to both sides of the equation, which results in $\mathbf{X = 2}$.

Thus, both $\mathbf{X = 2}$ and $\mathbf{X = 4}$ satisfy this equation.

The following, is very similar to example 3, but it is focused on solving an equations, with the series of steps and calculations integrated into the text. This technique should be considered experimental, because solving an equation in this way might be confusing, to some or even most readers.

Example 5), Mathematics integrated into the text, use to solve equations, or to demonstrate how an equation was solved:

Solving for X: $2X^2 = -7X^2 + 27$ as follows:

$2X^2 + 7X^2 = 27$, then $9X^2 = 27$, then $X^2 = \frac{27}{9}$, Thus, $X^2 = 3$, and finally: $X = \pm\sqrt{3}$

Checking Calculation for $X = +\sqrt{3}$, with the original equation**:**

$2X^2 = -7X^2 + 27$, by substitution $2(\sqrt{3})^2 = -7(\sqrt{3})^2 + 27$, then $2(3) = -7(3) + 27$ Thus, $6 = -21 + 27$, and finally: $6 = 6$.

Checking calculations for $X = -\sqrt{3}$**,** with the original equation:

$2X^2 = -7X^2 + 27$, $2(-\sqrt{3})^2 = -7(-\sqrt{3})^2 + 27$, by substitution

$2(3) = -7(3) + 27$, then $6 = -21 + 27$ and finally: $6 = 6$

The above technique requires less space than the conventional style, but space is usually not important with the electronic format. The above may be useful, to show how an equation was derived, when most of the readers are likely to be acquainted with the derivation, and you only want to refresh their memory. However for most purposes, especially when you are writing for students, the conventional style should be used. The same equation is solved below in the conventional style:

$$2X^2 + 7X^2 = 27$$

$$9X^2 = 27$$

$$X^2 = \frac{27}{9}$$

$$X^2 = 3$$

$$X = \pm\sqrt{3}$$

Checking for $X = +\sqrt{3}$

$$2X^2 = -7X^2 + 27$$

$$2(\sqrt{3})^2 = -7(\sqrt{3})^2 + 27$$

$$2(3) = -7(3) + 27$$

$$6 = -21 + 27$$

$$6 = 6$$

Checking for $X = -\sqrt{3}$

$$2X^2 = -7X^2 + 27$$

$$2(-\sqrt{3})^2 = -7(-\sqrt{3})^2 + 27$$

$$2(3) = -7(3) + 27$$

$$6 = -21 + 27$$

$$6 = 6$$

Section 6) Circumventing the Difficulties of Aligning and Integrating Mathematical Notation Directly Into the Text

As explained in the previous section, integrating mathematical notation directly into the text is a very useful technique for presenting text with mathematics, especially when the primary focus of the document is not mathematical, or when there are only a few formulas involved. This technique was shown in **example 3**, from the previous section, and it is also presented below.

Example 3) **<u>Mathematics integrated into the text, to explain how to solve a simple quadratic equation</u>:** If $X^2 - 6X + 8 = 0$, than by factoring we obtain: $(X - 2)(X - 4) = 0$ Now if we divide the left and right sides of the equation by $(X - 2)$, the result is $(X - 4) = 0$ We can easily solve this for X, by adding $+4$ to the left and right side of the equation, which results in $X = 4$ Now, we will return to the equation, and solve for a second value of X: $(X - 2)(X - 4) = 0$, To calculate the second value X we divide both sides of the equation by $(X - 4)$, which results in $(X - 2) = 0$. If we solve this for X, by adding $+2$ to both sides of the equation, we obtain another value for X, which is $X = 2$. Thus, both $X = 2$ *and* $X = 4$ satisfy this equation.

Integrating and aligning mathematics perfectly with the text can be quite difficult, and problematic. Many people may find that good integration of text and mathematical notation is unattainable or unfeasible because of the time, effort and less than optimal results that are obtained. However, the difficulties usually appear when the mathematical notation is in the graphics format, for **HTML webpages.** Problems might also occur when converting a document with mathematical notation to another file format.

If you are not dealing with the circumstances mentioned above, and you are working with a modern equation editor, you are not likely to encounter the problems presented in the following paragraphs. If you use the new equation editor in Microsoft Word 2010, in the default file format, you will have perfect results, if you do not convert the document to a webpage. However, if you are creating webpages with mathematical notation, you will be faced with some challenges, and you should carefully read the following paragraphs.

The major problem involves aligning the mathematical notation with the text in an HTML webpage. The frustrating part about this effort occurs when perfectly align mathematical notation and text move out of alignment, while editing the webpage, or when converting a document to the HTML format. This can involve mathematical notation that moves on top of the text, or becomes misaligned in some other way. Sometimes, this involves a webpage with mathematical notation that is perfectly aligned when viewed with a specific web browser, or at a specific screen resolution, but appears misaligned when viewed with another browser or screen resolution. **These difficulties can occur even when the best equation editors and techniques are used.**

The difficulties mentioned above, appear to be caused by the greater spatial requirements for graphics, when compared to text. This can involve unseen borders that surround mathematical notation in the graphics format. Even if the mathematics is not in a graphics format, it will usually be converted to graphics, when a document is converted to an HTML webpage.

Avoiding the graphics format for math notation is a potential solution, but this can result in additional difficulties, because the commonly used web browsers do not support the alternative format, which is mathematical notation comprised of computer code, such as MathML. If mathematical notation is created with computer code, users will have to download and install special software to see the mathematical expressions. Most users would probably go to a different website, rather than go through the trouble and risks of downloading and installing special software. I discuss the above in more detail in another section of this e-book.

There are four solutions to the above difficulties. The simplest one is to display your mathematics with an alternative layout, if you find you cannot align the mathematical notation with the text, in your webpage. In general, when creating material for publication, even if it is only for the Internet, it is usually better to avoid any technique or layout that will result in noticeable imperfections. In regard to the above, a good alternative is to place the mathematics below a sentence, or paragraph, with a colon or other suitable punctuation, such as the following:

$$\int_a^b x^n dx = \frac{x^{n+1}}{n+1} = \frac{b^{n+1} - a^{n+1}}{n+1}$$

With this technique the mathematics, stands out better than when it is integrated directly into the text, and it may be preferable when you want to emphasize mathematical concepts or formulas.

Another way of dealing with the difficulties of aligning text and mathematics in a webpage is to use conventional text characters that are displayed on the keyboard, to write mathematical notation. This can be enhanced with the characters presented in the menus of most modern word processor software, such as Microsoft Word, and OpenOffice Write. See the three examples presented below:

1) An example with only keyboard font is
Y = mX + b

2) An example with the superscript, which is on the menu of most word processor software, including Microsoft Word, is
(x - 3)(x + 3) = x^2 - 9

3) An example with subscripts, which is also available in most word processor software, including Word is
***Z = mX_1* + mX_2**

If you want mathematical notation created with keyboard characters to resemble the styles produced by most equation editors, use italics fonts for letters, and non-italics fonts for numbers and mathematical symbols, such as +, -, =. In addition, entering one space between mathematical symbols, (such as +, -, =) will further enhance the appearance of the notation. With the above, it is usually better to enter non-breaking spaces, which prevents mathematical notation from breaking in two pieces, when there is not enough room on a line. For a minus sign (-) use a non-breaking dash. (How to create non-breaking spaces, and dashes is discussed several paragraphs below.)

When the needed fonts are not available on the keyboard, some writers use an alternative style of writing mathematical notation, such as writing **X^n**, instead of X^n. In general, it is best to avoid using this type of notation, unless you are reasonably sure that your readers will not encounter any difficulties with this alternative way of presenting mathematics.

The two techniques presented above, can be quite useful, but they are not the best solution if you want to present complex mathematical notation that is integrated into the text. I have found one solution that eliminates some of the difficulties, which is to simply use Microsoft Word 2010, with its **NEW** equation editor. With this equation editor, it is quite feasible to create mathematical expressions that are perfectly, or almost perfectly, align with the text. However, when the 2010 Word document is converted to a webpage the results are not always desirable, but usually better than most of the conventional equation editors. The new equation editor has many other desirable features. For example, if you change the size of the text in your document, the mathematical notation will automatically change along with the text. The same applies to many other modifications that are routinely performed on text, such as changes in color, italics, bold and underline.

Microsoft Word 2010, and its NEW equation editor functions extremely well with text and mathematics, as described above, because it produces mathematical notation in the form of computer code, based on a computer language called the Mathematical Markup Language. However, when a Word 2010 document is converted to HTML to create a webpage, the math notation is converted to a graphics format. In this conversion process, the perfection is not retained, and the results can vary from very good to unsatisfactory.

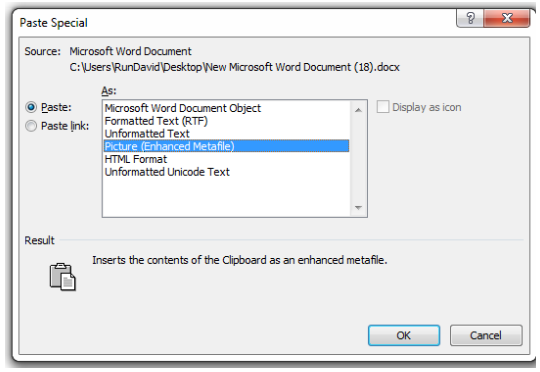
However, I devised a special technique that retains the text and mathematical notation alignment, when a Word 2010 document is converted to a HTML webpage. With this technique, if the text and mathematics is aligned, it cannot become misaligned when the document is converted to another format, such as HTML. **The technique simply involves, creating a single graphic of the mathematical notation and related text, which is essentially a digital photograph of the text and math notation. This can be done, with the cut and paste mechanism in Microsoft Word, which involves pasting the mathematical expressions and related text as an ENHANCED METAFILE graphic. If you do not know how to do this, follow the steps presented below:**

Step 1) Select the mathematical notation and related text, using the mouse or keyboard. Selected text is highlighted similar to this sentence, with a gray color. Note this step involves the same keystrokes, or menu clicks that are used for selecting text for cutting and pasting.

Step 2) While the text is still selected, hold down the CTRL key, and press the C key. If you press the C key first, the process will fail. You must press on the CTRL key first, and hold it down. Then press on the C key while holding down the CTRL key.

Step 3) Place the cruiser in the location where you want to paste the graphic. You can do this by left clicking with the mouse on the location where you want to place the graphic. This is not a critical step, because you can move the graphic to a different section of the document at a later point in time.

Step 4) While holding down the CTRL and ALT keys, press the V key, and a dialog box will open that looks like the following:



Step 5) In the above dialog box, scroll to the words, Picture (Enhanced Metafile), and click on the OK button with the mouse, or press the enter key. When this is done, the dialog box will close, and an Enhanced Metafile graphic, of the mathematical notation and text will be pasted where you placed the cursor.

When using the above technique, you should always save the original text in another document. Specifically the words and math in the Enhanced Metafile graphic cannot be edited, because the text and mathematical notation is comprised of a single structure. Thus, if you want to make changes in your text or mathematics, you must use the original text and math notation, and re-create the Enhanced Metafile graphic.

However, a few modifications can be made in the Enhanced Metafile graphic, which includes changing the background colors, and the size of the graphic, with the functions in Microsoft Word 2010. You can also place a frame around the Enhanced Metafile graphic, by clicking on it with the mouse. When this is done, several frames will appear on the ribbon on the upper portion of your screen. Click on the frame you prefer, and it will be automatically placed around the graphic.

Below, there is an example of text and mathematical notation created with the equation editor in Microsoft Word 2010. This is followed by a copy of the above, in the form of an Enhanced Metafile graphic.

Example of Math and Text, with Microsoft Word 2010:

A calculus integral written in conventional format is an example of a mathematical expression that is difficult to integrate into the text. However, Microsoft Word 2010 and its new equation editor provide the functionality to align text with an integral, almost perfectly, but you are viewing this in a webpage and the results you see with the following example maybe misaligned to varying degrees: $\int_a^b x^n dx = \frac{b^{n+1}-a^{n+1}}{n+1}$ The misalignments can result when the text and math notation are resized, moved and rearrange by your web browser to fit the dimensions and resolution of your computer screen.

Below there is an Enhanced Metafile graphic of the above paragraph, which retains the same degree of alignment of text and mathematical notation that existed in the original Microsoft Word document. This technique works because the web browser, or anything else, cannot move or rearrange the text and mathematical notation.

> A calculus integral written in conventional format is an example of a mathematical expression that is difficult to integrate into the text. However, Microsoft Word 2010 and its new equation editor provide the functionality to align text with an integral, almost perfectly, but you are viewing this in a webpage and the results you see with the following example maybe misaligned to varying degrees: $\int_a^b x^n dx = \frac{b^{n+1}-a^{n+1}}{n+1}$ The misalignments can result when the text and math notation are resized, moved and rearrange by your web browser to fit the dimensions and resolution of your computer screen.

If you plan to use an Enhanced Metafile graphic, in a webpage created with Microsoft Word 2010, you must remember to save a final copy of the webpage as Web Page Filtered, which removes formatting code that is unneeded for a completed webpage. If this is not done, the Enhanced Metafile graphic, will appear fuzzy or blurred.

As explained above, unlike a conventional paragraph, an Enhanced Metafile graphics cannot be shaped or reconfigured by web browsers to fit a specific computer screen. Thus, the graphic should be relatively narrow, so that it can be properly displayed on the majority of computer screens. If this is not done, the graphic may be too wide to fit on some of the older screens with resolution settings of 1024 x 768 or 800 x 600. To avoid this problem create the graphic so that it is about 1/3 the width of a conventional paragraph, on a screen with a resolution settings of 1600 x 900, or 1600 x 1200. This is assuming that Microsoft Word is set to display a paragraph at the width of the screen, such as with the setting called: **Web Layout, at 100%.** An Enhanced Metafile graphic created in this way, will appear almost as wide as a conventional paragraph on a screen with a resolution of 800 x 600.

The version of Microsoft Word that I am using, with Windows 7, automatically reduces the width of a paragraph, when the **Enhanced Metafile graphic is pasted**. When this is done, it automatically increases the height of the paragraph to compensate for the reduction in width. Initially this feature was creating graphics that were too narrow, but I corrected this problem, by temporarily changing the paragraph width settings to minus two (-2), on the left and right side of the computer screen.

When text is combined with mathematics in a paragraph, and the math notation requires two lines, such as integrals or fractions, the best strategy is to convert the entire paragraph to an **Enhanced Metafile graphic,** assuming the material will be displayed on a webpage. However, if the mathematical notation only requires one line, such as an equation without fractions, the above may not be necessary, with Microsoft Word 2010 and its new equation editor. The following is an example of an equation integrated into a conventional text paragraph.

Example of an equation and text) The following equation was created in Word 2010, with Microsoft's new equation editor: $3X - 2Z = 123$ Note the alignment with the text and the mathematical notation appeared excellent on my computer screens, even after the word document was converted to a webpage.

In spite of all the good features in Microsoft's equation editor, it has two minor disadvantages. Specifically, the only font available with this equation editor is Cambria Math. This might change in future versions, but it is NOT important, because using one font for the mathematics and another for the text will not confuse readers, and it may even help prevent confusion. In addition, it is not unusual for professionally produced publications to use two or three different fonts in the same article, such as a font for headings, and another font for the main text. However, if you believe that it is aesthetically important to have a perfect match of fonts, you can use Cambria Math for your entire document, or a font that you believe is an aesthetically pleasing combination with Cambria Math. Some fonts no doubt, look unattractive or inappropriate with the Cambria Math font.

The other minor disadvantage of Microsoft's new equation editor is it breaks up mathematical expressions, when there is not enough room for the expression to fit on a line, which is likely to happen when mathematical expressions are integrated directly into the text. That is the new equation editor has a feature that treats mathematical expressions as if they are sentences. For example, this feature may break up the equation: $a^2 + b^2 = c^2$, and place it on two lines, as follows:

$$a^2 +$$
$$b^2 = c^2$$

When a sentence is placed on two lines it is not confusing, but when a mathematical expression is presented on two lines, such as the above example, it is likely to be confusing to many of the readers. Some writers might prefer this feature, but it can result in a document that is difficult to understand.

<u>However, Microsoft's new equation editor accepts *NON-BREAKING spaces, that will eliminate the difficulties described in the above paragraph</u>. This involves entering a non-breaking space on the left and right of +, =, and whenever there is a space between characters. For a minus sign (-) use a non-breaking dash. There are other symbols that may require the non-breaking space. Thus, it is a good idea to test to see if your mathematical expression breaks apart, when pushed to the end of the line, with the shift key. If it does, it indicates a need for a non-breaking space. (Note: do not use non-breaking spaces or non-breaking dashes if you are planning to use a mathematical expression for computerize calculations.)

NOTE ON HOW TO ENTER NON-BREAKING SPACES: If you do not know how to enter non-breaking spaces, do the following: While holding down the Ctrl and Shift keys, press the space bar. If you have your Microsoft Word set to reveal paragraph marks, you will see the non-breaking space as a small circle, as seen in the following examples:

$$3X^{\circ} - 4^{\circ} = 22\cdot$$

The°addresses°is°ABCD

<u>Note the small circles indicating a non-breaking space are normally not visible when a Microsoft Word document is converted to HTML, or when the setting that reveals the paragraph marks are turned off. To make the circles visible with the above examples, I took screenshots, which results in graphics that are essentially pictures.</u>

A NOTE ON HOW TO ENTER NON-<u>BREAKING DASHES</u>: If you do not know how to enter non-breaking DASHES, do the following: While holding down the Ctrl and Shift keys, press the dash key.

Subsection) Additional Information In Regard To The Above, From Other Authors

If you want more information about the above see the following websites and videos from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine, www.Google.com. If the link that failed is for a video use www.Video.Google.com.

When you left click on a link for a video, a web page will open, which usually has a large number of high-quality videos that are related to the words on the hyperlink you clicked on. However, when you click on the link it will usually start only one video automatically, which may take a few seconds. If the video does not start automatically, left click on the link provided by the author of the video. This link is usually in the center of the screen.

Words on website: Use non-breaking spaces and non-breaking hyphens in Word

Words on website: Non-Breaking Spaces & Non-Breaking Hyphens

Words on website: Math in HTML (and CSS)

Words on website: Displaying Math in HTML

Words on website: Write, insert, or change an equation

Words on website: Creating Equations in Microsoft Office Word

Words on video: How To Create Equations in Microsoft Word 2010

Words on video: How to do equations in Microsoft Word 2010

Section 7) The Ideal Font Size For Electronic Math Documents, And Related Concepts

The ideal font size and line spacing for the body text (the main text) for electronic documents is subjective, and your opinion is likely to be influenced by the resolution setting on your computer screen, as well as the font size you have grown accustom to over the years. My opinion is **NOT** based on current styles, and many web designers would probably disagree with my perspective, which is based on **maximizing** readability, and **minimizing** eyestrain, for people that read lengthy electronic documents, especially on the web.

Website users, as well as anyone else that read electronic math documents, are very diverse in nature, and they have computer screens of varying sizes, and resolutions. Some users have computer screens that are 3 to 5 feet from their eyes, and some of these people have poor eyesight. In addition, the settings on a computer, the software used to view an electronic document, such as a web browser, and the file format, can greatly influence the image size of fonts on a computer screen. For example, fonts that look too large in a PDF document, viewed with Adobe Reader, may appear excessively small on an HTML webpage, viewed in Internet Explorer.

Webpages created with HTML, display fonts smaller than other file formats as a result of typical default browser settings. Thus, it is advisable to create HTML webpages, with fonts that are significantly larger than is customary for other file formats, and certainly larger than typical fonts used for hardcopy. In my opinion, the ideal font size for **HTML webpages** ranges from 16 pt. to 24 pt., with a line spacing ranging from 1.15 to 1.5. This is relatively large compared to most websites that I have seen, which usually have font sizes ranging from 10 pt. to 14 pt.

With the new wide computer screens, with resolution settings of 1600 x 900, font size of 14 pt., appear quite small. Reading an e-book in the HTML format, with a font size of 14 or less would probably result in eyestrain, with modern computer screens. With the older computer screens, with resolution settings of 1024 x 768, or 800 x 600, a font size of 14 pt. is displayed reasonably large, but it is still not the ideal for an e-book, in the HTML format.

For the e-book that you are now reading, **in the HTML format**, I used a font size of 18 pt., with a line spacing of 1.5. (For mathematical notation it is especially important to have adequate line spacing.) The font size of 18 is much larger than fonts used on most websites with academic material.

I used Verdana fonts for the HTML version of this e-book, because of their simple structure. Fonts with simple structures (sans-serif) are probably easier to read on less than ideal computer screens, when compared to fancy fonts, or fonts with complex structures. Good fonts for websites and e-books include: Arial, Verdana, Helvetica, and Tahoma.

The font size discussed above does not apply to PDF, and many other electronic formats, because they are usually used with software that automatically adjust the pages and fonts to fit the width of the computer screen. A conventional Microsoft Word document has this functionality, when the appropriate settings are applied. I have found that a font size of 16 pt. can appear excessively large in PDF, and some other electronic formats. A font size of 10 to 12 pt. might be the ideal for an e-book created in the PDF format. The above applies when the Adobe Reader is set at the default setting: SCREEN WIDTH.

Web browsers, also have the functionality of adjusting the size of webpages and fonts, but the webpages adjust automatically and it is up to the user to manually adjust the font size by clicking on appropriate controls. Many users do not know how to use these controls, and most people that encounter a large amount of text that is too small to read without straining their eyes, will probably go to a different website, rather than fiddle with the controls on their web browser.

The use of relatively small fonts on websites is probably the result of customs and habits that develop with hardcopy. When text is printed on paper, the image of the fonts do not very in size, the way it does with computer screens, with different resolution settings. People hold hardcopy documents in their hands when they read them, approximately 18 inches from their eyes. At 18 inches, font sizes of 10 pt. to 12 pt. are quite adequate, but computer screens are placed at distances ranging from 1.5 to 5 feet, from the eyes. With hardcopy, space on a page is limited, and expensive if a document is going to be published. Placing an advertisement in a newspaper can cost hundreds of dollars, and publishing a book can cost thousands of dollars. Thus, with hardcopy using the smallest feasible font size can save large sums of money. The savings obtained with small fonts in this case may be worthwhile, even if five or 10% of the population cannot read the text.

However, the limitations outlined above for hardcopy, certainly do not apply to HTML webpages, or any other type of electronic format. It generally makes little difference if an electronic document is 10 pages or 100 pages. In addition, a single webpage can hold a huge amount of material, because it automatically expands as text and graphics are entered. For example, this e-book in the HTML format, on the main website, is on a single webpage, and it contains the equivalent of 300 pages of hardcopy material, because of the large fonts, 1.5 line spacing, and large graphics. If I was planning to publish this e-book in hardcopy, I would use smaller fonts, smaller line spacing and much smaller graphics, and the entire e-book would probably fit on less than 150 Pages, which would save thousands of dollars in publishing costs. However, for an e-book in the HTML format, published on the Internet, the reductions outlined above would not save me any money whatsoever.

I pay a fixed yearly rent for website server space, with my own domains, and the size of my e-books does not result in a rental increase. However, if you do not rent or own your own commercial web server space, there might be restrictions imposed on you for the size of HTML documents, by the organization that owns the domain and web space you are using.

All of the above may not be very relevant to you if you are presenting a few words or short article on a webpage. However, if you are writing an e-book with thousands of words, simple sans-serif fonts that a relatively large, with adequate line spacing, is probably the ideal for maximizing readability, and minimizing eyestrain. This will result in a user-friendly layout, which is not necessarily the most attractive or stylish.

Subsection) Additional Information and Opinions From Other Authors In Regard To The Above

If you want more information and different opinions, about the above, see the following websites from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine, www.Google.com.

Words on website: Web Style Guide

Words on website: A glossary of typographic terms

Words on website: Setting Font Size

Words on website: Typographic Design

Words on website: CSS Line Spacing

Words on website: Improve readability with line-height

Words on website: Adding Space to Web Page Text

Words on website: So what is a good line height?

Words on website: The Ultimate Guide to Readable Web Typography

Chapter 3) The Technical Challenges of Creating High-Quality Electronic Math Documents And Related Concepts

Section 8) Challenges of Creating High Quality Math Notation for Websites, And Other Electronic Documents

The focus of the following paragraphs is on the technical aspects of creating mathematical notation that is aesthetically pleasing, easy-to-read, from the perspective of graphics and aesthetics. This is especially important for presenting mathematical documents and articles on the Internet. This can be challenging if you want high quality documents, with clearly written mathematical expressions combined with text. This is because, when entering a mathematical expression in word processor software, such as Microsoft Word, or OpenOffice Write, it may appear excellent. However, when the document is converted to HTML to display on the Internet, the mathematical notation can look less than desirable. Sometimes, when converting to HTML, the mathematical expressions can moves to different locations on the document.

One of the major reasons for the above problems is during the conversion to HTML the mathematical notation is usually converted to a graphics format. This conversion involves generating a set of pictures or photographs, from computer code. These pictures are often generated by the software in a **low resolution format**, to reduce the demands on computer resources. This involves a reduction in the number of kilobytes for a picture at the expense of quality. Sometimes this reduction is necessary, when there is a very large amount of mathematical notation in the graphics format, and in many cases there is no detectable difference in quality.

However, sometimes the reduction in resolution is taken to the extreme, by default settings programmed into equation editors and word processor software that are used to create mathematical documents. This reduction in resolution and related kilobytes might be unnecessary, in many cases, with the development of high-speed Internet connections and powerful desktop computers. This is especially the case, if you have a relatively small amount of mathematical notation and graphics, and your document is less than one half megabyte. If you are obtaining less than desirable results with the software you are using to create mathematical documents, try to locate the resolution settings, and experiment by increasing the resolution, to see if it improves the quality of your mathematical notation. This applies to both your equation editor and word processor software.

However, there are many other factors that influence the quality of mathematical notation, besides the above. For example, when I used *CONVENTIONAL EQUATION EDITORS with Microsoft Word documents the mathematical notation usually is excellent in overall quality and sharpness. However, when I convert these documents to HTML, the mathematical notation is usually fuzzy or blurry. Modifying the resolution settings did not alleviate this problem. However, by experimenting I found if I convert the Microsoft Word document to a filtered form of HTML the mathematical notation is sharp, with no imperfections. The filtered HTML conversion setting in Microsoft Word removes the formatting code that is unneeded for a completed webpage. It appears this formatting code somehow interferes with the appearance of mathematical notation created with conventional equation editors. (*Note, the problem described above does NOT apply to Microsoft's new equation editor, which is available in Microsoft Office 2010.)

All of the problems discussed above, (in this section) tend to occur when mathematical notation is converted to a graphics format. Of course, this does not apply to conventional text, because it is maintained in the form of computer code, even when a document is converted to the HTML format for the Internet. This is possible only because the software comprising modern operating systems and browsers were designed to interpret the computer code that relates to text, and display it in a visual format on a computer screen.

However, sometimes a few lines or a paragraph of conventional text is converted to a graphics format, by an individual creating a website. When this is done, all of the problems mentioned above with mathematical notation, can apply to text.

The discussion in the above paragraphs, suggest the question: why not create computer code to represent mathematical notation, which will eliminate all the problems associated with the graphic formats. The answer is this was already done a number of times, over the years, and there are a number of computer languages that can be used for mathematical notation, which is discussed in detail in the next section. However for code of this nature to have any utility for websites two conditions must be met: <u>1) There must be Internet browsers or other software that can interpret the code, and 2) The software or browsers that interpret the code, must be widely available and used by the majority of computer users.</u> The second condition has not been achieved.

Generally speaking, most Internet browsers cannot interpret code of this nature, except with specialized plug-ins. Asking visitors to your website to download and install the required plug-ins to see your mathematical notation is probably not a good strategy, unless they know you personally, or if the website is owned by a well-known university or computer company. Most users would probably go to a different website, rather than take a chance and download and install unfamiliar software to see your mathematical notation. In addition, there are many people that use the Internet that do not have the skills to download and install plug-ins.

However, if you create mathematical documents for hardcopy printing, or distribute your electronic documents to individuals that have the software needed to interpret the computer language used to create mathematical notation, you have more choices, than individuals that create math documents for the Internet. However, there is usually little difficulty with the graphics format when using modern word processor software, such as Microsoft Word, or OpenOffice write. Based on my experience, problems tend to show up only when creating mathematics documents to display on the Internet in the HTML format. Thus, you will obtain excellent quality with most word processors software and equation editors, with the graphics format, as well as mathematical notation that is based on a computer language.

Section 9) Computer Languages To Generate Mathematical Notation

There are computer languages and related technologies available for creating mathematical notation, which are developing at a rapid rate. This includes a computer language designed for creating mathematical notation for websites, which is called the Mathematical Markup Language or MathML. There were previous versions of this language that were developed, and the latest version is MathML 3.

There are various types of software available that can generate mathematical notation in MathML, by clicking on icons that represent mathematical symbols. An example of this type of software is MathType, which can generate computer code in MathML, and a number of other computer languages. MathType's functionality with computer code may be useful when we can all be certain that at least 90% of the browsers can support such code, without installing specialized plug-ins. (MathType can also generate mathematical notation in a number of graphic formats.)

MathType certainly is NOT the only software that can use the Mathematical Markup Language. There is a new equation editor in Microsoft word 2010 that also utilizes MathML. When using MathType or Microsoft's new equation editor, you normally do not see the MathML code, which is generated by clicking on icons that represent mathematical symbols, or by entering appropriate keystrokes. Thus, to use MathML you do not have to learn a computer language. This is fortunate because, the Mathematical Markup Language, is quite complex, which will become apparent with the example presented on the end of the next paragraph. This language was probably design with the assumption that it will be generated by software, when users enter mathematics with conventional notation using icons or keystrokes. From a practical perspective, users do not have to ever see the computer code that comprises the Mathematical Markup Language, if they have appropriate software.

If you copy a mathematical expression that was generated in MathML, and paste it into a basic text documents, such as Notepad, the code becomes visible. To demonstrate this I wrote the following equation $3X^3 = 3000$ with the new equation editor in Word 2010. Then I made the code visible as indicated above. However, when I tried to paste this code into this e-book, it was displayed as: $3X^3 = 3000$. That is, this e-book was created with Microsoft Word 2010, which immediately interprets the MathML code as conventional mathematical notation. To circumvent this difficulty, I converted the MathML code into a graphic format, which is presented below.

$3X^3 = 3000$ is presented below in the Mathematical Markup Language

```
<mml:math
xmlns:mml="http://www.w3.org/1998
/Math/MathML"
xmlns:m="http://schemas.openxmlfor
mats.org/officeDocument/2006/math"
><mml:mn>3</mml:mn><mml:msup
><mml:mrow><mml:mi>X</mml:mi
></mml:mrow><mml:mrow><mml:m
n>3</mml:mn></mml:mrow></mml:
msup><mml:mo>=</mml:mo><mml
:mn>3000</mml:mn></mml:math>
```

Note, I copied and pasted the above MathML code, into MathType, and MathType interpreted this code the same way that Microsoft Word 2010 did. That is as soon as the code was pasted into MathType the following equation was displayed: $3X^3 = 3000$

The MathML computer language was primarily created for the Internet, but as mentioned in a previous section, it has limited functionality in this regard, **simply because most people that use the Internet do not have the software needed to interpret this language.** This may change in the future, especially if the required software is incorporated directly into web browsers.

It appears that the software engineers that designed Microsoft Word 2010 and the new equation editor took the above into account. That is when a Word 2010 document is converted to a webpage, mathematical notation comprising MathML code, is converted to a graphics format, by default. If this conversion was directly from a Microsoft Word 2010 document (.docx) to a filtered webpage, the MathML code is apparently removed. That is opening a webpage created in this way, in Microsoft Word, does not provide the functionality to modify the mathematical expressions, because they are in a graphics format. However, you can change the size, of these graphics, or you can rewrite the mathematical expression with Microsoft's new equation editor, with the MathML code.

If a Microsoft Word 2010 document (.docx) is converted to a NON-FILTERED version of a webpage, the MathML code is retained in the mathematical notation, but the mathematical notation is also reproduced in a graphic format. With this type of conversion, the mathematical notation can be modified, without rewriting the entire expression, if the webpages opened in Word 2010. However, webpages of this nature are larger than the filtered version mentioned above, and generally, when all of the editing is completed a filtered version of the webpage should be generated. When this is done, you should always retain the original version of the document in a non-filtered format. This will be useful if you need to make modifications in your completed work, at a later point in time.

Subsection) MathJax Interprets MathML and LaTeX

What is MathJax? MathJax is free open source software, and it provides the needed functionality to interpret the Mathematical Markup Language, to present mathematical notation, in a conventional format on websites. MathJax can also interpret an older computer language that is often used for mathematical notation, called LaTeX. MathJax functions with all of the commonly used web browsers, including Internet Explorer, Firefox, and Chrome. MathJax does not provide the functionality needed to create mathematical expressions; it was designed primarily to view websites that used MathML or LaTeX for Mathematical notation.

MathJax can be used in two ways, one of which is with a conventional computer and web browser. This means visitors to a website with mathematical notation written in MathML or LaTeX, must be willing to download and install MathJax on their computer to view the mathematics. As explained above, this can be problematic, because website visitors may not want to download and install software from an unknown source, because of the risk of viruses and other malicious software.

MathJax can also be used directly from a web server, which is maintained by the manufacturer of the software. That is websites that utilize the MathJax server to display their math notation, require a few lines of JavaScript code to access the server, in their webpages. All of this eliminates the need for the user to download and install software on their computers, but there are some problems with this technique also. The computer code for the mathematics is not processed instantly, in the way conventional text is processed and displayed.

I accessed a website that contained mathematics, and it was using the MathJax server, and it required a minute or two to process a few pages of mathematics written with LaTeX code. A link to this website is presented below:

www.luschny.de/math/factorial/hadamard/HadamardsGammaFunctionMJ.html

The problems with the above technology, would be eliminated if all of the required code needed to interpret and display the mathematical notation created with MathML or LaTeX, were retained in the webpage and/or on the web server. Developing this concept into functioning software is most likely quite challenging, and probably expensive. However, the technology is very likely to improve, and many new developments might be available in a few years.

The above was greatly simplified, and if you want more detailed information about MathJax, go to their website at:

www.MathJax.org

MathJax is free open source software, and you can download it from the MathJax website located at:

www.MathJax.org/2012/02/11/news/mathjax-v2-0-beta-now-available-on-cdn

Subsection) Additional Information In Regard To The Above, From Other Authors

If you want more information about the above see the following websites from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine at www.Google.com

Words on website: Publishing Math on the Web

Words on website: The mission of the Scientific and Technical Information Exchange (STIX) font project is the creation of a comprehensive set of fonts that serve the scientific and engineering communities.

Words on website: Mathematical Markup Language (MathML) Version 3.0 (www.w3.org/TR/MathML3/)

Words on website: "Mathematical Markup Language (MathML) is an application of XML for describing mathematical notations and capturing both its structure and content. It aims at integrating mathematical formulae into World Wide Web pages and other documents. It is a recommendation of the W3C math working group."

Words on website: Hints, tips, and help for writing mathematics well

Words on website: MathPlayer User Manual

(PDF) Words on website: Using MathType to Create TEX and MathML Equations

Words on website:Displaying a formula

Words on website: Wolfram Research

Chapter 4) Techniques and Software For Creating High-Quality Electronic Math Documents

Section 10) Introduction to Software Used For Creating Math Notation

Another problem with writing mathematical notation for the electronic format is it can be very time consuming with certain types of software and certain techniques. For example, with some word processors, you must enter mathematical expressions using specialized notation, which is displayed by the software in terms of conventional mathematical notation. This may not be much of a problem if you only have a few mathematical expressions to place on a website. However, if you create websites, or any other type of document, with dozens of mathematical expressions, spending even 15 minutes on each mathematical expression may be excessively time-consuming.

The best software provides the functionality for entering complex mathematical expressions with an efficiency and speed that is similar to entering one or two sentences of conventional text. This generally, involves **LESS THAN 60 SECONDS** to enter most mathematical expressions.

Thus, when deciding which software is best for your needs, you should make comparisons based on the time and effort required to enter mathematical expressions, using various types of software. You will probably find great differences in this regard, if you check out a number of equation editors, and word processor software packages. You can also compare the software on the quality of the mathematical notation they produce, but in most cases you probably will not find tremendous differences in this regard.

(NOTE: The above actually applies to almost any type of software. That is it is not uncommon to find that a task that requires 30 minutes with one software package, can be completed in less than five minutes with the same quality with a competing brand of software. This factor is not necessarily related to price or the reputation of the manufacture of the software.)

All of the material discussed in the remainder of this e-book, are based on techniques and software I frequently use. This includes all of the following software, which is highly efficient:

1) MathType

2) Mathcad

3) Microsoft Word

4) Microsoft’s old equation editor 3

5) Microsoft’s new equation editor, in Word 2010

The computer programs listed above are discussed in separate sections, and I use these programs to create this e-book. Two of the software devices listed above can also solve complex mathematical expressions as soon as they are entered (Mathcad, and Microsoft's new equation editor, with a special add-in). All of the above software will generate mathematical expressions, in the graphics format, if you are producing webpages. However, two of the equation editors can also produce mathematical expressions in MathML, as was explained in the previous sections of this e-book (MathType, and Microsoft's new equation editor in Word 2010).

It is important to keep in mind that the computer programs used to create electronic math documents are fairly complex. You will encounter a considerable amount of complexity even if you are using popular software, such as Microsoft Word or OpenOffice write. This is especially the case if you are creating webpages with mathematics and text, which involves more complexity and many challenges that are not present when creating conventional documents. However if you have advanced expertise in desktop publishing or in creating websites you will probably have no difficulty in creating mathematical documents, even if you never did so before. The same applies if you have expert skills with creating mathematics documents with a specific software package, and you switch to some of the software mentioned in this e-book. In such a case, you might have to practice an hour or two to become familiar with new techniques and/or new software packages.

However, if you only have conventional computer skills, such as typing a term paper in Microsoft Word, you will probably have to practice and study the relevant material, before you can create mathematical documents with ease and efficiency. If you only want to learn the very basics, it may require only a couple of hours of practice and study, such as with one equation editor, to enter simple math expressions in conventional Word documents.

However, if you want to learn how to create electronic math documents for websites, in various styles and color combinations, with supporting text and graphics, using all of the software presented in this e-book, the task is significantly more challenging than the above, assuming you have only conventional computer skills. This will become apparent, if you examine the documentation from the manufactures of the software presented in the following paragraphs. Most of these software packages have instruction booklets that range in length from 100 pages to over 500 pages. Thus, depending on your current knowledge and skills, mastering this material can require anywhere from one or two hours of study and practice per day for one to 36 months. People fail at complex tasks of this nature when they **INADVERTENTLY** attempt to master the material that experts acquired over a period of many years, in a few hours or days, which usually leads to frustration. An analogy is: the untrained often think they are attempting to climb a 10 story building, but they are really climbing Mount Everest.

Section 11) Microsoft's Old Equation Editor 3

The new version of Microsoft Office 2010 has a new type of equation editor, as well as the old equation editor. In a later section I will discuss the new version, but this section is focused on the old equation editor, which is available in Microsoft Office 2003, and later versions. (It may have also been available in earlier versions than 2003.)

The only problem with the old equation editor is it was inadvertently hidden by Microsoft, and many people do not know that it even exists. To access the old equation editor, carry out the following steps, in Microsoft Word, Excel, PowerPoint, or Publisher, (for all versions):

1) In Microsoft Word, Excel, PowerPoint, or Publisher, Look for the word Insert, and when you find it, click on it.

2) Then look for the word **object** and click on it, and a relatively large menu will open.

3) Then scroll down the menu until you see the words **Microsoft Equation 3**.

4) Then, left click on the words: **Microsoft Equation 3**, and the **Editor will open**.

Microsoft's old equation editor 3 is relatively easy to use. It has a series of menus and icons that you can click on, to insert the symbols needed to create a mathematical expression. Some people might find this difficult or time-consuming, if they never used software of this type. However, after practicing with this software for a few hours or less, most people will probably find that they can create mathematical expressions quickly and efficiently. For detailed information, see the instructions that come with Microsoft word's equation editor, or the websites and videos at the end of this section.

The following mathematics was created with the old Microsoft equation editor 3. The frames and background colors were added for aesthetics, with the functions in Microsoft Word.

$$5X + 5 = 55$$
$$5X = 50$$
$$X = 10$$
$$Checking:$$
$$5(10) + 5 = 55$$
$$50 + 5 = 55$$
$$55 = 55$$

$$\sin(a)^2 + \cos(a)^2 = 1$$
$$\sin(a)^2 = 1 - \cos(a)^2$$
$$\sin(a) = \pm\sqrt{1 - \cos(a)^2}$$

$$E = mc^2$$

$$\frac{E}{c^2} = m$$

$$\int_A^B x^n dx = \frac{x^{n+1}}{n+1} = \frac{B^{n+1} - A^{n+1}}{n+1}$$

$$\int_C^D Kx^2 dx = \frac{Kx^3}{3} = \frac{KD^3 - KC^3}{3}$$

Subsection) Additional Information In Regard To the Above, From Other Authors

If you want more information about the above see the following websites and videos from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine, at: www.Google.com If the link that failed is for a video use www.Video.Google.com.

When you left click on a link for a video, a web page will open, which usually has a large number of high-quality videos that are related to the words on the hyperlink you clicked on. However, when you click on the link it will usually start only one video automatically, which may take a few seconds. If the video does not start automatically, left click on the link provided by the author of the video. This link is usually in the center of the screen.

Words on website: Information Systems & Technology

Words on website: **Add equations with Microsoft Equation**

(PDF) Words on website: **Equations (using *Equation Editor 3*)**

Words on website: **Creating Mathematics inside Microsoft Word**

Words on video: **How to use the Equation Editor**

Words on video: **How To Use Equation Editor - Part 1**

Words on video: **How To Use Equation Editor - Part 2**

Section 12) MathType, an Advanced Equation Editor

MathType is an advanced standalone equation editor, with a layout and functionality that is more or less similar to Microsoft Equation editor 3, but it has significantly more mathematical symbols. The main advantage of MathType is its great versatility, which makes it useful for creating websites with mathematical notation. It can be used with almost any word processor, including Microsoft Word, and OpenOffice write. It can also be used with Microsoft Excel, PowerPoint, Publisher, Outlook, and OneNote, and many other computer programs that are used for mathematics.

When MathType is loaded on your computer, you can access it from all of the above software packages, by clicking on **insert**, then **object**, and a menu opens. Then, scroll down the menu and when you see the word: **MathType, left click on it**. This is the same way that Microsoft Equation editor 3 is accessed, which was described in the previous section.

However, from the latest version of Microsoft Word, and PowerPoint, 2010, you can ALSO access the MathType controls from a ribbon of icons, on the top of the computer screen.

A very important feature of MathType is its conversion functionality. That is MathType can convert the mathematical symbols entered by the user into a number of graphic formats, as well as into a number of computer languages which includes the following:

1) Encapsulated PostScript (EPS) is a graphics format

2) Encapsulated PostScript/WMF is a graphics format

3) Encapsulated PostScript/TIFF is a graphics format

4) Windows Metafile (WMF) is a graphics format

5) Graphics Interchange Format (GIF) is a graphics format

6) MathML is the Mathematical Markup Language

7) TeX is a computer language

8) LaTeX is a computer language

There are many other advantages to MathType, besides the above. However, MathType has one major disadvantage, which is its great complexity. This is associated with its great versatility. Many users may be confused about the various graphic formats and computer languages mentioned above. However, MathType can be used in a relatively simple way, with its default settings, which will eliminate potential difficulties, but it will also eliminate some of the versatility. In addition, some of the default settings are less than optimal, especially for websites. For example, MathType's default setting for font size is too small for creating high quality mathematical notation for a website.

NOTE, the font size in MathType can be increased, with its complex set of controls. The font size can also be increased in a simpler way, when the mathematical notation is inserted into Microsoft Word and similar word processor software, by dragging the lower corner of the mathematical notation with the mouse.

I find MathType's advanced features useful when I want to create calculation software, which involves a conversion process from Microsoft Excel to JavaScript. During this conversion process the quality of graphics with mathematical notation is sometimes severely degraded. With MathType there are many ways of circumventing problems of this nature, such as by creating mathematical expressions in the form of very high resolution GIF images, or replacing the graphics with the math notation after the conversion.

A few examples of mathematical notation and calculations created with MathType are presented below this paragraph. The calculations were carried out manually using MathType instead of pencil and paper. Performing manual calculations in this way is very useful when the mathematics is very complex, or lengthy, because it is likely to reduce the chances of making errors, when compared with pencil and paper calculations. In addition, if an error is made, it is much easier to spot it, with this technique then it would be with pencil and paper calculations.

Note, the background colors and frames on the following mathematical expressions, were created with Microsoft Word for the purposes of aesthetics.

$$\int_{2}^{12} x dx = \frac{x^2}{2} = \frac{12^2 - 2^2}{2} = \frac{144 - 4}{2} = \frac{140}{2} = 70$$

3X-6=24

3X=30

X=10

Checking:

3X-6=24

3(10)-6=24

30-6=24

24=24

$$\int_A^B x^n dx = \frac{x^{n+1}}{n+1} = \frac{B^{n+1} - A^{n+1}}{n+1}$$

Subsection) Calculations with MathType and WolframAlpha

A very interesting feature of MathType consists of a built-in mechanism designed to access an Internet computer server called WolframAlpha. When the user enters a mathematics problem in MathType, and clicks on a menu icon with the words: **View in WolframAlpha**, MathType transmits the math problem to the WolframAlpha computer, which is running mathematics software. This software and **WolframAlpha** makes an attempt to unravel the mathematical notation that it received from MathType, and then it attempts to calculate a solution.

WolframAlpha is actually more than a calculation device. The company that created it (Wolfram Research) calls it a computational knowledge engine. However, this device really is an experimental project, and it often provides incorrect or irrelevant answers even to mathematics problems. This appears to be the result of its relatively low ability to interpret written language, and conventional mathematical notation. WolframAlpha will sometimes even misinterpret data transmitted from MathType, and display irrelevant or incorrect calculated results.

Nevertheless this project is very interesting, and WolframAlpha provided correct calculations for the mathematics problems presented below this paragraph, which were transmitted from MathType. I very carefully check these calculations manually to confirm the accuracy of the calculations. (NOTE: If you want more information on WolframAlpha see: www.wolframalpha.com,and for a video see: www.wolframalpha.com/tour/what-is-wolframalpha.html)

$$\int_{2}^{8} xdx = 30$$

Checking :

$$\int_{2}^{8} xdx = \frac{x^2}{2} = \frac{8^2 - 2^2}{2} = \frac{64 \ -4}{2} = \frac{60}{2} = 30$$

$$\int_{2}^{4} X^2 dX = \frac{56}{3} = 18.66667$$

Checking

$$\int_{2}^{4} X^2 dX = \frac{X^3}{3} = \frac{4^3 - 2^3}{3} = \frac{64-8}{3} = \frac{56}{3} = 18.66667$$

$$4X + 6 = 26$$

$$X = 5$$

Checking

$$4X + 6 = 26$$

$$4X = 20$$

$$X = \frac{20}{4} = 5$$

Subsection) Additional Information In Regard To The Above, From Other Authors

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When you left click on a link for a video, a web page will open, which usually has a large number of high-quality videos that are related to the words on the hyperlink you clicked on. However, when you click on the link it will usually start only one video automatically, which may take a few seconds. If the video does not start automatically, left click on the link provided by the author of the video. This link is usually in the center of the screen.

Words on website: Try MathType free for 30 days!

Words on website: Works with over 500 Applications & Websites

Words on website: Using MathType to Create TEX and MathML Equations

Words on video: Using Math Type

Words on video: Using MathType with the Windows 7 Math Input Panel

Words on video: MathType Tutorial: Formatting Equations

Section 13) Creating Math documents with Mathcad

Mathcad can be used to write mathematical expressions, in much the same way as MathType, discussed in the previous section. However, Mathcad is designed to perform complex mathematical calculations, such as for engineering and science. Mathcad displays the data entered by the user, along with the calculated results, in an electronic document. This document can be printed, as well as inserted into Microsoft Word, PowerPoint, Excel, and a number of other applications. The data entered into Mathcad and the calculated results can also be transferred to almost any word processor, spreadsheet, or presentation software with the cut-and-paste function. This may require pasting in graphic format, poor software that does not accept the Mathcad code.

Mathcad is different than conventional mathematics software. Specifically, most mathematics software, cannot interpret conventional mathematical notation. This even applies to spreadsheet software, which becomes obvious when spreadsheets are used at a very advanced level. Mathematics software of this nature generally requires learning a set of symbols and mathematical notation that is more or less a computer language, which is based on the symbols on the keyboard. However, each brand of mathematics software interprets the keyboard symbols differently, which essentially means that it is necessary to learn a new computer language for each brand of mathematics software. All of this can be time-consuming, and it is likely to increase the chances of making errors.

The great advantage of Mathcad is it uses conventional mathematical notation, with only a few exceptions. That is the user enters mathematical expressions by clicking on icons, in a way that is similar to MathType. Anyone that has a mathematical background can easily understand calculations in a Mathcad document, which makes it excellent for record-keeping and formal documentation. As a result of the above, Mathcad is highly efficient and user-friendly, and complex mathematical expressions can be quickly entered. Calculated results are obtained in most cases by simply clicking with the mouse.

The following calculations were performed in Mathcad documents that were embedded in this webpage. Note, the frames and background colors were created for aesthetics, with the functions in Microsoft Word.

$$2X^2 + 2X - 24 = 0 \text{ solve } \rightarrow \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

Checking calculations

When $X := 3$

$$2X^2 + 2X - 24 = 0$$

When $X := -4$

$$2X^2 + 2X - 24 = 0$$

3 and -4 both satisfy the equation

$$X^2 + X - 110 = 0 \text{ solve } \rightarrow \begin{pmatrix} 10 \\ -11 \end{pmatrix}$$

Checking calculations

When $X := 10$

$$X^2 + X - 110 = 0$$

When $X := -11$

$$X^2 + X - 110 = 0$$

10 and -11 both satisfy the equation

$$40X^2 + 200X = 100 \text{ solve } \rightarrow \begin{pmatrix} \frac{\sqrt{35}}{2} - \frac{5}{2} \\ -\frac{\sqrt{35}}{2} - \frac{5}{2} \end{pmatrix}$$

$$\int_3^{10} X \, dX \rightarrow \frac{91}{2} = 45.5$$

$$\int_2^{8} X^2 \, dX = 168$$

$$\int_2^{43} 2X^2 \, dX = 52999.33333333336$$

$$\int_{2}^{4} X^{6}\, dX = 2322.285714285714$$

__The same Mathcad calculations are presented below, without the frames:__

$$2X^2 + 2X - 24 = 0 \text{ solve } \rightarrow \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

Checking calculations

When $X := 3$

$$2X^2 + 2X - 24 = 0$$

When $X := -4$

$$2X^2 + 2X - 24 = 0$$

3 and -4 both satisfy the equation

$$X^2 + X - 110 = 0 \text{ solve } \rightarrow \begin{pmatrix} 10 \\ -11 \end{pmatrix}$$

Checking calculations

When $X := 10$

$$X^2 + X - 110 = 0$$

When $X := -11$

$$X^2 + X - 110 = 0$$

10 and -11 both satisfy the equation

$$40X^2 + 200X = 100 \text{ solve } \rightarrow \begin{pmatrix} \frac{\sqrt{35}}{2} - \frac{5}{2} \\ -\frac{\sqrt{35}}{2} - \frac{5}{2} \end{pmatrix}$$

$$\int_3^{10} X\,dX \rightarrow \frac{91}{2} = 45.5$$

$$\int_2^8 X^2\,dX = 168$$

$$\int_2^{43} 2X^2\,dX = 52999.333333333336$$

$$\int_2^4 X^6\,dX = 2322.285714285714$$

$$\boxed{\int_2^4 \int_3^6 X\,dX\,dY = 27}$$

$$\int_{4}^{23}\int_{2}^{12} X^2 Y \, dX \, dY = 147060$$

$$\int_{2}^{4}\int_{1}^{9}\int_{10}^{12} x \cdot y \cdot z \, dx \, dy \, dz = 5280$$

$$\int_{a}^{b} x \, dx \rightarrow \frac{b^2}{2} - \frac{a^2}{2}$$

$$\int_{C}^{D}\int_{A}^{B} x \cdot y \, dx \, dy \rightarrow \frac{\left(A^2 - B^2\right) \cdot \left(C^2 - D^2\right)}{4}$$

$$\int_{E_z}^{F_z}\int_{C_y}^{D_y}\int_{A_x}^{B_x} x \cdot y \cdot z \, dx \, dy \, dz \rightarrow -\frac{\left[(A_x)^2 - (B_x)^2\right] \cdot \left[(C_y)^2 - (D_y)^2\right] \cdot \left[(E_z)^2 - (F_z)^2\right]}{8}$$

$$\int \sin(x) \, dx \rightarrow -\cos(x)$$

$$\boxed{\int \cos(x)\, dx \rightarrow \sin(x)}$$

$$\boxed{\int \tan(x)\, dx \rightarrow -\ln(\cos(x))}$$

Subsection) Demonstrating A Useful Concept, Using Mathcad: Parallel and Serial Connections, Between Formulas

Two paragraphs below there are two sets of calculations that were carried out with Mathcad, and they represent a very useful concept, which I use when I create calculation devices. Specifically, a set of numbers can be used for multiple calculations, by transmitting the numbers electronically to a set of formulas. When this is done the formulas behave as if they are electronic components wired together.

There are two basic configurations that can be used to connect the formulas, which have distinct purposes, and provide different calculated results. **One involves the direct transmission of the numbers to each formula.** When electronic components are connected in this way, the configuration is called **parallel connections**. The other configuration involves a chain like sequence of formulas, connected together, where each formula transmits its calculated results to another formula. This can involve many formulas linked together in a chain like sequence, where each formula in the chain transmits its calculated result to the next formula in the sequence. **I originally learned these concepts in electronics, and I applied them to mathematics and software.**

Note, in the two examples presented below, the letter is on top, **D, E, M**, with the colons and equal-signs are input fields. The numbers placed in these fields are transmitted to all of the formulas. With the parallel configuration, presented below, the numbers are transmitted directly to each formula. With the serial configuration the numbers are transmitted to one formula, which transmits its calculated results to another formula, etc. The example of serial configuration that I present here, involves six formulas in the sequence.

This is a parallel configuration

$D := 4 \qquad E := 3 \qquad M := 5$

$$D + E + M = 12$$

$$D^2 - E + M = 18$$

$$D \cdot E \cdot M = 60$$

$$(E \cdot M)^D = 50625$$

$$\left(\frac{D + E}{D}\right)^M = 16.413$$

This is a serial configuration

$D := 4$ $E := 3$ $M := 5$

$$\mathrm{LinkOne} := D + E + M = 12$$

$$\mathrm{LinkTwo} := \mathrm{LinkOne} + D + E + M = 24$$

$$\mathrm{LinkThree} := \frac{(D + E + M)}{\mathrm{LinkTwo}} = 0.5$$

$$\mathrm{LinkFour} := \frac{(D \cdot E) \cdot \mathrm{LinkThree}}{M} = 1.2$$

$$\mathrm{LinkFive} := \frac{(E \cdot M)^{D}}{\mathrm{LinkFour}} = 42187.5$$

$$\left(\frac{D + \mathrm{LinkFive}}{D + E + M}\right) = 3515.9583333333$$

Subsection) Additional Information on Mathcad, From Other Authors

If you want more information about the above see the following websites and videos from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine, www.Google.com. If the link that failed is for a video use www.Video.Google.com.

When you left click on a link for a video, a web page will open, which usually has a large number of high-quality videos that are related to the words on the hyperlink you clicked on. However, when you click on the link it will usually start only one video automatically, which may take a few seconds. If the video does not start automatically, left click on the link provided by the author of the video. This link is usually in the center of the screen.

(PDF) Words on website: Mathcad

Words on website: Get a 30 Day Free Trial

(PDF) Words on website: MathCAD Tutorial

Words on video: Engineering Calculations with Mathcad

Words on video: MathCAD 15.0 Explained

Chapter 5) Microsoft Office 2010 And Its New Equation Editor

Section 14) Microsoft Office 2010, Has a New Equation Editor

The 2010 Microsoft Office suite comes with a new highly efficient equation editor. This editor has a large number of unique qualities, and it is really much more than an equation editor. As a result, I am devoting an entire chapter to this software, to explain and display some of its key features and diverse functionality.

If you plan to purchase an equation editor the best strategy in my opinion is to purchase Microsoft Word 2010, which includes Microsoft's new equation editor. This software has most, if not all, of the mathematical functionality that most mathematicians, scientists, and students need. Another advantage to Microsoft Word is the large number of third-party software devices that can be incorporated into this software to increase its functionality. This includes MathType and Mathcad, which were discussed in previous sections of this e-book.

With Microsoft's new equation editor it is easy to create just about any type of mathematical expression, with the minimum expenditure of time, directly in Microsoft Word, OneNote, Outlook, Excel, and PowerPoint. When it is used in Microsoft Word, equations can easily be integrated directly into the text such as the following: $\mathbf{3X = 33}$ **then** $\mathbf{X = 3}$. This is very useful, and I do not know of any other equation editor that provides a similar level of precision, functionality, and efficiency: in terms of the time and effort required to enter mathematical notation.

AN IMPORTANT NOTE: Microsoft's new equation editor does not work with the older Microsoft Word format, with the file extension **.doc**. Thus, if you want to use this equation editor, in Word you must use one of the following file formats: **.docx, .docm, .htm**, **mht**, **.rtf**

The new equation editor has additional functionality, with a free add-in that is downloaded from Microsoft. With this add-in the new equation editor **can actually solve complex mathematics problems**, directly in Microsoft Word, in a way that is more or less similar to Mathcad. This includes, solving algebraic equations, and performing calculations involving trigonometry, calculus, logarithms and arithmetic. With the add-in the equation editor can even solve symbolic equations, which do not contain numbers.

However, the calculation capabilities of the editor will only function in Microsoft Word and OneNote. That is the equation editor, does not solve mathematics problems in Excel, PowerPoint, and Outlook, but you can use this device to enter mathematical expressions in this software, which can be solve manually. (The above might change in future versions of the equation editor.)

Even more amazing is the new equation editor with the add-in can actually graph equations on a two or three dimensional graph. That is as soon as the user clicks on a button the equation editor and **add-in** generates a graph of appropriate dimensions and proportions, and then graphs the equation entered by the user in less than a second.

The three-dimensional graphs generated by the equation editor, can be moved around in a computer simulated three-dimensional space. This is done by clicking on the graph, which opens a special window, where the graph can be manipulated with the mouse, or by clicking on buttons. This window even has buttons to start a continuous circular motion of a three dimensional graph. This motion can be set for clockwise or counterclockwise continuous movements. When the special window is closed the graphs do not move.

The calculation and graphing functionality of Microsoft's new equation editor and add-in, will be presented in the following sections in this chapter. This includes all of the following:

1) **Algebraic calculations**

2) **Trigonometric calculations**

3) **Calculus**

4) **Two-dimensional graphs**

5) **Two-dimensional trigonometric graphs**

6) **Three-dimensional graphs**

7) **Three-dimensional trigonometric graphs**

The calculated results in the following sections of this e-book were edited slightly to optimize readability and aesthetics. This included moving calculated result slightly, and background colors were added to some of the calculated results and graphs. Both the two-dimensional and three-dimensional graphs were placed in frames to improve aesthetics.

Subsection) A FREE Standalone Calculation Device Similar to The Above, From Microsoft

Microsoft has a standalone software device called Microsoft Mathematics 4. This device performs the same mathematics as the new equation editor and add-in for Word 2010, which was discussed above. However Microsoft Mathematics 4, is created primarily for students, and it can provide step-by-step solutions to math problems, and you do not have to own Microsoft word to use this product. Microsoft Mathematics 4 provides the functionality needed to save the mathematics that you enter, in its own special document, which has a file extension of: **.gcw**. You can also export the calculated results to the new Microsoft Word format, with the file extension: **.docx.**

Microsoft Mathematics 4 does not appear to be as efficient as the new equation editor and add-in for Word 2010. It takes a little more time to use this device, and it is not designed to create professional math documents, or webpages with math. However, Microsoft Mathematics 4 appears to be a better learning device than the above.

Surprisingly Microsoft is providing Mathematics 4 for FREE, and it can be downloaded from the following website:

www.microsoft.com/download/en/details.aspx?id=15702

If this link fails, do a Google search **www.Google.com** with the words in quotation marks **"Microsoft Mathematics"** (Do not use the 4, when searching, because this number is likely to change, with future versions.)

Subsection) Additional Information

In Regard To The Above, From Other Authors

If you want more information about the above see the following websites and videos from other authors, by left clicking on the blue links, presented below. If a link fails, enter the blue words into Google's search engine, www.Google.com. If the link that failed is for a video use www.Video.Google.com.

When you left click on a link for a video, a web page will open, which usually has a large number of high-quality videos that are related to the words on the hyperlink you clicked on. However, when you click on the link it will usually start only one video automatically, which may take a few seconds. If the video does not start automatically, left click on the link provided by the author of the video. This link is usually in the center of the screen.

Words on website: Write, insert, or change an equation

(PDF)Words on website: Mathematics Teachers and Students

Words on website: Solve and Graph Equations in Word

Words on website: Add Math Equations With Word

Words on website: Microsoft Mathematics Add-In for Word and OneNote

Words on website: Microsoft Mathematics 4.0

Words on website: Wikipedia Microsoft Mathematics

Words on website: Solve and Graph Equations in Word

Words on video: How to do equations in Microsoft Word 2010

Words on video: Microsoft Mathematics Add-in for Word ...

Words on video: Microsoft Mathematics Add-In

Words on video: Microsoft Math

Words on video: Microsoft Word 2010 - User Guide Equations

Section 15) Algebraic Calculations in Microsoft Word 2010, With Its New Equation Editor, and Add-In

$$3X = 33$$

$$X = 11$$

$$4Y + 24 = 124$$

$$Y = 25$$

$$X^2 - 5 = 95$$

$$X = -10 \; or \; X = 10$$

$$X^2 + X^3 = 12$$

$$X = 2$$

$$X^2 + X^3 = A$$

$$x = \sqrt[3]{\sqrt{\left(\frac{A}{2} - \frac{1}{27}\right)^2 - \frac{1}{729}} + \frac{A}{2} - \frac{1}{27}} + \sqrt[3]{-\sqrt{\left(\frac{A}{2} - \frac{1}{27}\right)^2 - \frac{1}{729}} + \frac{A}{2} - \frac{1}{27}} - \frac{1}{3}$$

$$3X - 9 + 2X = 25$$

$$X = \frac{34}{5}$$

$$X - 10X = Y + 10$$

$$X = \frac{-Y - 10}{9}$$

$$X^a - 10X = Y + 10$$

$$Y = -10\,X + X^a - 10$$

$$aX + bX = C$$

$$X = \frac{C}{a+b}$$

$$aX^2 + bX + C = 0$$

$$X = -\frac{\left(\sqrt{b^2 - 4\,a\,C}\right) + b}{2\,a} \quad and/or\ X = \frac{\left(\sqrt{b^2 - 4\,a\,C}\right) - b}{2\,a}$$

$$aX^3 + bX + C = 0$$

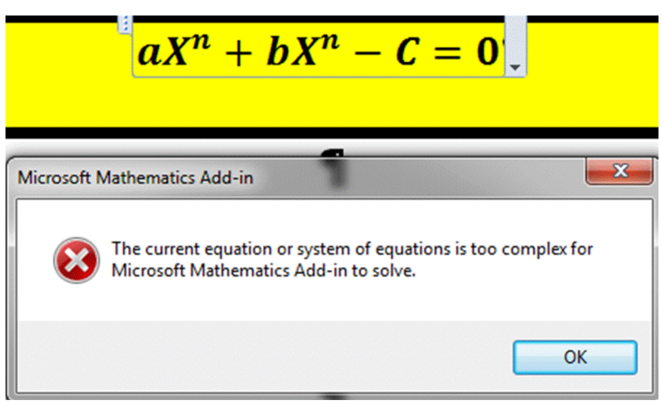
$$X = \sqrt[3]{\sqrt{\frac{b^3}{27\,a^3} + \frac{C^2}{4\,a^2}} - \frac{C}{2\,a}} + \sqrt[3]{-\sqrt{\frac{b^3}{27\,a^3} + \frac{C^2}{4\,a^2}} - \frac{C}{2\,a}}$$

Solved for X

$$(Y-3)(Y+3)(X+4)(X-2) = 0$$

$$\begin{cases} X = 2 \text{ or } X = -4, & Y \neq -3 \text{ and } Y \neq 3 \\ X \in \mathbb{R}, & Y = -3 \text{ or } Y = 3 \end{cases}$$

For the following equation I got an error message from the Microsoft mathematical add-in indicating that the equation was too complex to solve. See the screenshot below. However, this equation is not too difficult for a human to solve, simply by factoring out the X^n, and then performing conventional algebraic manipulations. Thus, I solved it myself, which can be seen below.



Manually Solved

$$aX^n + bX^n - C = 0$$

$$X^n(a + b) - C = 0$$

$$X^n(a + b) = C$$

$$X^n = \frac{C}{a+b}$$

$$X = \sqrt[n]{\frac{C}{a+b}}$$

Solved for Y

$$(Y - 3)(Y + 3)(X + 4)(X - 2) = 0$$

$$\begin{cases} Y = 3 \text{ or } Y = -3, & X \neq -4 \text{ and } X \neq 2 \\ Y \in \mathbb{R}, & X = -4 \text{ or } X = 2 \end{cases}$$

Solved for X

$$(Y - A)(Y + B)(X + C)(X - D) = 0$$

$$\begin{cases} X = -C \text{ or } X = D, & (B + Y)\,(Y - A) \neq 0 \\ X \in \mathbb{R}, & (B + Y)\,(Y - A) = 0 \end{cases}$$

Solved for Y

$$(Y - A)(Y + B)(X + C)(X - D) = 0$$

$$\begin{cases} Y = -B \text{ or } Y = A, & (X + C)\,(X - D) \neq 0 \\ Y \in \mathbb{R}, & (X + C)\,(X - D) = 0 \end{cases}$$

Section 16) Trigonometric Calculations In Microsoft Word 2010, With Its New Equation Editor, And Add-In

The Microsoft Mathematics Add-in and Equation Editor has controls to perform trigonometric calculations in RADIANS, DEGREES, and GRADIENTS. The following calculations were performed as indicated:

Degrees

$$\sin(30) = \frac{1}{2}$$

Degrees

$$\cos(30) = \frac{\sqrt{3}}{2}$$

Degrees

$$\tan(30) = \frac{\sqrt{3}}{3}$$

Degrees

$$cot(30) = \sqrt{3}$$

Degrees

$$sec(30) = \frac{2\sqrt{3}}{3}$$

Degrees

$$csc(30) = 2$$

Degrees

$$arcSin\left(\frac{1}{2}\right) = 30$$

Degrees

$$arcCos\left(\frac{\sqrt{3}}{2}\right) = 30$$

Degrees

$$arcTan\left(\frac{\sqrt{3}}{3}\right) = 30$$

Degrees

$arcCot(\sqrt{3}) = 30$

Degrees

$arcSec\left(\frac{2\sqrt{3}}{3}\right) = 30$

Degrees

$arcCsc(2) = 30$

Radians $sin\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$

Degrees $sin(45) = \frac{\sqrt{2}}{2}$

Radians $cos\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$

Degrees $cos(45) = \frac{\sqrt{2}}{2}$

Radians $tan\left(\frac{\pi}{4}\right) = 1$

Degrees $tan(45) = 1$

Radians $cot\left(\frac{\pi}{4}\right) = 1$	**Degrees** $cot(45) = 1$
Radians $sec\left(\frac{\pi}{4}\right) = \sqrt{2}$	**Degrees** $sec(45) = \sqrt{2}$
Radians $csc\left(\frac{\pi}{4}\right) = \sqrt{2}$	**Degrees** $csc(45) = \sqrt{2}$

Degrees

$arcCot(1) = 45$

Degrees

$arcSin\left(\frac{\sqrt{2}}{2}\right) = 45$

Degrees

$$arcSec(\sqrt{2}) = 45$$

Degrees

$$arcCos\left(\frac{\sqrt{2}}{2}\right) = 45$$

Degrees

$$arcCsc(\sqrt{2}) = 45$$

Degrees

$$arcTan(1) = 45$$

$$\left(sin(A)\right)^2 + \left(cos(A)\right)^2 = 1$$

$$\left(csc(A)\right)^{-2} + \left(sec(A)\right)^{-2} = 1$$

$$\left(sin(a)\right)\left(csc(a)\right) = 1$$

$$\left(cos(a)\right)\left(sec(a)\right) = 1$$

$$\left(tan(a)\right)\left(cot(a)\right) = 1$$

Section 17) Calculus in Microsoft Word 2010 With Its New Equation Editor, And Add-In

$$\int sin(Q)dQ = -\cos(Q) + C$$

$$\int cos(Q)dQ = \sin(Q) + C$$

$$\int tan(Q)dQ = -\ln(abs(\cos(Q))) + C$$

$$\int cot(Q)dQ = \ln(abs(\sin(Q))) + C$$

$$\int_{A}^{B} sin(x)dx = cos(A) - cos(B)$$

$$\int_{A}^{B} cos(x)dx = sin(B) - sin(A)$$

$$\int_{0}^{\frac{\pi}{4}} sin(x)dx = -\frac{\sqrt{2}}{2} + 1$$

$$\int_{0}^{\frac{\pi}{4}} cos(x)dx = \frac{\sqrt{2}}{2}$$

$$\int_{3}^{12} xdx = \frac{135}{2}$$

$$\int_{5}^{11} x^2dx = 402$$

$$\int_{A}^{B} x^2dx = \frac{B^3 - A^3}{3}$$

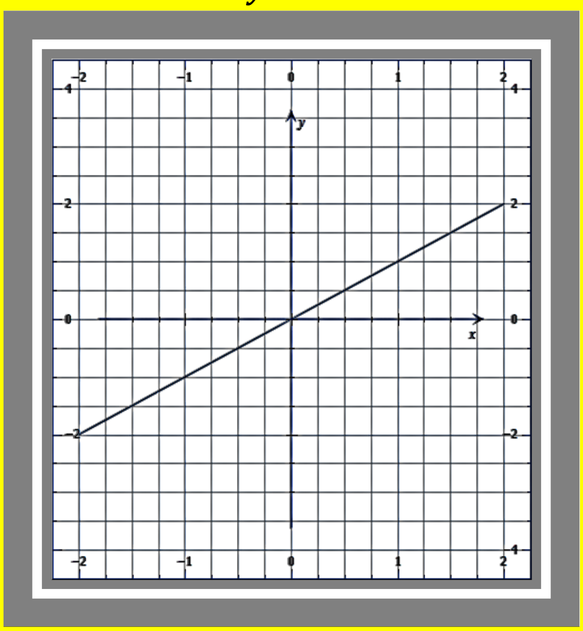
$$e = 2.718281828459$$

$$\int_{2}^{3} x^{e} dx = \frac{3^{e+1} - 2^{e+1}}{e+1} = 12.445856013278$$

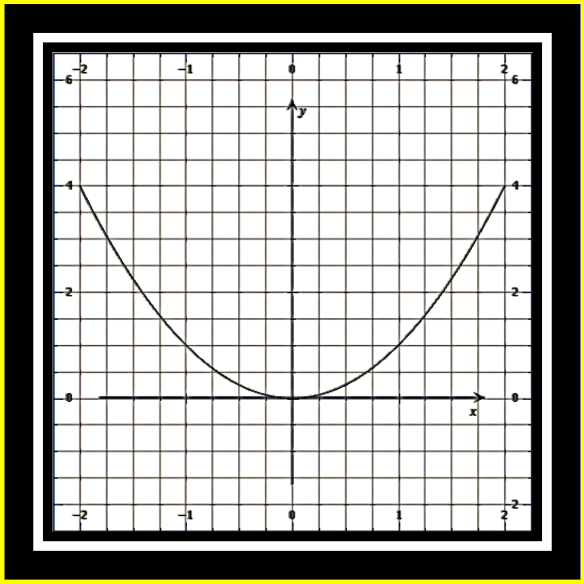
$$\int_{2e}^{4e} ex^{e} dx = \frac{(4\, e^{2})^{e+1} - (2\, e^{2})^{e+1}}{e^{2} + e} = 26874.042138912315$$

Section 18) Two-Dimensional Graphs In Word 2010, Generated With Microsoft's New Equation Editor, And Add-In

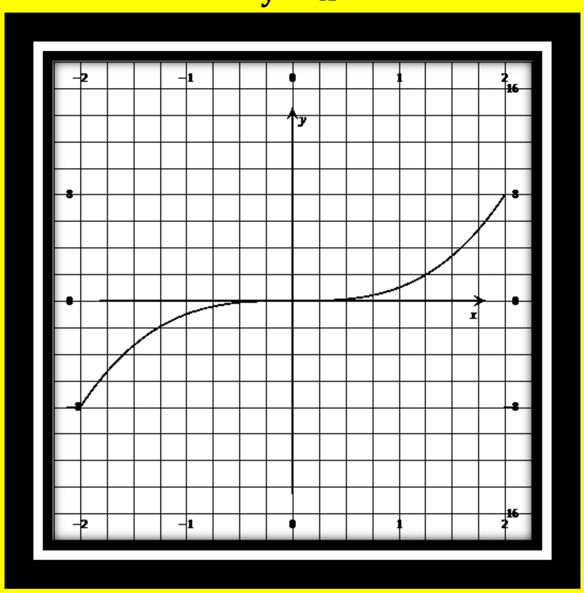
$$y = x$$



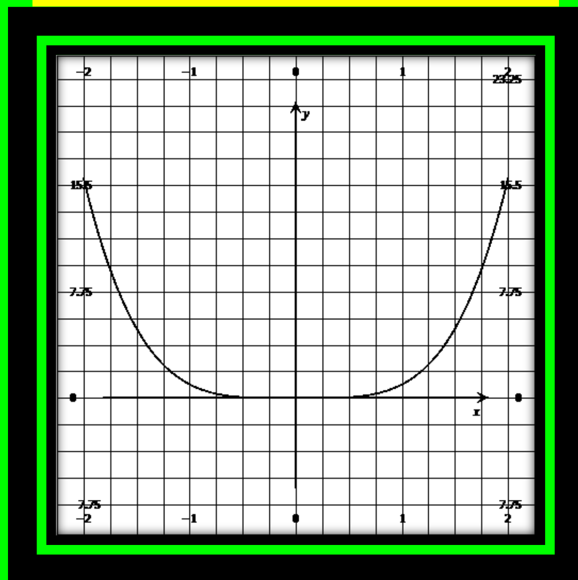
$$y = x^2$$



$$y = x^3$$

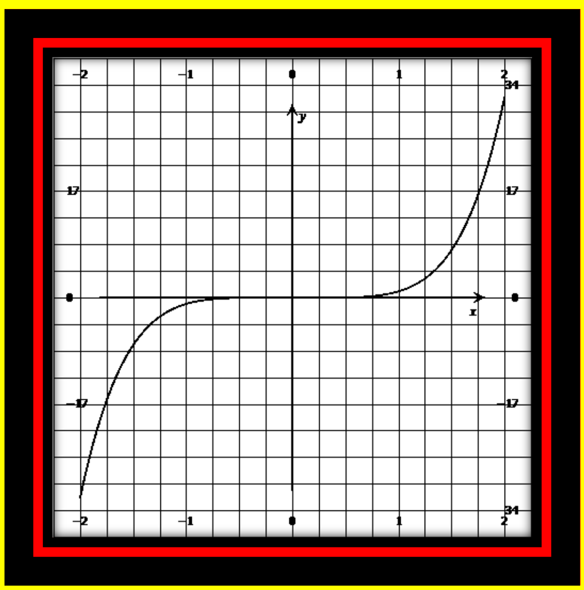


$y = x^4$



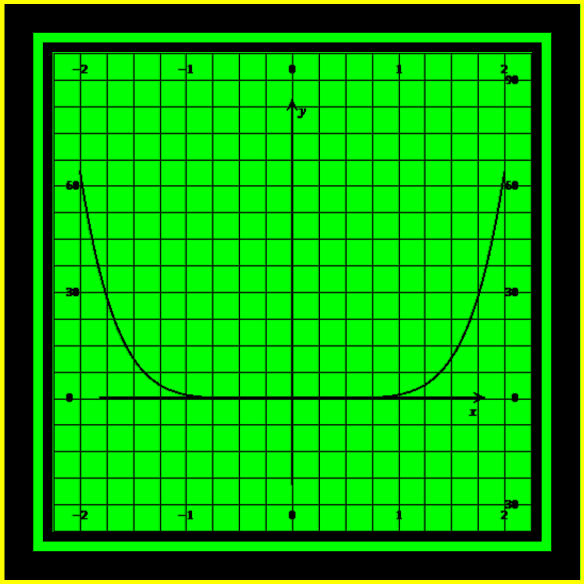
−2
−1
0
1
2
23.25
y
15.5
15.5
7.75
7.75
0
0
x
−7.75
−7.75
−2
−1
0
1
2

$y = x^5$

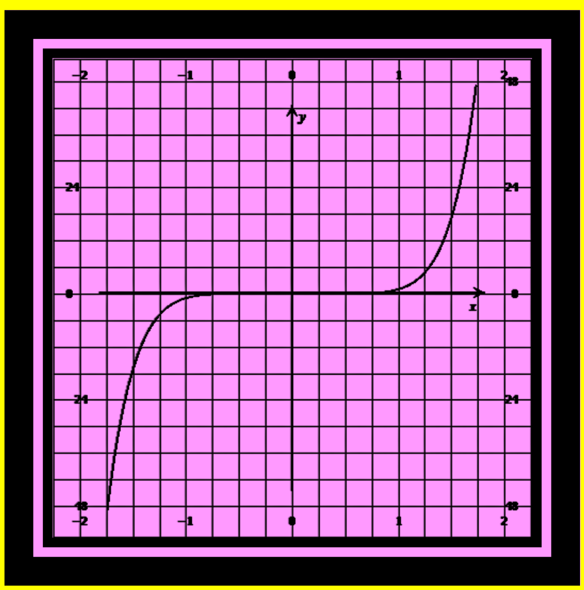


−2
−1
0
1
2
34
y
17
17
0
0
x
−17
−17
34
−2
−1
0
1
2

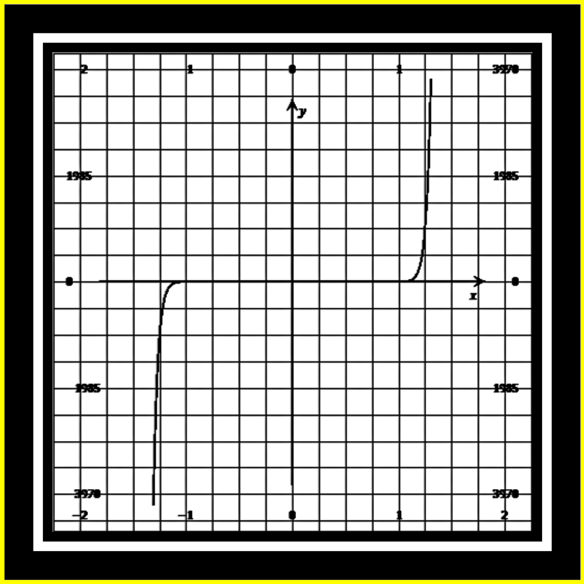
$$y = x^6$$



$$y = x^7$$

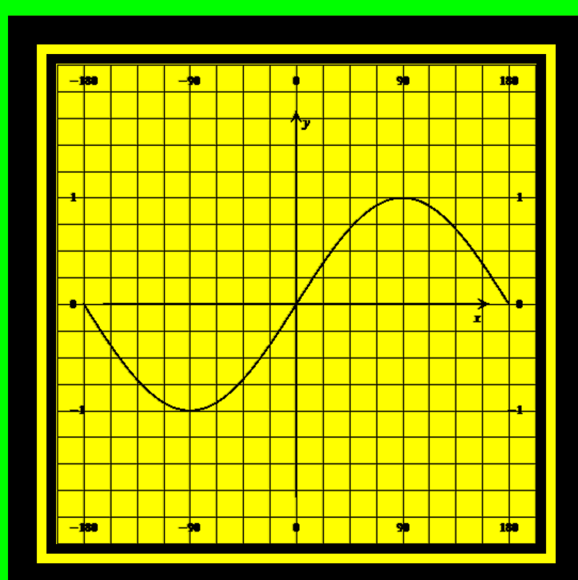


$$\mathbf{y = x^{31}}$$

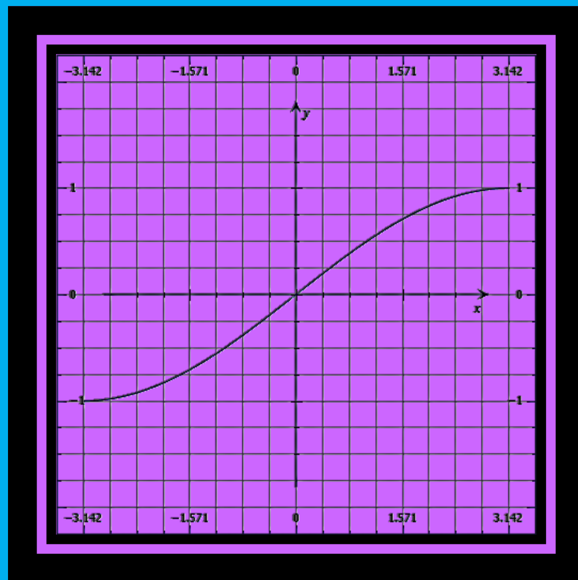


Section 19) Two-Dimensional Trigonometric Graphs In Word 2010, Generated With Microsoft's New Equation Editor, And Add-In

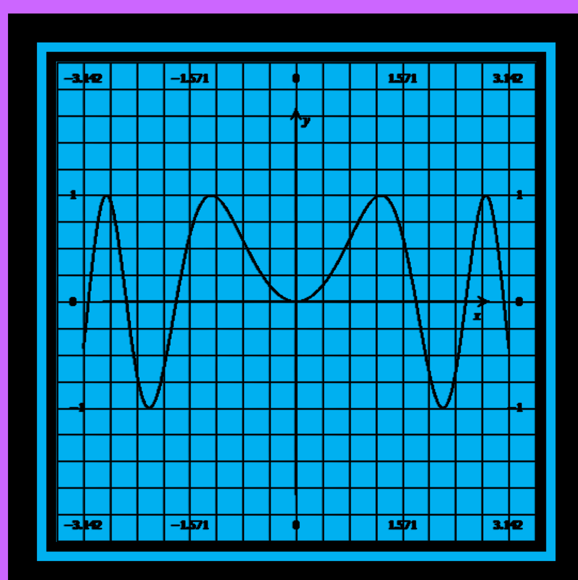
$$y = \sin(x)$$



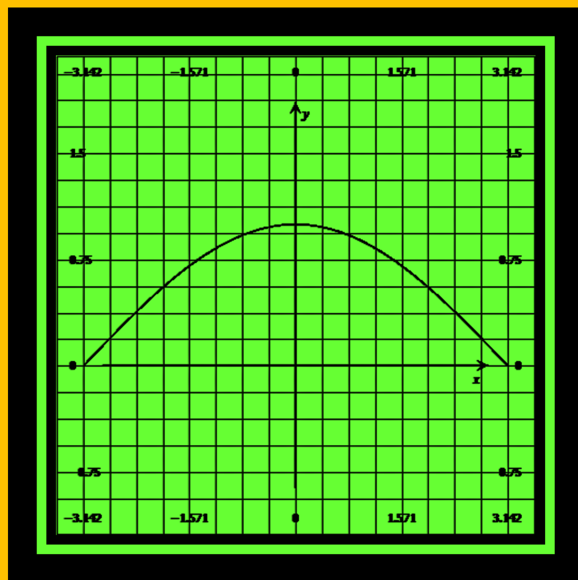
$$y = \sin\left(\frac{x}{2}\right)$$



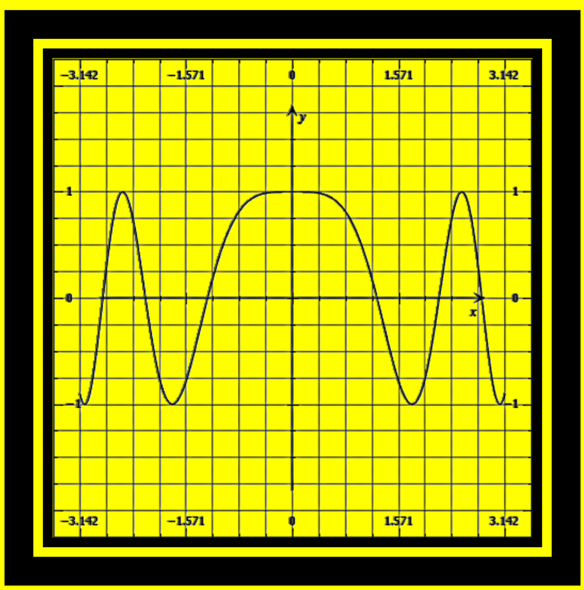
$$y = \sin(x^2)$$



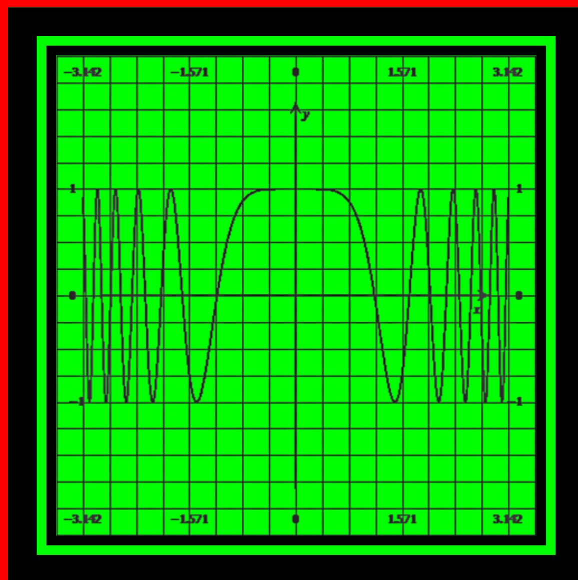
$$y = \cos\left(\frac{x}{2}\right)$$



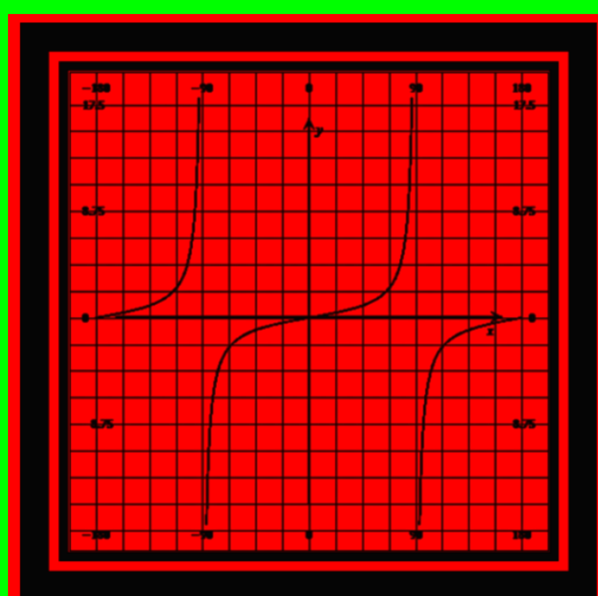
$$y = \cos(\,x^2)$$



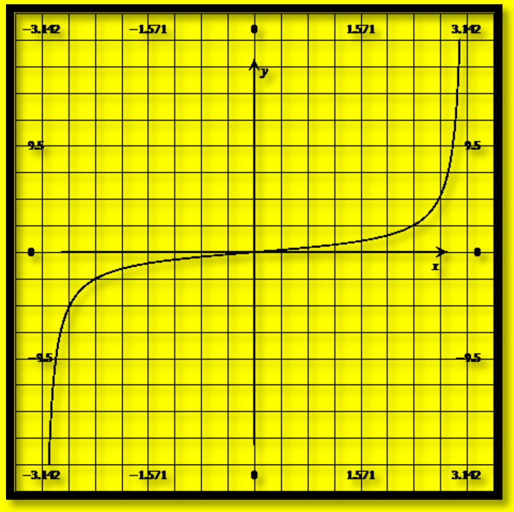
$y = \cos(\,x^3)$



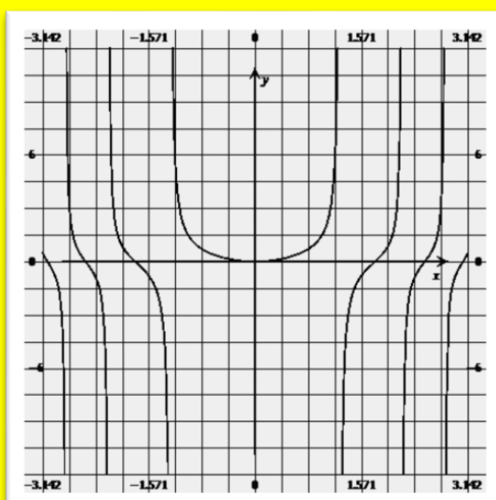
$y = \tan(x)$



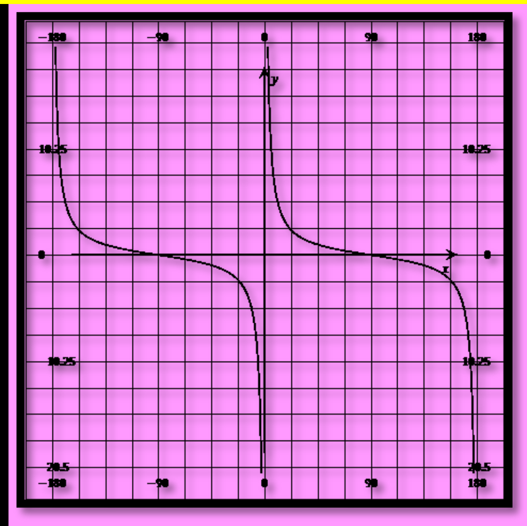
$$y = \tan\left(\frac{x}{2}\right)$$



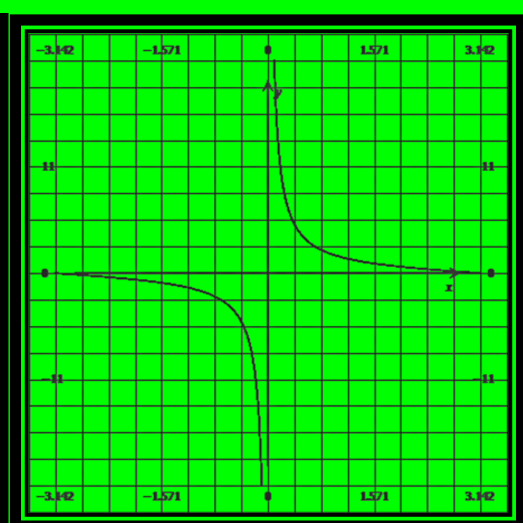
$$y = \tan(x^2)$$



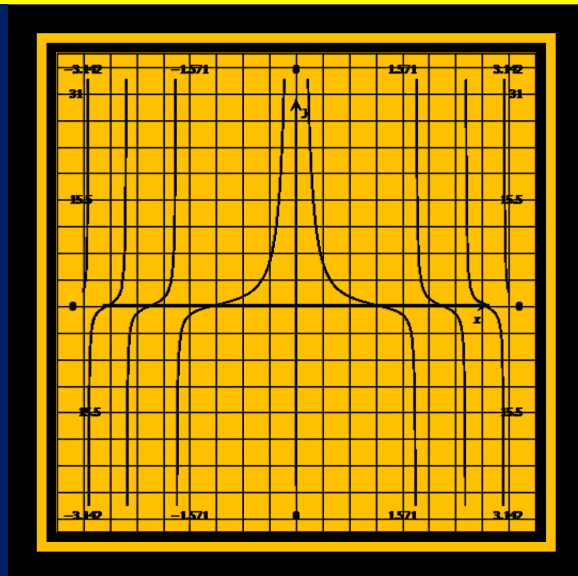
$$y = \cot(x)$$



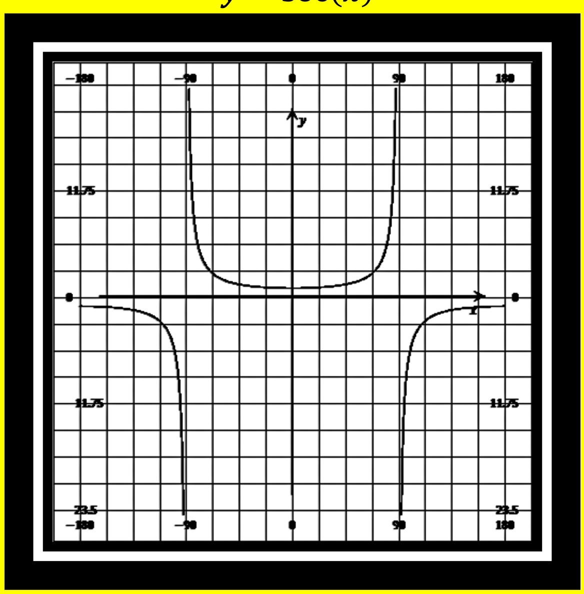
$$y = \cot\left(\frac{x}{2}\right)$$



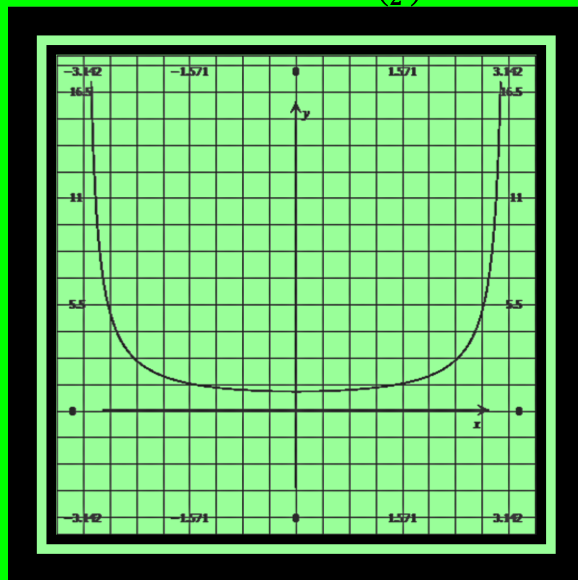
$$y = \cot(x^2)$$



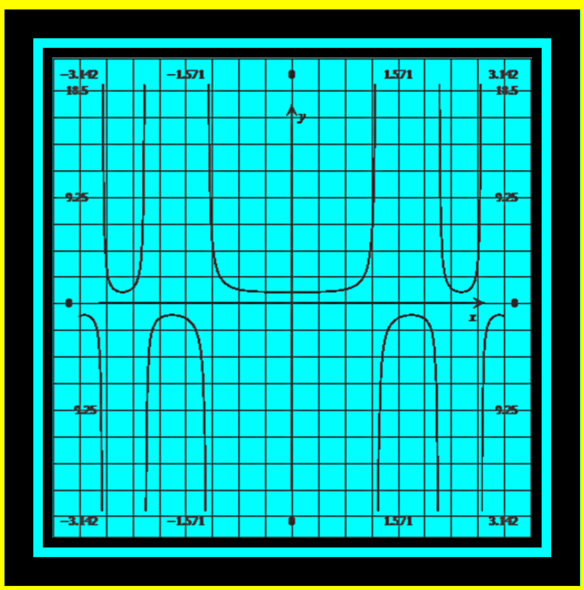
$$y = \sec(x)$$



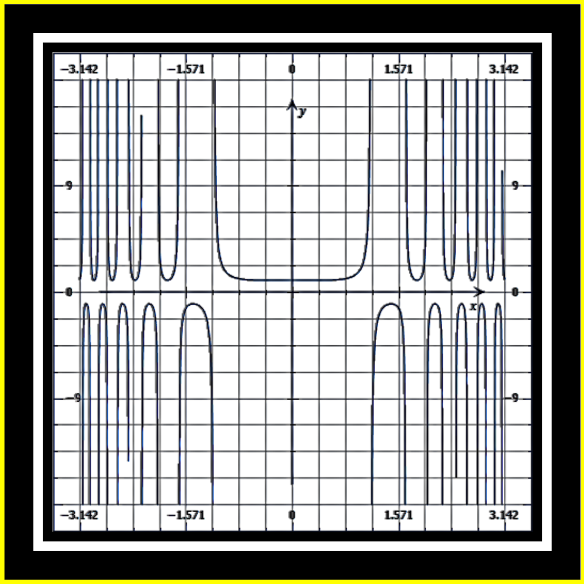
$$y = \sec\left(\frac{x}{2}\right)$$



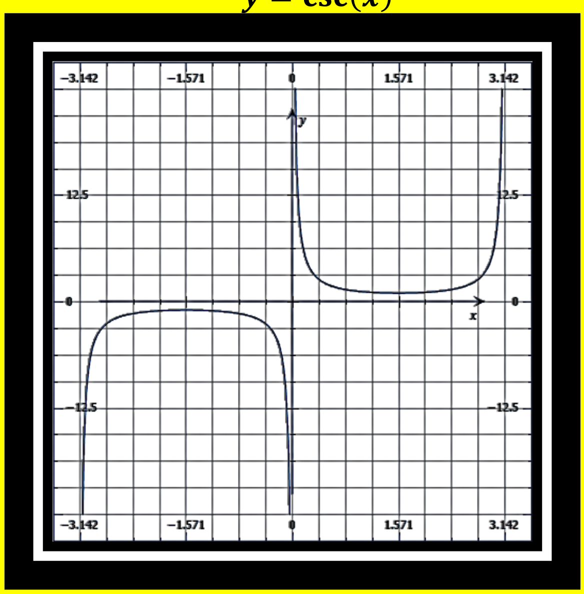
$$y = \sec(x^2)$$



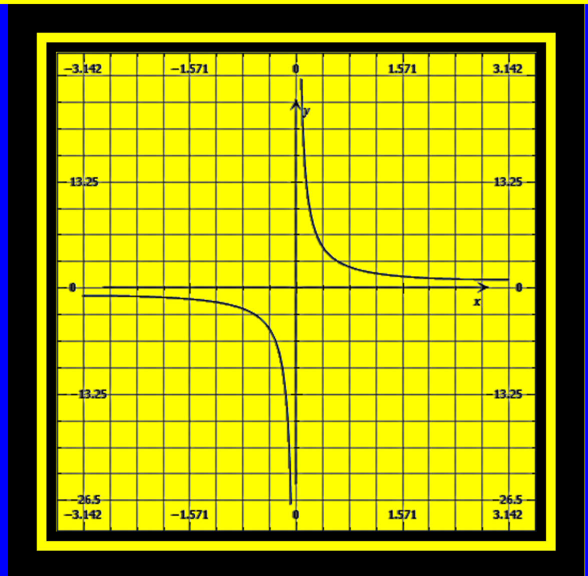
$y = \sec(x^3)$



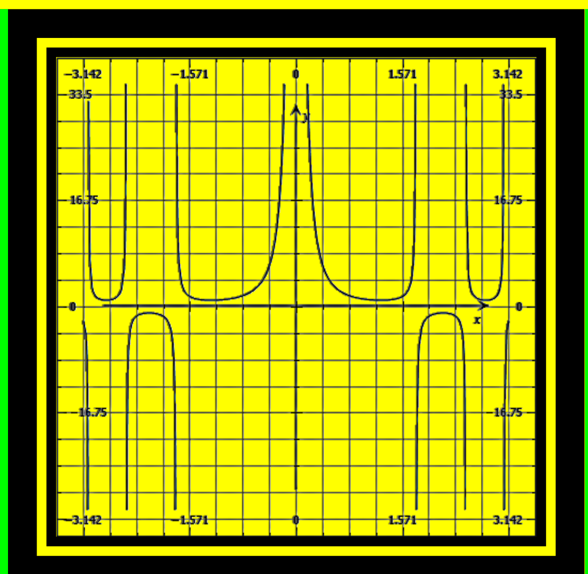
$y = \csc(x)$



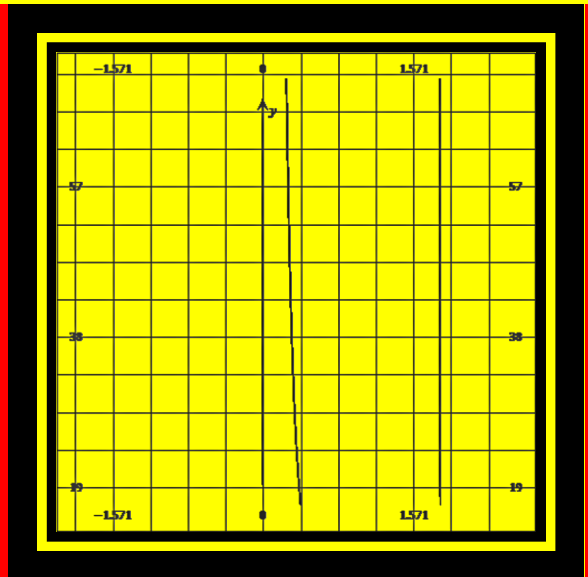
$$y = \csc\left(\frac{x}{2}\right)$$



$$y = \csc(x^2)$$



$$y = \csc(x^3)$$



Section 20) Description and Examples of 3-D Graphs, Generated In Microsoft Word 2010, With Its New Equation Editor, And Add-In

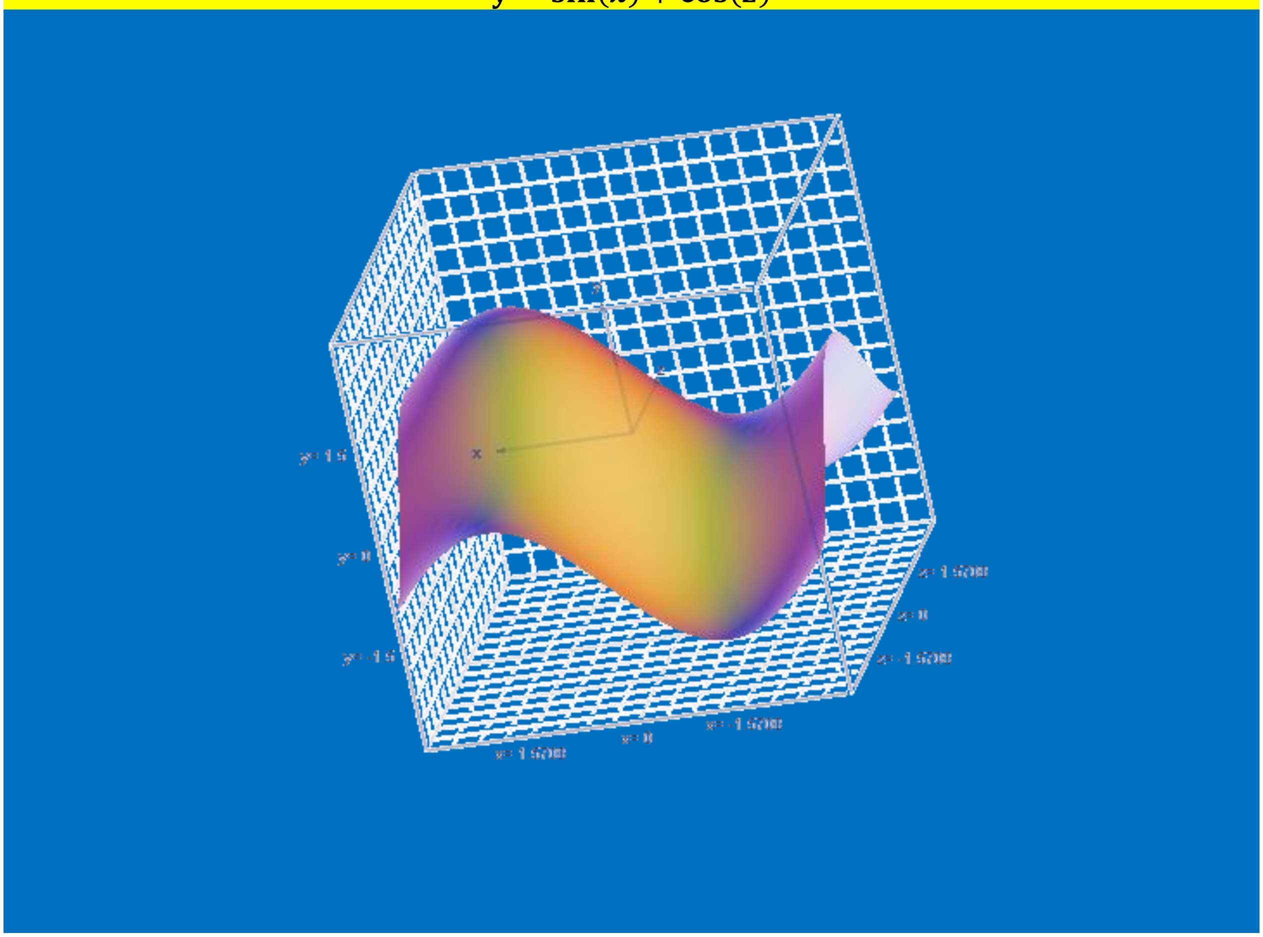
The following graphs were produced in a three dimensional format, with Microsoft's mathematical add-in, and the new equation editor in Microsoft Word 2010. Background colors and frames were added to each graph for aesthetics.

The three dimensional format provided the functionality of moving the graphs in a computer simulated three dimensional space. When a graph is moved to a different position the angle of view changes, and the appearance changes, but the graph itself does not change. This is similar to moving any three-dimensional object around in real space. For example, if you move your laptop computer in different positions, you will see a different view of the same entity. That is, you can look at your laptop from the top surface, and you can turn it upside down and examined the bottom surface. Each of these movements will change the appearance of your laptop computer, but your laptop does not change. The same principle applies to the three-dimensional graphs, in a computer simulated three-dimensional space.

However, once three-dimensional graphs (created with the above software) are placed on a webpage they cannot be moved to different angles and positions. Thus, to demonstrate how the same graph can look from different angles, I am presenting below this paragraph a series of pictures I took with the copy mechanism of the graph of the trigonometric equation:

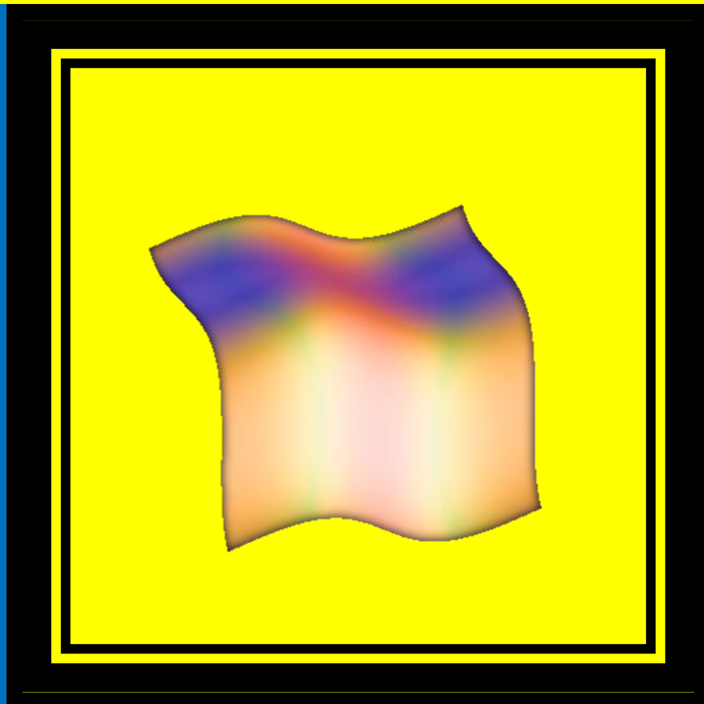
$$\mathbf{y} = \mathbf{sin}(\boldsymbol{x}) + \mathbf{cos}(\boldsymbol{z}).$$

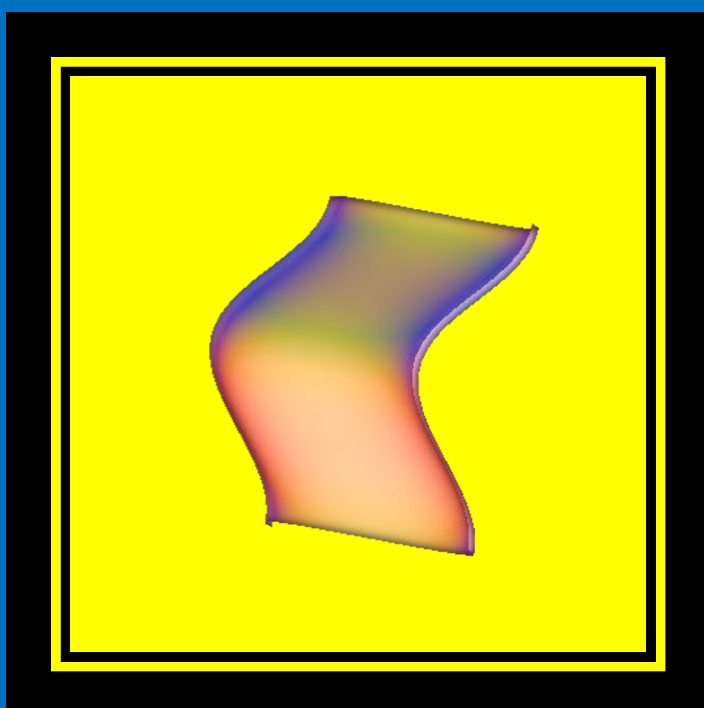
$$\mathbf{y} = \mathbf{sin}(\boldsymbol{x}) + \mathbf{cos}(\boldsymbol{z})$$



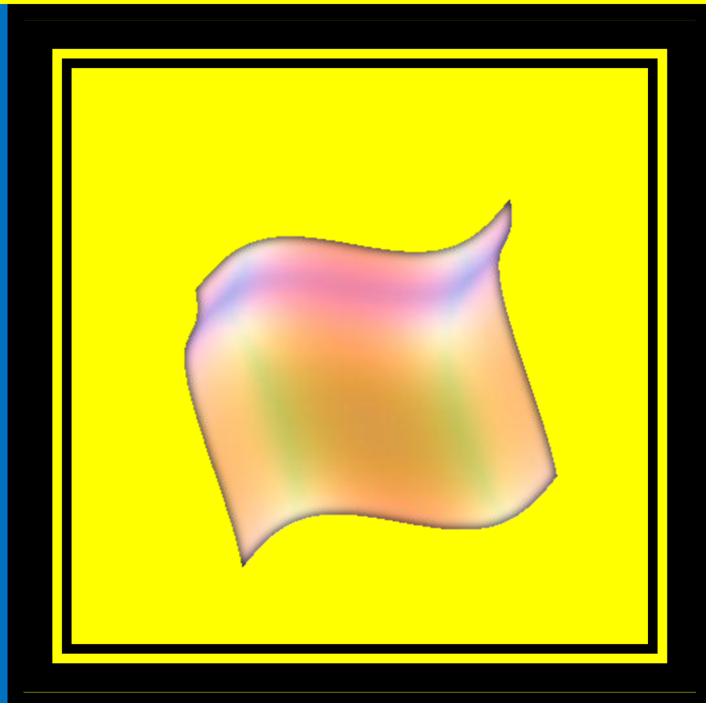
The following eight pictures are of the above graph from different angles. I am assuming the above view is the top surface area of the graph, based on the orientation of the positive Y axis.

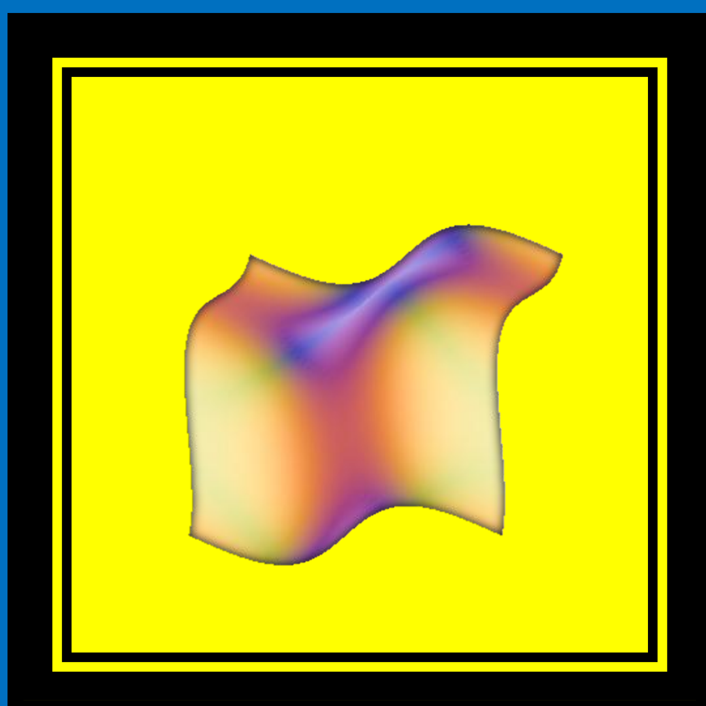
$$y = \sin(x) + \cos(z)$$





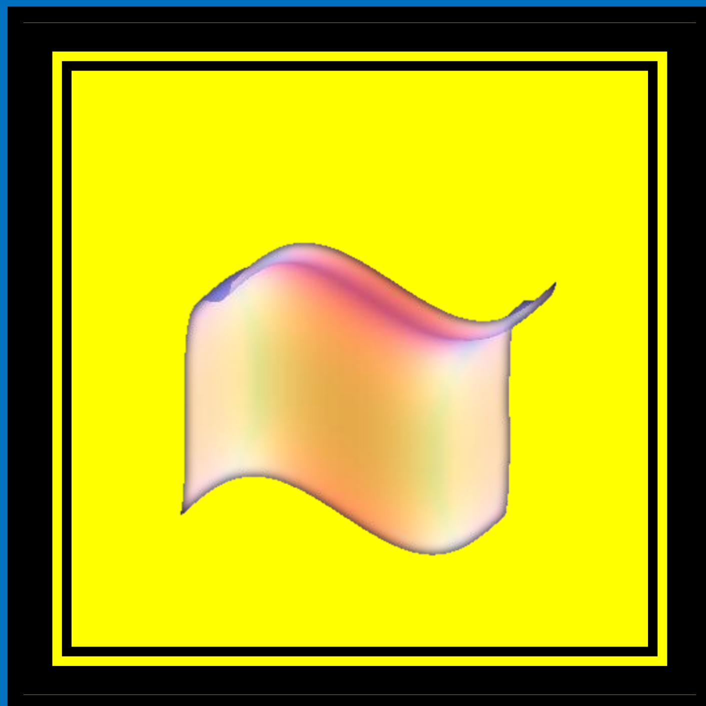
$y = \sin(x) + \cos(z)$

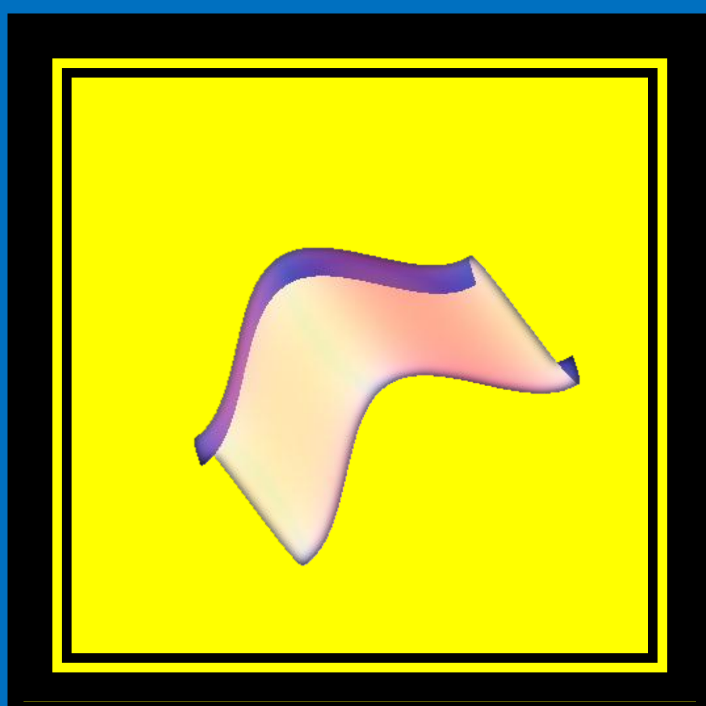




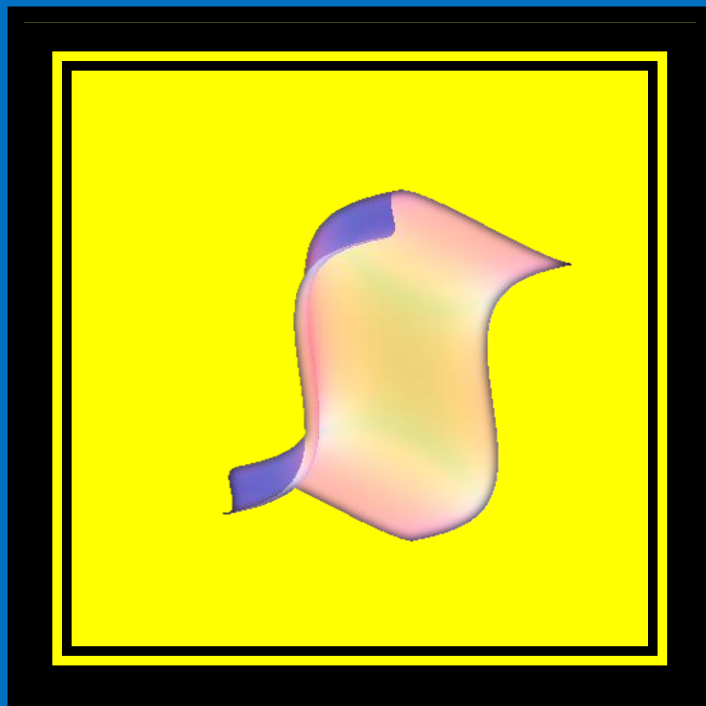
The four pictures below, shows the lower surface area (the underside) of the above graph, from four angles.

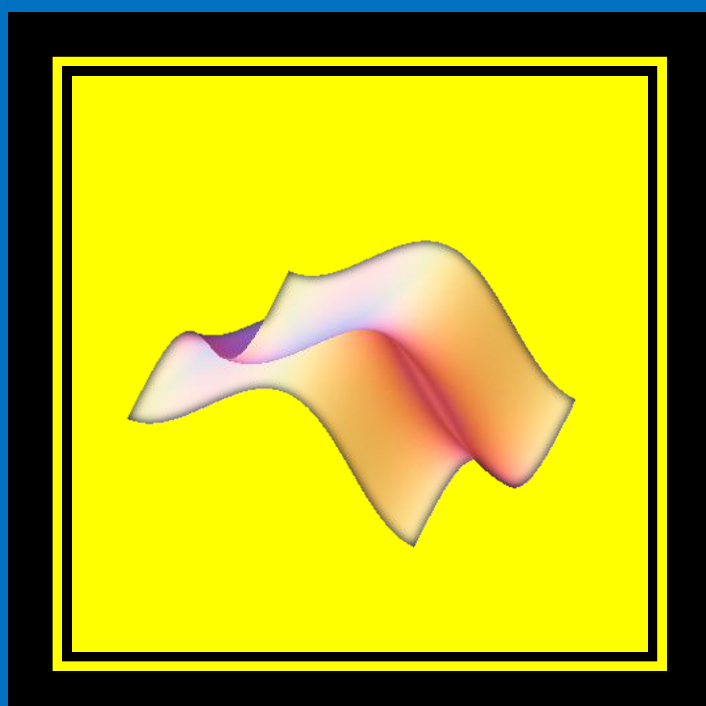
$$y = \sin(x) + \cos(z)$$





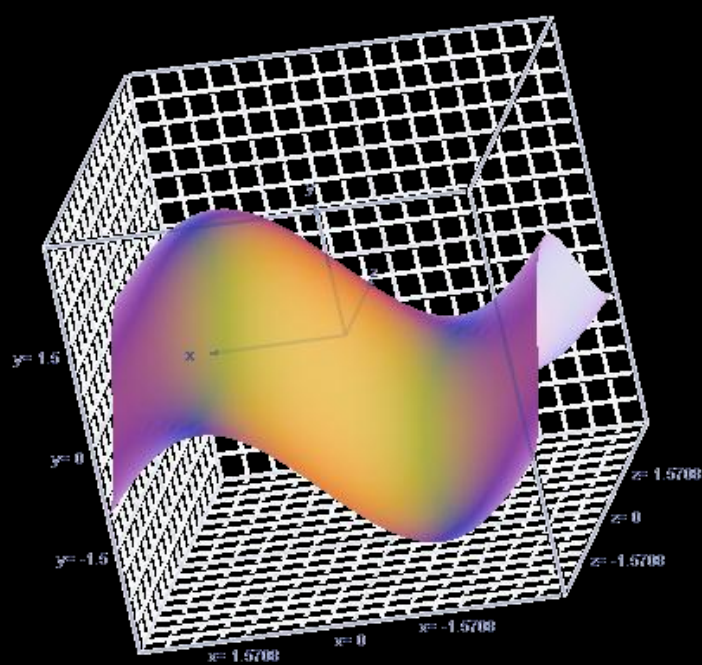
$y = \sin(x) + \cos(z)$





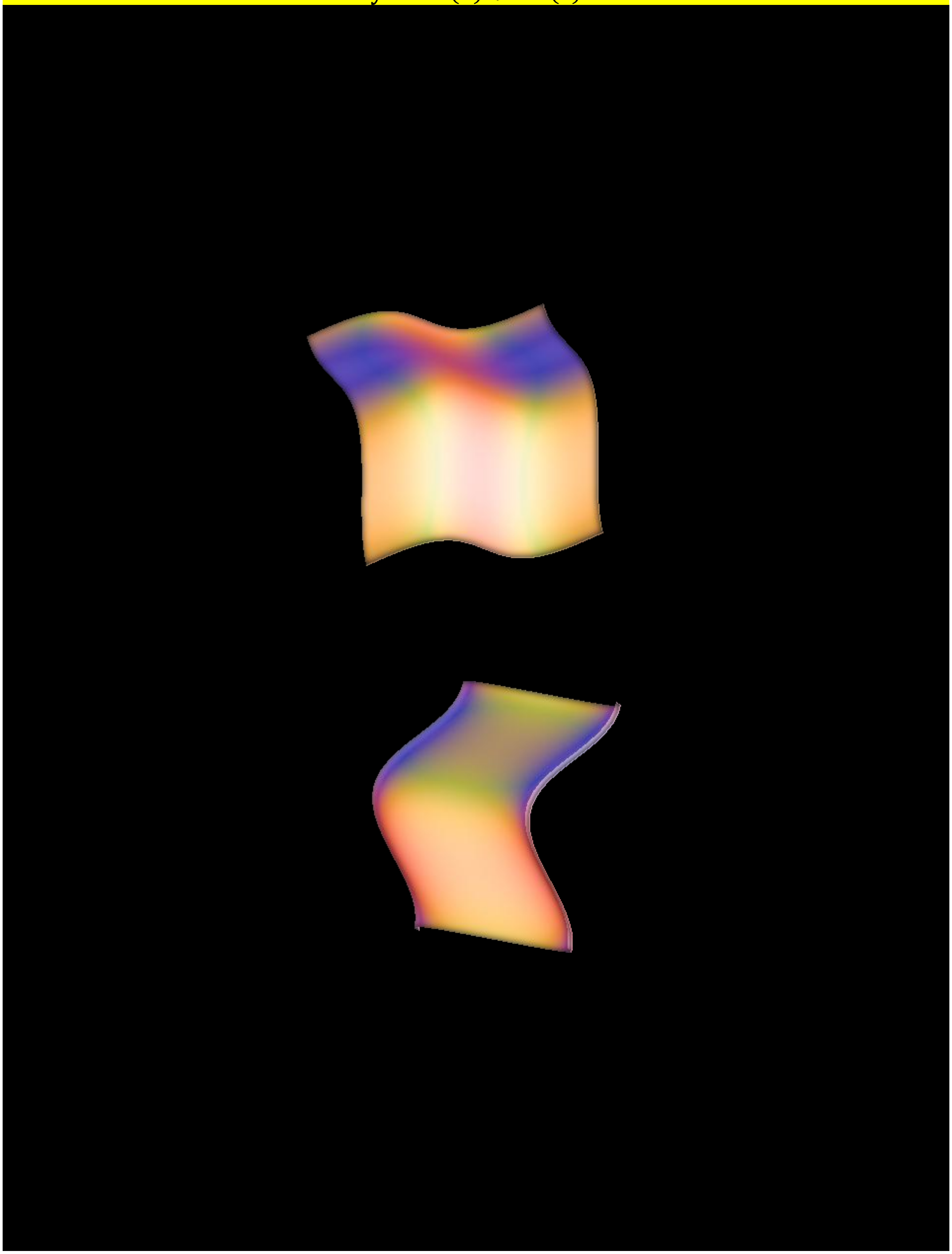
The following is the same graph as above, but it is displayed on a black background below, which affects its appearance, but it does not change the graph in anyway, from a mathematical perspective.

$$\mathbf{y} = \sin(x) + \cos(z)$$

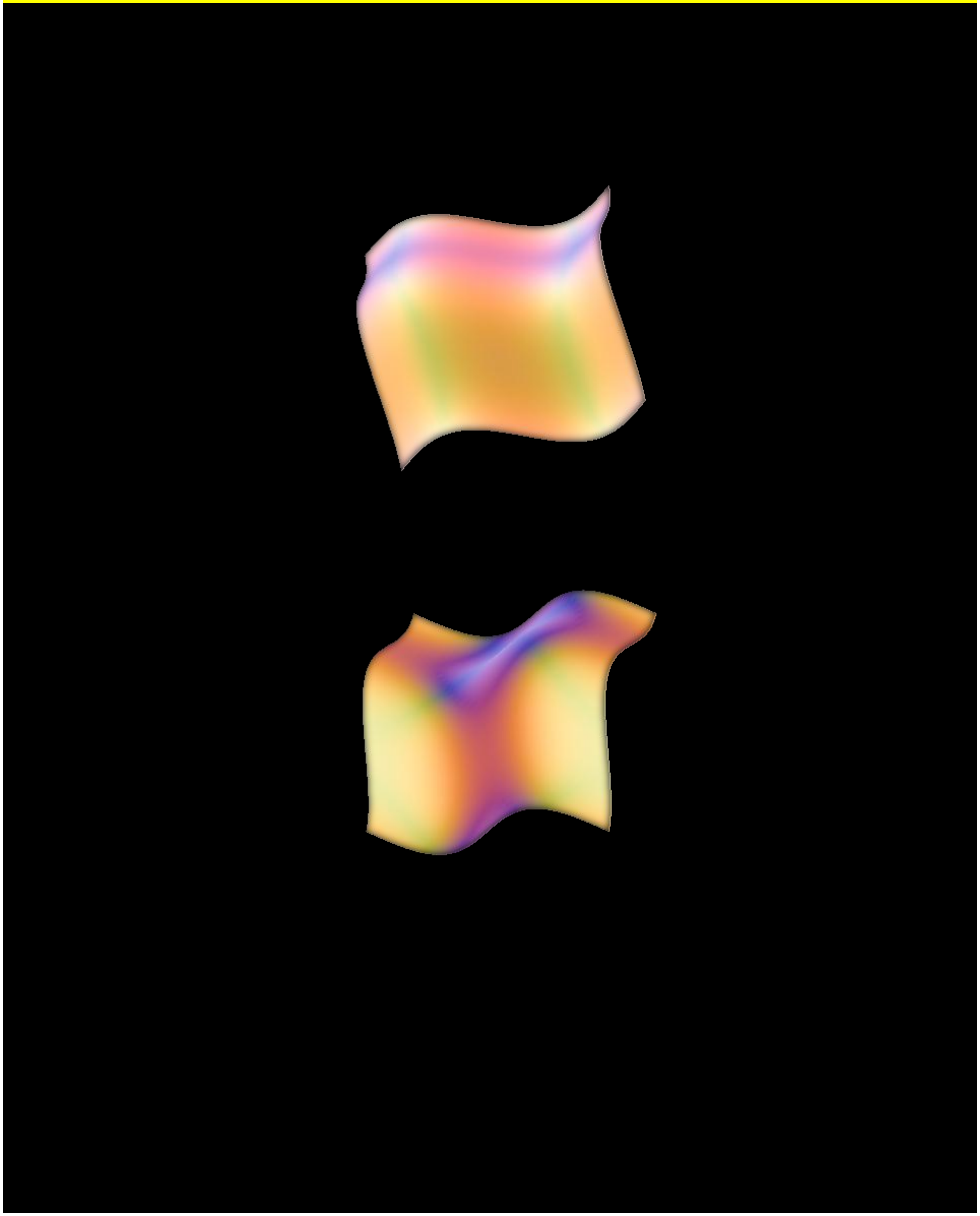


The following eight pictures are of the above graph from different angles. I am assuming the above view is the top surface area of the graph, based on the orientation of the positive Y axis.

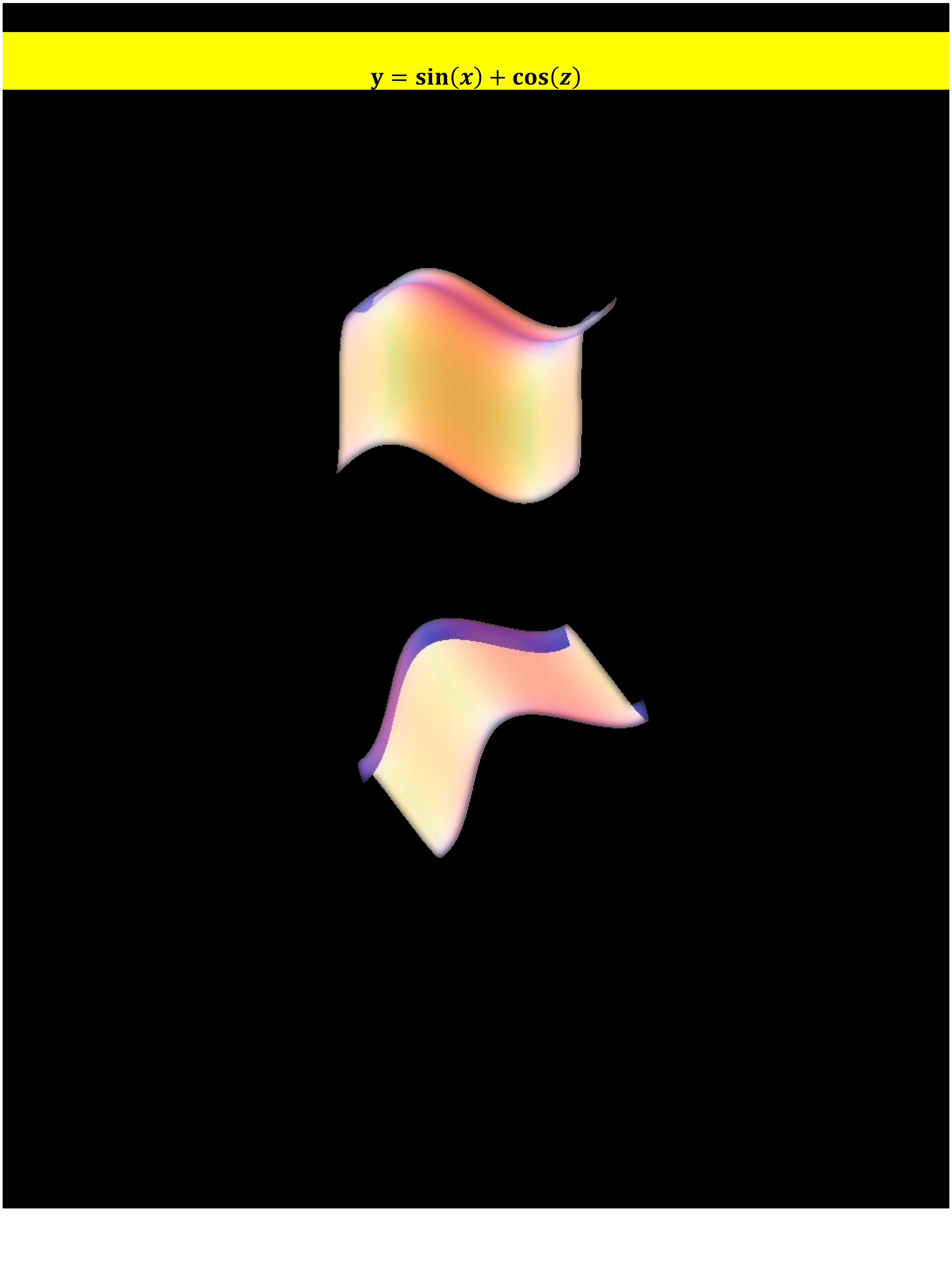
$$\mathbf{y = \sin(\mathit{x}) + \cos(\mathit{z})}$$



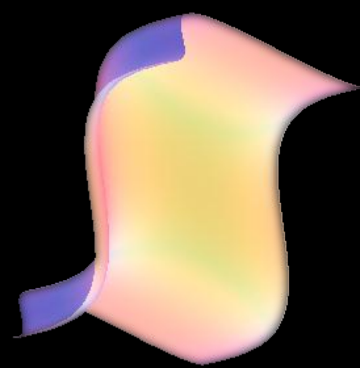
$$\mathbf{y} = \mathbf{sin}(\boldsymbol{x}) + \mathbf{cos}(\boldsymbol{z})$$

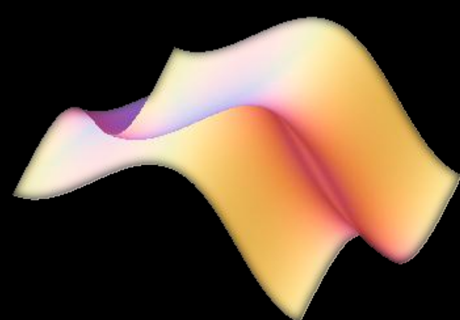


<u>The four pictures below, shows the lower surface area (the underside) of the above graph, from four angles, with a black background</u>



$$y = \sin(x) + \cos(z)$$



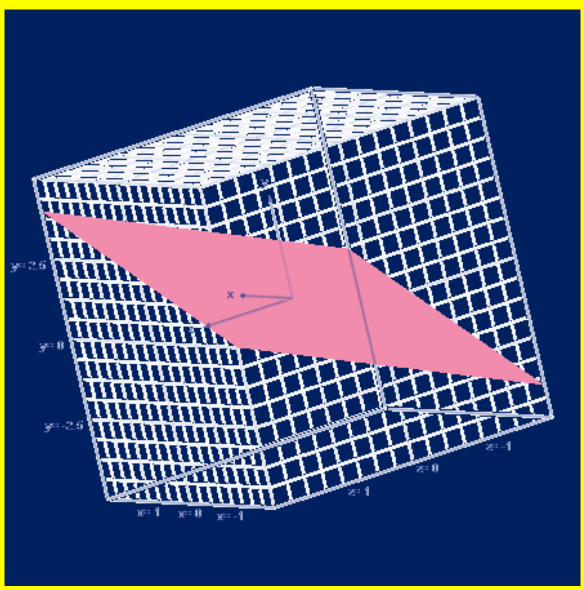


The following two sections have additional three-dimensional graphs. When you examine these sections keep the principles presented above in mind. Specifically, three-dimensional graphs created with Microsoft's new equation editor and add-in, can be moved and viewed from different angles. Changing the angle of view of a graph changes its appearance, but it does not change the graph itself.

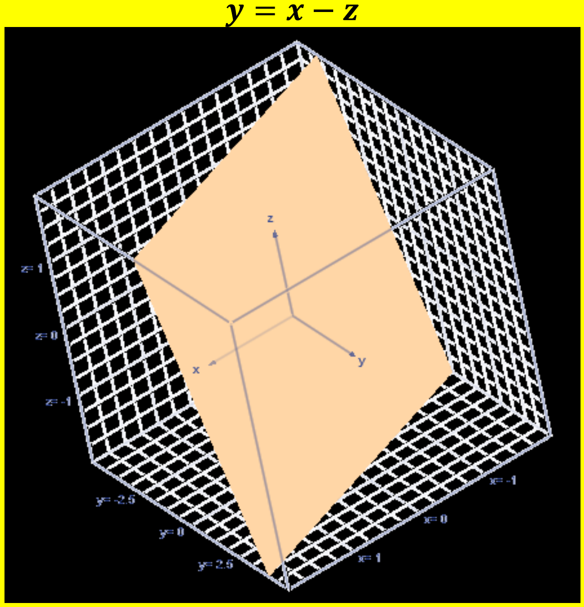
Section 21) Three-Dimensional Graphs *In Word 2010, Generated With Microsoft's New Equation Editor, And Add-In*

The following are three-dimensional graphs created with the new Microsoft equation editor and mathematical add-in. The graphs were positioned to optimize aesthetics, in the computer simulated three-dimensional space. Background colors and frames were added to each graph for aesthetics.

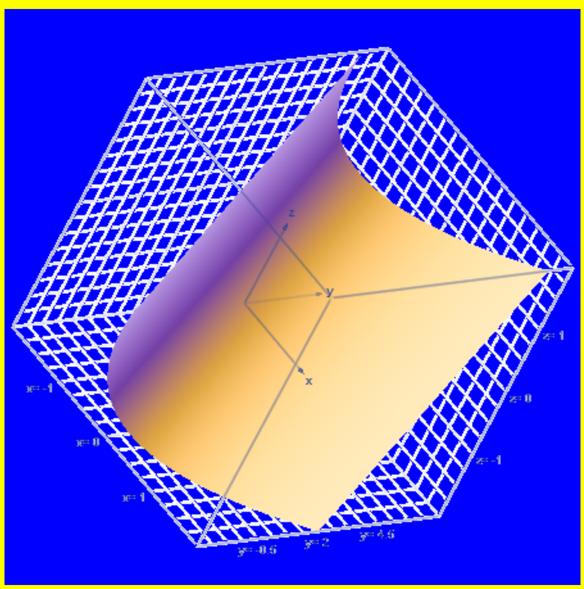
$$y = x + z$$



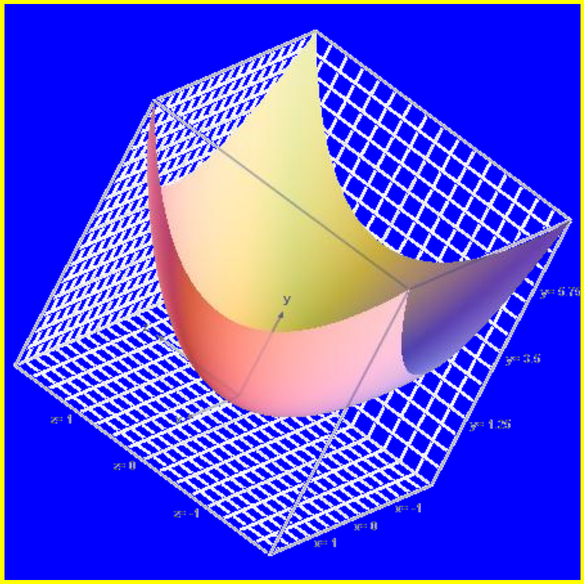
$$y = x - z$$



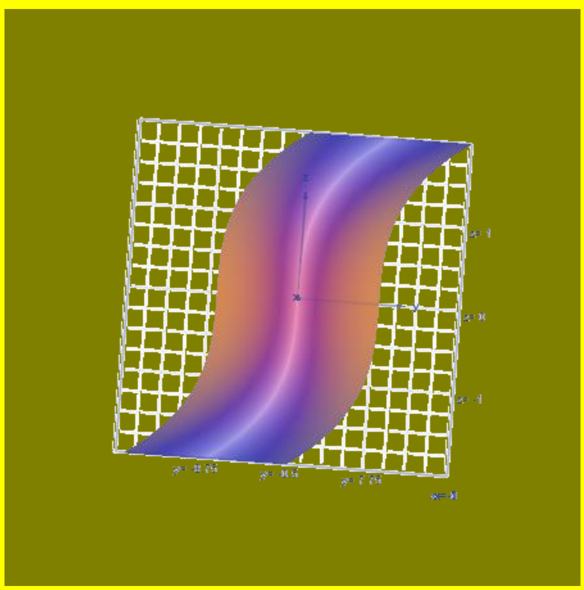
$$y = x^2 + z$$



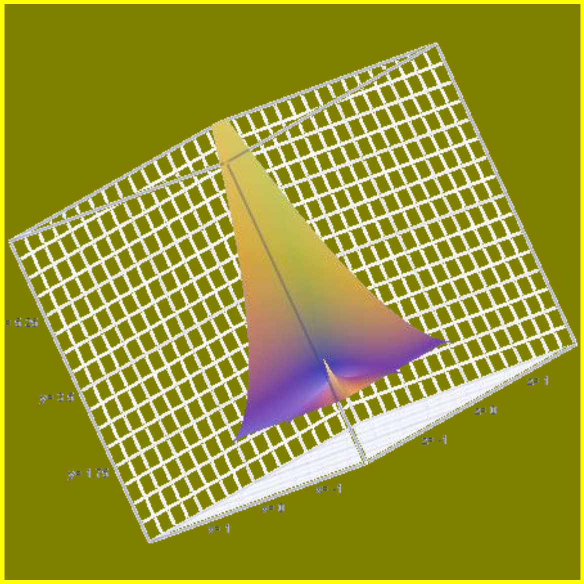
$$y = x^2 + z^2$$



$$y = x^3 + z^3$$

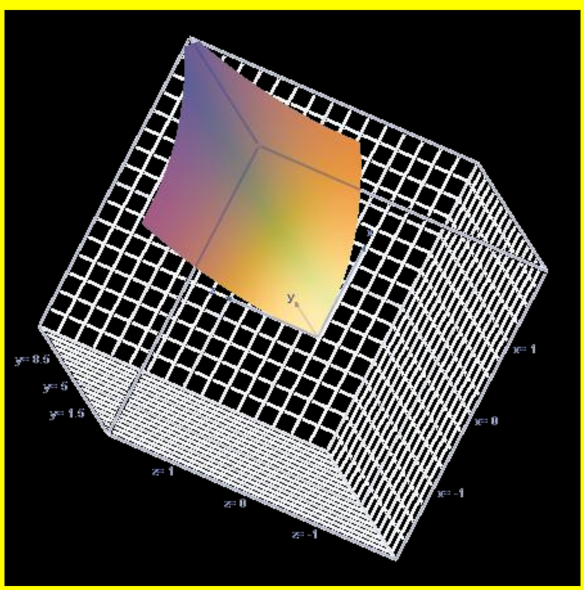


$$y = x^z + z^x$$

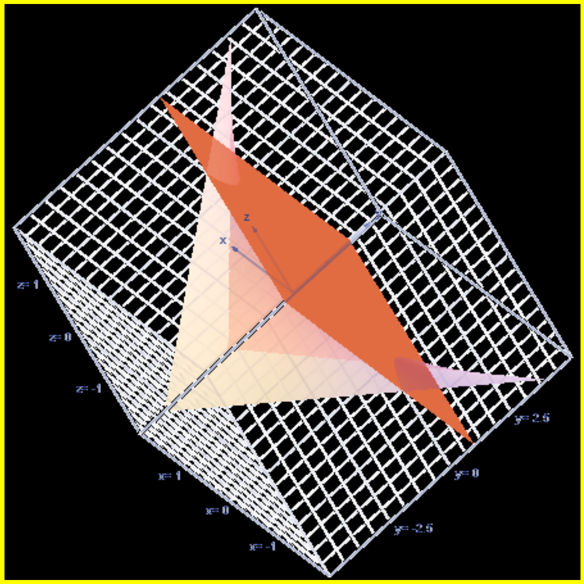


$$y = x^e + z^e$$

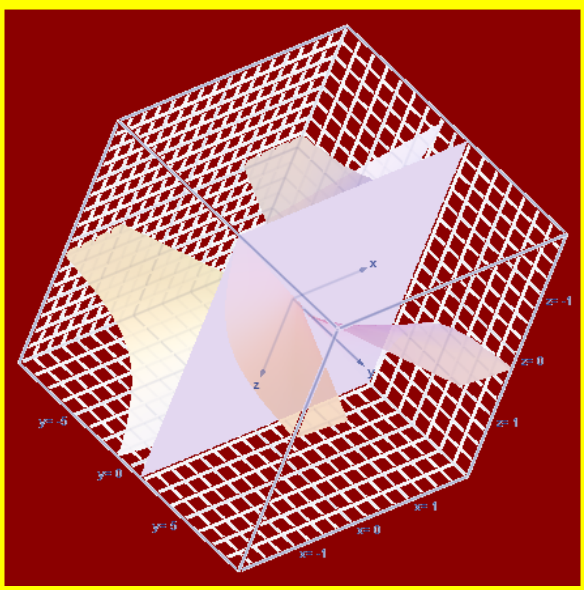
$$(e = 2.718281828459)$$



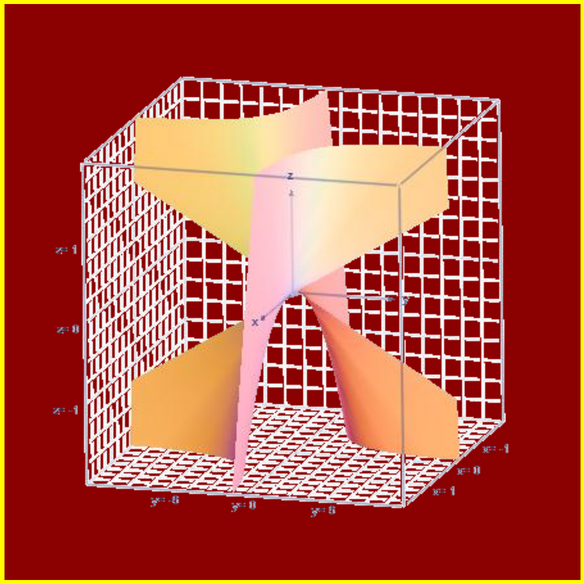
$$Y = xz$$



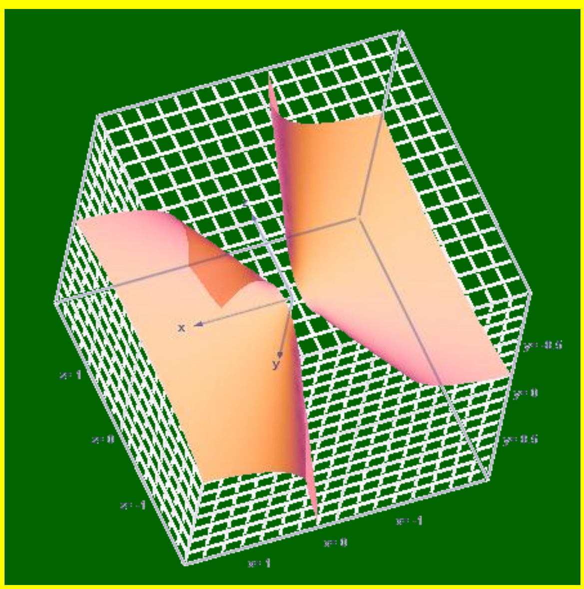
$$Y = \frac{x}{z}$$



$$y = \frac{z}{x}$$



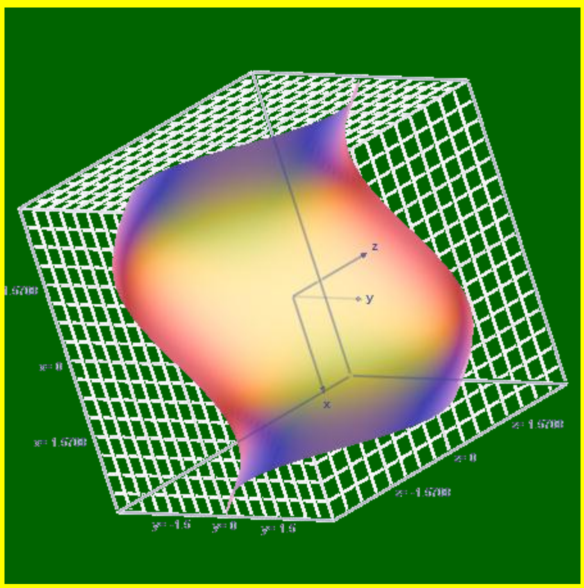
$$y = \frac{z^2}{x}$$



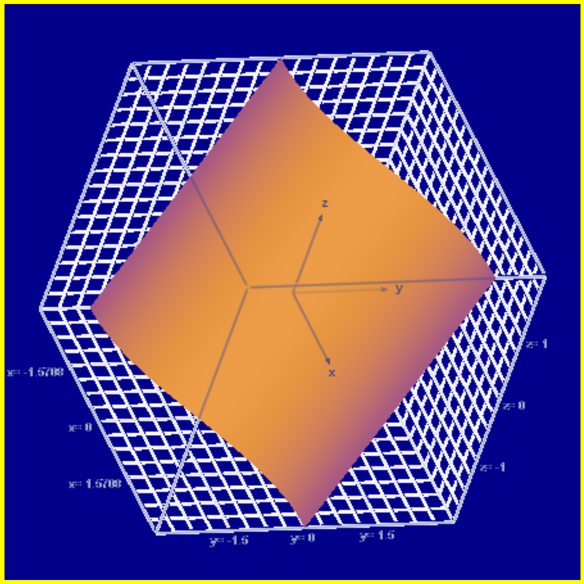
***Section 22)* Three-Dimensional Trigonometric Graphs *in Word 2010, Generated With Microsoft's New Equation Editor, And* Add-In**

The following are three-dimensional trigonometric graphs created with the new Microsoft equation editor and mathematical add-in. The graphs were positioned to optimize aesthetics, in the computer simulated three-dimensional space. Background colors and frames were added to each graph for aesthetics.

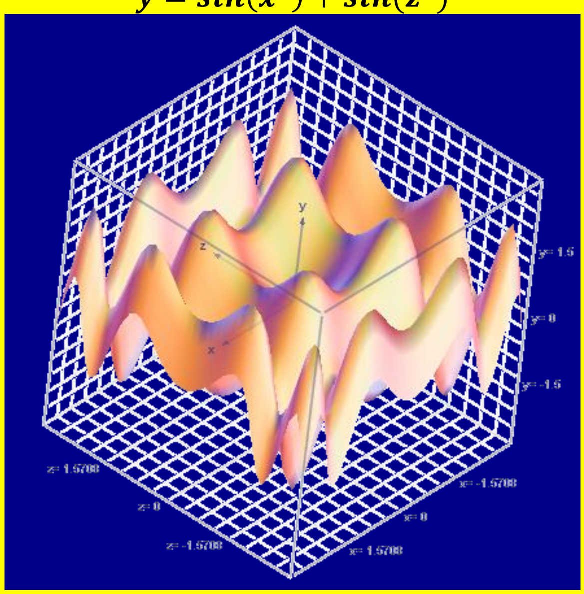
$$y = sin(x) + sin(z)$$



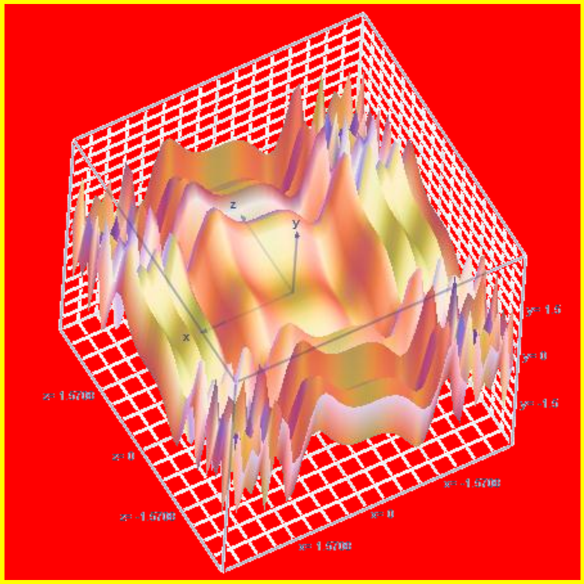
$$y = sin\left(\frac{x}{2}\right) + \left(\frac{z}{2}\right)$$



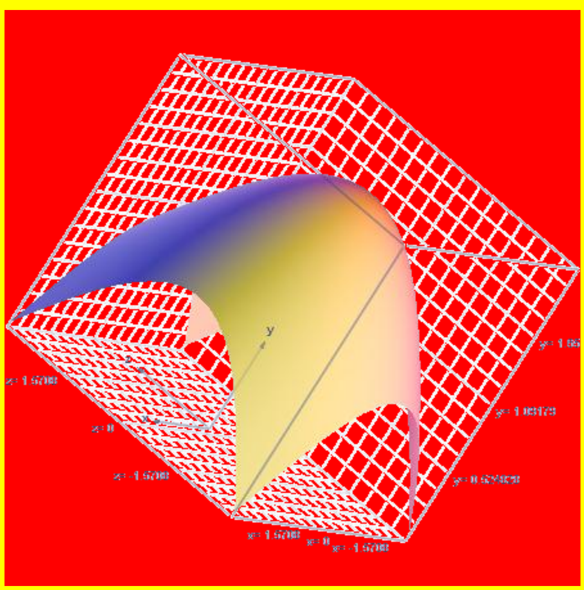
$$y = sin(x^2) + sin(z^2)$$



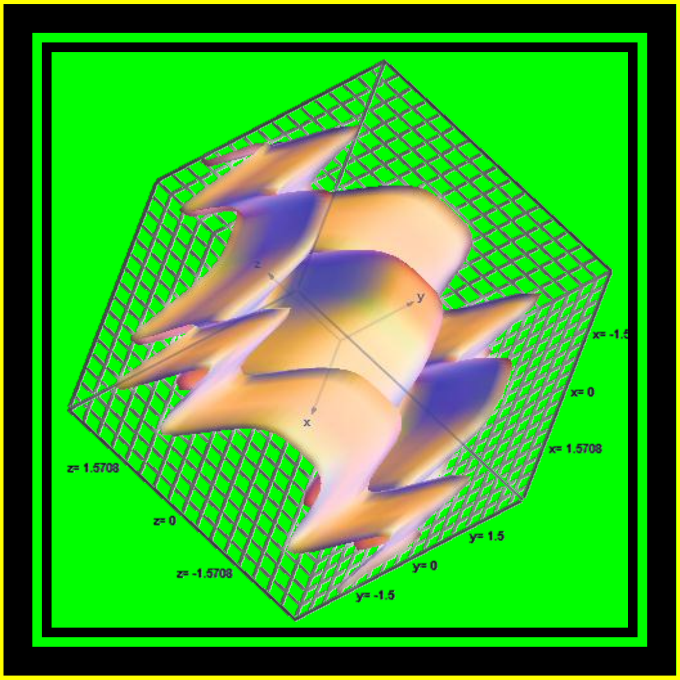
$$y = sin(x^3) + sin(z^3)$$



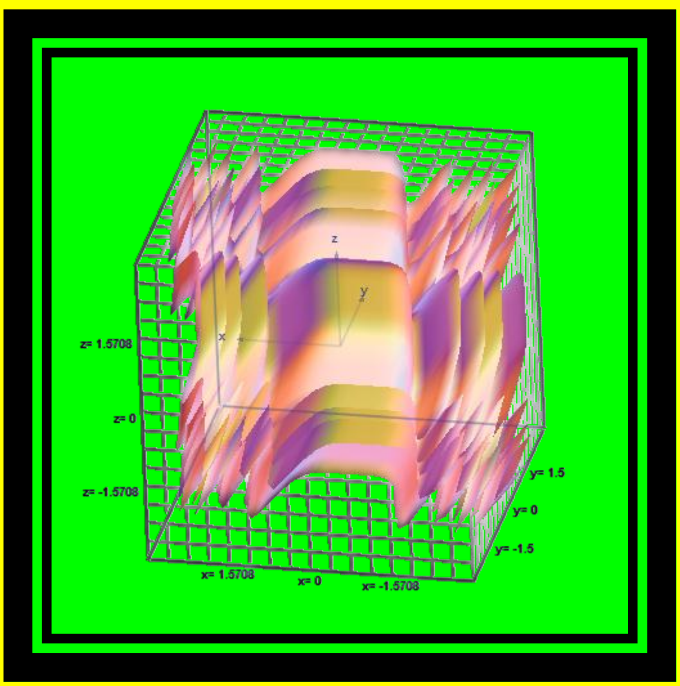
$$y = cos\left(\frac{x}{2}\right) + cos\left(\frac{z}{2}\right)$$



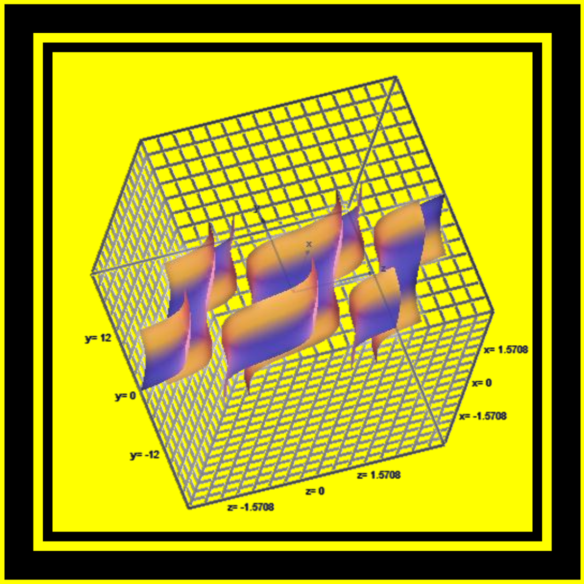
$$y = cos(\, x^2) + cos(\, z^2)$$



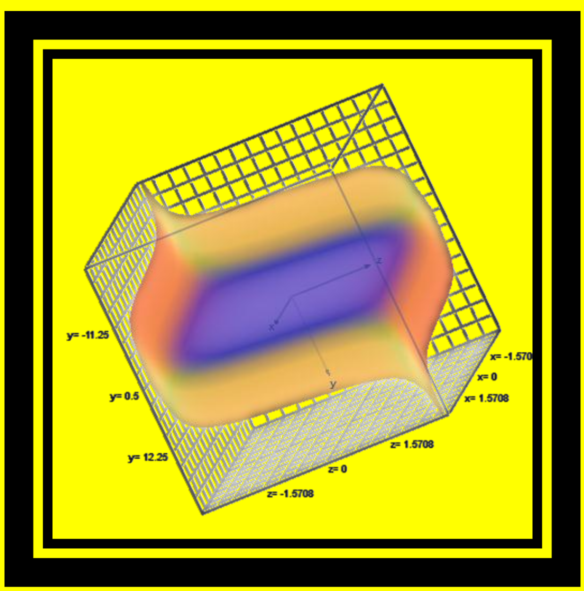
$$y = cos(\, x^3) + cos(\, z^3)$$



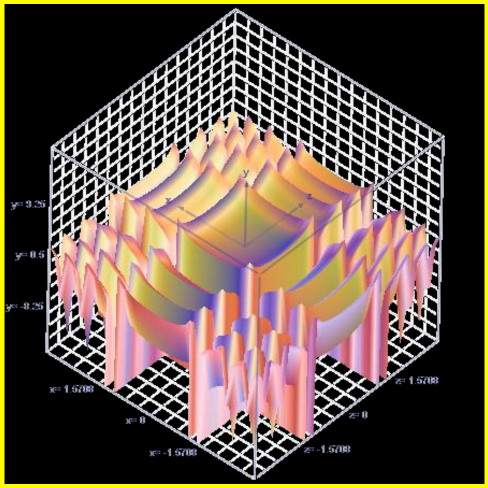
$$y = tan(x) + tan(z)$$



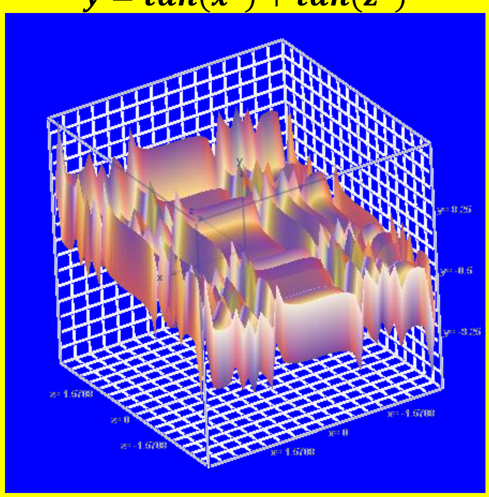
$$y = tan\left(\frac{x}{2}\right) + tan\left(\frac{z}{2}\right)$$



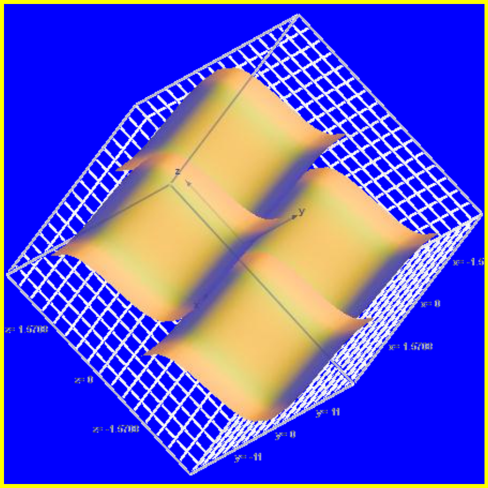
$$y = tan(x^2) + tan(z^2)$$



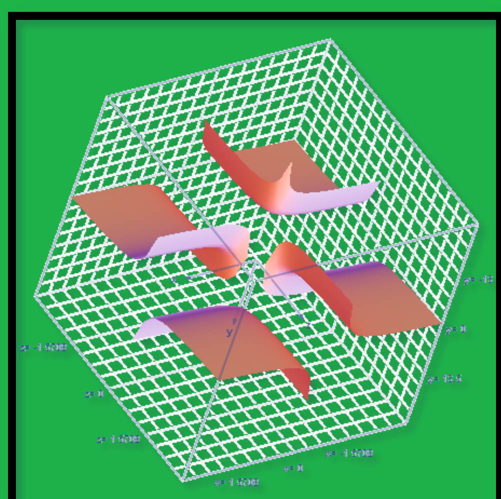
$$y = tan(x^3) + tan(z^3)$$



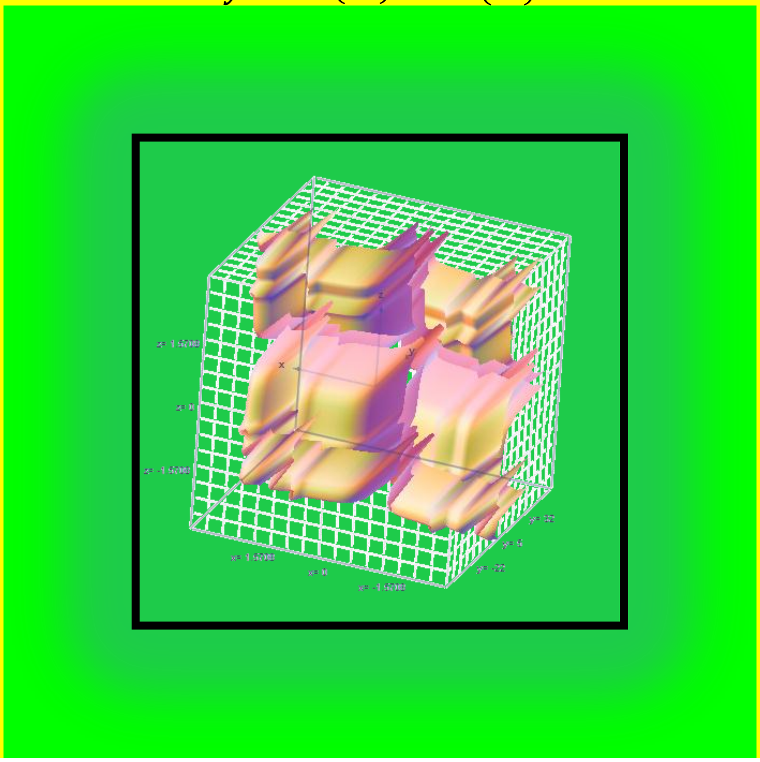
$$y = cot(x) + cot(z)$$



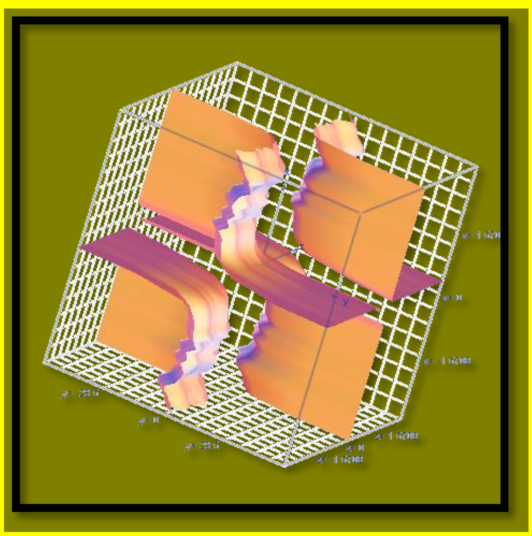
$$y = cot\left(\frac{x}{2}\right) + cot\left(\frac{z}{2}\right)$$



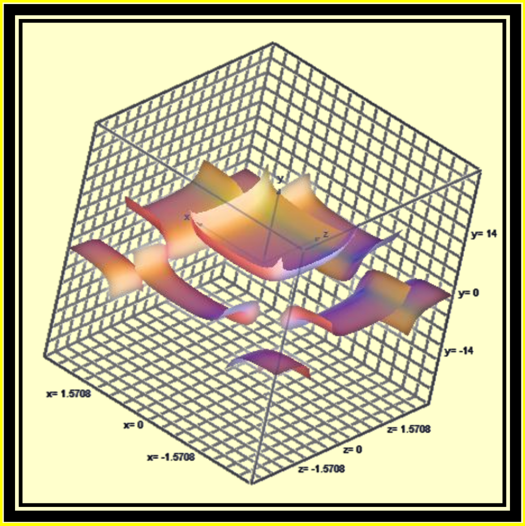
$$y = cot(x^2) + cot(z^2)$$



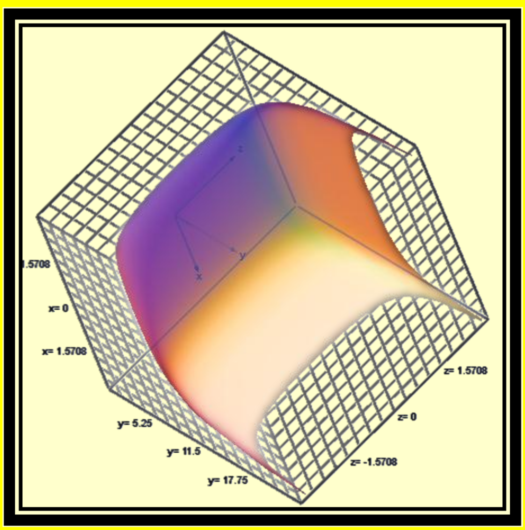
$$y = cot(x^3) + cot(z^3)$$



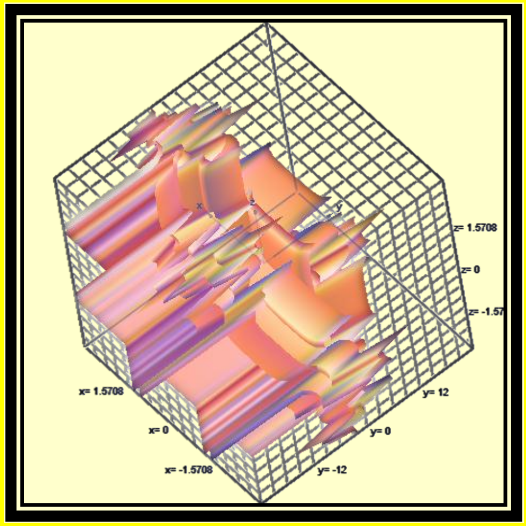
$$y = sec(x) + sec(z)$$



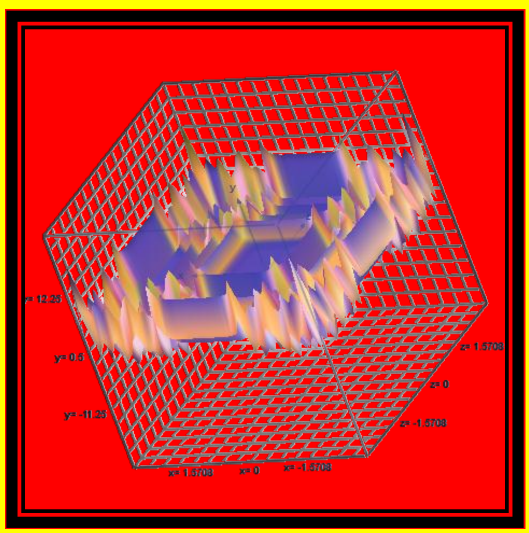
$$y = sec\left(\frac{x}{2}\right) + sec\left(\frac{z}{2}\right)$$



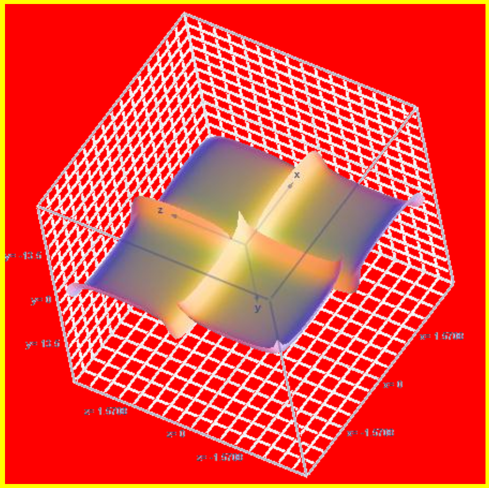
$$y = sec(x^2) + sec(z^2)$$



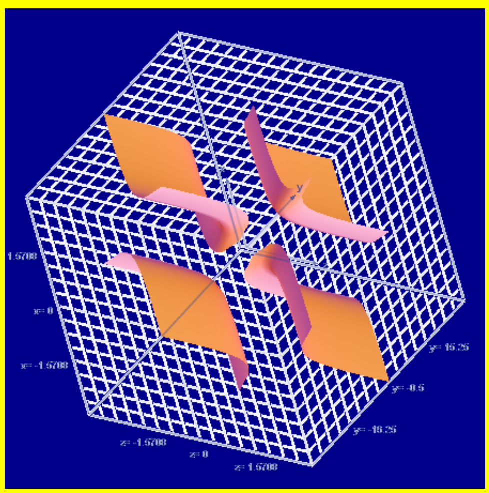
$$y = sec(x^3) + sec(z^3)$$



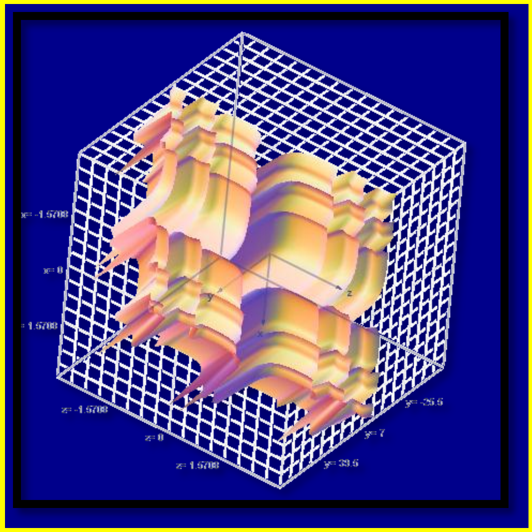
$$y = csc(x) + csc(z)$$



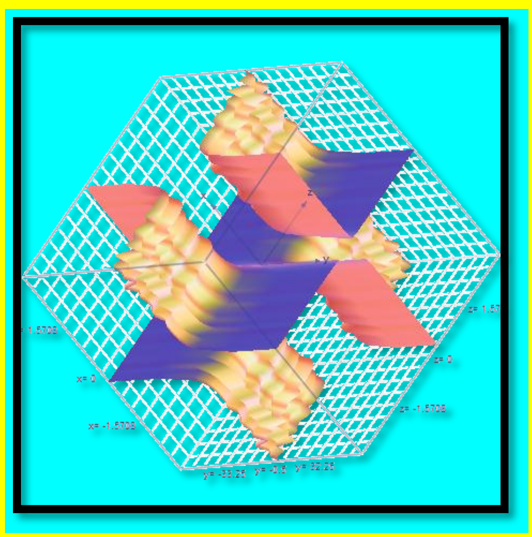
$$y = csc\left(\frac{x}{2}\right) + csc\left(\frac{z}{2}\right)$$



$$y = csc(x^2) + csc(z^2)$$



$$y = csc(x^3) + csc(z^3)$$



Chapter 6) Computer Programs With Mathematical Notation, And Related Concepts

IMPORTANT NOTE

The three sections in this chapter deal with electronic math documents in the form of software, or documents with embedded computer programs. All of the software discussed is accessible by left clicking on links provided in the following three sections. All of this software, (with only one exception) functions online over the Internet, and does not require any installation. If you do not examine the software that relates to each section you probably will not be able to understand the concepts and principles presented in this chapter. Section 23 has 21 links, section 24 as three links, and section 25 has only one link.

***Section 23)* Calculation Software, Based On JavaScript, Embedded In Webpages With Text And Mathematical Notation**

Computer programs that contain mathematical notation, and/or display calculated results on a computer screen are a type of electronic math document, as explained in the first chapter of this e book. Creating computer programs with mathematical notation present the same challenges as building websites with mathematics, or writing an e-book on mathematics. I have created a number of computer programs in this category, most of which are specialize calculation devices, that perform various types of computations, involving algebra, arithmetic, calculus, and trigonometry. Many of the calculation devices I created are embedded in webpages, with mathematical notation and text, and some of them resemble a conventional electronic math document. Most of these calculation devices are based on the JavaScript computer language, which can be interpreted by conventional Internet browsers.

I generally design and build these calculation devices, to maximize efficiency and user friendliness. To do this I use some of the same design concepts I use in conventional mathematics documents, as explained in previous sections of this e-book. This includes clearly written instructions and related material, with relatively large fonts.

However, unlike conventional math documents, computer software usually requires input from the user. This generally involves a series of steps carried out with the keyboard and/or mouse, such as entering numbers, clicking on buttons, selecting items from a menu, etc. To create highly efficient calculation software, I minimize the number of steps that are required by the user to perform a calculation, by programming almost all of the steps into the software. I do this because computers can carry out routine steps much faster and better than humans can. A set of steps that would require a couple of hours of work, computers can perform in less than one second, with almost no chance of errors.

In general, highly efficient software performs a task with a minimum number mouse clicks and keyboard entries, with a minimum level of complexity, for the user of the software. However, creating software of this nature can be challenging, but quite achievable, especially when creating mathematics software. I created calculation devices with OVER 100 steps programmed into the software. I have also designed and built calculation devices that simultaneously carry out over 100 calculations, and present over 100 calculated results, based on a few numbers entered by the user.

However, software with most of the mathematical steps programmed into it must be designed and built for a specific purpose, and usually for the mathematical needs of a specific individual or company. This is because when software is created with the mathematical steps programmed into it, it can only perform the set of calculations that it was designed to carry out. Nevertheless, calculation devices created with this design concept, can carry out sets of very complex calculations that would require hours of work with conventional mathematics software, in a few seconds.

All of the above will become obvious, if you access the *[Multiple Trigonometric Calculator](), at www.techfortext.com/Trig1 .
This calculation device performs over 45 calculations simultaneously over the Internet, involving trigonometry, as soon as the user enters an angle and height for a right triangle. If you attempt to perform these calculations, with conventional mathematics software, it will probably require at least one or two hours of tedious work. This will include entering, and reentering numbers with 12 digits, and entering keystrokes and mouse clicks to perform various mathematical operations involving trigonometry. The calculation device at www.TechForText.com/Trig1 can complete all of the calculations, as soon as the user enters two numbers, and clicks with the mouse. Most people can do this in less than 30 seconds. (***NOT: The Multiple Trigonometric Calculator is ABOUT 8 FEET LONG, from left to right, and to see all of the calculated results, you must scroll to the right, with the arrow key. This is the largest and longest trigonometric calculation device that I have ever seen on the Internet, or anywhere else. I built this device primarily to demonstrate the concepts described above.**)

To create calculation software, I used conventional mathematical concepts with Microsoft Excel, essentially as a computer language. This involves a type of computer code that I create by translating conventional mathematical concepts, into a format that the computer can understand. Creating software in this way initially results in an Excel device, which I electronically convert to the JavaScript computer language, with specialized software. After conversion, I usually slightly edit the JavaScript code, in an HTML editor, to improve functionality and aesthetics. After this, I copy and paste the code into another HTML editor, which contains the computer code for a webpage. With this set of techniques I can embed a calculation device into a webpage with hundreds, or even thousands, of words of text and mathematical notation. This can be seen by examining the 21 websites listed below, which I designed and built with embedded JavaScript calculation devices.

Some of the calculation devices listed below were created for demonstration purposes, but many of them were designed for practical utility, such as solving homework problems that involves a quadratic equation, calculating a budget, or checking grocery bills. Most of the devices listed below, were created from December 2008 to January 2010.

Website-1) Exponential-Calculator
See: www.Tech-For-Text.com/M1

Website-2) Integral-Calculus-Calculator
See: www.Tech-For-Text.com/M2

2

Website-3) Quadratic-Equation-Calculator
See: www.Tech-for-Text.com/M3

Website-4) Division-Calculator
See: www.Tech-For-text.com/M4

Website-5) The Percentage Clock-Calendar
See: www.Tech-For-Text.com/Clock

Website-6) The Shopper's-Calculator
See: www.David100.com/M6

Website-7) Physics Calculator for Molecular Speed
See: www.Tech-For-text.com/M5

Website-8) The Online Time Calculator for Adding Hours and Minutes
See: www.Tech-For-Text.com/M7

Website-9) Budget-Rate Calculator
See: www.Tech-For-Text.com/Budget1

Website-10) Correction Factor Budget Calculators
See: www.Tech-For-Text.com/Budget2

Website-11) This is a simple adding device
See: www.tech-for-text.com/t/Budget/Addition/Addition.htm

Website-12) The Compound Interest Calculator
See: www.techfortext.com/Interest/Interest/Interest.htm

Website-13) (Very interesting) Decision Channeling Calculator
See: www.TechForText.com/Decision

NOTE: The Decision Channeling Calculator was created as an experimental device. This Calculator demonstrates that software in the JavaScript and spreadsheet formats can be created with decision making capabilities, coupled with the functional capacity to channel numbers through predetermined pathways, and to perform over 100 calculations simultaneously. The online JavaScript version of the Calculator is embedded in a webpage.

For a Description of the Multiple Trigonometric Calculator
See : www.TechForText.com/Trig

Website-14) The Radius-Sphere Calculator
See: www.TechForText.com/Sphere

Website-15) A New Type of Integral Calculus Calculator
See: www.TechForText.com/Integral

Website-16) Five Term Integral Calculus Calculator
See: www.TechForText.com/Integral5

Website-17) MegaIntegral Calculus Calculators
See: www.TechForText.com/MegaIntegrals

Website-18) Multiple Trigonometric Calculator
See: www.TechForText.com/Trig1
Note: The Multiple Trigonometric Calculator is ABOUT 8 FEET LONG, from left to right, and to see it all scroll from left to right, with the arrow key.

Website-19) A manuscript and links to Calculation devices for budgeting:
See: www.Tech-For-Text.com/Budget

Website-20) Correction Factor Budget Calculators
See: www.Tech-For-Text.com/Budget2
Note: This website contains special calculation devices for planning and carrying out a budget. The devices compare your budget plans, with the way you actually carried out your budget, and then numbers are calculated that tell you how accurately you predicted expenses, and how well you followed your budget.

Website-21) Budget-Rate Calculator
www.Tech-For-Text.com/Budget1

Note: To use the Budget-Rate Calculator you must enter the start date and end date of your budget. If you plan to use this calculator for an actual budget, you should download the Excel version by clicking on the following link:

For the Budget-Rate Calculator with a database sorting function and the Excel format, left click on these words. This requires Microsoft Excel 2003 or later, and Windows.

Note, on most of the websites listed above there are detailed instructions, and different versions of the calculation devices available for FREE download.

Section 24) Website Communication Forms With Software-Based Calculation Devices

The three website communication forms presented below, I created for a friend, and they are on his web space, with his e-mail address programmed into the devices. I created these web forms with built-in calculation devices, using a similar technique described in the previous sections. When a user enters text and numbers into these devices, and presses a submit button, the message the user entered is transmitted to the e-mail address that is programmed into the device. The e-mail address is not visible to the user, and the user does not have to have an e-mail account to transmit a message with these forms.

I designed all of these web forms in an unconventional style. The forms I created have larger fonts and more room to enter a message then conventional web forms. They are colorful, and they display the date and time that they are accessed.

Website-Form 1) A Web Form With Mathematics
See: www.BetterAndBetterBusiness.com/C
If the link fails, use: www.TechForText.com/BBB/1

Website-Form 2) A Web Form With Mathematics
See: www.BetterAndBetterBusiness.com/C1
If the link fails, use: www.TechForText.com/BBB/2

Website-Form 3) A Web Form With Mathematics
See: www.BetterAndBetterBusiness.com/C2
If the link fails, use: www.TechForText.com/BBB/3

Section 25) Interactive Mathematical Notation

Note, to understand the following, it is necessary to examine the website I created with interactive mathematical notation, after reading the text. The link to the website is presented three paragraphs below.

This section presents a concept and method I devised for creating interactive mathematical notation. This involves software-based mathematical expressions that can be changed by the users of the software. When the user makes such changes, **related mathematical steps** and/or **solutions** are automatically recalculated and displayed in the software.

With this concept and technique it is possible to create instructional illustrations that present step-by-step solutions for various types of mathematics problems. Illustrations of this nature, allows the users to view the step-by-step solutions, with any set of numbers they enter. To show how this works in practice, I created a website with an illustration of four simple algebraic equations, with step-by-step solutions. This looks more or less similar to a conventional website illustration. However, on the upper section of the illustration there are four input boxes, with numbers. These numbers can be changed by the user, which will modify the entire illustration automatically. That is when a new set of numbers are entered, a new set of algebra problems are generated, with a related set of mathematical steps leading to the solutions.

To understand the above, it is necessary to examine the website I created with the interactive mathematical notation, which can be accessed by left clicking on the Web address below this paragraph. This website presents instructions and the calculation device with the interactive notation on the left side, and displays the computer code I use to create the notation on the right side. With most computer screens, it is necessary to scroll to the right, with the arrow key, to see the computer code.

www.TechForText.com/Interactive-Math

To create the interactive mathematical notation, I used the same technical and theoretical concepts that I used when I create calculation devices, with a few major additions. The actual procedure is highly complex, and would require many pages to explain in detail, but the basic principles can be summarized in three steps as follows:

1) I remove all of the numbers in the mathematics problems, and replaced them with letters, or sometimes even words, and then I solve the problem for a designated unknown, which is usually X. I generally solve these problems in the conventional way, using pencil and paper.

2) Then I manually translate each step into computer code.
The code that I devise for each step is essentially a special type of spreadsheet formula that will work with Microsoft Excel. I create calculation devices in Excel, which I convert to the JavaScript computer language, using specialized software.

3) Then I modify the code that I devised in step two, so that it will display mathematical notation along with the calculations.
These modifications involve instructions for the computer, indicating if a symbol is mathematical notation that is to be displayed, or if it is computer code used for the calculations. For example the expression =A&"+ X="&B, instructs the computer to access numbers for A and B, which are located in cell A and cell B, and to display **+X=** as mathematical notation. If we assume that there is a 3 in cell A and the 9 in cell B, the computer will display =A&"+ X="&B as follows: 3 + X = 9 The precise location of the ampersand (&) and the quotation marks (" ") tells the computer what is mathematical notation, and what is computer code.

For more details see the following website:

www.TechForText.com/Interactive-Math

End of the Book

See the TABLE OF CONTENTS below

If to go to the top of this website left click on these words

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