MathTalk™

for **Scientific Notebook®**

using

Dragon NaturallySpeaking®

Voice Mathematics

Pre-algebra, Algebra, Trig, Calculus
Statistics, Graphing, etc.

1116

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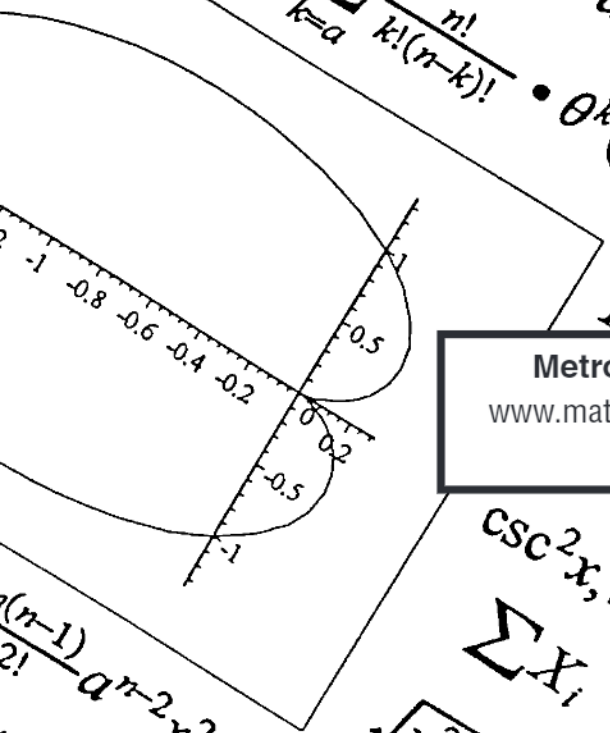

MATHTALK FOR DRAGON NATURALLYSPEAKING
TABLE OF CONTENTS

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Any justification irregularities are due to the software in which the manual was written.

TUTORIAL

Welcome to MathTalk™/ScientificNotebook™ FOR Dragon NaturallySpeaking® Versions 12 +

MathTalk/ScientificNotebook allows you to "**voice**" mathematical symbols and equations of virtually any type, shape or form.

It contains even more sentence commands with variables which enables the User to voice math even faster. For example, just say "3 x-ray minus 2" to get $3x - 2$ or "2 yankee square plus 10" to get $2y^2 + 10$ or "5 alpha over 7 bravo" to get $\frac{5a}{7b}$.

Moreover, it is designed so that the keyboard, mouse, and voice can be used interactively. The user can move back and forth at will between these mediums, employing the tool that accomplishes the job at hand most easily.

The capabilities of this program may seem quite varied. The user need only use the part that applies to the task at hand. If the user is voicing pre-algebra, then the user need only use the program for that purpose. The same goes for algebra, calculus, statistics, etc. Again, use this as a tool to accomplish the task!

To use **MathTalk/ScientificNotebook**, you will need **Dragon NaturallySpeaking ®** (**DNS**) **version 12. 0 +. MathTalk/ScientificNotebook** also requires **Windows 7® or better**.

The instructions and comments which follow will facilitate the use of MathTalk. The Initial Training, and Training Modules are constructed to develop your understanding and voice recognition to a comfort level that will make MathTalk quite easy to use. You will soon find that "talking" equations is much easier than typing them.

HELPFUL DEFINITIONS:

Pictionary -a list of the names of stand alone commands and the actions they accomplish.

Tutorial - examples and explanations of use of commands.

Sentence Commands - allows the user to voice more than one expression at a time. An example of this would be to say "square root of twenty". This particular command allows you to say any root (from square to ninth) of any number (1 through 20) or of any letter (a through z, including caps) or any greek letter (including caps)!

Variable List - list of variables for use in Sentence Commands.

Training Modules - training for Pre-Algebra, Algebra, Calculus, Trig, Statistics.

The program contains the following learning assistance items:

1. Manual /Tutorial
2. Pictionary
3. Learning Assistance Module which is comprised of
   a. Video demonstrations on the MathTalk CD video demo including:
      "Quick Reference Laminate"
      "Training MathTalk"

"Adding Text to MathTalk" (also refer to Voicing or Typing Text in Table of Contents)

b. Direct online access to available Sentence Commands, Variable Lists, stand alone commands in Pictionary, Manual/Tutorial search.

4. Recommended training for Pre-Algebra, Algebra, Trig, Calculus, and Statistics.
5. Find two QUICK REFERENCE laminates containing the International and Greek Alphabets, and as well as, a list of often used sentence commands, with examples, (Say "**sample commands**" to view.) to make voicing math even faster!! Learning Assistance Module is available by a single voice command. Just say "mathtalk learning module" at anytime for a list of commands to access video demos, lists of sentence commands and their variables, stand alone commands in the Pictionary, and Training Modules.

With the system requirements met, the load instructions followed exactly, and the training/dictation techniques followed, you will be awed by this powerful tool!

Remark: **It is very important to save your speech file after each sessions or maybe even several times a session**. **You may do this by clicking** "save user files" **in the DragonBar**, **NaturallySpeaking**.

GETTING STARTED

It as is understood that you have followed the installation instructions EXACTLY such that you may proceed as follows:

1. From the Desktop say "**start mathtalk**" or "**start shortcut to mathtalk**" as per the Load Instructions which will bring up ScientificNotebook.
2. Follow the directions in "Before You Begin to Use MathTalk", including saying "**train initial commands**" to train the commands listed and then "**train alphabet**" to train the International Alphabet. Using the International Alphabet is **REQUIRED**!
   Interested Users may also say "**train greek**".
   Find included a laminated sheet of the International and Greek alphabet.
3. Each MathTalk Training Module is discussed in the following topics. Select a Training Module and follow the directions.
4. When ready to create your own math, you may say "**new file**" and then "**ok**" to open a new document.
5. Be sure to say "**next line**" to move the cursor to a new line when voicing mathematics.

MATHTALK FOR PRE-ALGEBRA(c)

If your use of MathTalk is Pre-Algebra, we recommend the following steps.

1. Begin with:
   a. Watch some of the examples on the Demo CD video. These will help you learn to talk to MathTalk. We RECOMMEND this step!
   b. Study "Rules for Correcting" – see listing in Table of Contents, Tutorial. This is equally as important. The user must convey to the computer if there is a

misrecognition – otherwise, the computer will not know!
c. Study "Voicing or typing Text" – see listing in Table of Contents, Tutorial.
d. Study "next line and enter key commands" by saying "**next line command**".
e. Review Trouble Shooting by saying "**trouble shooting**".

2. **NEXT**
   a. Study the MathTalk PreAlgebra Examples immediately following # 6.
   b. Review variables that apply to the examples that follow. **In the following examples**, **the command to access these lists will be given at the appropriate time**.
   This includes the International Alphabet which is accessed by saying "**international alphabet**" and "**sample commands**" .

3. Study these topics which appear in the following paragraphs (You may refer to the Table of Contents).
   Rules for Voicing Commands
   Improve Your Recognition Rate
   Rules for Correcting

4. Complete the Pre-Algebra Training Module. Instructions will be at the top of the page. To access this training, say "**prealgebra training**". Be sure to say "**exit training**" upon completion (This is also stated on the training document.) so as to NOT save the document.
   This training will help the user:
   a. Find their dictation rhythm for MathTalk.
   b. Learn to pause between commands (i.e. wait until the command executes the keystrokes) before saying the next command.
   c. Learn to formulate what to say BEFORE saying it!
   d. Learn commands that are common throughout MathTalk.

5. You may choose to NOT read the remainder of the manual! Seriously, there is no need for the user to learn all the MathTalk commands! The user need utilize only the commands necessary to accomplish the task!

6. At any time say "**mathtalk learning module**" to access all help commands.

MathTalk PreAlgebra Examples(c)

Number examples:

Say: "**twenty-five**", "**comma**", "**fifteen**", "**comma**", "**sixty-eight**", "**comma**", "**8**", "**hundred**"
Get: 25, 15, 68, 800
Note you cay say:
Any number 1-99, hundred, and zero. (Sometimes you may need to say "math mode" before you say the numbers for the numbers to appear in *red*.)

Fraction examples:

Say: "**4 over 5**", "**comma**", "**alpha over bravo**", "**comma**", "**9 over charlie**", "**comma**", "**hotel over 3**", "**comma**", "**twenty- five over sixty- five**", "**comma**", "**cap alpha over thirty-five**"

Get: $\frac{4}{5}, \frac{a}{b}, \frac{9}{c}, \frac{h}{3}, \frac{25}{65}, \frac{A}{35}$

Note that you may say:

1. Any number from 1-99 over any number 1-99.
2. Any number from 1-99 over any letter. The Letter Variable List contains letters of the alphabet and cap letters of the alphabet. It is necessary to use the International Alphabet to speak letters. Review the International Alphabet. Say "**international alphabet**". Then view the Cap Letter List by saying "**cap letter list**".
3. Any letter over any letter.
4. Any letter over any number 1-99.

Plus and Minus examples:

Say: "**plus 5**", "**comma**", "**minus 8**", "**comma**", "**plus x-ray**", "**comma**", "**minus yankee**", "**comma**", "**plus one fourth**", "**comma**", "**minus one third**"

Get: $+5, -8, +x, -y, +\frac{1}{4}, -\frac{1}{3}$

Note that you may say:

1. Plus any number from 0-20 (includes other variables). Review Numbers Variable List by saying "**numbers list**".
2. Minus any number from 0-20 (includes other variables).
3. Plus any letter. Review International Alphabet.
4. Minus any letter.

Number/Letter Number/Letter examples:

Say: "**3 x-ray**", "**comma**", "**4 yankee**", "**comma**", "**thirty-five alpha**", "**comma**", "**fifteen cap romeo**", "**comma**", "**x-ray yankee**"

Get: $3x, 4y, 35a, 15R, xy$

Note that you may say:

1. Any number 1-99 and any letter.
2. Any letter and any letter.

Square/Cube examples:

Say: "**alpha cubed**", "**comma**", "**yankee squared**", "**comma**", "**x-ray cubed**", "**comma**", "**cap hotel squared**"

Get: a^3, y^2, x^3, H^2

Note that you may say:

Any letter squared/cubed. (Includes "cap letter".)

Square/Cube Root examples:

Say: "**square root of twenty**", "**comma**", "**square root of charlie**", "**comma**", "**cube root**", "**fifteen**", "**move out**", "**comma**", "**cube root of one third**", "**comma**", "**ninth root of 8**"

Get: $\sqrt{20}, \sqrt{c}, \sqrt[3]{15}, \sqrt[3]{\frac{1}{3}}, \sqrt[9]{8}$

Note that you may say:

1. Square root of any number 0-20 (includes other variables). Review Numbers Variable List by saying "**numbers list**".
2. Square root of any letter.
3. Cube root of any number 0-20 (includes other variables).
4. Cube root of any letter.
5. Square root of any letter. Includes "cap letter".
6. Any root, square thru ninth, of numbers 0-20 (includes other variables).

If the user wishes additional information, saying "**mathtalk learning module**" gives the user learning access help.

Recommended:

a. Review Sentence Commands and Variables Lists. In viewing these, you will see that you have already been using Sentence Commands and Variable Lists when you completed the training module as discussed in number 4 above! To view Sentence Commands with examples, say "**show sentence commands**". To view Variable Lists, say "**variable menu**" and "**sample commands**".

b. View the Pictionary by saying "**pictionary search**" to bring up the Pictionary menu.

c. Additional Pre-Algebra examples are in the Manual/Tutorial. See Table of Contents.

d. You may choose do the Training Module again.

MATHTALK FOR ALGEBRA(c)

If your use of MathTalk is Algebra, we recommend the following steps.

1. Begin with:
   a. Watch some of the examples on the Demo CD video. These will help you learn to talk to MathTalk. We RECOMMEND this step!
   b. Study "Rules for Correcting" – see listing in Table of Contents, Tutorial. This is equally as important. The user must convey to the computer if there is a misrecognition – otherwise, the computer will not know!
   c. Study "Voicing or Typing Text" – see listing in Table of Contents, Tutorial.
   d. Study "next line and enter key commands" by saying "**next line command**".
   e. Review Trouble Shooting by saying "**trouble shooting**".

2. **NEXT**
   a. Study the MathTalk Algebra Examples immediately following # 6.
   b. Review variables that apply to the examples that follow. **In the following examples, the command to access these lists will be given at the appropriate time**.
   This includes the International Alphabet which is accessed by saying "**international alphabet**" and "**sample commands**".

3. Study these topics which appear in the following paragraphs (You may refer

to the Table of Contents).
Rules for Voicing Commands
Improve Your Recognition Rate
Rules for Correcting

4. Complete the Algebra Training Module. Instructions will be at the top of the page. To access this training, say "**train algebra**". Be sure to say "**exit training**" upon completion (This is also stated on the training document.) so as to NOT save the document.
   This training will help the user:
   a. Find their dictation rhythm for MathTalk.
   b. Learn to pause between commands (i.e. wait until the command executes the keystrokes) before saying the next command.
   c. Learn to formulate what to say BEFORE saying it!
   d. Learn commands that are common throughout MathTalk.

5. You may choose to NOT read the remainder of the manual! Seriously, there is no need for the user to learn all the MathTalk commands! The user need utilize only the commands necessary to accomplish the task!

6. At any time say "**mathtalk learning module**" to access all help commands.

MathTalk Algebra Examples(c)

Number examples:

Say: "**twenty-five**", "**comma**", "**fifteen**", "**comma**", "**sixty-eight**", "**comma**", "**8**", "**hundred**"
Get: 25, 15, 68, 800
Note you cay say:
Any number 1-99, hundred, and zero. (Sometimes you may need to say "math mode" before you say the numbers for the numbers to appear in *red*.)

Fraction examples:

Say: "**4 over 5**", "**comma**", "**alpha over bravo**", "**comma**", "**9 over charlie**", "**comma**", "**hotel over 3**", "**comma**", "**twenty- five over sixty- five**", "**comma**", "**cap alpha over thirty-five**"
Get: $\frac{4}{5}, \frac{a}{b}, \frac{9}{c}, \frac{h}{3}, \frac{25}{65}, \frac{A}{35}$
Note that you may say:
1. Any number from 1-99 over any number 1-99.
2. Any number from 1-99 over any letter. The Letter Variable List contains letters of the alphabet and cap letters of the alphabet. It is necessary to use the International Alphabet to speak letters. Review the International Alphabet. Say "**international alphabet**". Then view the Cap Letter List by saying "**cap letter list**".
3. Any letter over any letter.
4. Any letter over any number 1-99.

Plus and Minus examples:

Say: "**plus 5**", "**comma**". "**minus 8**", "**comma**", "**plus x-ray**", "**comma**", "**minus yankee**", "**comma**", "**plus one fourth**", "**comma**", "**minus one third**"

Get: $+5, -8, +x, -y, +\frac{1}{4}, -\frac{1}{3}$

Note that you may say:

1. Plus any number from 0-20 (includes other variables). Review Plus Numbers Variable List by saying "**plus numbers list**".
2. Minus any number from 0-20 (includes other variables). Review Minus Numbers Variable list by saying "**minus numbers list**".
3. Plus any letter. Review International Alphabet.
4. Minus any letter.

Number/Letter Number/Letter examples:

Say: "**3 x-ray**", "**comma**", "**4 yankee**", "**comma**", "**thirty-five alpha**", "**comma**", "**fifteen cap romeo**", "**comma**", "**x-ray yankee**"

Get: $3x, 4y, 35a, 15R, xy$

Note that you may say:

1. Any number 1-99 and any letter.
2. Any letter and any letter.

Square/Cube examples:

Say: "**alpha cubed**", "**comma**", "**yankee squared**", "**comma**", "**x-ray cubed**", "**comma**", "**cap hotel squared**"

Get: a^3, y^2, x^3, H^2

Note that you may say:

Any letter squared/cubed. (Includes "cap letter".)

Square/Cube Root examples:

Say: "**square root of twenty**", "**comma**", "**square root of charlie**", "**comma**", "**cube root**", "**fifteen**", "**move out**", "**comma**", "**cube root of one third**", "**comma**", "**ninth root of 8**"

Get: $\sqrt{20}, \sqrt{c}, \sqrt[3]{15}, \sqrt[3]{\frac{1}{3}}, \sqrt[9]{8}$

Note that you may say:

1. Square root of any number 0-20 (includes other variables). Review Numbers Variable List by saying "**numbers list**".
2. Square root of any letter.
3. Cube root of any number 0-20.
4. Cube root of any letter.
5. Square root of any letter. Includes "cap letter".
6. Any root, square through ninth, of numbers 0-20.

Exponent examples:

Say: "**alpha**", "**exponent x-ray**", "**alpha**", "**exponent yankee**", "**comma**", "**x-ray**", "**exponent minus 4**", "**comma**", "**echo**", "**exponent minus pi over 2**", "**comma**", "**cap victor**", "**exponent**", "**parens**", "**x-ray square plus yankee square**", "**sine theta**", "**end exponent**"

Get: $a^x a^y, x^{-4}, e^{-\frac{\pi}{2}}, V^{(x^2+y^2)\sin\theta}$

Note that you may say:
(Say "**exponent sentence commands**" to view all available exponent commands.):
1. exponent any letter. Includes cap letter.
2. exponent any minus letter. Includes cap letter and Greek letter.
3. exponent greek letter
4. exponent any number 0-20 (includes other variables). To view Numbers List say "**numbers list**".
5. exponent minus numbers 1-9. To view Minus Numbers List, say "**minus numbers list**".
6. exponent any number 1-99 & any Greek letter
7. exponent any number 1-99 & any letter

Subscript examples:
Say : "**alpha**", "**sub 2**", "**comma**", "**bravo**", "**sub india**", "**comma**", "**charlie**", "**sub one one**", "**comma**", "**x-ray**", "**sub alpha charlie**", "**comma**", " **yankee**", "**sub alpha minus 1**", "**comma**", "**echo**", "**sub bravo plus 5**","**comma**", "**log**", "**subscript**", "**one half**", "**move out**"
Get: $a_2, b_i, c_{11}, x_{ac}, y_{a-1}, e_{b+5}, \log_{\frac{1}{2}}$
Note that you may say:
(Say "**sub sentence commands**" to view all available sub commands.)
1. sub any number 1-9.
2. sub any number 1-9 and any number 1-9.
3. sub any letter
4. sub any letter and any letter
5. sub any letter plus/minus any number 1-9.

If the user wishes additional information, saying "**mathtalk learning module**" gives the user learning access help.
Recommended:
a. Review Sentence Commands and Variables Lists. In viewing these, you will see that you have already been using Sentence Commands and Variable Lists when you completed the training module as discussed in number 4 above! To view Sentence Commands with examples, say "**show sentence commands**". To view Variable Lists, say "**variable menu**" and "**sample commands**".
b. View the Pictionary by saying "**pictionary search**" to bring up the Pictionary menu.
c. You may choose do the training module again.

MATHTALK FOR TRIG(c)

If your use of MathTalk is Trig, we recommend the following steps.

1 Begin with:

a. Watch some of the examples on the Demo CD video. These will help you learn to talk to MathTalk. We RECOMMEND this step!

b. Study "Rules for Correcting" – see listing in Table of Contents, Tutorial. This is equally as important. The user must convey to the computer if there is a misrecognition otherwise, the computer will not know!

c. Study "Voicing or Typing Text" – see listing in Table of Contents, Tutorial.

d. Study "next line and enter key commands" by saying "**next line command**".

e. Review Trouble Shooting by saying "**trouble shooting**".

2. **NEXT**

a. Study the MathTalk Trig Examples immediately following # 6.

b. Review variables that apply to the examples that follow. **In the following examples**, **the command to access these lists will be given at the appropriate time**.

This includes the International Alphabet which is accessed by saying "**international alphabet**" and "**sample commands**".

c. Say "**trig list**" to review a list of available trig commands.

3. Study these topics which appear in the following paragraphs (You may refer to the Table of Contents).

Rules for Voicing Commands
Improve Your Recognition Rate
Rules for Correcting

4. Complete the Trig Training Module. Instructions will be at the top of the page. To access this training, say "**train trig**". Be sure to say "**exit training**" upon completion (This is also stated on the training document.) so as to NOT save the document.

This training will help the user:

a. Find their dictation rhythm for MathTalk.

b. Learn to pause between commands (i.e. wait until the command executes the keystrokes) before saying the next command.

c. Learn to formulate what to say BEFORE saying it!

d. Learn commands that are common throughout MathTalk.

5. You may choose to NOT read the remainder of the manual! Seriously, there is no need for the user to learn all the MathTalk commands! The user need utilize only the commands necessary to accomplish the task!

6. At any time say "**mathtalk learning module**" to access all help commands.

MathTalk Trig Examples(c)

Number examples:

Say: "**twenty-five**", "**comma**", "**fifteen**", "**comma**", "**sixty-eight**", "**comma**", "**8**", "**hundred**"

Get: $25, 15, 68, 800$

Note you cay say:

Any number 1-99, hundred, and zero. (Sometimes you may need to say "math mode" before you say the numbers for the numbers to appear in *red*.)

Fraction examples:

Say: "**4 over 5**", "**comma**", "**alpha over bravo**", "**comma**", "**9 over charlie**", "**comma**", "**hotel over 3**", "**comma**", "**twenty- five over sixty- five**", "**comma**", "**cap alpha over thirty-five**"

Get: $\frac{4}{5}, \frac{a}{b}, \frac{9}{c}, \frac{h}{3}, \frac{25}{65}, \frac{A}{35}$

Note that you may say:

1. Any number from 1-99 over any number 1-99.
2. Any number from 1-99 over any letter. The Letter Variable List contains letters of the alphabet and cap letters of the alphabet. It is necessary to use the International Alphabet to speak letters. Review the International Alphabet. Say "**international alphabet**". Then view the Cap Letter List by saying "**cap letter list**".
3. Any letter over any letter.
4. Any letter over any number 1-99.

Plus and Minus examples:

Say: "**plus 5**", "**comma**", "**minus 8**", "**comma**", "**plus x-ray**", "**comma**", "**minus yankee**", "**comma**", "**plus one fourth**", "**comma**", "**minus one third**"

Get: $+5, -8, +x, -y, +\frac{1}{4}, -\frac{1}{3}$

Note that you may say:

1. Plus any number from 0-20 (includes other variables). Review Plus Numbers Variable List by saying "**plus numbers list**".
2. Minus any number from 0-20 (includes other variables). Review Minus Numbers Variable list by saying "**minus numbers list**".
3. Plus any letter. Review International Alphabet.
4. Minus any letter.

Number/Letter Number/Letter examples:

Say: "**3 x-ray**", "**comma**", "**4 yankee**", "**comma**", "**thirty-five alpha**", "**comma**", "**fifteen cap romeo**", "**comma**", "**x-ray yankee**", "**comma**", " **2 cap zulu**"

Get: $3x, 4y, 35a, 15R, xy, 2Z$

Note that you may say:

1. Any number 1-99 and any letter.
2. Any letter and any letter.

Parentheses examples:

Say: "**parens hotel**", "**parentheses cap fee**", "**parentheses minus 9**",

"**parentheses alpha bravo**", "**parentheses 1**", "**parentheses one one**"
Get: (h) (Φ) (-9) (a,b) (1) $(1,1)(Z)$
Note that you may say:
1. parentheses any letter (includes cap letter).
2. parentheses any Greek letter (includes cap Greek letter).
3. parentheses minus any letter.
4. parentheses any number.
5. parentheses minus any number.

Say "**parentheses sentence commands**" to view many more examples.

Square/Cube examples:
Say: "**alpha cubed**", "**comma**", "**yankee squared**", "**comma**", "**x-ray cubed**", "**comma**", "**cap hotel squared**"
Get: a^3, y^2, x^3, H^2
Note that you may say:
Any letter squared/cubed. (Includes "cap letter".)

Square/Cube Root examples:
Say: "**square root of twenty**", "**comma**", "**square root of charlie**", "**comma**", "**cube root**", "**fifteen**", "**move out**", "**comma**", "**cube root of one third**", "**comma**", "**ninth root of 8**"
Get: $\sqrt{20}$, $\sqrt{c}$, $\sqrt[3]{15}$, $\sqrt[3]{\frac{1}{3}}$, $\sqrt[9]{8}$
Note that you may say:
1. Square root of any number 0-20 (includes other variables). Review Numbers Variable List by saying "**numbers list**".
2. Square root of any letter.
3. Cube root of any number 0-20.
4. Cube root of any letter.
5. Square root of any letter. Includes "cap letter".
6. Any root, square through ninth, of numbers 0-20.

Exponent examples:
Say: "**alpha**", "**exponent x-ray**", "**alpha**", "**exponent yankee**", "**comma**", "**x-ray**", "**exponent minus 4**", "**comma**", "**echo**", "**exponent minus pi over 2**", "**comma**", "**cap victor**", "**exponent**", "**parentheses**", "**x-ray square plus yankee square**", "**sine theta**", "**end exponent**"
Get: $a^x a^y, x^{-4}, e^{-\frac{\pi}{2}}, V^{(x^2+y^2)\sin\theta}$
Note that you may say:
(Say "**exponent sentence commands**" to view all available exponent commands.):
1. exponent any letter. Includes cap letter.
2. exponent any minus letter. Includes cap letter and Greek letter.
3. exponent greek letter
4. exponent any number 0-20 (includes other variables). To view Numbers List say "**numbers list**".
5. exponent minus numbers 1-9. To view Minus Numbers List, say "**minus**

numbers list".

6. exponent any number 1-99 & any Greek letter
7. exponent any number 1-99 & any letter

Subscript examples:

Say : "**alpha**", "**sub 2**", "**comma**", "**bravo**", "**sub india**", "**comma**", "**charlie**", "**sub one one**", "**comma**", "**x-ray**", "**sub alpha charlie**", "**comma**", " **yankee**", "**sub alpha minus 1**", "**comma**", "**echo**", "**sub bravo plus 5**","**comma**", "**log**", "**subscript**", "**one half**", "**move out**"

Get: $a_2, b_i, c_{11}, x_{ac}, y_{a-1}, e_{b+5}, \log_{\frac{1}{2}}$

Note that you may say:

(Say "**sub sentence commands**" to view all available sub commands.)

1. sub any number 1-9.
2. sub any number 1-9 and any number 1-9.
3. sub any letter
4. sub any letter and any letter
5. sub any letter plus/minus any number 1-9.

Trig Function examples:

Says: "**sine squared x-ray**", "**comma**","**cosecant squared theta**", "**comma**", "**hyperbolic cotangent lambda**", "**comma**", "**inverse sine theta**"

Get: $\sin^2 x,\ \csc^2\theta,\ \coth\lambda,\ \sin^{-1}\theta$

Note that you may say:

1. any trig function and any letter
2. any trig function

Say "**trig list**", "**numarg list**", and "**argument list**" for variable lists. Review Trig Sentence commands by saying "**trig sentence commands**".

Over command example:

Say: "**3 over 4**", "**sixty-five over seventy-nine**", "**3 pi over 4**", "**pi over 6**"

Get: $\frac{3}{4}\ \frac{65}{79}\ \frac{3\pi}{4}\ \frac{\pi}{6}$

Note that you may say:

1. any number 1-99 over any letter (includes cap letters).
2. any number 1-99 over any Greek letter (includes cap Greek letters).
3. any number 1-99 over any number 1-99.

(Say "**numbers list**" to view another variable list.)

If the user wishes additional information, saying "**mathtalk learning module**" gives the user learning access help.

Recommended:

a. Review Sentence Commands and Variables Lists. In viewing these, you will see that you have already been using Sentence Commands and Variable Lists when you completed the training module as discussed in number 4 above! To view Sentence Commands with examples, say "**show sentence commands**". To view Variable Lists, say "**variable menu**" and "**sample commands**".

b. View the Pictionary by saying "**pictionary search**" to bring up the Pictionary menu.
c. You may choose do the Training Module again.

MATHTALK FOR CALCULUS(c)

If your use of MathTalk is Calculus, we recommend the following steps.

1. Begin with:
   a. Watch some of the examples on the Demo CD video. These will help you learn to talk to MathTalk. We RECOMMEND this step!
   b. Study "Rules for Correcting" – see listing in Table of Contents, Tutorial. This is equally as important. The user must convey to the computer if there is a misrecognition otherwise, the computer will not know!
   c. Study "Voicing or Typing Text" – see listing in Table of Contents, Tutorial.
   d. Study "next line and enter key commands" by saying "**next line command**".
   e. Review Trouble Shooting by saying "**trouble shooting**".

2. **NEXT**
   a. Study the MathTalk Calculus Examples immediately following # 6.
   b. Review variables that apply to the examples that follow. **In the following examples**, **the command to access these lists will be given at the appropriate time**. This includes the International Alphabet which is accessed by saying "**international alphabet**" and "**sample commands**".

3. Study these topics which appear in the following paragraphs (You may refer to the Table of Contents).
   Rules for Voicing Commands
   Improve Your Recognition Rate
   Rules for Correcting

4. Complete the Calculus Training Module. Instructions will be at the top of the page. To access this training, say "**train calculus**". Be sure to say "**exit training**" upon completion (This is also stated on the training document.) so as to NOT save the document.
   This training will help the user:
   a. Find their dictation rhythm for MathTalk.
   b. Learn to pause between commands (i.e. wait until the command executes the keystrokes) before saying the next command.
   c. Learn to formulate what to say BEFORE saying it!
   d. Learn commands that are common throughout MathTalk.

5. You may choose to NOT read the remainder of the manual! Seriously, there is no need for the user to learn all the MathTalk commands! The user need utilize only the commands necessary to accomplish the task!

6. At any time say "**mathtalk learning module**" to access all help commands.

MathTalk Calculus Examples(c)

Number examples:

Say: "**twenty-five**", "**comma**", "**fifteen**", "**comma**", "**sixty-eight**", "**comma**", "**8**", "**hundred**"

Get: $25, 15, 68, 800$

Note you cay say:

Any number 1-99, hundred, and zero. (Sometimes you may need to say "math mode" before you say the numbers for the numbers to appear in *red*.)

Fraction examples:

Say: "**4 over 5**", "**comma**", "**alpha over bravo**", "**comma**", "**9 over charlie**", "**comma**", "**hotel over 3**", "**comma**", "**twenty- five over sixty- five**", "**comma**", "**cap alpha over thirty-five**"

Get: $\frac{4}{5}, \frac{a}{b}, \frac{9}{c}, \frac{h}{3}, \frac{25}{65}, \frac{A}{35}$

Note that you may say:

1. Any number from 1-99 over any number 1-99.
2. Any number from 1-99 over any letter. The Letter Variable List contains letters of the alphabet and cap letters of the alphabet. It is necessary to use the International Alphabet to speak letters. Review the International Alphabet. Say "**international alphabet**". Then view the Cap Letter List by saying "**cap letter list**".
3. Any letter over any letter.
4. Any letter over any number 1-99.

Plus and Minus examples:

Say: "**plus 5**", "**comma**", "**minus 8**", "**comma**", "**plus x-ray**", "**comma**", "**minus yankee**", "**comma**", "**plus one fourth**", "**comma**", "**minus one third**"

Get: $+5, -8, +x, -y, +\frac{1}{4}, -\frac{1}{3}$

Note that you may say:

1. Plus any number from 0-20 (includes other variables). Review Plus Numbers Variable List by saying "**plus numbers list**".
2. Minus any number from 0-20 (includes other variables). Review Minus Numbers Variable list by saying "**minus numbers list**".
3. Plus any letter. Review International Alphabet.
4. Minus any letter.

Number/Letter Number/Letter examples:

Say: "**3 x-ray**", "**comma**", "**4 yankee**", "**comma**", "**thirty-five alpha**", "**comma**", "**fifteen cap romeo**", "**comma**", "**x-ray yankee**"

Get: $3x, 4y, 35a, 15R, xy$

Note that you may say:

1. Any number 1-99 and any letter.
2. Any letter and any letter.

Square/Cube examples:

Say: "**alpha cubed**", "**comma**", "**yankee squared**", "**comma**", "**x-ray cubed**",

"**comma**", "**cap hotel squared**"
Get: a^3, y^2, x^3, H^2
Note that you may say:
Any letter squared/cubed. (Includes "cap letter".)

Square/Cube Root examples:
Say: "**square root of twenty**", "**comma**", "**square root of charlie**", "**comma**", "**cube root**", "**fifteen**", "**move out**", "**comma**", "**cube root of one third**", "**comma**", "**ninth root of 8**"
Get: $\sqrt{20}, \sqrt{c}, \sqrt[3]{15}, \sqrt[3]{\frac{1}{3}}, \sqrt[9]{8}$
Note that you may say:
1. Square root of any number 0-20 (includes other variables). Review Numbers Variable List by saying "**numbers list**".
2. Square root of any letter.
3. Cube root of any number 0-20.
4. Cube root of any letter.
5. Square root of any letter. Includes "cap letter".
6. Any root, square through ninth, of numbers 0-20.

Exponent examples:
Say: "**alpha**", "**exponent x-ray**", "**alpha**", "**exponent yankee**", "**comma**", "**x-ray**", "**exponent minus 4**", "**comma**", "**echo**", "**exponent minus pi over 2**", "**comma**", "**cap victor**", "**exponent**", "**parentheses**", "**x-ray square plus yankee square**", "**sine theta**", "**end exponent**"
Get: $a^x a^y, x^{-4}, e^{-\frac{\pi}{2}}, V^{(x^2+y^2)\sin\theta}$

Note that you may say:
(Say "**exponent sentence commands**" to view all available exponent commands.):
1. exponent any letter. Includes cap letter.
2. exponent any minus letter. Includes cap letter and Greek letter.
3. exponent greek letter.
4. exponent any number 0-20 (includes other variables). To view Numbers List say "**numbers list**".
5. exponent minus numbers 1-9. To view Minus Numbers List, say "**minus numbers list**".
6. exponent any number 1-99 & any Greek letter.
7. exponent any number 1-99 & any letter.

Subscript examples:

Say : "**alpha**", "**sub 2**", "**comma**", "**bravo**", "**sub india**", "**comma**", "**charlie**", "**sub one one**", "**comma**", "**x-ray**", "**sub alpha charlie**", "**comma**", " **yankee**", "**sub alpha minus 1**", "**comma**", "**echo**", "**sub bravo plus 5**", "**comma**", "**log**", "**subscript**", "**one half**", "**move out**".

Get: $a_2, b_i, c_{11}, x_{ac}, y_{a-1}, e_{b+5}, \log_{\frac{1}{2}}$

Note that you may say:

(Say "**sub sentence commands**" to view all available sub commands.)

1. sub any number 1-9.
2. sub any number 1-9 and any number 1-9.
3. sub any letter
4. sub any letter and any letter
5. sub any letter plus/minus any number 1-9.

Plus Delta examples:

Say: "**x-ray plus delta x-ray**", "**comma**", "**cap november plus delta cap november** "

Get: $x + \Delta x, N + \Delta N$

Note that you may say any letter plus delta letter (includes cap letter).

Derivative examples:

Say: "**derivative with respect to x-ray**, **derivative with respect to tango**", "**delta cap foxtrot delta x-ray**, **delta romeo delta theta** "

Get: $\frac{d}{dx} \frac{d}{dt} \frac{dF}{dx} \frac{dr}{d\theta}$

Note that you may say:

1. d any letter and d any letter.
2. d any letter and d any Greek letter (includes cap letter). Review Greek Letter List by saying "**greek letter list**". Say "**derivative sentence commands**" to view more examples.

Higher Order Derivative examples:

Say: "**second derivative of yankee with respect to x-ray**", "**fourth derivative of romeo with respect to theta**"

Get: $\frac{d^2y}{dx^2} \frac{d^4r}{d\theta^4}$

Note that you can say:

Say "**higher order list**" to view all available Higher Order commands.) Say "**higher order sentence commands**" to view more examples.

1. 2nd thru 9th derivative of any letter with respect to any letter (includes cap letter).
2. 2nd thru 9th derivative of any letter with respect to any Greek letter (includes cap Greek letter).

Partial Derivative examples:

Say: "**mixed partial of foxtrot with respect to romeo and theta**", "**second partial of x-ray with respect to whiskey**"

Get: $\frac{\partial^2 f}{\partial r \partial \theta}\ \frac{\partial^2 x}{\partial w^2}$
Note that you may say:
Say "**partial sentence commands**" and "**second partial sentence commands**" to view more examples.

Limit examples:
Say: "**limit at hotel goes to zero**", "**tab key**", "**limit**", "**cap greek delta**", "**theta goes to zero**", "**move out**", "**tab key**", "**limit as alpha goes to 3**"
Get: $\lim_{h\to 0}\ \lim_{\Delta\theta\to 0}\ \lim_{a\to 3}$
Note that you may say:
1. limit as any letter goes to any number 0-20 (say "**numbers list**" to view other variables).
2. limit as any letter goes to any letter (includes cap letter).
3. limit as any Greek letter goes to any number 0-20.
4. limit as delta any letter goes to zero.
5. limit as delta any Greek letter goes to zero.

Say "**sentence limit commands**" to view more examples.

Parentheses examples:
Say: "**parentheses hotel**", "**parentheses cap fee**", "**parentheses minus 9**", "**parentheses alpha bravo**"
Get: $(h)(\Phi)(-9)(a,b)$
Note that you may say:
1. parentheses any letter (includes cap letter).
2. parentheses any Greek letter (includes cap Greek letter).
3. parentheses minus any letter.
4. parentheses any number.
5. parentheses minus any number.

Say "**parentheses sentence commands**" to view many more examples.

Integral examples:
Say: " **integral with joint scripts**", "**limits zero to 2 pi**", "**integral with limits**", "**limits minus one fourth to infinity**", "**integral with lower limit**", "**minus 5**", "**move out**"
Get: $\int_0^{2\pi}\ \int_{-\frac{1}{4}}^{\infty}\ \int_{-5}$
Note that you may say:
To view variable lists, say " **numbers list**", "**minus numbers list**", "**letter list**", "**minus letter list**", "**greek letter list**", "**sample commands**".
1. integral with joint scripts
2. integral with limits
3. integral with lower limit
4. integral with over limits
5. integral with subscript

Say "**limits sentence commands**" to view many more examples.

Sum examples:
Say: "**sum with joint scripts**", "**india**", "**equals**", "**limits 1 to november**", "**sum with limits**" ,"**limits zero to infinity**"
Get: $\sum_{i=1}^{n} \sum_{0}^{\infty}$
Note that you may say:
To view variable lists, say " **numbers list**", "**minus numbers list**", "**letter list**", "**minus letter list**", "**greek letter list**".

1. sum with joint scripts
2. sum with limits
3. sum with lower limit
4. sum with subscript

* To see a list of stand alone sum commands with no variables, say "**go to summation commands**".

If the user wishes additional information, saying "**mathtalk learning module**" gives the user learning access help.

Recommended:

a. Review Sentence Commands and Variables Lists. In viewing these, you will see that you have already been using Sentence Commands and Variable Lists when you completed the training module as discussed in number 4 above! To view Sentence Commands with examples, say "**show sentence commands**". to view Variable Lists, say " **variable menu**" and "**sample commands**".
b. View the Pictionary by saying "**pictionary search**" to bring up the Pictionary menu.
c. You may choose do the training module again.

MATHTALK FOR STATISTICS(c)

If your use of MathTalk is Statistics, we recommend the following steps.

1. Begin with:
   a. Watch some of the examples on the Demo CD video. These will help you learn to talk to MathTalk. We RECOMMEND this step!
   b. Study "Rules for Correcting" – see listing in Table of Contents, Tutorial. This is equally as important. The user must convey to the computer if there is a misrecognition – otherwise, the computer will not know!
   c. Study "Voicing or Typing Text" – see listing in Table of Contents, Tutorial.
   d. Study "next line and enter key commands" by saying "**next line command**".
   e. Review Trouble Shooting by saying "**trouble shooting**".

2. **NEXT**
   a. Study the MathTalk Statistics Examples immediately following # 6.
   b. Review variables that apply to the examples that follow. **In the following**

examples, **the command to access these lists will be given at the appropriate time**.

This includes the International Alphabet which is accessed by saying "**international alphabet**" and "**sample commands**".

3. Study these topics which appear in the following paragraphs (You may refer to the Table of Contents).
   Rules for Voicing Commands
   Improve Your Recognition Rate
   Rules for Correcting

4. Complete the Statistics Training Module. Instructions will be at the top of the page. to access this training, say "**train statistics**". Be sure to say "**exit training**" upon completion (This is also stated on the training document.) so as to NOT save the document.
   This training will help the user:
   a. Find their dictation rhythm for MathTalk.
   b. Learn to pause between commands (i.e. wait until the command executes the keystrokes) before saying the next command.
   c. Learn to formulate what to say BEFORE saying it!
   d. Learn commands that are common throughout MathTalk.

5. Study the Statistics Section of the Manual\Tutorial. See the Table of Contents.

6. You may choose to NOT read the remainder of the manual! Seriously, there is no need for the user to learn all the MathTalk commands! The user need utilize only the commands necessary to accomplish the task!

7. At any time say "**mathtalk learning module**" to access all help commands.

MathTalk Statistics Examples(c)

Number examples:

Say: "**twenty-five**", "**comma**", "**fifteen**", "**comma**", "**sixty-eight**", "**comma**", "**8**", "**hundred**"
Get: $25,15,68,800$
Note you cay say:
Any number 1-99, hundred, and zero. (Sometimes you may need to say "math mode" before you say the numbers for the numbers to appear in *red*.)

Letter examples:

Say: "**alpha**", "**equals minus 2**", "**comma**", "**theta**", "**equals**", "**1 over 6**"
Get: $a = -2, \theta = \frac{1}{6}$
Note that you may say any letter using the International Alphabet. To review the International Alphabet, say "**international alphabet**' (includes cap letter). Review the Greek Letter List by saying "**greek letter list**" (includes cap Greek letter).

Fraction examples:
Say: "**4 over 5**", "**comma**", "**alpha over bravo**", "**comma**", "**9 over charlie**", "**comma**", "**hotel over 3**", "**comma**", "**twenty- five over sixty- five**", "**comma**", "**cap alpha over thirty-five**"
Get: $\frac{4}{5}, \frac{a}{b}, \frac{9}{c}, \frac{h}{3}, \frac{25}{65}, \frac{A}{35}$
Note that you may say:
1. Any number from 1-99 over any number 1-99.
2. Any number from 1-99 over any letter. The Letter Variable List contains letters of the alphabet and cap letters of the alphabet. It is necessary to use the International Alphabet to speak letters. Review the International Alphabet. Say "**international alphabet**". Then view the Cap Letter List by saying "**cap letter list**".
3. Any letter over any letter.
4. Any letter over any number 1-99.

Plus and Minus examples:
Say: "**plus 5**", "**comma**", "**minus 8**", "**comma**", "**plus x-ray**", "**comma**", "**minus yankee**", "**comma**", "**plus one fourth**", "**comma**", "**minus one third**"
Get: $+5, -8, +x, -y, +\frac{1}{4}, -\frac{1}{3}$
Note that you may say:
1. Plus any number from 0-20 (includes other variables). Review Plus Numbers Variable List by saying "**plus numbers list**".
2. Minus any number from 0-20 (includes other variables). Review Minus Numbers Variable list by saying "**minus numbers list**".
3. Plus any letter. Review International Alphabet.
4. Minus any letter.

Number/Letter Number/Letter examples:
Say: "**3 x-ray**", "**comma**", "**4 yankee**", "**comma**", "**thirty-five alpha**", "**comma**", "**fifteen cap romeo**", "**comma**", "**x-ray yankee**"
Get: $3x, 4y, 35a, 15R, xy$
Note that you may say:
1. Any number 1-99 and any letter.
2. Any letter and any letter.

Exponent examples:
Say: "**alpha**", "**exponent x-ray**", "**alpha**", "**exponent yankee**", "**comma**", "**x-ray**", "**exponent minus 4**", "**comma**", "**echo**", "**exponent minus pi over 2**", "**comma**", "**cap victor**", "**exponent**", "**parentheses**", "**x-ray square plus yankee square**", "**sine theta**", "**end exponent**"
Get: $a^x a^y, x^{-4}, e^{-\frac{\pi}{2}}, V^{(x^2+y^2)\sin\theta}$
Note that you may say:
(Say "**exponent sentence commands**" to view all available exponent commands.):
1. exponent any letter. Includes cap letter.
2. exponent any minus letter. Includes cap letter and Greek letter.
3. exponent greek letter
4. exponent any number 0-20 (includes other variables). To view Numbers List

say "**numbers list**".

5. exponent minus numbers 1-9. To view Minus Numbers List, say "**minus numbers list**".
6. exponent any number 1-99 & any Greek letter
7. exponent any number 1-99 & any letter

If the user wishes additional information, saying "**mathtalk learning module**" gives the user learning access help.

Recommended:

a. Review Sentence Commands and Variables Lists. In viewing these, you will see that you have already been using Sentence Commands and Variable Lists when you completed the training module as discussed in number 4 above! To view Sentence Commands with examples, say "**show sentence commands**". To view Variable Lists, say "**variable menu**" **and** "**sample commands**".
b. View the Pictionary by saying "**pictionary search**" to bring up the Pictionary menu.
c. You may choose do the training module again.

MATHTALK TUTORIAL

RULES FOR VOICING COMMANDS

All commands must be preceded by a pause and followed by a pause. This is true for voicing any commands in NaturallySpeaking!
Speak distinctly and slowly. **Speak each syllable of each and every word**!
Do not pause between words when speaking a command.
Wait until the command executes before continuing.

IMPROVE YOUR RECOGNITION RATE

You can greatly increase your speech recognition rate by adhering to the following suggestions:

1. Watch some of the examples on the Demo CD video.

2. It is important to position your microphone correctly. Place the microphone at least 1 inch from the corner of the mouth. For a voice with much volume, you may need to move the microphone further away.

3. Distinguish small differences by emphasizing them. Thus, to distinguish between "**limits zero to pi**" and "**limits zero to two pi**", emphasize the "**two**" as you say the phrase. Similarly, to distinguish between "**mixed partial of foxtrot with respect to x-ray and yankee**"and "**mixed partial of foxtrot with respect to yankee and x-ray**", emphasize the word underlined. With use, you will find what pitch and speed to use in pronunciation to obtain optimum speech recognition.

4. Finally, speak firmly at a steady pace, but pause between commands.

5. See the command executed on the screen before proceeding.

6. Save speech files often by saying "**save user files**" or click 'save user files'.

RULES FOR CORRECTING

SPECIAL NOTE: After using any of the following correction methods, it may be necessary to say "**button click**" to activate the MathTalk screen.

If the wrong math command appears on the screen:

A. Erase the misrecognition using NaturallySpeaking commands such "delete previous 1/15 characters".
B. Then repeat the command.
C. If the misrecognition continues, erase the misrecognition as described above. Then say "**train command**" which will bring up a train dialog box. In this dialog box, say the command one word at a time. All commands in MathTalk are in lower case.
   1) With the correct command in the box, say "**train**". Train the command and say "**done**". Then back in ScientificNotebook, say the command again.
   2) If voicing the command produces a misrecognition in this dialog box, say "**correct that**". With the Correction dialog box open, then type/spell the command. For example, you would type/spell "second partial of yankee with respect to whiskey" (do not include the " "). Say "Click Train" to train the command, say "Click Done" to return to the Correction dialog box, and then say "Choose 1" (assuming the correct command is in the number one place). This is a standard correction technique for NaturallySpeaking.
   3) It will be necessary to say "**button click**" to activate the MathTalk screen.

(NOTE: The Dragon command "Scratch That" can delete the entire line!)

EDITING COMMANDS

Copy
- copy this, copy to beginning of line, copy to end of line

Paste
- paste this, paste that

Delete
- backspace 1 to 20
  - Example: **say** "backspace 8"
- delete next 1 to 10 characters
  - Example: **say** "delete next 10 characters"
- delete previous 1 to 10 characters
  - Example: **say** "delete previous 6 characters"

Move
- move left/right/back/forward 1 to 20 characters/words
  - Example: **say** "move right 10 characters"
- move up/down 1 to 20 lines/paragraphs
  - Example: **say** "move up 2 lines"
- move to beginning of line: **say** "beginning of line"

move to end of line: **say** "end of line"

Select

select next/previous 1 to 20 characters/words

Example: **say** "select next 10 characters"

You can also say "**erase line**", "**erase to beginning of line**", "**erase 2 lines**", "**erase 3 lines**", and "**delete rest of line**".

Can't Remember What To Say?

If you can't remember what to say, remember the "go to" commands to view stand alone commands. For example, if you wish to view commands beginning with the letter "s", say "**go to sierra commands**" which will take you into the Pictionary to the commands that begin with the letter "s". Using the International Alphabet, say "**go to** and the letter **commands**" to view commands beginning with that letter. Saying "**pictionary search**" will take you to other "go to" commands for searches such as commands beginning with "integral" which would be accessed by saying "**go to integral commands**".

Using the International Alphabet & Greek Alphabet

When saying **letters** of the alphabet, i.e. a, b, c... , or A, B, C... , the International Alphabet must be used. **In fact**, **it is REQUIRED**! Thus, to obtain **abc**, you would say "**alpha**, **bravo**, **charlie**". Likewise, to obtain **ABC**, you would say "**cap alpha**, **cap bravo**, **cap charlie**". Thus, for example, you cannot say "**u square**"–you must say "**uniform square**".

For Greek letters, you simply say the Greek letter–with the exception of **alpha**, **delta**, **nu**, **xi**, **eta**, **zeta**, **and fee**. In the case of the first seven letters, precede them with the word "**greek**", i.e., "**greek alpha**", "**greek delta**", "**greek november**", "**greek x**", "**greek eta**", "**greek zeta**". Also for phi, say "**fee**". This is necessary, since alpha and delta are International Alphabet letters, nu and xi sound so much like mu and psi (command is "sigh"), and beta, eta and zeta sound too much like theta.

See the Quick Reference laminate or say "**international alphabet**" and "**greek alphabet**". ALSO SEE NEXT PAGE !

In this regard be sure and read the section below entitled "**Derivative Commands**, **Differential**, **and Delta Commands**".

Derivative Commands, **Differential**, **and Delta Commands**

You must say "delta" to get a "d" and "cap greek delta" to get Δ. For example, say "delta yankee delta x-ray", "comma", "delta yankee", "comma", "cap greek delta", "yankee", "comma", "cap greek delta", "x-ray" to get $\frac{dy}{dx}$, dy, Δy, Δx.

The International Alphabet is listed below.

For 'Cap' say 'cap *letter*'.

a alpha	j juliette	s sierra
b bravo	k kilo	t tango
c charlie	l lima	u uniform
d delta	m mike	v victor
e echo	n november	w whiskey
f foxtrot	o oscar	x x-ray
g golf	p papa	y yankee
h hotel	q quebec	z zulu
i india	r romeo	

Greek Alphabet

(* denotes exceptions to simply saying the Greek letter.)

CAP	SAY	
	α	*Greek Alpha *(for Alpha)*
	β	Beta
	γ	Gamma
Γ		cap Gamma
	δ	* Greek Delta *(for Delta)*
Δ		* cap Greek Delta *(for cap Delta)*
	ε	Epsilon
	ζ	*Greek Zeta *(for Zeta)*
	η	* Greek Eta *(for Eta)*
	θ	Theta
Θ		cap Theta
	ι	Iota
	κ	Kappa
	λ	Lambda
Λ		cap Lambda
	μ	Mu
	ν	* Greek november *(for Nu)*

CAP	SAY	
	ξ	* Greek x-ray *(for X)*
Ξ		* cap Greek x-ray *(for cap X)*
	π	Pi
Π		cap Pi
	ρ	Rho
	σ	Sigma
Σ		cap Sigma
	τ	Tau
	υ	Upsilon
	ϕ	* fee *(for Phi)*
Φ		* cap fee *(for cap Phi)*
	χ	Chi
	ψ	* sigh *(for Psi)*
Ψ		* cap sigh *(for cap Psi)*
	ω	Omega
Ω		cap Omega

Sentence Commands

Sentence commands are really an entire set of commands. They have the form "xx <xx>, xx <xx>", where the angles and x's can be intermixed in anyway you like. For example the first sentence command is "<Alphabet> derivative". By saying "kilo derivative", "lima derivative", "mike derivative", "november derivative", and "sierra derivative", this command produces $\frac{d^k y}{dx^k}$, $\frac{d^l y}{dx^l}$, $\frac{d^m y}{dx^m}$, $\frac{d^n y}{dx^n}$, $\frac{d^s y}{dx^s}$. Similarly, the command "<Letter> over <Letter>" allows you to get $\frac{a}{b}$, $\frac{u}{v}$, $\frac{X}{Y}$ by saying "alpha over bravo", "uniform over victor", and "cap x-ray over cap yankee", i.e., any letter over any letter. See Quick Reference laminate for other examples.

Types of Math Commands

- Angle <Letter> (English or Greek) Example: Say "**angle x-ray**" or "**angle theta**" to get $\angle^x$, or $\angle^\theta$.

- Angle <Letter> with arc (English or Greek) Example: Say "**angle x-ray with arc**" to get $\overset{\frown}{\angle}^x$.

- <Cap Letter> Examples: Say "**cap alpha**", "**cap bravo**" to get AB.

- <DigitsGroup> Examples: "23.459", ".00185", "1.3476". Here you must say the digits one at a time but you should not pause between them. That is say "2-3-point-4-5-9", "point-zero-zero-1-8-5", "1-point-3-4-7-6". Do not pause between digits. Do pause at the commas between the three numbers.

- Decorations (Decor) i.e. hats, bars and tildas
- Derivatives
  - <Alphabet> Example: $\frac{d^n y}{dx^n}$
  - <HigherOrder> Examples: $\frac{d^3 u}{dv^3}$, $\frac{d^4 x}{d\theta^4}$
  - derivative with respect to <Letter> Examples: $\frac{d}{dr}$, $\frac{d}{d\lambda}$
  - delta<Letter> Examples: $dy, dx, d\theta$
  - delta<Letter>delta<Letter> Examples: $\frac{dy}{dx}$, $\frac{dr}{d\theta}$
  - mixed partial of <Letter>... Examples: $\frac{\partial^2 f}{\partial x \partial y}$, $\frac{\partial^2 u}{\partial x \partial \theta}$, $\frac{\partial^2 R}{\partial \phi \partial \theta}$
  - partial of..... Examples: $\frac{\partial f}{\partial x}$, $\frac{\partial F}{\partial \theta}$
  - partial with respect to... Examples: $\frac{\partial}{\partial x}$, $\frac{\partial}{\partial \lambda}$
  - second partial..... Examples: $\frac{\partial^2 f}{\partial x^2}$, $\frac{\partial^2 r}{\partial \theta^2}$

- Dialog boxes
- Editing
  - Copy, and move Commands
  - delete next/previous 1-10 characters
  - undo that
  - <Move or Select> <Direction> <Number /1 to 40>

• Exponent commands (In exponent examples we assume that you have already said "echo" i.e. exponent is on "e")

Exponent <Letter> ———————— Examples: e^{x}, e^{m}, e^{l}
Exponent <Greek Letter>———— Examples: e^{θ}, e^{ω}, e^{Ω}
Exponent <Minus Letter>———— Examples: e^{-x}, e^{-m}, e^{-l}
Exponent <Minus Greek Letter>– Examples: $e^{-\theta}$, $e^{-\omega}$, $e^{-\lambda}$ (Upper case Greek Letters are not included in the minus Greek Letter vocabulary. To enter expressions such as $e^{-\Omega}$, see the tutorial.)
Exponent <Numbers>————— Examples: e^{8}, $e^{\frac{\pi}{2}}$, $e^{2\pi}$
Exponent <Minus Numbers>—— Examples: e^{-8}, $e^{-\frac{\pi}{2}}$, $e^{-2\pi}$
superscript———————————— Examples: $e^{\sin^2\theta}$, $e^{x^2+y^2}$, $e^{\cot^2\lambda-1}$
exponent———————————— Examples: Same as Superscript

• Formatting Commands See tutorial
• Graphing See tutorial
• Greek characters See tutorial
• Integral Commands See tutorial

• **Letter (includes caps) and Number Commands**

Command	Examples
The following list is available on Quick Reference laminate and/or by saying "**sample commands**".	
<Letter>	$a,\ b,\ c,\ x,\ y,\ z$
<Letter><Letter>	$ab,\ xy,\ uv$
<Number/1 to 99>	$1,\ 11,\ 25,\ 65,\ 99$
<Number/1 to 99> <Letter>	$27r,\ 5n,\ 10x$
<Number/1 to 99> <Letter> <Letter>	$5xy,\ 21cd$
<Number/1 to 99> <Greek Letter>	$2a,\ 13\beta,\ 3\Theta$
plus <Letter>	$+a,\ +b$
minus <Letter>	$-x,\ -y$
plus <Number/1 to 99>	$+27,\ +15$
minus <Number/1 to 99>	$-10, -53$
plus <Number/1 to 99><Letter>	$+3a, +10y$
minus <Number/1 to 99><Letter>	$-5x,\ -20b$
<Letter> plus <Letter>	$x+y,\ r+s,\ X+Y$
<Letter> minus <Letter>	$c-d,\ w-z, R-S$
<Letter> plus <Number/1 to 99>	$p+33,\ h+1, F+5$
<Letter> minus <Number/1 to 99>	$r-10,\ s-5,\ Y-20$
<Number/1 to 99> plus <Number/1 to 99>	$6+7, 13+42$
<Number/1 to 99> minus <Number/1 to 99>	$17-5, 35-25$
<Number/1 to 99> plus <Letter>	$26+i,\ 17+z,\ 25+B$
<Number/1 to 99> minus <Letter>	$10-n,\ 32-v,\ 15+N$
<Number/1 to 99> <Letter> plus <Letter>	$3x+y,\ 2u+y, a+b,\ 3A+D$
<Number/1 to 99> <Letter> plus <Number/1 to 99>	$6a+9,\ 11x+3,\ y+2,\ 22R+18$

<Number/1 to 99> <Letter> minus <Letter>	$3x - y,\ 25a - b$
<Number/1 to 99> <Letter> minus <Number/1 to 99>	$3x - 10,\ 2a - 4$
<Number/1 to 99> <Letter> plus <Number/1 to 99> <Letter>	$3x + 2y,\ 5v + 3i$
<Number/1 to 99> <Letter> minus <Number/1 to 99><Letter>	$4a - 3b,\ 2x - 3y$
<Letter> plus <Number/1 to 99><Letter>	$x + 3y,\ a + 5b,\ Y + 7X$
<Letter> minus <Number/1 to 99><Letter>	$n - 20m,\ x - 2y,\ A - 35B$
equals <Number/1 to 99>	$= 25,\ = 6,\ = 87$
equals minus <Number/1 to 99>	$= -16,\ = -3$
equals <Letter>	$= e,\ = c,\ = X$
equals minus <Letter>	$= -i, = -h,\ = -Y$
equals <Number/1 to 99> <Letter>	$= 3a,\ = 8y$
equals minus <Number/1 to 99> <Letter>	$= -2b,\ = -15r$
<Letter><SqCube> (includes Greek & cap)	$b^2, \sigma^2, A^3, \Gamma^3, x^2,\ y^3, \theta^2, \lambda^2$
<Number/1 to 99> <Letter> <SqCube>	$7b^2,\ 3x^3,\ 5A^3$
<Letter> square plus <Number/1 to 99>	$x^2 + 2,\ y^2 + 5,\ H^2 + 15$
<Number/1 to 99> <Letter> <SqCube> plus <Number/1 to 99>	$2x^2 + 10,\ 3r^2 + 1$
<Letter> square minus <Number/1 to 99>	$x^2 - 9,\ y^2 - 9,\ A^2 - 2$
<Number/1 to 99><Letter> <SqCube> minus <Number/1 to 99>	$3x^2 - 5,\ 2y^2 - 7$
<Letter> square plus <Letter> square	$a^2 + b^2,\ x^2 + y^2$
<Letter> square minus <Letter> square	$c^2 - d^2,\ x^2 - y^2$
times <Number/1 to 99>	$\times 6, \times 85$
<Number/1 to 99> times <Number/1 to 99>	$4 \times 5,\ 15 \times 10$
Combinations of <Letter>,<GreekLetter>, <Number 1-99> over <Letter>,<GreekLetter>, <Number 1-99>	$\frac{b}{\beta}, \frac{w}{v}, \frac{2}{y},\ \frac{\beta}{3}, \frac{X}{Y},\ \frac{x}{y}, \frac{7}{y},\ \frac{33}{z},\ \frac{w}{10},\ \frac{2}{x}$
<Number/1 to 99> <Letter> over <Number/1 to 99> <Letter>, <Number/1 to 99> <Letter> over <Number/1 to 99>	$\frac{5a}{7b},\ \frac{x}{y}, \frac{3x}{5},\ \frac{6k}{3d},\ \frac{5R}{10Y}$
<Number/1 to 99> over <Number/1 to 99> <Letter>, <Number/1 to 99> over <Number/1 to 99>	$\frac{2}{3x},\ \frac{17}{4y}, \frac{2}{3},\ \frac{11}{12},\ \frac{75}{20},\ \frac{15}{30S}$
<Number/1 to 99> spaces	
Function <Letter>	$f(\ ),\ w(\ ),\ B(\ )$
parens <Number/1 to 99>	$(5),\ (27)$
parens minus <Number/1 to 99>	$(-6),\ (-45)$
<Letter> <Decor>	$\hat{\eta}, \hat{\theta}, \overline{x}, \overline{X}, \widetilde{\lambda}$
<Letter> plus delta <Letter>	$x + \Delta x,\ y + \Delta y,\ h + \Delta h$
<Letter> factorial, <Letter> minus <Letter> factorial, <Letter> plus <DigitsOnly> factorial and <Letter> minus <DigitsOnly> factorial	$n!(n - x)!(m - 1)!(m + 2)!,\ (l + 1)!$
<Letter> <Primes>	$X', f'', \theta''', \delta'$
<Letter> <Primes> of <Greek Letter>	$e''(\pi)$
cap greek delta (*pause here) <Letter>	$\Delta x,\ \Delta h,\ \Delta m$
<Number/1 to 9> by <Number/1 to 9> determinant	See examples below.

- limit as <Letter> goes to <Letter> also to Greek letters and Numbers
  Examples: $\lim_{x\to y}$, $\lim_{x\to 0}$, $\lim_{n\to\infty}$, $\lim_{\alpha\to-\infty}$
- limits <Letter> to <Letter> also Greek letters and Numbers
  These are limits to put on integrals, summations, products, intersections, unions,vertical bars, etc. See the tutorial.

- log base 10 <Letter> & natural log <Letter> (includes Greek)
  Examples: $\log a$, $\ln \lambda$
- Math Mode See the Tutorial
- Matrix / Determinants See the Tutorial
  <Number/1 to 9 by Number /1 to 9> bracket matrix
  <Number/1 to 9 by Number /1 to 9> matrix
  <Number/1 to 9 by Number /1 to 9> determinant
- Minus Numbers Commands
  Minus <Numbers>
- Parentheses Commands
  Say "**parentheses x-ray**","**parentheses x-ray yankee**","**parentheses minus one one**"
  to get $(x), (x,y), (-1,1)$
- Plus Numbers Commands
  Plus <Numbers>
- Saving, closing and opening commands
- Summation Commands
- Subscripts See the Tutorial
  <DigitsOnly>
  <DigitsOnly> <DigitsOnly>
  <Letter>
  <Letter> <Letter>
  <Letter> minus <DigitsOnly>
  <Letter> plus <DigitsOnly>
  Subscript

- Toolbars
- Type commands - Table of Contents
- <Root> root of <Letter, Greek Letter or Number>. Examples: $\sqrt{\pi}$, $\sqrt[3]{2}$, $\sqrt[x]{n}$
- <Trig> Examples: sin, cos, $\tan^2$
- <Trig> <Argument> Examples: $\sin x$, $\cos\theta$, $\tan^2\omega$, $\tan^{-1}\theta$, $\sinh^2 x$

There are many more special purpose and special symbol commands such as A R process, Bessel function, reviewing commands, etc. You will be exposed to these commands and more in the tutorial.

Opening, Closing, and Saving Files

If you need to open a file, close a file or save a file, you can do it in Scientific Notebook by saying: "**open file**", "**close file**", and "**save file**" respectively. You can also say "**save this**" or "**save as**".

About Voicing Commands in Dialog Boxes and Toolbars

When you are in the **ScientificNotebook** you can access any of the menus on the Toolbar by saying, "**click file**", "**click open**", "**click edit**", etc. You'll have no trouble knowing what to say since it will be **written right on the screen in front of you**. The same is true for dialog boxes. In Scientific Notebook you will often be in a dialog box. For example, if you say "change variable", you will be in the "change variable dialog box". Similarly if you say "integrate by parts", you will be in the "integrate by parts dialog box". Whenever you are in a dialog box you **must use the International Alphabet**. **To review Dialog Box Variables**, **say** "**dialog box variables**". **You may also review Variable Lists in the Manual**.

A Tutorial on using MathTalk/ScientificNotebook

We will first introduce a number of the more basic **commands** and then proceed to the Tutorial in **MathTalk/ScientificNotebook**. You'll find it quite easy. You just read along, follow the instructions and watch what happens. **Try it**, **you'll like it**, **it's fun**!!

Voicing Math Symbols

We are going to initially voice some simple symbol commands to give you a quick feel for how **MathTalk/ScientificNotebook** works.

Voicing or Typing Text

If you want to voice text, we suggest that you say "**show dictation box**", dictate the text, and then say "**OK**" to place the text in MathTalk. Say "**go to type commands**" to view a list of "type..." commands that will enter short marcoed text into MathTalk without going into "show dictation box".

If you choose to type text, you **must** be in "**text mode**". You can get there by saying "**text mode**" or clicking the "**red M**" on the Toolbar which will change to a "**black T**".

You can say "**type text**" which will turn off the microphone and put you in text mode. When you are ready to return to "**math mode**", **turn on** the microphone.

mouse grid

The "mouse grid" command is a very important command. When you need to click an option and the Alt commands or key words don't work, you can always click by using the "mouse grid" command.

mouse grid on window

Mouse grid on window is the same as mouse grid except that it does not grid the entire screen. It only grids the part that is the active window. Thus if you are graphing and the plot properties dialog box is open, you can grid the box only by saying "mouse grid on window".

replacing a letter or symbol

This command allows you to replace symbols with different symbols. For example, if you say "**quadratic equation**", you will get $ax^2 + bx + c = 0$. If you want $az^2 + bz + c = 0$, you can just change the x to a z manually. Or you can position the cursor at the beginning of

the math expression. Then move the cursor to the immediate left of the first **x** in that math expression by saying "**move right** ? **spaces**". Now say "**replace next character**" which will 1) highlight the first **x**, 2) open the Replace Dialog Box placing the **x** in "Search for", and 3) place the cursor in "Replace with" position. Now place **z** in the "Replace with" box by saying "**zulu**". Say "**find next**", "**replace**", "**yes**"and then "**end replace**". And you will get $az^2 + bz + c = 0$.

In the Replace dialog box, be sure "whole words only" is **not** checked!!

If you wish to replace the next two characters in a math expression, position the cursor to the immediate left of the two characters, say "**replace next two characters**", and follow step 2 above.

Special Note: When the last character(s) to be replaced is selected, say "**end replace**". See the following example.

Suppose that you wish to change the x in the equation $(a+x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2!}a^{n-2}x^2 + \cdots + x^n$ to Δ. Note there are four x's in this expression. First place the cursor at the immediate left of the first x (i.e. left most x) in that expression. Now say "**replace next character**" which will 1) highlight the first x, 2) open the Replace Dialog Box placing the x in "Search for", and 3) place the cursor in "Replace with" position.

Now place Δ in the "Replace with" box by saying "**cap greek delta**". Say "**find next**", "**replace**", "**yes**", "**replace**" , "**replace**" and then "**end replace**". (Again saying, "replace" is continued like until the last x that you want to replace is selected. Then with that x still selected, say "end replace".)

The result: $(a+\Delta)^n = a^n + na^{n-1}\Delta + \frac{n(n-1)}{2!}a^{n-2}\Delta^2 + \cdots + \Delta^n$

Of course, if you wanted to replace all of the x's to the end of the document with Δ, you would just say "replace all".

For a video demonstration, see the Replace video on the MathTalk Demo CD.

replace text Command

If you wish to replace text, you select the text you want to replace and say "replace text". This will then give you the opportunity to replace this text, and any other text that is the same.

display equation, **number equation**, **remove number**, **numbering help**, **end display**, **and align here**

The **display equation** command is used to **set off** an equation or group of equations. It sets off the equation and places the cursor in the proper position to begin voicing/typing the equation or set of equations. The equations in the display will all be aligned. If you wish to align them somewhere other than the equals sign, you can use the command "**align here**". **See** "**Help**" **in ScientificNotebook if you do not understand the** "**align here**" **command**. **If you wish to number the equation**, **this is the place to do so**. Just say "**number equation**". Then enter the line number (i.e. 1,2,...) of the display where you want the number to appear and say "**custom**" . Now enter the number in parentheses (if you want it in parentheses) by saying "parentheses" and then the number. Then say "**ok**". The display will appear selected. Say "**end display**". **If you say anything else before you say** "**end display**", **you will erase the line**! **If you do not want to number the equation**, **say** "**end**

display" **instead of** "**number equation**". This will take you out of the display box.

In display or to the right of a number, you can remove a number in a single line equation by saying "**remove number**" and then saying "**none**", "**ok**" in response to the dialog box that appears. To get out of display, say "**end display**". You can remove the number in a multiline equation (assuming you entered it in "display equation") as follows. With the cursor either in the display or to the right of the number, say "**remove number**". In the dialog box, enter the number of the row of the equation that the display number is on and say "**none**", "**ok**". Again, say "**end display**". For further instructions on numbering equations, say "**numbering help**".

next line and **enter key Commands**

As normal, **enter key** takes you to the next line. However since MathTalk is written in the section body tag "Body Text", the enter key will also put you in Body Text Font. **Therefore any time you are entering math symbols**, **you should go to the next line by saying** "**next line**."

move out Command

Display equation, fraction, exponent, etc. are commands that place you in "mathematical boxes". Before you can go to the next line (unless you want a new line within the box) you must be out of a box. The command "**move out**" will get you out of a single box. However you could be inside several boxes so you may have to say the command several times. Alternatively you can say "**out all**" which moves the cursor out of all the boxes.

Type Face Commands

There are a number of voice commands available to you to change the font appearance in **Text Mode** and **Math Mode**. They include the following:

Bigger font
Bold on
Bold off
Italics on
Italics off
Set font
Smaller font
Underline on (In Text Mode only)
Underline off (In Text Mode only)
Underbar (In Math Mode only)*

*Actually, "**underbar**" is just one of many **Math Talk** commands that allow you to put bars, hats, etc. under and over characters. You can say "**decoration menu**" to see your choices.

Want to see some one-liners?

After you have done the training exercise, with **ScientificNotebook** still open, click on the microphone.

In each example, some dialog is given which produces the resulting mathematical

expressions. **You should say the dialog as many times as you like**. **If you say exactly what the script says, you should get the indicated results**. **If you go through all of the examples, even if there are symbols with which you are unfamiliar, you will know how to use MathTalk/ScientificNotebook**.

Pause at the commas between commands. Do **not** pause between words within commands. Say all words within the quotes as **continuous speech**. **Be sure to wait until the math appears on the screen before saying the next command**!

For easy viewing, set the screen at 150%. You can change the screen display by saying "**larger**"(equals 150%), "**much larger**"(equals 200%), "**normal screen**"(equals 100 %), "**smaller**"(equals 85%), "**much smaller**", (equals 50%). You can also say "**100 percent**", "**200 percent**", "**150 percent**", "**85 percent**", "**50 percent**", or "**400 percent**". If you wish to erase the entire screen, say "**select all**", "**delete that**".

Example 1: These are examples of voice commands for common mathematical expressions. Most begin with the word "review", because they are reviewing the expression.

Remark: **If a lengthy equation goes off the screen, say "normal screen" or "smaller" to see the entire expression . Then say "larger" to return to 150 percent**.

Words in quotes are to be said in continuous speech. To go to the next line say "**next line**". **Pause between commands and wait for the math to appear on the screen before continuing**! **Do not pause within commands**.

"**You Say**"	"**You Get**"
"3 x-ray plus 4 yankee", "equals 7",	$3x + 4y = 7$
"eleven x-ray square minus 2"	$11x^2 - 2$
"9 yankee over twenty-one zulu"	$\frac{9y}{21z}$
"review binomial squared"	$(x+y)^2 = x^2 + 2xy + y^2$
"review difference of two squares"	$x^2 - y^2 = (x+y)(x-y)$
"review difference of two cubes"	$x^3 - y^3 = (x-y)(x^2 + xy + y^2)$
"review sum of two cubes"	$x^3 + y^3 = (x+y)(x^2 - xy + y^2)$
"quadratic equation"	$ax^2 + bx + c = 0$
"quadratic formula"	$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
"review quadratic formula"	$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
"review binomial formula"	$(a+x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2!}a^{n-2}x^2 + \cdots + x^n$

"review definition of the derivative" $\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$

"normal density" $\frac{1}{\sqrt{2\pi}\sigma} \exp\{-\frac{1}{2\sigma^2}(x-\mu)^2\}$

"normal integral" $\frac{1}{\sqrt{2\pi}\sigma} \int_{-\infty}^{x} \exp\{-\frac{1}{2\sigma^2}(t-\mu)^2\}dt$

Letters and Numbers

For available Letter, Greek Letter, and Number variables, say "**math talk learning module**" and "**sample commands**".

You can voice/type any letters or numbers you want as follows.

Numbers:

a) You can say zero or any integer 1 to 99.

b) For plus/minus numbers, you can say plus/minus any number 1 through 9.

c) If you have trouble with recognition of individual digits, you can say "**numeral** #". For example, "**numeral 5**", "**numeral 8**".

Examples:

Say: "**5**", "**comma**", "**8**", "**comma**", "**zero**", "**comma**", "**99**"
To Get: 5, 8, 0, 99

Say: "**minus 8**", "**comma**", "**plus 5**"
To get: −8, +5

Say: "**two seven point five eight six**"
To Get: 27.586

Say: "**minus point zero three nine four**"
To Get: −.0394

The commands "**27.586**" and "**minus .0394**" are examples of the Digits Group command. This command allows you to say any number in sequence, as well as a negative sign and a decimal point. You must say the numbers in sequence, i.e., for "27", you may say "**two seven**" or "**twenty-seven**". However, you need not pause between digits; in fact, you should NOT pause between digits. Thus, the whole command should be said in continuous speech without pausing. You may say single digit numbers, **OR** without pausing, you may say, for example, **twenty-seven**, **point**, **five**, **eighty-six**.

The <Number 1 to 99> <Letter>, <Greek Letter> Commands

You can say any number from 1 to 99 followed by any letter in the Letter vocabulary or followed by any letter in the Greek Letter vocabulary.

Examples:

Say: "**x-ray**", "**comma**", "**3 spaces**", "**3 x-ray**", "**comma**", "**3 spaces**",

"**9 yankee**", "**comma**", "**3 spaces**", "**12 whiskey**", "**comma**", "**3 spaces**",
"**65 alpha**", "**comma**", "**3 spaces**", "**11 cap bravo**", "**comma**",
"**3 spaces**", "**4 greek alpha**", "**comma**", "**3 spaces**", "**21 lambda**",
"**comma**", "**3 spaces**", "**33 beta**"

To Get: x, $3x$, $9y$, $12w$, $65a$, $11B$, 4α, 21λ, 33β

"Cap" Commands

To say any uppercase letter, precede it by "cap". For example say "**cap alpha**", "**cap bravo**", "**cap x-ray**", "**cap yankee**", "**cap greek delta**", and "**cap gamma**" to get: $ABXY\Delta\Gamma$.

Exponents, Superscripts, and Subscripts Commands

You can raise any symbol to any power with the exponent command. For the exponents 2 and 3 you can say square or cube. For higher orders, say the number. You can say (in continuous speech) "**exponent**", followed by any word in the vocabularies "Greek Letter", "Letter", "Minus Letter", "Numbers", "Minus Numbers". To get more complicated exponents, say "**exponent**" or "**superscript**", pause and enter the exponent you desire.
You can say any subscript you want by saying "**subscript**", pausing and entering the desired subscript.

To view Sub Sentence Commands, see MathTalk Learning Module.

Examples:

Say: "**x-ray square**", "**lima cube**", "**zulu**", "**exponent 6**", "**x-ray**", "**exponent minus 4**", "**echo**", "**exponent minus pi over 2**"
To Get: x^2 l^3 z^6 x^{-4} $e^{-\frac{\pi}{2}}$

Say: "**cap victor**", "**exponent**", "**parentheses**", "**x-ray square plus yankee square**", "**move out**", "**sine theta**", "**end exponent**" (or "**move out**"), "**tab key**", "**echo**", "**exponent**", "**minus**", "**one half**", "**x-ray square**", "**end exponent**".
To Get: $V^{(x^2+y^2)\sin\theta}$ $e^{-\frac{1}{2}x^2}$

Say: "**alpha**", "**sub one**", "**lambda**", "**sub one two**", "**sigma**", "**sub x-ray**", "**cap whiskey**", "**sub x-ray yankee**"
To Get: a_1 λ_{12} σ_x W_{xy}
If you want something more complicated, you just say the symbol and say "subscript" and enter what you wish. To get out of the subscript, say "end subscript" or "move out".

Root "of" Commands

You can say in continuous speech "square root, cube root, 4th root, 5th root, 6th root, 7th root, 8th root, 9th root", "of" any word in the "Letter", "Greek Letter", or

"Numbers" vocabulary.

Examples:
Say: "**square root of x-ray**", "**cube root of cap romeo**", "**4th root of beta**", "**5th root of pi**", "**6th root of 3**"
To Get: $\sqrt{x}$ $\sqrt[3]{R}$ $\sqrt[4]{\beta}$ $\sqrt[5]{\pi}$ $\sqrt[6]{3}$
If you want something more complicated you can say "square root", or "cube root" or "general root", pause, and put in whatever you want.

Say: "**square root**", "**x-ray square plus yankee square**", "**move out**"
To Get: $\sqrt{x^2 + y^2}$

Say: "**general root**", "**ten**", "**tab**", "**greek alpha**", "**plus**", "**beta**", "**minus fifteen**", "**move out**"
To get: $\sqrt[10]{\alpha + \beta^2 - 15}$

Pre-Algebra Examples
1. Find the volume of a cube with an edge of 4 inches.
Say "**4 times 4**", "**times 4**", "**equals 16**", "**times**", "**4**", "**equals sixty-four**".
Get: $4 \times 4 \times 4 = 16 \times 4 = 64$

2. Evaluate the expression $9 + 5(3 + 2 \cdot 7)$.
Say "**9 plus 5**", "**parentheses**", "**3 plus 2**", "**times dot**", "**7**", "**move out**", "**equals 9**", "**plus 5**", "**parentheses seventeen**", "**equals 9**", "**plus**", "**eighty-five**", "**equals ninety-four**"
Get:
$9 + 5(3 + 2 \cdot 7) = 9 + 5(17) = 9 + 85 = 94$

3. To simplify $\left(7 \cdot \frac{1}{12}\right) \cdot \left(3 \cdot \frac{1}{4}\right)$
Say "**parentheses**", "**7**", "**times dot**", "**1 over twelve**", "**move out**", "**times dot**", "**parentheses**", "**3**", "**times dot**","**one fourth**", "**move out**", "**equals**", "**7 over twelve**", "**times dot**", "**3 over 4**", "**equals**", "**twenty-one over forty-eight**", "**equals**", "**7 over sixteen**".
Get:
$\left(7 \cdot \frac{1}{12}\right) \cdot \left(3 \cdot \frac{1}{4}\right) = \frac{7}{12} \cdot \frac{3}{4} = \frac{21}{48} = \frac{7}{16}$

4. To simplify $4y + 6y + 8$
Say "**4 yankee plus 6 yankee**", "**plus 8**", "**equals**", "**ten yankee**", "**plus 8**"
Get: $4y + 6y + 8 = 10y + 8$

Trigonometry Commands

Examples:
Say: "**sine**", "**cosine**", "**tangent**", "**cosecant x**", "**cotangent theta**",

"**secant squared fee**", "**arc tangent yankee**", "**inverse sine theta**", "**hyperbolic cosine lambda**"

To Get: $\sin \quad \cos \quad \tan \quad \csc x \quad \cot\theta \quad \sec^2\phi \quad \arctan y \quad \sin^{-1}\theta \quad \cosh\lambda$

Say: "**4**", "**plus**", "**3 india**", "**equals 5**", "**parentheses**", "**cosine**", "**36**", "**degrees**", "**52**", "**seconds**", "**plus india**", "**sine**", "**36**", "**degrees**", "**52**", "**seconds**", "**move out**"

To Get: $4 + 3i = 5(\cos 36°52' + i \sin 36°52')$

The "parentheses" Commands

"Parentheses" commands are commands that are used for entering functions, intervals, one and two tupels, and parentheses. For example, if you say "**parentheses**", "**move out**", "**parentheses x-ray**","**parentheses x-ray yankee**", "**parentheses minus one one**", you will get:

$(\square) \qquad (x), \qquad (x,y), \qquad (-1,1)$

and if you say "**foxtrot**","**parentheses x-ray**","**beta**","**parentheses x-ray yankee**", and "**cap romeo**","**parentheses lambda theta**", you will get:
$f(x), \qquad \beta(x,y), \qquad R(\lambda,\theta)$
For a list of "**Parentheses**" commands, see the MathTalk Learning Module. Or say "**show parentheses commands**".

REMARK: When saying commands, make a brief pause at the commas between commands. Do not pause if there is no comma. If the comma is spelled out it is a command, say it just like any other command.

Examples: (Be sure you pause at the "," when saying the commands. Do not pause otherwise.)
Say: "**foxtrot**", "**parentheses x-ray**", "**comma**", "**foxtrot**", "**parentheses one**", "**comma**", "**foxtrot**", "**parentheses minus one**", "**comma**", "**golf** ", "**parentheses yankee**", "**comma**", "**romeo**", "**parentheses sierra**", "**comma**", "**lambda**", "**parentheses theta**", "**comma**", "**greek delta**", "**parentheses epsilon**", "**comma**", "**cap fee**", "**parentheses zulu**", "**comma**", "**hotel**", "**parentheses zero**", "**comma**", **and** "**cap gamma**", "**parentheses one half**"

To Get: $f(x), f(1), f(-1), g(y), r(s), \lambda(\theta), \delta(\varepsilon), \Phi(z), h(0), \Gamma(\frac{1}{2})$

Say: "**cap foxtrot** ", "**parentheses x-ray yankee**", "**comma**", "**whiskey**", "**parentheses uniform victor**", "**comma**", "**uniform**", "**parentheses romeo theta**", "**comma**", "**yankee**", "**parentheses minus one one**", "**comma**", "**foxtrot of x-ray yankee and zulu**", "**comma**", "**cap foxtrot of x-ray yankee and zulu**"

To Get: $F(x,y)$, $w(u,v)$, $u(r,\theta)$, $y(-1,1)$, $f(x,y,z)$, $F(x,y,z)$

REMARK: The function of three variables is different than one and two variables in that it only offers you the arguments x,y,z and you simply say "**foxtrot of x-ray yankee and zulu**". There are no other choices for arguments. You can, of course, use the replace command to replace them or you can manually replace them or voice a two variable function and augment it. You could also just enter it a letter at a time.

Function <Letter> Command

Standard functions can be typed by the "parentheses" commands. However if you want to type something like $f(x^2)$, or $U(\sin^2\theta)$, you will need to use the command "function <Letter>". That is, to get $f(x^2)$, say "**function foxtrot**", "**x-ray square**", "**move out**". To get $U(\sin^2\theta)$, say "**function cap uniform**", "**sine squared theta**", "**move out**". To get $F^2(x)$, you need not use the function command. Simply say "**cap foxtrot squared**","**parentheses x-ray**"

The "over" Commands

You can say in continuous speech any letter (English or Greek) **over** any other letter. You can say in continuous speech any single digit **over** any letter and any letter **over** any single digit.

Examples: (**Pause at the** ",")

Say: "**x-ray over yankee**", "**equals**", "**greek alpha over beta**", "**equals**", "**cap bravo over 7**", "**equals**", "**2 over pi**"

To get: $\frac{x}{y} = \frac{\alpha}{\beta} = \frac{B}{7} = \frac{2}{\pi}$

You can enter as complicated a fraction as you like by saying "fraction", entering the numerator, saying "over", entering the denominator, and saying "end fraction" or "move out".

Say: "**romeo**", "**equals**", "**fraction**", "**alpha x-ray**", "**plus**", "**bravo yankee**", "**over**", "**charlie x-ray**", "**plus**", "**delta yankee**", "**end fraction**"

To Get: $r = \frac{ax+by}{cx+dy}$

"decor" Commands

These commands allow you to place hats, bars, or tildes over any word in the "Letter" variables and the "Greek Letter" variables. This includes all English upper and lower case letters and all Greek upper and lower case letters that are supported by Scientific Notebook. If you wish to put a decoration on more than a single letter, then you use the "over bar", "over hat", "over tilde" commands.

Examples:

Say: "**x-ray bar**", "**cap x-ray bar**", "**theta hat**", "**yankee tilde**"

To Get: $\overline{x}$ $\overline{X}$ $\hat{\theta}$ $\tilde{y}$

Say: "**over bar**", "**x-ray**", "**plus yankee**", "**move out**", "**over hat**", "**alpha**", "**theta**", "**move out**"

To get: $\overline{x+y}$ $\widehat{a\theta}$

Factorial Commands

You can say, in continuous speech, any English letter factorial, any English letter minus an English letter factorial, and any English letter factorial plus or minus the digits 1-9.

Examples:

Say: "**november factorial**", "**mike minus one factorial**", "**lima plus three factorial**", "**november minus x-ray factorial**", "**x-ray plus yankee factorial**"

To Get: $n!(m-1)!(l+3)!(n-x)!(x+y)!$

<Letter> Square Plus or Minus <Letter>

You can say, in continuous speech, any letter square plus any letter square, and any letter square minus any letter square.

Examples:

Say: "**x-ray square plus yankee square**", "**alpha square plus bravo square**", "**greek alpha square plus beta square**", "**uniform square minus victor square**"

To Get: x^2+y^2 a^2+b^2 $\alpha^2+\beta^2$ u^2-v^2

<Letter> plus delta <Letter> Commands

You can say, in continuous speech, any English letter plus delta any English letter.

Examples:

Say: "**x-ray plus delta x-ray**", "**yankee plus delta yankee**", "**hotel plus delta hotel**", "**victor plus delta victor**", "**cap november plus delta cap november**"

To Get: $x+\Delta x$ $y+\Delta y$ $h+\Delta h$ $v+\Delta v$ $N+\Delta N$

Derivative Commands

You can say, in continuous speech, derivative with respect to any English or Greek Letter. You can also say in continuous speech d <Letter> d <Letter> or d <Letter> d <Greek Letter>. You can say "first derivative".

Examples:

Say: "**derivative with respect to x-ray**", "**derivative with respect to tango**", "**derivative with respect to theta**", "**derivative with respect to lambda**", "**delta foxtrot delta x-ray**", "**delta cap foxtrot delta x-ray**", "**delta romeo delta theta**", "**delta uniform delta victor**", "**delta yankee delta x-ray**".

To Get: $\frac{d}{dx}$ $\frac{d}{dt}$ $\frac{d}{d\theta}$ $\frac{d}{d\lambda}$ $\frac{df}{dx}$ $\frac{dF}{dx}$ $\frac{dr}{d\theta}$ $\frac{du}{dv}$ $\frac{dy}{dx}$

Higher Order Derivative Commands

You can say in continuous speech higher order derivatives (2nd through 9th) of any English letter with respect to any English letter or Greek Letter. You can also just say 2nd through 9th derivative. Also you can say a letter of the alphabet derivative, i.e. to get $\frac{d^n y}{dx^n}$, say "november derivative".

Examples:

Say: "**second derivative of yankee with respect x-ray**", "**fourth derivative of romeo with respect to theta**", "**third derivative of cap golg with respect to tango**", "**fourth derivative**", "**ninth derivative**", "**mike derivative**", "**kilo derivative**".

To Get: $\frac{d^2y}{dx^2}$ $\frac{d^4r}{d\theta^4}$ $\frac{d^3G}{dt^3}$ $\frac{d^4y}{dx^4}$ $\frac{d^9y}{dx^9}$ $\frac{d^my}{dx^m}$ $\frac{d^ky}{dx^k}$

Partial Derivative Commands

You can say any of the following commands. Examples of each are shown.

mixed partial of <Letter> with respect to <Greek Letter> and <Greek Letter>
Say: "**mixed partial of foxtrot with respect to romeo and tau**", to get: $\frac{\partial^2 f}{\partial r \partial \tau}$

mixed partial of <Letter> with respect to <Letter> and <Greek Letter>
Say: "**mixed partial of yankee with respect to romeo and theta**", to get: $\frac{\partial^2 y}{\partial r \partial \theta}$
mixed partial of <Letter> with respect to <Letter> and <Letter>
Say: "**mixed partial of cap foxtrot with respect to x-ray and yankee**", to get: $\frac{\partial^2 F}{\partial x \partial y}$
partial of <Letter> of <Letter> and <Letter> with respect to <Letter>
Say: "**partial of foxtrot of x-ray and yankee with respect to x-ray**", to get: $\frac{\partial f(x,y)}{\partial x}$
partial of <Letter> with respect to <Greek Letter>
Say: "**partial of romeo with respect to theta**", to get: $\frac{\partial r}{\partial \theta}$
partial of <Letter> with respect to <Letter>
Say: "**partial of cap lima with respect to sierra**", to get: $\frac{\partial L}{\partial s}$
partial with respect to <Greek Letter>
Say: "**partial with respect to omega**", to get: $\frac{\partial}{\partial \omega}$
partial with respect to <Letter>
Say: "**partial with respect to x-ray**", to get: $\frac{\partial}{\partial x}$
second partial of <Letter> with respect to <Greek Letter>
Say: "**second partial of hotel with respect to beta**", to get: $\frac{\partial^2 h}{\partial \beta^2}$
second partial of <Letter> with respect to <Letter>
Say: "**second partial of yankee with respect to whiskey**", to get: $\frac{\partial^2 y}{\partial w^2}$
cross partial
Say: "**cross partial**" to get: $\frac{\partial^2 f}{\partial y \partial x}$

mixed partial

Say: "**mixed partial**" to get: $\frac{\partial^2 f}{\partial y \partial x}$

partial derivative

Say: "**partial derivative**" to get: $\frac{\partial y}{\partial x}$

partial

Say: "**partial**" to get: ∂

second partial

Say: "**second partial**" to get: ∂^2

Differential Commands

In the example below, don't forget to pause at the commas or you will get a derivative. (That is say "**delta yankee**", "**delta x-ray**", **not** "**dy dx**".)
Say: "**delta yankee**", "**delta x-ray**", "**delta zulu**", "**tab key**", "**delta fee**", "**delta theta**", "**delta lambda**".
To get: $dy\,dx\,dz \qquad d\phi\,d\theta\,d\lambda$

Integral Commands	**Resulting Action**
[integral]	$\int$
[integral with joint scripts]	$\int_{\square}^{\square}$
[integral with limits]	$\int_{\square}$
[integral with lower limit]	$\int_{\square}$
[integral with subscript]	$\int_{\square}$

In each case the cursor will be at the lower limit. You can enter any lower limit you want and then say "**upper limit**" (if required). After entering the upper limit, say "**end upper limit**", "**end limits**", **or** "**move out**". If you want limits and you said "integral", you can add a lower limit as a subscript by saying "subscript" and proceeding as in "integral with joint scripts".

An easy way to add most limits: **Use the** limits command **listed below**.

Limits < > to < >

This command puts limits on integrals, sums, products, unions, intersections, and vertical bars. You say, in continuous speech, "**limits < > to < >**", where the < >'s can be filled in with any word in the Letter, Greek Letter, Numbers, Minus Letter, or Minus Numbers vocabularies. **Only use this command when the cursor is positioned at the lower limit or subscript**!

Examples:

Say: "**integral with limits**", "**limits alpha to 2 pi**", "**integral with joint scripts**", "**limits minus infinity to infinity**", "**sum with limits**", "**kilo**", "**equals**", "**limits 1 to november**", "**union with limits**", "**india**", "**equals**", "**limits**

minus mike to mike", "**vertical bar with limits**", "**limits minus 5 to 5**", "**integral**", "**lower limit**", "**x-ray square**", "**upper limit**", "**x-ray**", "**plus 2**", "**move out**", "**natural log yankee**", "**delta yankee**", "**integral with limits**", "**tango**", "**minus one**", "**upper limit**", "**tango**", "**plus one**", "**end upper limit**", "**yankee**", "**exponent 4**", "**delta yankee**"

To Get: $\int_{a}^{2\pi}$ $\int_{-\infty}^{\infty}$ $\sum_{k=1}^{n}$ $\bigcup_{i=-m}^{m}$ $|_{-5}^{5}$ $\int_{x^2}^{x+2} \ln y dy$ $\int_{t-1}^{t+1} y^4 dy$

Sum or Summation Commands

You can say "**sum** " or "**summation**", in any of the commands that include limits or scripts. They perform the same action. Pick the one that gives you the best word recognition.

The basic commands are:

[summation] **Here you must say** "**summation**", **you cannot say** "**sum**".
[sum with joint scripts]
[summation with joint scripts]
[sum with limits]
[summation with limits]

[sum with lower limit]
[summation with lower limit]

[sum with subscript]
[summation with subscript]

After adding the index, the limits are added just as with integrals.

Example:

Say: "**sum with limits**", "**mike**", "**equals**", "**limits zero to infinity**"

To Get: $\sum_{m=0}^{\infty}$

Union, Intersection, Product, Vertical Bar Commands

The commands are the same as for integrals and sums, and they work the same way. They are:

"**union with limits**", or "**union with joint scripts**"
"**intersection with limit**", or "**intersection with joint scripts**"
"**product with limits**", or "**product with joint scripts**"
"**vertical bar with limits**", "**vertical bar**", "**victor bar**"

Matrix and Determinant Commands

You can enter any $n \times m$ matrix, where $1 \le n \le 9$ and $1 \le m \le 9$, with paren notation, i.e. ( ), or "bracket matrix", i.e.[ ] notation. You can also enter a determinant in the same way.

Example:
Say: "**2 by 2 bracket matrix**", "**x-ray**", "**sub one one**","**tab key**",
"**x-ray**", "**sub one two**","**tab key**", "**x-ray**", "**sub two one**", "**tab key**",
"**x-ray**", "**sub two two**", "**end matrix**"

To Get: $\begin{bmatrix} x_{11} & x_{12} \\ x_{21} & x_{22} \end{bmatrix}$

Type Commands A list of **Type Commands** which enter Connecting words is detailed in the MathTalk Learning Module. You mat say "**show type commands**" to view these commands.

In the following examples, we will issue several commands in a row, separated by spaces and commas. Say the commands in continuous speech, but **pause** between commands. **WAIT FOR THE MATH TO APPEAR ON THE SCREEN BEFORE VOICING THE NEXT COMMAND**. **Commands are set off in quotes**. For example, if you say (pausing at the commas) "**cap x-ray**", "**sub tango**", "**comma**", "**four spaces** ", "**cap x-ray**", "**parentheses tango**", **you'll get** X_t, $X(t)$. Try it! **Don't forget to go to the next line by saying** "**next line**".

You Say	**You Get**
"**cap x-ray**", "**sub tango**", "**comma**", "**four spaces**", "**cap x-ray**", "**parentheses tango**", "**four spaces**", "**cap yankee bar**", "**comma**", "**yankee bar**", "**comma**", "**theta hat**", "**comma**", "**x-ray**", "**sub india juliette**"	$X_t, X(t)\ \ \overline{Y}, \overline{y}, \widehat{\theta}, x_{ij}$

REMARK: To maximize speech recognition, speak at a firm, steady pace. Also, emphasize small differences in commands. We'll call your attention to this and other suggestions as we go through this Tutorial.

"**integral**", "**comma**", "**tab key**",
"**integral with joint scripts**", "**limits minus infinity to infinity**",
"**integral with joint scripts**", "**limits zero to infinity**", "**comma**",
"**tab key**", "**double integral**", "**comma**",
"**tab key**", "**contour integral**" $\int,\quad \int_{-\infty}^{\infty}\int_{0}^{\infty},\quad \iint,\quad \oint$

"**delta uniform delta x-ray**", "**comma**", "**delta victor delta x-ray**", "**comma**",
"**delta yankee delta x-ray**", "**comma**", "**tab key**", "**first derivative**",
"**comma**", "**second derivative**",
"**comma**", "**third derivative**" $\frac{du}{dx}, \frac{dv}{dx}, \frac{dy}{dx},\quad \frac{dy}{dx}, \frac{d^2y}{dx^2}, \frac{d^3y}{dx^3}$

"**mixed partial of foxtrot with respect to x-ray and yankee**", "**comma**", "**tab key**", "**mixed partial of** cap* **foxtrot with respect to x-ray and yankee**" $\frac{\partial^2 f}{\partial y \partial x},\quad \frac{\partial^2 F}{\partial y \partial x}$

(*Here you should **emphasize** the word "**cap**")

"**echo**","**exponent**", "**minus**, "**one-half**"
"**tango square**", "**end exponent**", "**comma**", "**tab key**",
"**echo**", "**exponent minus x-ray**", "**comma**", $e^{-\frac{1}{2}t^2}$, e^{-x}, $e^{\frac{3\pi}{2}}$
"**tab key**", "**echo**", "**exponent 3 pi over 2**"

Example 2: Now we'll write a few one-line equations by voice in ScientificNotebook. **Words in quotes are to be said with continuous speech**. **Slight pauses should be made at the commas**. **Say** "**next line**" **to go to the next line**.

You Say	**You Get**
"**three**", "**x-ray cube**", "**plus**", "**x-ray square**" "**minus four**", "**equals zero**"	$3x^3 + x^2 - 4 = 0$

"**absolute value**", "**x-ray**", "**move out**", "**equals**"
"**expanding left brace**", "**minus x-ray**", "**comma**",
"**four spaces**", "**x-ray**", "**less than or equal to**",
"**zero**", "**next line**", "**x-ray**", "**comma**", "**four spaces**",
"**x-ray**", "**greater than or equal to**", "**zero**", "**out all**".*

$$|x| = \begin{cases} -x, & x \le 0 \\ x, & x \ge 0 \end{cases}$$

* "**out all**" is a command that will move the cursor out of all boxes. Here you could have said "move out" twice to get the same result.

"**sine squared theta**", "**plus**", "**cosine squared theta**", "**equals one**" $\sin^2\theta + \cos^2\theta = 1$

"**cap foxtrot**", "**parentheses x-ray**", "**equals**",
"**normal integral**" $F(x) = \frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^{x} \exp\{-\frac{1}{2\sigma^2}(t-\mu)^2\}dt$

"**alpha romeo process**" $X_t - \phi_1 X_{t-1} - \phi_2 X_{t-2} - \cdots - \phi_p X_{t-p} = a_t$

"**juliette november**", "**equals**", "**bessel function**" $J_n(t) = \sum_{k=0}^{\infty} \frac{(-1)^k \left(\frac{t}{2}\right)^{n+2k}}{k!\Gamma(n+k+1)}$

"**3 delta wave equation**" $\frac{\partial^2 u}{\partial t^2} - c^2\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right] = 0$

"**bold cap x-ray**", "**equals**", "**x-ray matrix**"

$$\mathbf{X} = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{pmatrix}$$

"**yankee**", "**double prime**", "**plus**", "**x-ray square**",
"**yankee**", "**prime**", "**minus yankee**", "**equals**"
"**sine squared x-ray**

$$y'' + x^2y' - y = \sin^2 x$$

"**bold cap x-ray**", "**bold cap x-ray**", "**inverse**",
"**equals**", "**identity matrix**"

$$\mathbf{X}\mathbf{X}^{-1} = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 1 \end{pmatrix}$$

Tip: You can go to the top of any document by saying "**top of document**". Similarly, you can go to the bottom by saying "**bottom of document**".

Example 3: In this example, we will introduce **Type Commands**. These are words that are often used while entering math expression, such as "Thus", "Therefore", "Consequently", "is", "if", "or", "odd", "and", etc. When you want to use a connecting word command you must precede it by the word "type". Thus you would say "**type therefore**" if you wanted the word "therefore" inserted (first, you may need to say "**text mode**"). This example will demonstrate the use of the Type Commands.

First, we intend to enter the text and mathematics below, **beginning with** (**a**) **and ending with** $\frac{3\pm\sqrt{5}\,i}{2}$.

(a) Use the quadratic formula to find the roots of $x^2 - 3x + 4 = 0$.

$$ax^2 + bx + c = 0 \;\Rightarrow\; x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Therefore

$$\begin{aligned} x &= \frac{3 \pm \sqrt{9 - 4 \times 4}}{2} \\ &= \frac{3 \pm \sqrt{9 - 16}}{2} \\ &= \frac{3 \pm \sqrt{5}\,i}{2}. \end{aligned}$$

REMARK: If you wish to type the text, you may type all the text rather than dictating it.

In that case, say "**type text**". When you finish, turn on the microphone to return to entering math. Otherwise proceed as follows. **Pause at the commas**. **Do not pause within a command**.

Say: **next line**, **show dictation box**, dictate the following text: **left parenthesis**, **alpha** (it may be necessary to correct this to get "**a**"), **right parenthesis**, **cap use the quadratic formula to find the roots of**, **OK** (will be back in math), **2 spaces**, **x-ray square minus 3**, **x-ray plus 4**, **equals zero**, **period**, **display equation**, **review quadratic formula**, **end display**, **next line**, **type therefore**, **display equation**, **x-ray**, **equals**, **fraction**, **3**, **plus or minus**, **square root**, **9 minus 4**, **times 4**, **move out**, **over**, **2**, **move out** (or "end fraction"), **next line**, **equals**, **fraction**, **3**, **plus or minus**, **square root**, **9 minus sixteen**, **move out**, **over**, **2**, **move out**, **next line**, **equals**, **fraction**, **3**, **plus or minus**, **square root of 5**, **move out**, **india**, **over**, **2**, **move out**, **period**, **end display**.

You Get

(a) Use the quadratic formula to find the roots of $x^2 - 3x + 4 = 0$.

$$ax^2 + bx + c = 0 \;\Rightarrow\; x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Therefore

$$\begin{aligned} x &= \frac{3 \pm \sqrt{9 - 4 \times 4}}{2} \\ &= \frac{3 \pm \sqrt{9 - 16}}{2} \\ &= \frac{3 \pm \sqrt{5}\, i}{2}. \end{aligned}$$

Read This! **If you plan to output in Braille the document on which you are working, we strongly recommend that you do not use the "display equation" command. Although it is possible that the translator will correctly interpret equations in the "display" format, it is highly likely that it will not. We will therefore repeat the example, but without using "display equation".**

Example 3 repeated without using the command "display equation"

Say: **next line**, **show dictation box**, dictate the following text: **left parenthesis**, **alpha** (it may be necessary to correct this to get "**a**"), **right parenthesis**, **cap use the quadratic formula to find the roots of**, **OK** (will be back in math), **2 spaces**, **x-ray square minus 3**, **x-ray plus 4**, **equals zero**, **period**, **next line**, **review quadratic formula**, **next line**, **type therefore**, **next line**, **next line**, **x-ray**, **equals**, **fraction**, **3**, **plus or minus**, **square root**, **9 minus 4**, **times 4**, **move out**, **over**, **2**, **move out**, **next line**, **5 spaces**, **equals**, **fraction**, **3**, **plus or minus**, **square root**, **9 minus sixteen**, **move out**, **over**, **2**, **move out**, **next line**, **5 spaces**, **equals**, **fraction**, **3**, **plus or minus**, **square root of 5**, **move out**, **india**, **over**, **2**, **move out**, **period**.

You Get:

(a) Use the quadratic formula to find the roots of $x^2 - 3x + 4 = 0$.

$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Therefore

$x = \frac{3 \pm \sqrt{9-4\times4}}{2}$

$= \frac{3 \pm \sqrt{9-16}}{2}$

$= \frac{3 \pm \sqrt{5}\, i}{2}$.

In the first part of this example, we showed how to add text by saying "show dictation box", dictating the text, and then saying "OK" to place the text in MathTalk. We also used the *connecting word* **Therefore**. *Connecting words* are words that are often used in mathematical expressions to connect one set of expressions to another or to state a condition. When entering a connecting word by voice always precede it by the word "type". For example, say "type for" to enter the connecting word "for". For a list of connecting words, see the Table of Contents or say "**go to type commands**".

Now, we will solve the problem, "show that $\int_{-\infty}^{\infty} e^{-t^2}\, dt = \sqrt{\pi}$. You will note that we only need Connecting words, so we never have to go to **Text Mode**. In **Math Mode**, start a new line by saying "**next line**".

You Say : **type cap let***, **5 spaces**, **x-ray**, **equals**, **romeo**, **cosine theta**, **comma**, **5 spaces**, **yankee**, **equals**, **romeo**, **sine theta**, **period**, **5 spaces**, **type cap then***, **display equation**, **parentheses**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **tango square**, **end exponent**, **delta tango**, **move out**, **squared**, **equals**, **integral with joint scripts**, **limits minus infinity to infinity**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **parentheses**, **x-ray square plus yankee square**, **move out**, **end exponent**, **delta x-ray**, **delta yankee**, **next line**, **equals two**, **integral with joint scripts**, **limits zero to pi**, **integral with joint scripts**, **limits zero to infinity**, **echo**, **exponent**, **minus**, **romeo square**, **end exponent**, **romeo**, **delta romeo**, **delta theta**, **next line**, **equals**, **minus**, **integral with joint scripts**, **limits zero to pi**, **echo**, **exponent**, **minus**, **romeo square**, **end exponent**, **vertical bar with limits**, **limits zero to infinity**, **delta theta**, **next line**, **equals**, **integral with joint scripts**, **limits zero to pi**, **delta theta**, **equals**, **pi**, **period**, **end display next line**, **type therefore***, **5 spaces**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **tango square**, **end exponent**, **delta tango**, **equals**, **square root of pi**, **move out**, **period** .

*These are connecting words.

You Get :

Let $x = r\cos\theta$, $y = r\sin\theta$. Then

$$\left(\int_{-\infty}^{\infty} e^{-t^2}\,dt\right)^2 = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$$
$$= 2\int_0^{\pi}\int_0^{\infty} e^{-r^2} r\,dr\,d\theta$$
$$= -\int_0^{\pi} e^{-r^2}\Big|_0^{\infty}\,d\theta$$
$$= \int_0^{\pi} d\theta = \pi.$$

Therefore $\int_{-\infty}^{\infty} e^{-t^2}\,dt = \sqrt{\pi}$.

Again, to emphasize that if you want an output in Braille do not use the command "display equation", we repeat the last part of the example without using the command display equation. Also we will introduce some new commands, **2 lines**, **2 tabs**, **5 spaces**, and **5 spaces**. We use these commands to improve the appearance of the display. You can say "*x* spaces", where *x* ranges from 1 to 5. You can also say **3 lines** and **3 tabs**. The line commands just add extra "enters" for spacing and keep you in Math Mode.

You Say : **next line**, **parentheses**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **tango square**, **end exponent**, **delta tango**, **move out**, **squared**, **equals**, **integral with joint scripts**, **limits minus infinity to infinity**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **parentheses**, **x-ray square plus yankee square**, **out all***, **delta x-ray**, **delta yankee**, **2 lines**, **3 tabs**, **four spaces** **equals two**, **integral with joint scripts**, **limits zero to pi**, **integral with joint scripts**, **limits zero to infinity**, **echo**, **exponent**, **minus**, **romeo square**, **end exponent**, **romeo**, **delta romeo**, **delta theta**, **2 lines**, **3 tabs**, **four spaces**, **equals**, **minus**, **integral with joint scripts**, **limits zero to pi**, **echo**, **exponent**, **minus**, **romeo square**, **end exponent**, **vertical bar with limits**, **limits zero to infinity**, **delta theta**, **2 lines**, **3 tabs**, **four spaces**, **equals**, **integral with joint scripts**, **limits zero to pi**, **delta theta**, **equals**, **pi**, **period**, **2 lines**, **type therefore**, **5 spaces**, **integral with joint scripts**, **limits minus infinity to infinity**, **echo**, **exponent**, **minus**, **tango square**, **end exponent**, **delta tango**, **equals**, **square root of pi**, **move out**, **period** .

* Note that here we used the command **out all** to get us out of both the exponent and the parentheses.

You Get :

$$\left(\int_{-\infty}^{\infty} e^{-t^2}dt\right)^2 = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+y^2)}dxdy$$
$$= 2\int_0^{\pi}\int_0^{\infty} e^{-r^2} r dr d\theta$$
$$= -\int_0^{\pi} e^{-r^2}\Big|_0^{\infty} d\theta$$
$$= \int_0^{\pi} d\theta = \pi.$$

Therefore $\int_{-\infty}^{\infty} e^{-t^2}dt = \sqrt{\pi}$.

More on Text Mode / Math Mode

As the final part of this example, we are going to add text created in Dragon. We are going to type the following (beginning with "Let ..." and ending with " ...complete the proof.")

REMARK: The Greek letter Phi is used here. For better recognition we spell it "fee" in all of the commands. Therefore you should say "fee".

Let $\{\phi_n : n = 1,2,3\cdots\}$ be an orthogonal basis and show that

$$\int_0^1 a(x)\,dx \le \limsup_{n\to\infty} \phi_n(a)$$

$$\int_0^1 a(x)b(x)\,dx \le \limsup_{n\to\infty} \psi_n(a,b) \qquad 1.2$$

to complete the proof.

You Say : **type cap let**, **2 spaces**, **braces**, **fee**, **sub november**, **colon**, **november**, **equals**, **sequence one two three**, **move out**, **5 spaces**, **show dictation box**, dictate the following text: **be an orthogonal basis and show that**, **OK** (will be back in math), **display equation**, **integral with joint scripts**, **limits zero to one**, **alpha**, **parentheses x-ray**, **delta x-ray**, **less than or equal to**, **bottom label**, **limit superior**, **tab key**, **november goes to infinity**, **move out**, **fee**, **sub november**, **parentheses**, **alpha**, **move out**, **next line**, **integral with joint scripts**, **limits zero to one**, **alpha**, **parentheses x-ray**, **bravo**, **parentheses x-ray**, **delta x-ray**, **less than or equal to**, **bottom label**, **limit superior**, **tab key**, **november goes to infinity**, **move out**, **sigh** (**for greek Psi**), **sub november**, **parentheses alpha bravo**, **move out**, **number equation**, **two**, **custom**, **one point two**, **ok**, **end display**, **next line**, **show dictation box**, dictate the following text: **to complete the proof period**, **OK** (will be back in math).

You Get :

Let $\{\phi_n : n = 1,2,3,\cdots\}$ be an orthogonal basis and show that

$$\int_0^1 a(x)\,dx \le \limsup_{n\to\infty} \phi_n(a)$$

$$\int_0^1 a(x)b(x)\,dx \le \limsup_{n\to\infty} \psi_n(a,b) \qquad 1.2$$

to complete the proof.

REMARK: The dialogue in the number equations box will be clear. When there is more than one line in the equation you will probably always choose "custom". **The command "number equation" can only be used in the display equation box!**

In the next example, we will work several problems ranging from simple to difficult. You need not work through all of them, but we recommend that you read through all of them and voice some of them. You will, we think, be surprised and impressed with the power of

MathTalk in the "Compute Mode".

Remark: **If you wanted to type the text**, **rather than dictate it**, **you say** "**type text**" **instead of** "**text mode**"!! **Remember**, "**type text**" **also turns off the voice bar**, **and you will have to turn it back on manually**.

Solving Problems Using The Compute Mode

* **MuPad is the computation engine used for these computations**.

Example 4: Working math problems by **voice** in **ScientificNotebook** using the **Compute** feature: (**Words between commas are to be said with continuous speech**. **Pause at the commas and wait for the math to be created before continuing**.)

Problem 1: Factor $x^2 - y^2$

Solution : Say "**x-ray square minus yankee square**", "**factor**".

You'll get: $x^2 - y^2 = (x - y)(x + y)$

Problem 2: Combine and simplify the sum $\frac{3x^2+3x}{8x^2+7} + \frac{5x^2+3}{2x^2+x+7}$

Solution : Say: "**fraction**", "**3 x-ray square**", "**plus 3 x-ray**", "**over**", "**8 x-ray square plus 7**", "**move out**", "**plus**", "**fraction**", "**5 x-ray square plus 3**", "**over**", "**2 x-ray square**", "**plus x-ray**", "**plus 7**", "**move out**", "**simplify**".

You'll get: $\frac{3x^2+3x}{8x^2+7} + \frac{5x^2+3}{2x^2+x+7} = \frac{46x^4+9x^3+83x^2+21x+21}{(8x^2+7)(2x^2+x+7)}$

Problem 3: Solve the following equation $x^3 - x^2 + x - 1 = 0$.

Solution : Say "**x-ray cube**", "**minus**", "**x-ray square**", "**plus x-ray**", "**minus one**", "**equals zero**", "**solve**"

You'll get: $x^3 - x^2 + x - 1 = 0$, Solution is: $1, -i, i$

Problem 4: Solve the following linear system:

$$\begin{aligned} x + y - 2z &= 1 \\ 2x - 4y + z &= 0 \\ 2y - 3z &= -1 \end{aligned}$$

Solution : Say: "**3 by 3 system**", "**x-ray plus yankee**", "**minus 2 zulu**", "**equals one**", "**tab key**", "**2 x-ray minus 4 yankee**", "**plus zulu**", "**equals zero**", "**tab key**", "**2 yankee minus 3 zulu**", "**equals minus one**", "**solve exact**".

You'll get: $\begin{aligned} x + y - 2z &= 1 \\ 2x - 4y + z &= 0 \\ 2y - 3z &= -1 \end{aligned}$, Solution is: $\left[x = \frac{17}{8}, y = \frac{11}{8}, z = \frac{5}{4}\right]$

Problem 5: Evaluate $\int_{-\infty}^{\infty} e^{-t^2}\,dt$.

Note: We did this the hard way in Example 3. Now we'll do it the easy way.

Solution : Say "**integral with joint scripts**", "**limits minus infinity to infinity**", "**echo**", "**exponent**", "**minus**", "**tango square**", "**move out***", "**delta tango**", "**evaluate**".

You'll get : $\int_{-\infty}^{\infty} e^{-t^2}\,dt = \sqrt{\pi}$ **I told you it was the easy way!**

*You can also say "end exponent" here.

REMARK: In the following examples, a dialog box will open in the process. You'll have no trouble knowing what to say, since the choices will be on the screen in front of you. **However**, **in dialog boxes**, **when entering English letters you must use the International Alphabet**!!

Problem 6: Use integration by parts to find $\int x \sin 2x\,dx$.

Solution : Say "**integral**", "**x-ray**", "**sine**", "**2 x-ray**", "**delta x-ray**", "**integrate by parts**", "**x-ray**", " **ok**", "**evaluate**".

You'll get: $\int x \sin 2x\,dx = -\frac{1}{2}x\cos 2x - \int\left(-\frac{1}{2}\cos 2x\right)dx =$
$\frac{1}{2}\cos x \sin x + \int 0\,dx - \frac{1}{2}x\cos 2x = \frac{1}{2}\cos x \sin x - \frac{1}{2}x\cos 2x$

Problem 7: a) Find the exact general solution to the ODE

$$y' + \frac{1}{x}y = \cos x.$$

b) Use the series method to find the general solution to the ODE

$$y'' + xy' + y = \sin x.$$

Solution : a) Say: "**yankee prime**", "**plus**", "**1 over x-ray**", "**yankee**", "**equals**", "**cosine x-ray**", "**solve oscar delta echo**", "**x-ray**", "**ok**".

You'll get: $y' + \frac{1}{x}y = \cos x$, Exact solution is: $-\frac{1}{x}(C_4 - \cos x - x\sin x)$

b) Say: "**yankee double prime**", "**plus x-ray**", "**yankee prime**", "**plus yankee**", "**equals**", "**sine x-ray**", "**series solution**", "**x-ray**", "**ok**".

You'll get: $y'' + xy' + y = \sin x$, Series solution is:
$y(0) + xy'(0) - \frac{1}{2}x^2y(0) + x^3\left(-\frac{1}{3}y'(0) + \frac{1}{6}\right) + \frac{1}{8}x^4y(0) + O(x^5)$

Note: You can get the solution to as many terms as you want by saying "**change series order**" and entering the order you desire.

Problem 8: a) Generate 9 values of a normal, mean 1, variance 4 (i.e., $N(1,4)$), random variable.(Remember, variance 4 implies that the standard deviation is 2.)

b) Calculate the sample mean, median, standard deviation and variance of this data.

c) Find the following z-values from a $N(0,1)$: $Z_{.1}, Z_{.05}, Z_{.025}, Z_{.01}$.

Solutions : a) Say "**random numbers**", "**9**", "**normal**", "**one**", "**tab**", "**two**", "**ok**".

We got (you'll get something different):
1. 248 3, 4. 646 4, –. 263 19, –3. 659 2, –2. 910 2, –. 627 62, 4. 727 8, 4. 919, 2. 037 3

b) **For each of the following commands** position the cursor in the data or immediately at it's end, and say "**sample mean**", "**sample median**", "**sample standard deviation**", "**sample variance**".
Note: Here you will need to move the cursor to the proper position before you say the next command. This can be done by keyboard, mouse, or voice.

We got (you'll get something different):
Variance(s): 10. 599, Standard deviation(s): 3. 255 6, Mean(s): 1. 124 3,
Median(s): 1. 124 3

Actually, you will not get the same numbers, since they are random. You will get

similar numbers along with the corresponding sample mean, **median**, **std. dev.**, **variance**.

Solution : c) Say "**zulu point one**", "**comma**", **zulu point zero five**", "**comma**", "**zulu point zero two five**","**comma**", "**zulu point zero one**".

You'll get: $z_{.1} = 1.282, z_{.05} = 1.645, z_{.025} = 1.960, z_{.01} = 2.326$

Problem 9: Matrix example. Here you can enter any matrix you want by saying "**matrix**", or "**bracket matrix**" if you want brackets rather than parens. When the dialog box comes up, answer the questions. To get the matrix below, we said "**bracket matrix**", "**4**", "**columns**", "**4**", "**ok**" and then entered the numbers, moving from cell to cell by saying "tab key". **Each time** with the cursor in or directly following the matrix, say "**positive definite**", "**matrix determinant**", "**matrix inverse**".

You'll get: $\begin{bmatrix} 6 & 2 & 2 & 2 \\ 2 & 2 & 1 & 1 \\ 2 & 1 & 2 & 1 \\ 2 & 1 & 1 & 2 \end{bmatrix}$

, inverse: $\begin{bmatrix} \frac{1}{3} & -\frac{1}{6} & -\frac{1}{6} & -\frac{1}{6} \\ -\frac{1}{6} & \frac{5}{6} & -\frac{1}{6} & -\frac{1}{6} \\ -\frac{1}{6} & -\frac{1}{6} & \frac{5}{6} & -\frac{1}{6} \\ -\frac{1}{6} & -\frac{1}{6} & -\frac{1}{6} & \frac{5}{6} \end{bmatrix}$, determinant: 12 is positive definite

You can get most any characteristic of a matrix that you want by saying "**matrix menu**" and then saying the property listed on the menu. For example, for the matrix below place the cursor in or directly behind the matrix and say "**matrix menu**", "**eigenvalues**". Place the cursor back in the matrix and say "**matrix menu**", "**characteristic polynomial**". You'll get

$\begin{pmatrix} 4 & 2 & 2 \\ 2 & 2 & 1 \\ 2 & 1 & 2 \end{pmatrix}$, characteristic polynomial: $X^3 - 8X^2 + 11X - 4$,

eigenvalues: $1, \frac{7}{2} - \frac{1}{2}\sqrt{33}, \frac{1}{2}\sqrt{33} + \frac{7}{2}$

Note: After each command, you will have to place the cursor in the matrix. Also, you must say "**matrix menu**" to see what your options are. This will bring up the matrix menu and you can say anything on the menu.

REMARK: Using Help. You can get the Help Menu by saying "**help**". You can move to any subtopic in Help by saying the name of the subtopic. For example, if you want to

search, say "**search**". When you get to where you want to be, either spell in the search words (using the International Alphabet), or dictate the search words. You can, of course, type from the keyboard.

Problem 10: Find the first four derivatives of e^{x^2}.

REMARK: **If you have previously defined x or y, say "clear definitions" before you do this example. If you don't know if you already have x and y defined, say "show definitions"**.

Solution : Say: "**yankee**", "**equals echo**", "**exponent**", "**x-ray square**", "**move out**", "**define equal**", "**next line**", "**first derivative**", "**evaluate**", "**next line**", "**second derivative**", "**evaluate**", "**next line**", "**third derivative**", "**evaluate**", "**next line**", "**fourth derivative**", "**evaluate**".

You'll get:

$y = e^{x^2}$

$\frac{dy}{dx} = 2xe^{x^2}$

$\frac{d^2y}{dx^2} = 2e^{x^2} + 4x^2e^{x^2}$

$\frac{d^3y}{dx^3} = 12xe^{x^2} + 8x^3e^{x^2}$

$\frac{d^4y}{dx^4} = 12e^{x^2} + 48x^2e^{x^2} + 16x^4e^{x^2}$

Remark: **Say "clear definitions" NOW! If you fail to clear the definitions, the graphing in the next section will not always work since** y will still be defined as $y = e^{x^2}$.

Graphing by Voice Commands

* **MuPad is the computation engine used for these computations**.

Example 5: Graphing by **voice** in **Scientific Notebook**.

In graphing functions and data, MathTalk employs the following convention:

1. 2 D graphs or data are plotted point by point if you voice a "plot" command.
2. 2 D graphs or data are plotted continuously (i.e. connected lines) if you voice a "graph" command.
3. 3 D graphs are plotted the **same** whether you 'plot' or 'graph'.

For example if you say "plot data", "plot points", or "plot this" the data or curve will be plotted point-wise. If you say "graph this" or "graph data", the data will be plotted as a continuous curve. The commands "plot data", "plot this", and "graph this" are by default always 2 D rectangular coordinates.

Setting the range

For a graph or a plot to be useful, it must be plotted over the range of interest. Although Scientific Notebook selects a default range that is often the appropriate range, this is not always the case. Therefore, at times you will need to change the range. This is done in Plot Properties. In the examples below, we will demonstrate how to change the range and how to reset other plot properties.

Before we begin graphing, we need to set some defaults for 3d graphs to make our graphs more understandable. We will first set the color at Z (greyscale) and the surface at mesh. In the last part of this example, we will show you how you can change those settings.

Say: "**tools**", "**computation setup**", "**three d plot**", "**surface mesh**", "**drop list**".

Now using the "move down 1" command, and/or "move up 1" command, scroll to "mesh".
Then

Say: "**directional shading**", "**drop list**".

Again, using the "move up/down" commands, scroll to Z greyscale. Now

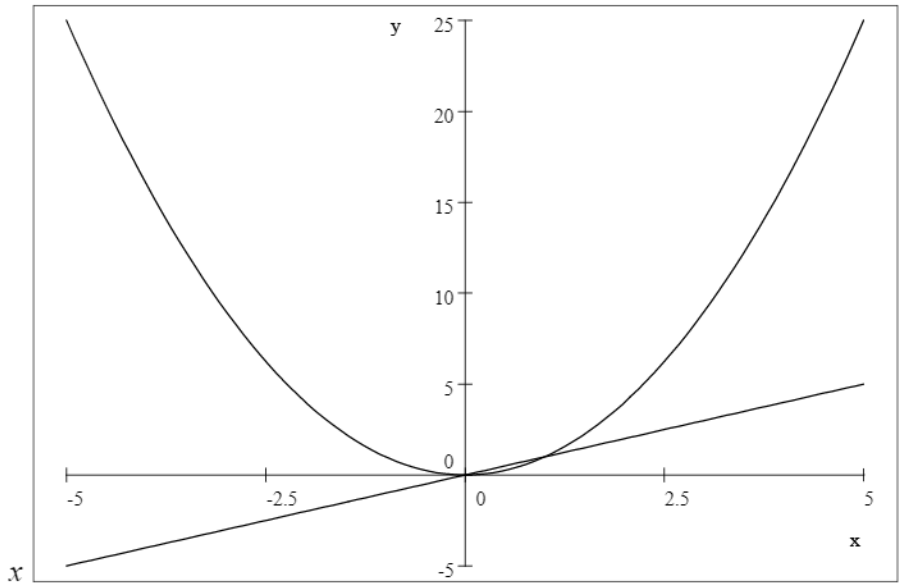
Say: "**ok**", "**ok**".

Graphing defined functions

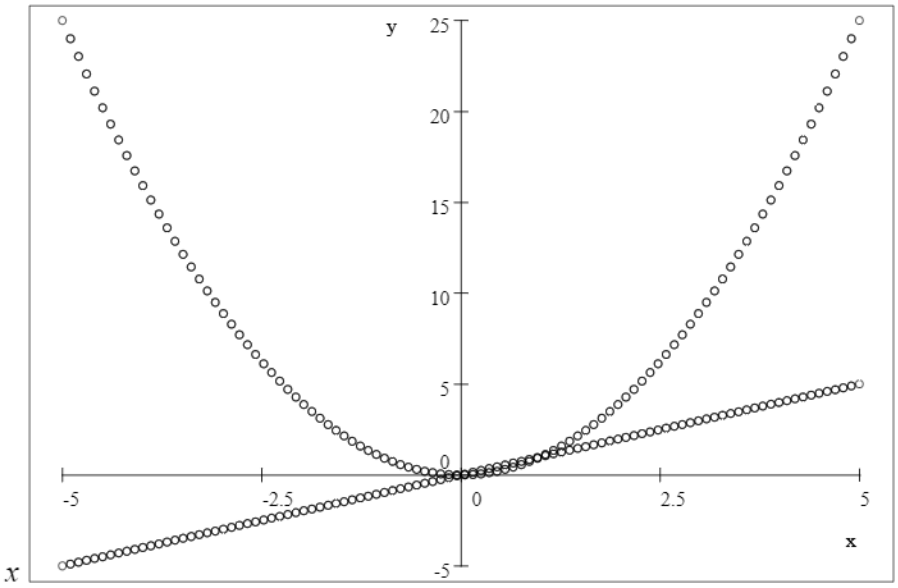
Graph $y = x$ and $y = x^2$ on the same graph. Use rectangular coordinates.

a) Say "**x-ray**", "**add expresssion**". In the Items Plotted dialog box, say "**x-ray squared**", "**click OK**" .

You'll get



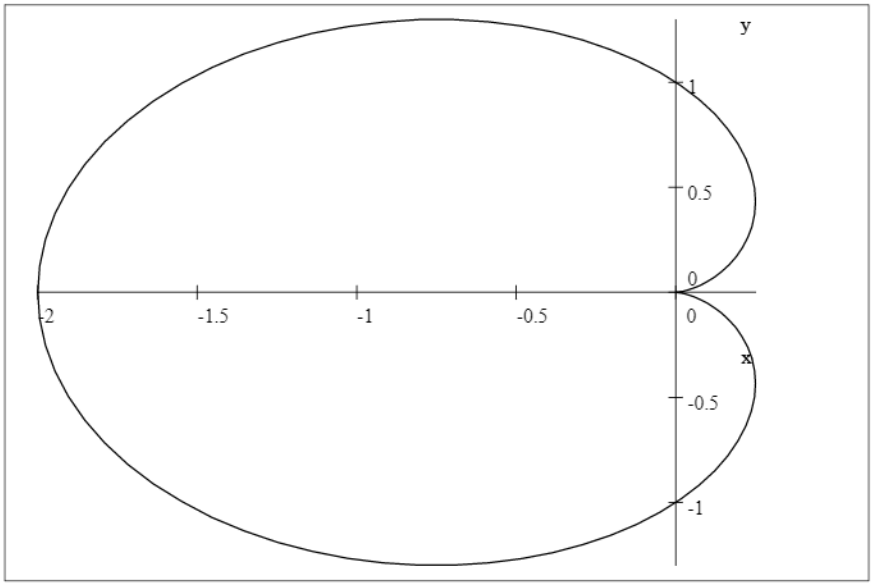
REMARK: You must be in Math Mode (i.e. the "red M") when saying any equation or graph command. Saying "**next line**" will accomplish this.
REMARK: If instead you said "**x-ray**", "**add plot expresssion**", and then in the Items Plotted dialog box said "**x-ray squared**", "**click OK**", you would get



b) Graph $r = 1 - \cos\theta$ in polar coordinates.

Say: "**one**", "**minus**", "**cosine theta**", "**graph polar**".

You'll get:

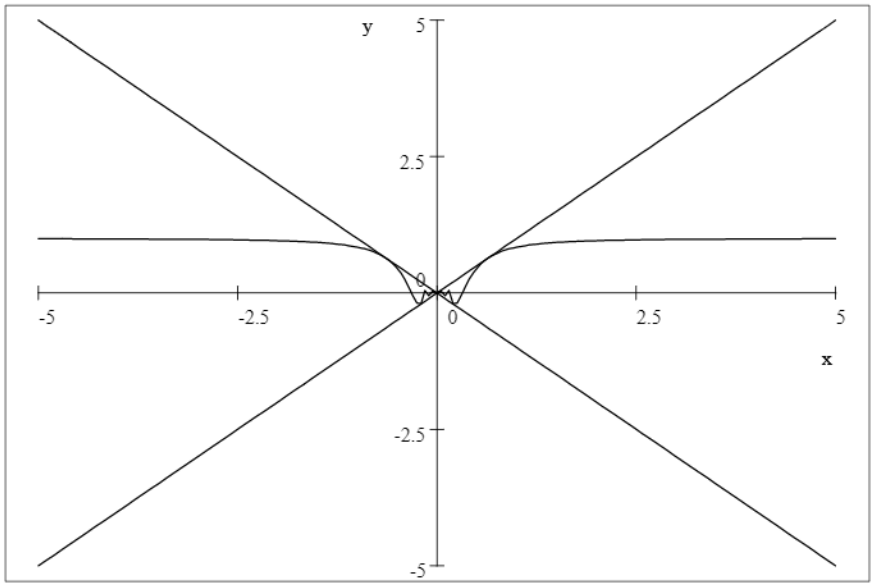


$1 - \cos\theta$

c) Graph $x \sin \frac{1}{x}, x, -x$ on the same graph.

Say: "**x-ray**", "**sine**", "**one over x-ray**", "**add expressiosn**". In the Items Plotted dialog box, say "**x-ray**", "**add item**", "**minus x-ray**", "**click OK**".

You will get the following graph:



$x \sin \frac{1}{x}$

In this case, our interest is in the behavior close to the origin, so we need to change the

range. To do this, "click" the graph. Probably the easiest way to do this is to:

Say: "**mouse grid**". Then say any number that's on the graph.
Now say: "**button click**". A small square will appear in the bottom right-hand corner of the graph. Click that square. Again, the easiest way is probably to use the mouse grid. When you click this box, the "Plot Properties" dialog box will open.

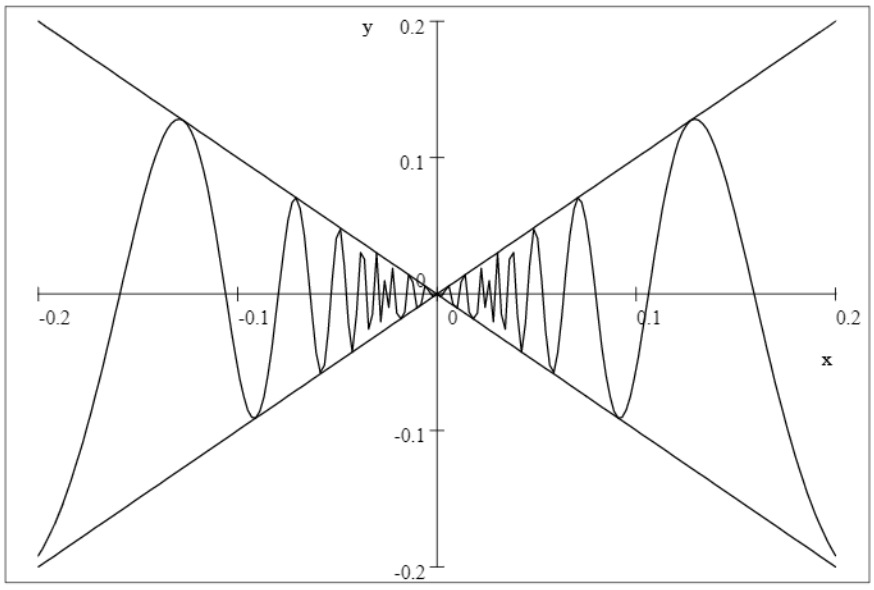
Note: The ledger names do not have a letter underlined, so you cannot use the alt key to open them. You can, however, say the name of the ledger.

Say: "**view**", (to uncheck default) "**default**", "**x-ray**", "**minus**", "**point numeral 2**", "**tab key**", "**point numeral 2**", "**tab key**", "**minus**", "**point numeral 2**", "**tab key**", "**point numeral 2**", (while in "View" to label the graph, say "**plot labels**"), "**ok**".

After the graph appears, click a vacant spot on the screen to remove the boxed outline. You can say "**button click**" to accomplish this.
* Can say "**move mouse right**", "**stop**" (when mouse is out of graph), "**button click**".

Warning! Be sure you are in an open place on the screen and not on a margin surrounding the screen. Clicking a margin may erase your graph!

You'll get



$x \sin \frac{1}{x}$

d) We will now plot the 3 dimensional graph of x^2y^3, followed by the 3d graph of $x^2 \sin xy + y^2 \cos xy$. For the second graph, we will go to "Plot Properties" and install the following settings: (We'll tell you below how to install them.)

1. Set the range of x and y as -3.14 to 3.14.

2. Set the range of z at −25 to 25.

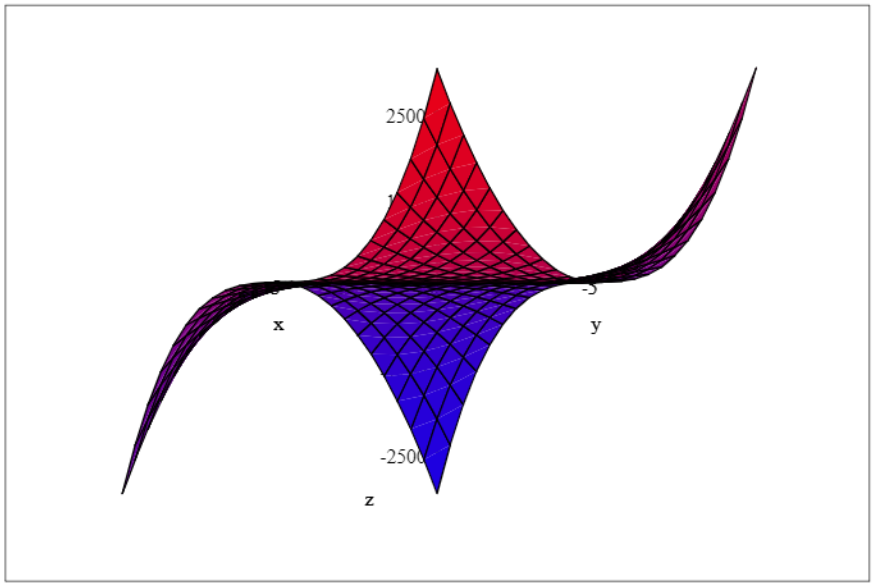
3. Set the shading at Z (hue).

4. Set the surface mesh at "mesh".

5. Set the surface style at Color Patch.

Here is the dialog to accomplish all of this! First, say "**next line**" to start on a new line and

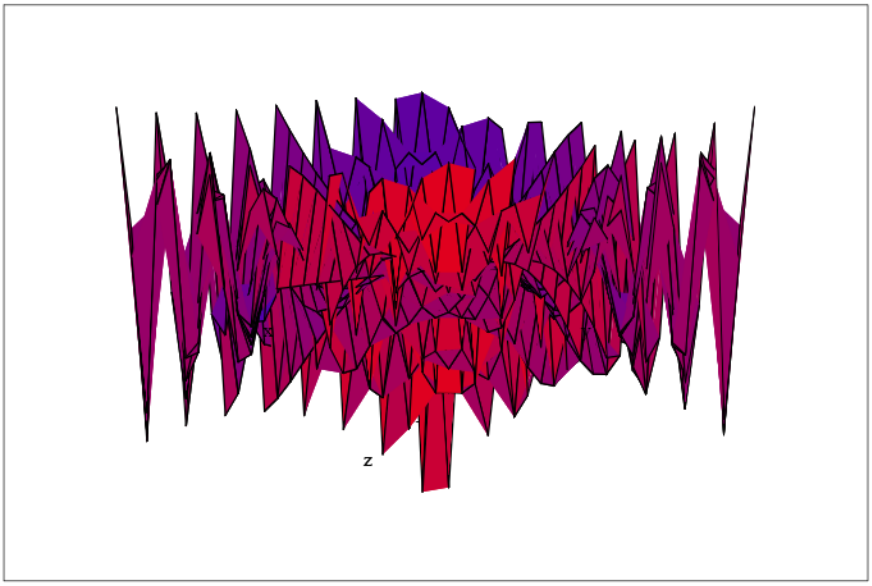
Say: "**x-ray square**", "**yankee cube**", "**3 delta graph**".
You should get



x^2y^3

Say: "**next line**", "**x-ray square**", "**sine x-ray**", "**yankee**", "**plus**", "**yankee square**", "**cosine**", "**x-ray yankee**", "**3 delta graph**".

You should get



$x^2 \sin xy + y^2 \cos xy$

Now we want to change the range and the color scheme. To do this we need to place the cursor on the graph and say "**button click**". You can do this by mouse commands. (If you use the mouse grid, some delay can occur due to replotting of the graph. If this happens just say "**button click**" again.)

Repeat the procedure to click the small box on the lower right-hand corner of the graph. Since the box is small, it is probably best to use the mouse grid here. When you do this, the Plot Properties dialog box will open.

Say: "**View**", "**default**", "**x-ray**", "**minus 3.14**", "**tab key**", "**3.14**", "**tab key**, "**minus 3.14**", "**tab key**", "**3.14**", "**tab key**", "**minus 25**", "**tab key**", "**25**",
(while in "View" to label the graph, say "**plot labels**").
Then say "**items plotted**", "**directional shading**", "**drop list**".

Now scroll up or down to "Z hue" by using the "up/down one" commands.

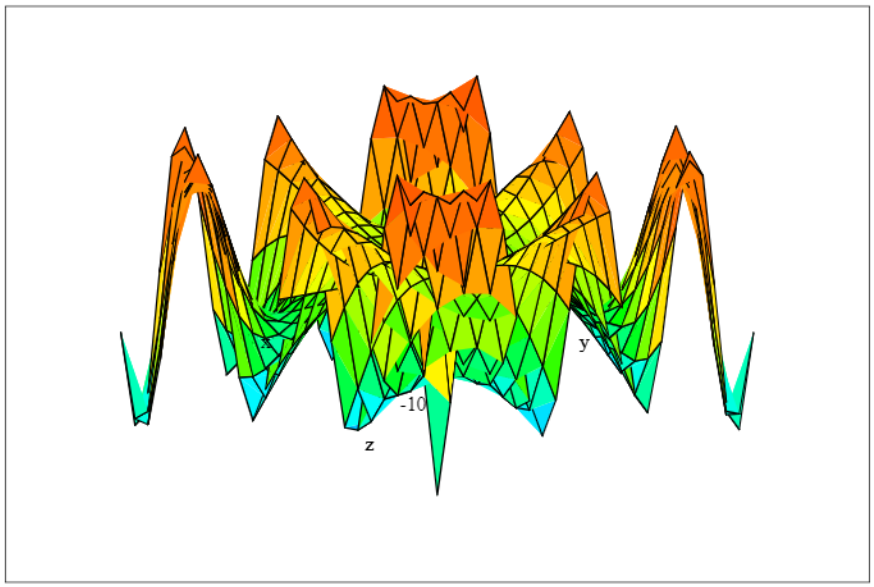
Say: "**surface mesh**", "**drop list**". As before, scroll up or down to "mesh".

Say: "**surface style**", "**drop list**". Scroll again to "color patch".

Then say: "**ok**". **Be sure the mouse is not on the margin or when you click the screen you will lose your graph**! Now click an open space on the screen to remove the boxed frame.

The result should be:

$x^2 \sin xy + y^2 \cos xy$



Plotting Data and Curve Fitting

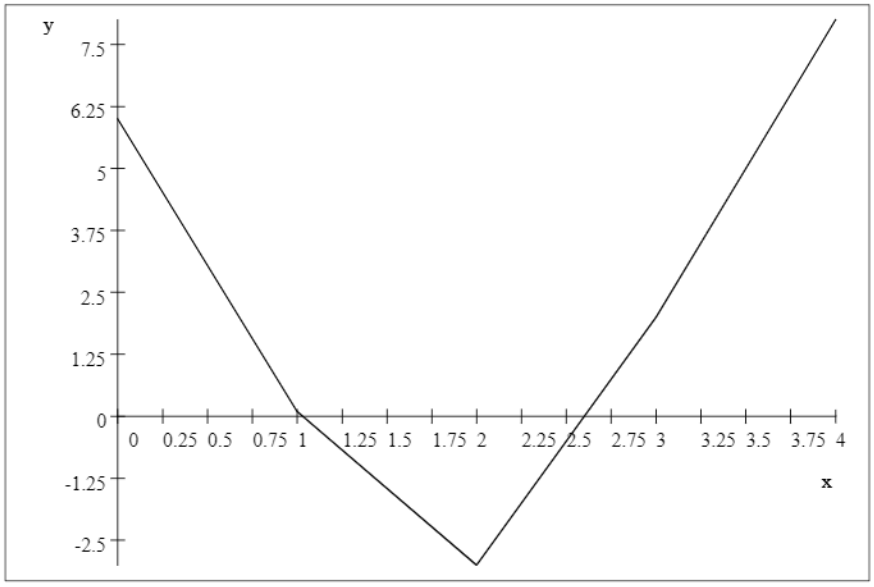
Note: In several cases, a command will open a dialog box. In such cases, you should wait for the dialogue to appear before issuing the next command.

In this example, we demonstrate how to plot data and fit a curve to it by voice using Scientific Notebook. We also want to compare the plotted graph with the fitted graph by placing them side by side. Currently the default for graphs is probably set at "Displayed". To put the graphs side by side, we need to change that to "in line". To do this say "**Tools**", "**computation setup**", "**plot layout**", "**in line**", "**ok**" (All of these choices will be in front of you on the menu. Also, this will make the default "in line" until you change it.)

Now, to enter the data, say "**next line**" and "**enter data**". You'll get a dialog box. Since we are going to put in 5 data pairs say "**5**", (* if columns is a number different than 2, say "**columns**", "**2**" before saying) "**ok**". A matrix will appear with the cursor in the upper left hand corner.

Say: "**zero**", "**tab**", "**6**", "**tab**", "**1**", "**tab**", "**point numeral 1**", "**tab**", "**2**", "**tab**", "**minus 3**", "**tab**", "**3**", "**tab**", "**2**", "**tab**", "**4**", "**tab**", "**8**".
You will have now have created the data matrix shown below. To plot the data, say: "**graph this**".

You'll get



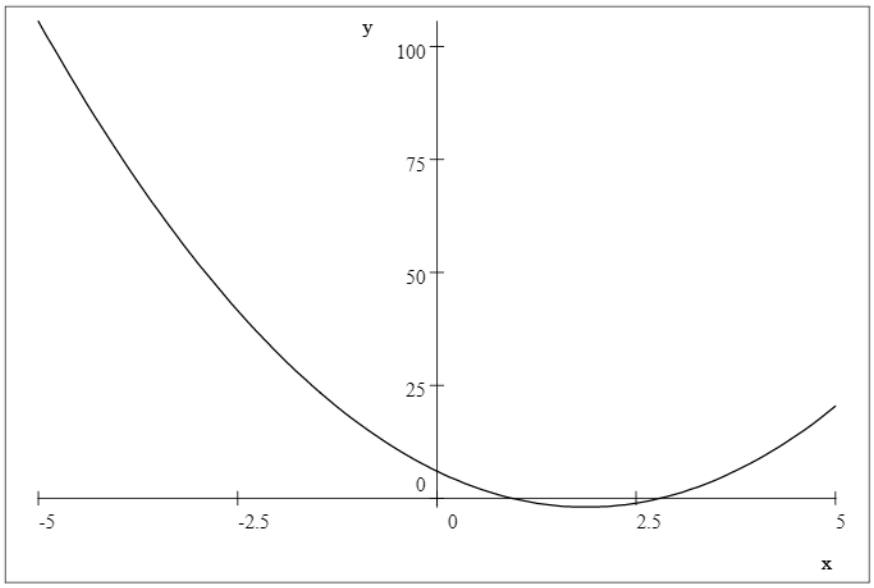
0	6
1	.1
2	–3
3	2
4	8

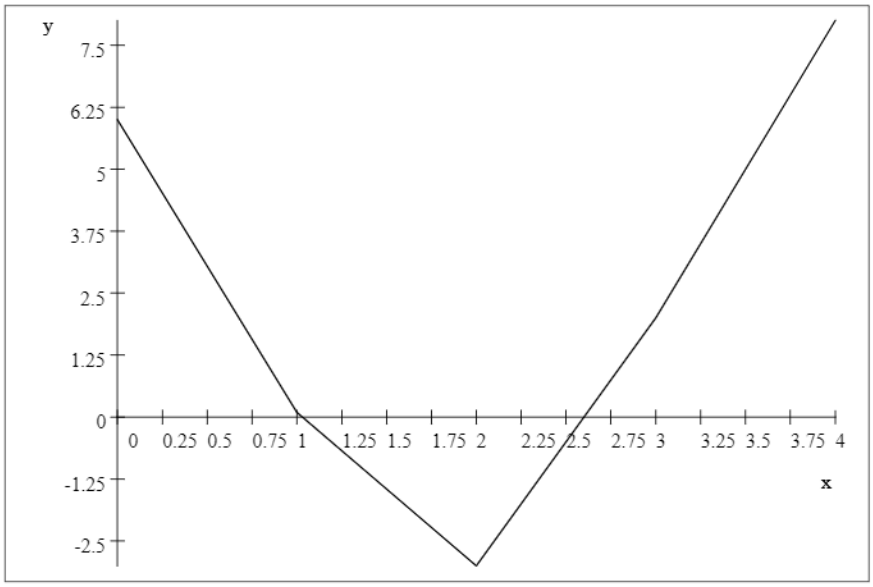
Now say "**fit polynomial**". When the dialog box opens, say "**last column**", "**polynomial of degree**", "**tab key**", "**2**", "**ok**". Then say, "**graph polynomial**".

Note: In the dialog box you are just reading the proper choices from the menu. If they are already checked correctly, you can just say "OK". If some of the boxes are checked correctly, just say the ones you want to change. For example, if "last column" is already checked, but "polynomial of degree" is not, just start the dialog with "polynomial of degree", etc.

You'll get:

0	6	
1	.1	
2	–3	, Polynomial fit: $y = 2.2786x^2 - 8.5243x + 5.9971$
3	2	
4	8	





(You may choose to say "fifty percent" if all does not fit on the screen.)

We still have a problem!

These graphs are not really comparable since the y range in the first is about 16 times the range of the second graph. We can however fix that as follows. First use the mouse grid to click on the graph on the left and repeat the process to click on the box in the lower right hand corner. When the dialog box opens say: "**view**", "**default**","**x-ray**", "**zero**", "**tab key**", "**4**", "**tab key**","**minus 3**", "**tab key**","**8**", "**ok**".

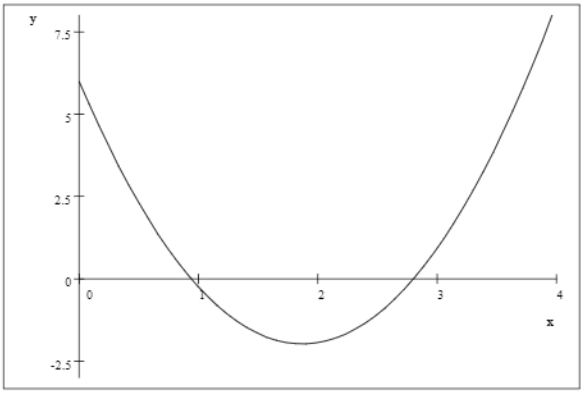
Then click on an open place on the screen to take the graph out of the editing box.

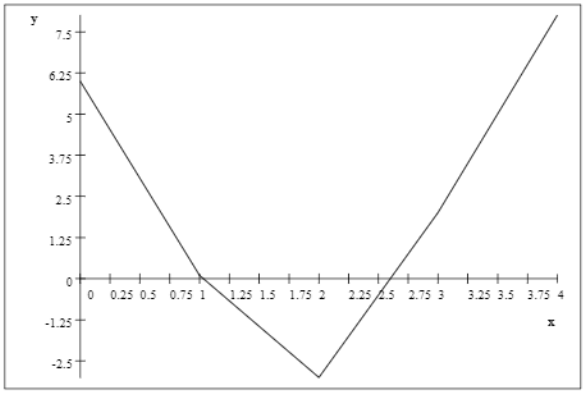
Warning! Be sure you are in an open place on the screen and not on a margin

surrounding the screen. Clicking a margin may erase your graph!

You'll get

0 6
1 .1
2 −3 , Polynomial fit: $y = 2.2786x^2 - 8.5243x + 5.9971$
3 2
4 8





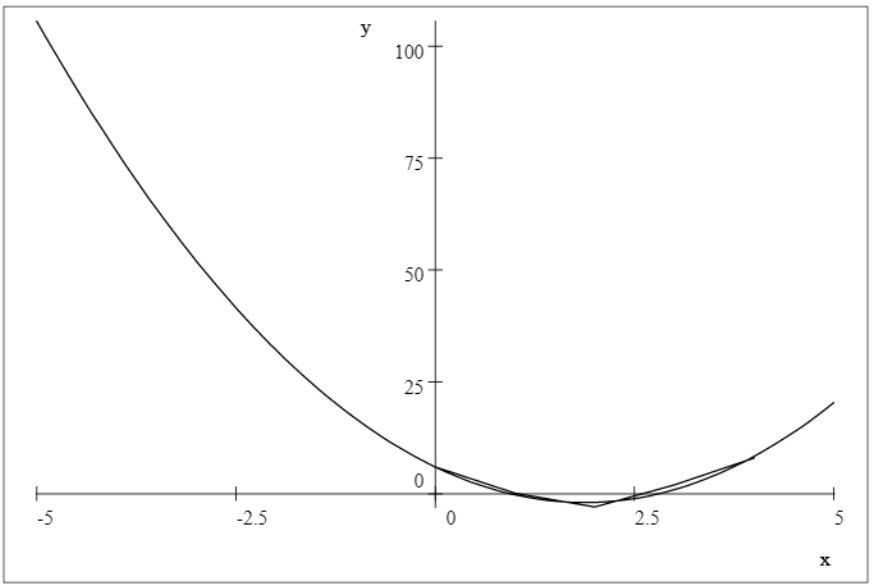
Now you're finished but lets do it again another way. Instead of "graph this", we'll say "plot this". Suppose that we have already entered the data so that we have

0 6
1 .1
2 −3
3 2
4 8

Again with the cursor in the data say "**fit polynomial**" and answer the dialog box as before. You will get:

0 6
1 .1
2 −3 , Polynomial fit: $y = 2.2786x^2 - 8.5243x + 5.9971$
3 2
4 8

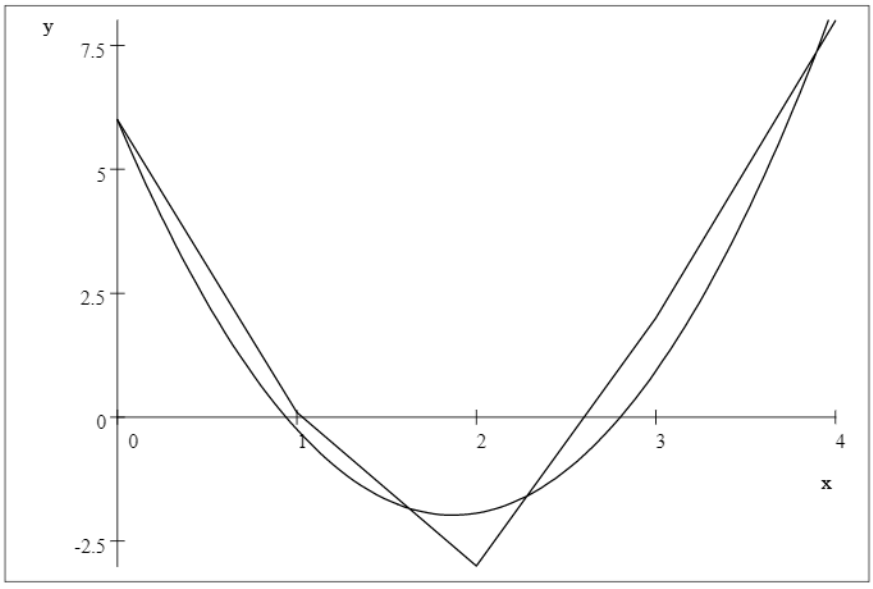
Now say "**overlay polynomial**". You will get:



0	6
1	.1
2	−3
3	2
4	8

Polynomial fit: $y = 2.2786x^2 - 8.5243x + 5.9971$

Now click the graph as before and set the range as before to get the final result with the curve fit graphed along with the plotted data :

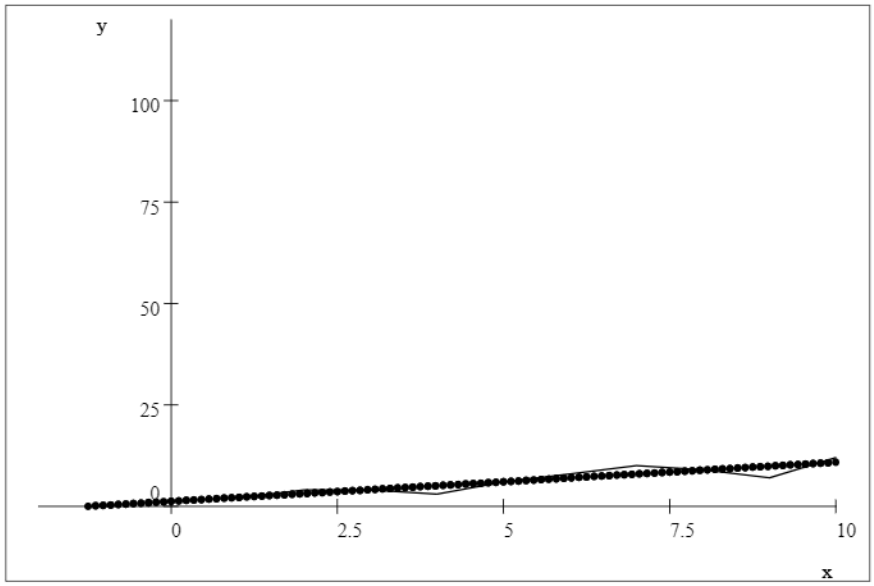


0	6
1	.1
2	−3
3	2
4	8

Polynomial fit: $y = 2.2786x^2 - 8.5243x + 5.9971$

Fitting and graphing a regression line

You can fit a regression line with any number of dependent variables . You can also fit and graph a regression line with independent variable x as shown in the graph below. You may want to reset the range after you plot this.



1	2
2	4
3	4
4	3
5	6
6	8
7	10
8	9
9	7
10	12

Regression is: $y = \frac{53}{55}x + \frac{6}{5}$

Here's how you do it (2 D example):

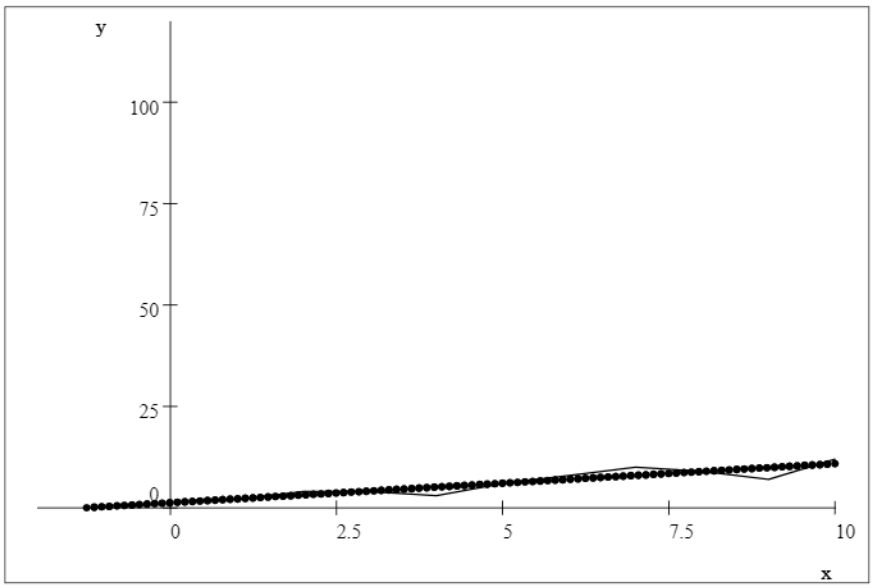
1. On a new line, beginning at the left margin, enter the data by saying "**enter data**". In order to fit a regression line with independent variable x, and dependent variable y, Scientific Notebook requires you to place an x in the first data cell and a y in the second cell of the first line. If you have already entered the data and did not do that, you must put the cursor anywhere **in** the data and say "**insert x-ray yankee**". The columns will then be labeled automatically.

2. After you have the data entered and labeled as described in step 1, with the cursor anywhere in the data, say "**fit regression line**". Here is what you will see if you use the data set listed here.

x	y
1	2
2	4
3	4
4	3
5	6
6	8
7	10
8	9
9	7
10	12

, Regression is: $y = \frac{53}{55}x + \frac{6}{5}$

3. Now say "**graph regression line**". You will get



1	2
2	4
3	4
4	3
5	6
6	8
7	10
8	9
9	7
10	12

Regression is: $y = \frac{53}{55}x + \frac{6}{5}$

REMARK: The appearance of the graph will vary according to the range you select for x and y. Note that the labels x y at the top of the two columns have been removed. This is because, contrary to the case of fitting a regression line, Scientific Notebook does not allow the first two elements to be letters when graphing data. Therefore the command "**graph regression line**" removes those labels so that the data and the line can be plotted. **To use**

the command "graph regression line" you must begin a new line and enter the data at the left most position of the page!

REPEATING Can't Remember What To Say?

If you can't remember what to say, remember the "go to" commands to view stand alone commands. For example, if you wish to view commands beginning with the letter "s", say "**go to sierra commands**" will take you into the Pictionary to the commands that begin with the letter "s". Using the International Alphabet, say "**go to** and the letter **commands**" to view commands beginning with that letter in the Pictionary. Saying "**pictionary search**" will take you to other "go to" commands for searches such as commands beginning with "integral" which would be accessed by saying "**go to integral commands**".

Saving, Print Preview and Printing

If you would like to save your work, just say "**save this**" and give it a name. Normally you will want to preview you work before you print it. To do so say "**print preview**". This will take you to the first page of the document in **print preview**. **From page 1 in print preview**, you can go to any page you want to review by saying "**preview** *x*", where *x* is any number 2 thru 15. For example, if you want to preview page 10, say "**print preview**", "**preview 10**". If you want to preview a page number greater than 15 you can say "**preview 15**" and then say preview x, where x-1 is the number of pages you need to move forward. For example, if you want to preview page 20, say "**print preview**", "**preview 15**", "**preview 6**". Once you are satisfied, return to your document and print it by saying "**print this**".

Inserting a Value In a Formula

You may often want to evaluate mathematical expressions at a given value. The next two examples demonstrate how to do that. Now, suppose that you wish to evaluate the expression

$$y = x^2 \sin x + x \cos x$$

$x = \frac{\pi}{2}$

First, let's write down the equation.

Say: "**yankee**", "**equals**", "**x-ray square**", "**sine x-ray**", "**plus x-ray**", "**cosine x-ray**".

Now move the cursor above the line that the equation is on by placing the cursor at the end of the equation and saying "**insert one line**". Then say "**x-ray**", "**equals**", "**pi over 2**", "**define equal**", "**move down one**", (be sure the cursor is now in or at the end of the equation) "**evaluate**", "**evaluate numerically**".

Here's what you should get:

$$x = \frac{\pi}{2}$$
$$y = x^2 \sin x + x \cos x = \frac{1}{4}\pi^2 = 2.4674$$

Now suppose that you also want the equation at $\frac{\pi}{4}$. Move the cursor to the end of the equation (if cursor is at end of the line, say "**move left 17**" which places the cursor after $y = x^2 \sin x + x \cos x$) and say "**select to beginning of line**", "**copy this**", "**end key**", "**next line**", "**put here**" (or "paste",or "paste this"). (We are assuming the equation is on a line by itself. If not you can use the DNS command "select next/previous (number) characters".) Now say "**insert one line**", "**x-ray**", "**equals**", "**pi over 4**", * "**clear definitions**", "**define equal**", (or "new definition") "**move down one**", "**evaluate**", "**evaluate numerically**". * **Now don't forget to clear the definitions**. **Say** "**clear definitions**".

$$x = \frac{\pi}{2}$$
$$y = x^2 \sin x + x \cos x = \frac{1}{4}\pi^2 = 2.4674$$
$$x = \frac{\pi}{4}$$
$$y = x^2 \sin x + x \cos x = \frac{1}{8}\pi\sqrt{2} + \frac{1}{32}\pi^2\sqrt{2} = 0.99154$$

REMARK: You can change the number of digits displayed by saying "**set digits displayed**".

STATISTICAL MODULE

This section should be skipped by those persons that are not specifically interested in solving mathematical statistics problems. For those who choose to cover this section, the supervision of a statistics instructor may be helpful.

MathTalk has several voice commands designed to allow you to do basic mathematical statistics problems by voice. In particular, one can test hypotheses, find confidence intervals, find *p*-values, and determine *z* and *t*-values. Additionally, voice commands are included to determine critical values for Normal (μ, σ^2), Standard Normal, (i.e., $N(0,1)$), student-*t*, chi square, and *F* distributions.

Moreover, for any given $(a,\ b)$, $P[a \le X \le b], P[X \le a]$ and $P[X \ge a]$ are calculated on command for the normal (μ, σ^2), standard normal, t, χ^2, uniform, binomial, and F distributions. No graphing capabilities are included specifically for statistics. Before you try any of the examples below, clear the definitions by saying "clear definitions".

Remark: The letter "*Z*" is used to denote a Standard Normal random variable. The lower case "*z*" is used for a value of *Z* or the *z*-statistic

Remark: To use the statistical command training module - say, "**train statistics**".

Example 6

Given $\overline{x} = 3.2,\ \mu = 2,\ \sigma = 3$, and $n = 25$, find the *z*-statistic

$$z = \frac{(m-\mu)\sqrt{n}}{\sigma}, \quad \text{where } m = \overline{x}.$$

and calculate

a) $P[-z \le Z \le z]$
b) $P[Z \ge z]$
c) The *p*-value (for a one sided test assuming *p*-value $\le .5$).

REMARK: All *p*-values are for one sided test. For a two sided test just double them.
Now start a new line and find *z*.

Say: "**next line**", "**zulu statistic**".
You should get: $z = \frac{(m-\mu)\sqrt{n}}{\sigma}$

To enter the values of m (remember $m = \overline{x}$), μ, n, with the cursor at the end or in the equation say "**insert 1 line**", "**mike**", "**equals**", "**3 point 2**", "**define equal**", "**next line**, "**mu**", "**equals 2**", "**define equal**", "**next line**", "**november**", "**equals twenty five**", "**define equal**", "**next line**", "**sigma**", "**equals 3**", "**define equal**", "**move down 1**", (The cursor should now be on the same line as *z* and the *z* equation should be on a line by itself.) "**evaluate numerically**".

You should get

$m = 3.2$

$\mu = 2$

$n = 25$

$\sigma = 3$

$z = \frac{(m-\mu)\sqrt{n}}{\sigma} = 2.0$

REMARK: **These values of** $m, \mu, n,$ and, σwill remain defined at these values until you either redefine them or clear definitions.

a) To find $P[-z \le Z \le z]$, we use the command [standard normal probability]. This command writes the general expression for $P[a \le Z \le b]$ for the Standard Normal random variable, Z. That is say "standard normal probability" to get

$$P[a \le Z \le b] = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{1}{2}t^2} dt$$

In general, to calculate $P[a \le X \le b]$ for a given random variable X, say *the name of the distribution followed by the word* "probability". That is, for the T random variable,say "**tango probability**" to get

$$P[a \le X \le b] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})} \int_a^b \left(1 + \frac{t^2}{v}\right)^{-\frac{v+1}{2}} dt,$$

and say "**normal probability**" to get

$$P[a \le X \le b | \mu, \sigma] = \frac{1}{\sqrt{2\pi}\,\sigma} \int_a^b \exp\{-\frac{1}{2 \cdot \sigma^2}(t-\mu)^2\} dt.$$

Do not be disturbed if you do not understand the symbols on the screen. They simply represent a mathematical formulation for calculating an area under the given probability density curve.

Now let's continue with solving the problem at hand. We have calculated that $z = 2$ and we wish to find $P[-z \le Z \le z]$. Note that, here we want the Standardized Normal.

Say: "**standard normal probability**" to get

$$P[a \le Z \le b] = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{1}{2}t^2} dt$$

With the cursor in or directly following the equation
Say: "**insert 1 line**", "**alpha**", "**equals minus 2**", "**define equal**", "**next line**", "**bravo**", "**equals 2**", "**define equal**", "**move down 1**", "**evaluate numerically**"

You should get:

$a = -2$

$b = 2$

$$P[a \le Z \le b] = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{1}{2}t^2} dt = 0.39894(\text{numeric}) \int_{-2}^b e^{-\frac{1}{2}t^2} dt$$

To calculate probabilities such as $P[Z \ge 2]$ or $P[Z \le 2]$, proceed as follows.

b) To find the $P[Z \geq 2]$, Say: "**next line**", "**alpha**", "**equals 2**", "**new definition**" (or define equal), "**new line**", "**probability zulu greater than or equal to alpha**", "**evaluate numerically**".

You should get:

$a = 2$

$$P[Z \geq a] = \frac{1}{\sqrt{2\pi}} \int_a^{\infty} e^{-\frac{1}{2}t^2} dt = 0.022\,75$$

c) Now to obtain the p-value for this problem, say "**standard normal papa value**" or "**normal papa value**". You will obtain

$$\text{p value} = \frac{1}{\sqrt{2\pi}} \int_{|z|}^{\infty} e^{-\frac{1}{2}t^2} dt$$

This expression is simply the mathematical formula for the p-value for a Standard Normal random variable. You need not understand the formula. You do need to tell it the value of z. You have just calculated that $z = 2$. This is the value of z needed for the p value. Although you calculated z, you have never defined $z = 2$. So now, with the cursor on the line with the equation,

Say: "**insert 1 line**", "**zulu**", "**equals 2**", "**define equal**", "**move down 1**", "**evaluate numerically**"

$z = 2$

$$\text{p value} = \frac{1}{\sqrt{2\pi}} \int_{|z|}^{\infty} e^{-\frac{1}{2}t^2} dt = 0.022\,75$$

Unless you have some definitions that you don't want to clear, now clear the definitions by saying "**clear definitions**".

You can also calculate probabilities of the form $P[X \leq a]$, $P[X \geq a]$ for the Binomial, Chi Square, F, Normal, Standard Normal, T, and Uniform distributions. In the case of the binomial you can also calculate $P[X = a]$. This can be accomplished as follows:

For the Binomial:

Say "**probability binomial** { **less than or equal to** / *or* / **equal or less than** } **alpha**" to get

$$P[X \leq a | n, \theta] = \sum_{k=0}^{a} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$$

Say "**probability binomial** { **greater than or equal to** / *or* / **equal or greater than** } **alpha**" to get

$$P[X \geq a | n, \theta] = \sum_{k=a}^{n} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$$

Say "**probability binomial equals alpha**" to get

$$P[X = a | \theta, n] = \frac{n!}{a!(n-a)!} \cdot \theta^a (1-\theta)^{n-a}$$

Say "**probability binomial equals zero**" to get
$P[X = 0] = (1-\theta)^n$

Say "**probability binomial greater than zero**" to get
$P[X > 0] = 1-(1-\theta)^n$

The Chi Square:

Say "**probability chi square** { **less than or equal to** / *or* / **equal or less than** } **alpha**" to get

$$P[X \le a] = \frac{1}{2^{\frac{\nu}{2}}\Gamma\left(\frac{\nu}{2}\right)} \int_0^a t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$$

Say "**probability chi square** { **greater than or equal to** / *or* / **equal or greater than** } **alpha**" to get

$$P[X \ge a] = \frac{1}{2^{\frac{\nu}{2}}\Gamma\left(\frac{\nu}{2}\right)} \int_a^\infty t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$$

The F distribution

Say "**probability foxtrot** { **less than or equal to** / *or* / **equal or less than** } **alpha**" to get

$$P[F \le a|\nu_1,\nu_2] = \frac{\Gamma\left(\frac{\nu_1+\nu_2}{2}\right)}{\Gamma\left(\frac{\nu_1}{2}\right)\Gamma\left(\frac{\nu_2}{2}\right)} \left(\frac{\nu_1}{\nu_2}\right)^{\frac{\nu_1}{2}} \int_0^a \frac{t^{\frac{(\nu_1-2)}{2}}}{\left(1+\left(\frac{\nu_1}{\nu_2}\right)t\right)^{\frac{(\nu_1+\nu_2)}{2}}} dt$$

Say "**probability foxtrot** { **greater than or equal to** / *or* / **equal or greater than** } **alpha**" to get

$$P[F \ge a|\nu_1,\nu_2] = \frac{\Gamma\left(\frac{\nu_1+\nu_2}{2}\right)}{\Gamma\left(\frac{\nu_1}{2}\right)\Gamma\left(\frac{\nu_2}{2}\right)} \left(\frac{\nu_1}{\nu_2}\right)^{\frac{\nu_1}{2}} \int_a^\infty \frac{t^{\frac{(\nu_1-2)}{2}}}{\left(1+\left(\frac{\nu_1}{\nu_2}\right)t\right)^{\frac{(\nu_1+\nu_2)}{2}}} dt$$

The Normal distribution

Say "**probability normal** { **less than or equal to** / *or* / **equal or less than** } **alpha**" to get

$$P[X \le a|\mu,\sigma] = \frac{1}{\sqrt{2\pi}\sigma} \int_{-\infty}^a \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\} dt$$

Say "**probability normal** { **greater than or equal to** / *or* / **equal or greater than** } **alpha**" to get

$P[X \geq a|\mu,\sigma] = \frac{1}{\sqrt{2\pi}\sigma}\int_a^\infty \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\}dt$

The Standard Normal distribution

It is customary to refer to a Standard Normal random variable as a Z random variable or a Z statistic. As we have done previously, we will use the letter Z when referring to a Standard Normal random variable.

Say "**probability zulu** { **less than or equal to** / *or* / **equal or less than** } **alpha**"to get

$P[Z \leq a] = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^a e^{-\frac{1}{2}t^2}dt$

Say "**probability zulu** { **greater than or equal to** / *or* / **equal or greater than** } **alpha**" to get

$P[Z \geq a] = \frac{1}{\sqrt{2\pi}}\int_a^\infty e^{-\frac{1}{2}t^2}dt$

T, and Uniform distributions

For the T and Uniform distributions to get $P[X \leq a]$ or $P[X \geq a]$, insert the proper distribution name and proceed just as in the Chi Square, F and Normal distributions.

Example 7

Let X be the number of "ones" in ten tosses of a fair die (X is therefore a Binomial random variable.). Find the probability $X = 2$, i.e. $P[X = 2]$.

Say "**probability binomial equals alpha**" and you will get:

$P[X = a|\theta,n] = \frac{n!}{a!(n-a)!}\cdot\theta^a(1-\theta)^{n-a}$

Say: "**insert 1 line**", "**alpha**", "**equals 2**", "**define equal**", "**next line**", "**theta**", "**equals**", "**1 over 6**", "**define equal**", "**next line**", "**november**", "**equals 10**", "**define equal**", "**move down 1**", "**evaluate numerically**" .

You should get:

$a = 2$

$\theta = \frac{1}{6}$

$n = 10$

$P[X = a|\theta,n] = \frac{n!}{a!(n-a)!}\cdot\theta^a(1-\theta)^{n-a} = 0.29071$

Note: If you want $P[X \leq 2|\theta, n]$, you proceed the same way, except you begin by saying "**probability binomial equal or less than alpha**".

Example 8

Given the 8 data values $2.37, .77, 1.10, 3.65, 2.50, 2.38, 3.66, -1.48$, from a normal distribution, find the observed t-value under the assumption $\mu = 0$.

After you have entered the data, with the cursor in or directly at the end of the data, say "**sample mean**".
You'll get: Mean(s): 1. 868. Now move the cursor back into the data, and say "**sample sierra delta**".
You will get: Standard deviation(s): 1. 703 .

You can now calculate the t-statistic (or t-value). To do so, go to a new line and say "**t statistic**".

You'll get: $t = \frac{(m-\mu)\sqrt{n}}{s}$. **Remark**: remember $\overline{x} = m$.

Say: "**insert 1 line**", "**mike**", "**equals**", "**one point eight six eight**", "**define equal**", "**next line**", "**sierra**", "**equals**", "**one point seven zero 3**", "**define equal**", "**next line**", "**mu**", "**equals zero**", "**define equal**", "**next line**", "**november**", "**equals 8**", "**define equal**", "**move down 1**", "**evaluate numerically**".

You should get:
$m = 1.868$
$s = 1.703$
$\mu = 0$
$n = 8$
$t = \frac{(m-\mu)\sqrt{n}}{s} = 3.1025$

Say "**clear definitions**".

Example 9

a) Find the Z-value so that the area under a standard normal curve to its right is .025.

Solution:
Say "**zulu point zero two five**". You'll get : $z_{.025} = 1.960$.
You can use this method for $Z_{.1}, Z_{.05}, Z_{.025}$ and $Z_{.01}$.

For Z in general, you must proceed as follows:
Say: "**next line**", "**zulu critical value**"
You will get:

$$\frac{1}{\sqrt{2\pi}} \int_z^\infty e^{-\frac{1}{2}t^2} dt$$

Don't let it bother you if you do not understand the symbols on the screen. They simply represent a mathematical formulation for calculating an area under the standard normal curve. Now, let's suppose you want to know the $Z_{.2}$, i.e., the point such that the area under a standard normal curve to the right of Z is .2. Now say "**equals**", "**point**", " **2**". You will see the following on the screen:

$$\frac{1}{\sqrt{2\pi}}\int_z^{\infty} e^{-\frac{1}{2}t^2}dt = .2$$

Now say "**solve numerically**". You will get:

$$\frac{1}{\sqrt{2\pi}}\int_z^{\infty} e^{-\frac{1}{2}t^2}dt = .2, \text{ Solution is: } \{[z = 0.84162]\}$$

b) Now find $t_{.025}(7)$, i.e., the value of a t statistic with 7 degrees of freedom such that the area to its right is .025.

Solution: Say "**tango critical value**". You will get

$$\frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})}\int_t^{\infty}\left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du$$

Say: "**equals**", "**point zero two five**". Now say "**insert 1 line**", "**degrees of freedom**", "**equals 7**", "**define equal**", "**move down 1**", "**solve numerically**". You'll get

$$v = 7$$
$$\frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})}\int_t^{\infty}\left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du = .025, \text{ Solution is: } \{[t = 2.3646]\}$$

Example 10

This example uses the data from Example 8.
a) Find a 95% confidence interval (CI) for μ if it is known that $\sigma = 2$.

Solution: Say "**next line**", "**normal confidence interval for mu**". You will get
$CI = \left(m - z\frac{\sigma}{\sqrt{n}}, m + z\frac{\sigma}{\sqrt{n}}\right)$
You must now insert the values of $m, z, \sigma,$ and n.
Say: "**insert 1 line**", "**mike**", "**equals**", "**one point eight six eight**", "**define equal**", **next line**", "**zulu**", "**equals**", "**one point nine six**", "**define equal**", **next line**", "**sigma**", "**equals 2**", "**define equal**", **next line**", "**november**", "**equals 8**", "**define equal**", "**move down 1**", "**evaluate numerically**"

$m = 1.868$
$z = 1.96$
$\sigma = 2$
$n = 8$
$CI = \left(m - z\frac{\sigma}{\sqrt{n}}, m + z\frac{\sigma}{\sqrt{n}}\right) = \quad 0.48207 \quad 3.2539$

b) Find a 95% confidence interval for μ if σ is not known.

Solution: Here you need the *t*-distribution, so say "**next line**", "**tango confidence interval for mu**". Again, you will have to enter the values of the variables. The value of *t* required here is the *t* critical value you computed in Example 9. If you needed to compute it, you would need to compute it on a separate line and then enter it in the CI as we did in part (a) of this example. Now enter all the unknowns, i.e.,

$t = 2.365$ (Computed in Example 9)
$s = 1.703$ (Computed in Example 8)
$m = 1.868$ (Computed in Example 8)
$n = 8$

in the same manner as in part (a). To be safe begin by saying "**clear definitions**".

Remark: You do not have to say "**insert 1 line**". However it seems more logical to place the values of the parameters before the equation, rather than after it. You can, however, define the value of the parameter either place so long as you say "**define equal**" **before** you say "**evaluate numerically**".

If you do everything right you will get the following:

$t = 2.365$
$s = 1.703$
$m = 1.868$
$n = 8$
$CI = \left(m - t\frac{s}{\sqrt{n}}, m + t\frac{s}{\sqrt{n}}\right) = \quad 0.444\,03 \quad 3.292\,0$

TRANSLATING MATH INTO BRAILLE

using the Duxbury Braille Translator 10.5 +

*You may view a 'math to Braille' demo on the MathTalk Demo CD.

1. Create math in ScientificNotebook by voice and/or keyboarding.

2. **Save** the math as a .tex file in c:\Program Files\ScientificNotebook\ docs by saying "**save math as**", voice or type the name, then "**save**".

3. Next say, "**math to braille**" which will open the Duxbury Braille Translator and bring up the "open file" dialog box in c:\Program Files\ScientificNotebook\ docs.

4. Now select the file you wish to open. You may either a) voice the name of file and then say "**open that**" or b) click on the file, then use combinations of clicking and voicing to open that file in Duxbury.

5. The file is now open in the Duxbury Braille Translator. Say "**translate to Braille**".

To emboss, say "**emboss this**". Unless connected to an embosser, now say "**cancel**".

6. To close file and exit translator, say "**close file**", "**discard**", "**exit translator**".

Available voice commands with in the Duxbury Braille Translator:
"translate to Braille"
"emboss this"
"close file"
"discard"
"exit translator"
"open math" -when already in Duxbury may be used to open an additional file

HELP DOCUMENTS

MATHTALK LEARNING MODULE (c)

The MathTalk Learning Module is designed to quickly familiarize the user with the features of MathTalk.

HELPFUL DEFINITIONS:

Pictionary -a list of the names of stand alone commands and the actions they accomplish.
Tutorial - examples and explanations of use of commands.
Sentence Commands - allows the user to voice more than one expression at a time. An example of this would be to say "square root of twenty". This particular command allows you to say any root (from square to ninth) of any number (1 through 20) or of any letter (a through z, including caps) or any greek letter (including caps)!
Variable List - list of variables for use in Sentence Commands.
Training Modules - training for Pre-Algebra, Algebra, Calculus, Trig, Statistics.

This program contains the following learning features:

1) Manual /Tutorial
2) Pictionary
3) Learning Assistance Module which is comprised of
   a. Video demonstrations – See CD video demo
   b. Direct online access to available Sentence Commands, Variable Lists, stand alone commands in Pictionary, and Manual/Tutorial search Learning Assistance Program available by a single voice command. Just say "**mathtalk learning module**" for a list of commands to access video demos, access to lists of sentence commands and their variables, stand alone commands in the Pictionary, and Training Modules.

* The MathTalk documents were created in ScientificNotebook. There will be some spacing and justification differences.

TO VIEW:	**YOU SAY**
COMMAND INFORMATION	
Sentence Command Examples	sentence command examples
Sentence and Dialog Box Variables	variable menu
Manual/Tutorial Topics	tutorial search
Pictionary Search - Stand Alone Commands	pictionary search
Statistics	statistics commands
HELP TOPICS	
Command Training Modules (pre-algebra, algebra, calculus, trig, stat)	training modules
International Alphabet	international alphabet
How to Replace a Letter or Symbol	replace help
Scientific Notebook Help	scientific notebook help
Trouble Shooting	trouble shooting
ADDITIONAL FEATURES	
Translating Math to Braille (see Tutorial section, pages 76-77 of this manual)	translate to Braille
Technical Support	technical support

VIDEOS (see Demo CD Video)

Adding Text to MathTalk
Quick Reference Laminate
Training MathTalk
Replace Video- How to Replace a Letter or Symbol
Math to Braille

and examples of Pre-Algebra, Algebra, Trig, Calculus, Statistics, Graphing, etc.

REPLACE A LETTER OR SYMBOL (c)

This command allows you to replace symbols with different symbols. For example, if you say "**quadratic equation**", you will get $ax^2 + bx + c = 0$. If you want $az^2 + bz + c = 0$, you can just change the x to a z manually. Or you can position the cursor at the beginning of the math expression. Then move the cursor to the immediate left of the first **x** in that math expression by saying "**move right** ? **spaces**". Now say "**replace next character**" which will 1) highlight the first $\mathbf{x}$, 2) open the Replace Dialog Box placing the $\mathbf{x}$ in "Search for", and 3) place the cursor in "Replace with" position. Now place $\mathbf{z}$ in the "Replace with" box by saying "**zulu**". Say "**find next**", "**replace**", "**yes**"and then "**end replace**". And you will get $az^2 + bz + c = 0$.

Be sure "whole words only is **not** checked!!

If you wish to replace the next two characters in a math expression, position the cursor to the immediate left of the two characters, say "**replace next two characters**", and follow step 2 above.

Special Note: When the last character(s) to be replaced is selected, say "**end replace**". See the following example.

Suppose that you wish to change the x in the equation $(a+x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2!}a^{n-2}x^2 + \cdots + x^n$ to Δ. Note there are four x's in this expression. First place the cursor at the immediate left of the first x (i.e. left most x) in that expression. Now say "**replace next character**" which will 1) highlight the first x, 2) open the Replace Dialog Box placing the x in "Search for", and 3) place the cursor in "Replace with" position. Now place Δ in the "Replace with" box by saying "**cap greek delta**". Say "**find next**", "**replace**", "**yes**", "**replace**" , "**replace**" and then "**end replace**". (Again saying, "replace" is continued like until the last x that you want to replace is selected. Then with that x still selected, say "end replace".)

The result: $(a+\Delta)^n = a^n + na^{n-1}\Delta + \frac{n(n-1)}{2!}a^{n-2}\Delta^2 + \cdots + \Delta^n$

Of course, if you wanted to replace all of the x's to the end of the document with Δ, you would just say "replace all" to start with.

To exit this document, SAY, "**close file**".

For a video demonstration, see the CD video demo.

TUTORIAL SEARCH (c)

TO VIEW A TUTORIAL TOPIC ON:	YOU SAY
(listed in order of appearance in the Tutorial)	
Helpful Definitions	helpful definitions
MathTalk For Pre-Algebra	prealgebra mathtalk
MathTalk For Algebra	mathtalk algebra
MathTalk For Trig	mathtalk trig
MathTalk For Calculus	mathtalk calculus
MathTalk For Statistics	mathtalk statistics
Rules For Voicing Commands	command rules
Improve Your Recognition	improve recognition
Rules For Correcting	correction rules
Rules For Correcting Video	correction techniques
Editing Commands	editing commands
Using The International Alphabet	using international alphabet
Using The Greek Alphabet	greek alphabet
Types Of Math Commands	math command types
Voicing Text	voice text
Alt + letter commands	letter keystroke commands
Mouse Grid	grid tutorial
Align Text	align text
Next Line and Enter Key Commands	next line command
Move Out Command	move out command
Type Face Commands	type face commands
Math Entry Commands - several pages long	math entry examples
(Commands are also detailed in Pictionary)	pictionary search
One Line Equations By Voice	example one
Type Commands	example two
Display Equation	example three

LIST OF SENTENCE COMMANDS (c)

ALPHABET

<Alphabet> derivative
Example: Say "mike derivative". Get $\frac{d^m y}{dx^m}$

ANGLE

angle <Greek Letter>
Example: Say "angle theta". Get $\angle^{\theta}$
angle <Greek Letter> with arc
Example: Say "angle beta with arc". Get $\measuredangle^{\beta}$
angle <Letter>
angle <Letter> with arc
Example: Say "angle x-ray with arc". Get $\measuredangle^{x}$

BOLD

bold <Cap Letter>
Example: Say "bold cap november". Get **N**
bold <Greek Letter>
bold <Letter>

CAP

<Cap Letter>
Example: Say "cap hotel". Get H

D

delta <Greek Letter>
Example: Say "delta lambda". Get $d\lambda$
delta <Letter>
delta <Letter> delta <Greek Letter>
Example: Say "delta yankee delta theta". Get $\frac{dy}{d\theta}$
delta <Letter> delta <Letter>
Example: Say "delta yankee delta x-ray". Get $\frac{dy}{dx}$

DELETE

delete next <Number 2 to 10> characters
delete previous <Number 2 to 10> characters

DELTA

delta <Letter>
Example: Say "delta x-ray". Get Δx

DERIVATIVE

derivative with respect to <Greek Letter>
derivative with respect to <Letter>

Example: Say "derivative with respect to romeo. Get $\frac{d}{dr}$

<HOrdDeriv>

<HOrdDeriv> of <Letter> with respect to <Greek Letter>

Example: Say "fourth derivative of romeo with respect to theta". Get $\frac{d^4r}{d\theta^4}$

<HOrdDeriv> of <Letter> with respect to <Letter>

Example: Say "second derivative of cap golf with respect to tango". Get $\frac{d^2G}{dt^2}$

EXPONENT

exponent <Greek Letter>

exponent <Letter>

exponent <Minus Letter>

Example: Say "echo", "exponent minus x-ray". Get e^{-x}

exponent <Minus Numbers>

exponent <Numbers>

exponent <Number/1 to 99> <Greek Letter>

exponent <Number/1 to 99> <Letter>

FUNCTION

function <Letter>

Example: Say "function foxtrot" (or function foxtrot). Get $f(\square)$.

Then say "x-ray square", "move out". Get $f(x^2)$

GREEK LETTER

<Greek Letter>

<Greek Letter> <Decor>

Example: Say "theta hat". Get $\widehat{\theta}$

<Greek Letter> <Primes>

<Greek Letter> <SqCube>

Example: Say "fee cube". Get. ϕ^3

<Greek Letter> goes to <Numbers>

Example: Say "sigma goes to 5". Get $\sigma \rightarrow 5$

<Greek Letter> over <Greek Letter>

LETTER

<Letter>

<Letter> <Decor>

Example: Say "yankee tilde". Get $\tilde{y}$

<Letter> <Letter>

<Letter> <Primes>

<Letter> <SqCube>

Example: Say "yankee cube". Get y^3

<Letter> factorial

Example: Say "mike factorial". Get $m!$

<Letter> goes to <Letter>

<Letter> goes to <Numbers>

Example: Say "x-ray goes to zero". Get $x \rightarrow 0$

<Letter> minus <DigitsOnly> factorial

Example: Say "november minus 5 factorial". Get $(n-5)!$

<Letter> minus <Letter> factorial
<Letter> over <DigitsOnly>
<Letter> over <Greek Letter>
<Letter> over <Letter>

Example: Say "alpha over bravo". Get $\frac{a}{b}$

<Letter> over <Number1 to 99>
<Letter> plus <DigitsOnly> factorial
<Letter> plus <Letter> factorial
<Letter> plus delta <Letter>

Example: Say "victor plus delta victor". Get $v + \Delta v$

<Letter> square minus <Letter> square
<Letter> square plus <Letter> square

LIMIT

limit as <Greek Letter> goes to <Numbers>

Example: Say "limit as beta goes to 1". Get $\lim_{\beta \to 1}$

limit as <Letter> goes to <Letter>
limit as <Letter> goes to <Numbers>

Example: Say "limit as hotel goes to zero". Get $\lim_{h \to 0}$

limit as delta <Greek Letter> goes to zero
limit as delta <Letter> goes to zero

LIMITS

limits <Greek Letter> to <Greek Letter>
limits <Greek Letter> to <Letter>
limits <Greek Letter> to <Numbers>
limits <Letter> to <Greek Letter>

Example: Say "integral with limits", "limits alpha to 2 pi". Get $\int_{d}^{2\pi}$

limits <Letter> to <Letter>
limits <Letter> to <Numbers>
limits <Minus Letter> to <Greek Letter>

Example: Say "integral with limits", "limits minus 5 to lambda". Get $\int_{-5}^{l}$

limits <Minus Letter> to <Letter>
limits <Minus Letter> to <Minus Numbers>
limits <Minus Letter> to <Numbers>
limits <Minus Numbers> to <Letter>
limits <Minus Numbers> to <Minus Letter>
limits <Minus Numbers> to <Minus Numbers>
limits <Minus Numbers> to <Numbers>

Example: Say "vertical bar with limits", "limits minus 5 to 5". Get $|_{-5}^{5}$

limits <Numbers> to <Greek Letter>
limits <Numbers> to <Letter>
limits <Numbers> to <Numbers>

LOG

log base 10 <Greek Letter>
Example: Say "log base 10 beta". Get $\log\beta$
log base 10 <Letter>
Example: Say "log base 10 alpha". Get $\log a$

MINUS

<Minus Greek Letter>
Example: Say "minus theta". Get $-\theta$
<Minus Letter>
Example: Say "minus alpha". Get $-a$
<Minus Numbers>
Example: Say "minus 3". Get -3

MIXED PARTIAL

mixed partial of <Letter> with respect to <Greek Letter> and <Greek Letter>
mixed partial of <Letter> with respect to <Letter> and <Greek Letter>
mixed partial of <Letter> with respect to <Letter> and <Letter>
Example: Say "mixed partial of foxtrot with respect to x-ray and yankee".
Get $\frac{\partial^2 f}{\partial x \partial y}$

NATURAL LOG

natural log <Greek Letter>
Example: Say "natural log lambda". Get $\ln\lambda$
natural log <Letter>

NUMBER

<Number/1 to 9> by <Number/1 to 9> bracket matrix
Example: Say "2 by 2 bracket matrix". Get $\begin{bmatrix} \square & \square \\ \square & \square \end{bmatrix}$
<Number/1 to 9> by <Number/1 to 9> determinant
<Number/1 to 9> by <Number/1 to 9> matrix
<Number/1 to 99>
<Number/1 to 99> <Greek Letter>
<Number/1 to 99> <Letter>
<Number/1 to 99> over <Greek Letter>
<Number/1 to 99> over <Letter>
Example: Say "4 over alpha". Get $\frac{4}{a}$
<Number/1 to 99> over <Number/1 to 99>
<Number/1 to 99> spaces
<Numbers>

PARENTHESES

parentheses <Greek Letter>
Example: Say "parentheses theta". Get (θ)

parentheses <Greek Letter> <Greek Letter>
parentheses <Greek Letter> <Letter>
parentheses <Letter>
parentheses <Letter> <Greek Letter>
parentheses <Letter> <Letter>
Example: Say "parentheses x-ray yankee". Get (x,y)
parentheses <Letter> plus <Letter>
parentheses <Letter> plus delta <Letter>
parentheses <Minus Letter>
parentheses <Minus Numbers>
parentheses <Minus Numbers> <Minus Numbers>
parentheses <Minus Numbers> <Numbers>
Example: Say "parentheses minus one one". Get $(-1,1)$
parentheses <Numbers>
parentheses <Numbers> <Minus Numbers>
parentheses <Numbers> <Numbers>

PARTIAL

partial of <Letter> with respect to <Greek Letter>
Example: Say "partial of romeo with respect to theta". Get $\frac{\partial r}{\partial \theta}$
partial of <Letter> with respect to <Letter>
Example: Say "partial of cap lima with respect to sierra". Get $\frac{\partial L}{\partial s}$
partial with respect to <Greek Letter>
Example: Say "partial with respect to omega". Get $\frac{\partial}{\partial \omega}$
partial with respect to <Letter>
Example: Say "partial with respect to x-ray". Get $\frac{\partial}{\partial x}$

PLUS

<Plus Greek Letter>
Example: Say "plus cap greek x-ray". Get $+\Xi$
Example: Say "plus omega". Get $+\omega$
<Plus Letter>
Example: Say "plus alpha". Get $+a$
Example: Say "plus cap hotel". Get $+H$
<Plus Numbers>
Example: Say "plus 6". Get +6

ROOT

<Root> root of <Greek Letter>
Example: Say "fourth root of beta". Get $\sqrt[4]{\beta}$
<Root> root of <Letter>
Example: Say "fifth root of november". Get $\sqrt[5]{n}$
<Root> root of <Numbers>
Example: Say "square root of 2". Get $\sqrt{2}$

SECOND PARTIAL

second partial of <Letter> with respect to <Greek Letter>

Example: Say "second partial of hotel with respect to beta". Get $\frac{\partial^2 h}{\partial \beta^2}$

second partial of <Letter> with respect to <Letter>

Example: Say "second partial of yankee with respect to whiskey". Get $\frac{\partial^2 y}{\partial w^2}$

SQUARE ROOT

Square Root of <Greek Letter>

Example: Say "square root of fee". Get $\sqrt{\phi}$

Square Root of <Letter>

Square Root of <Numbers>

Example: Say "square root of 10". Get $\sqrt{10}$

SUB

sub <DigitsOnly>

sub <DigitsOnly> <DigitsOnly>

Example: Say "lambda", "sub one two". Get λ_{12}

sub <Letter>

Example: Say "sigma", "sub x-ray". Get σ_x

sub <Letter> <Letter>

Example: Say "cap whiskey", "sub x-ray yankee". Get W_{xy}

sub <Letter> minus <DigitsOnly>

sub <Letter> plus <DigitsOnly>

TRIG

<Trig>

Example: Say "cosine". Get cos

<Trig> <Argument>

Example: Say "tangent squared omega". Get $\tan^2 \omega$

<Trig> <NumArg>

Example: Say "inverse sine theta". Get $\sin^{-1} \theta$

VARIABLE LISTS

*Say "**sample commands**" to view sample list of variables used with variables.

ARGUMENT LIST

ALPHABET LIST USE International Alphabet

a alpha	j juliette	s sierra
b bravo	k kilo	t tango
c charlie	l lima	u uniform
d delta	m mike	v victor
e echo	n november	w whiskey
f foxtrot	o oscar	x x ray
g golf	p papa	y yankee
h hotel	q quebec	z zulu
i india	r romeo	

CAP ALPHABET LETTER LIST

* Add 'cap' to the International Alphabet letter in the above list.

LETTER LIST

Is composed of the above two lists:
ALPHABET LIST and CAP LETTER LIST.

GREEK LETTER LIST

cap chi	Ψ	fee	ϕ	lambda	λ
cap fee	Φ	gamma	γ	mu	μ
cap gamma	Γ	greek alpha	α	omega	ω
cap greek delta	Δ	beta	β	pi	π
cap greek x	Ξ	greek delta	δ	rho	ρ
cap omega	Ω	greek eta	η	sigh	ψ
cap pi	Π	greek november	ν	sigma	σ
cap sigh	Ψ	greek x-ray	ξ	tau	τ
cap sigma	Σ	greek x	ξ	theta	θ
cap theta	Θ	greek z	ζ	upsilon	υ
cap upsilon	ϒ	greek zulu	ζ		
chi	χ	iota	ι		
epsilon	ε	kappa	κ		

PLUS LETTER LIST (**For caps of any listed, say** "plus cap ...".

plus alpha	plus romeo	plus greek november
plus bravo	plus sierra	plus greek x-ray
plus charlie	plus tango	plus greek zulu
plus delta	plus uniform	plus iota
plus echo	plus victor	plus kappa
plus foxtrot	plus whiskey	plus lambda
plus golf	plus x-ray	plus mu
plus hotel	plus yankee	plus omega
plus india	plus zulu	plus pi
plus juliette		plus rho
plus kilo	plus chi	plus sigh
plus lima	plus epsilon	plus sigma
plus mike	plus fee	plus tau
plus november	plus gamma	plus theta
plus oscar	plus greek alpha	plus upsilon
plus papa	plus beta	
plus quebec	plus greek delta	

MINUS LETTER LIST

Use above list and substitute "**MINUS**" for "plus" in previous list.
(**For caps of any listed**, **say** "minus cap ...".

NUMBERS LIST

1 fifth	3 fourths	pi over 3
1 fourth	3 pi over 2	pi over 4
1 half	3 pi over 4	pi over 6
1 sixth	5 pi over 6	pi
1 space	5 sixths	0 (zero) thru 20
1 third	infinity	
2 pi	minus infinity	
2 thirds	pi over 2	

MINUS NUMBERS LIST

minus 1	minus 7	minus 1 sixth	minus infinity
minus 2	minus 8	minus 1 third	minus pi over 2
minus 3	minus 9	minus 2 pi	minus pi over 3
minus 4	minus 1 fifth	minus 3 pi over 2	minus pi over 4
minus 5	minus 1 fourth	minus 3 pi over 4	minus pi over 6
minus 6	minus 1 half	minus 5 pi over 6	minus pi

PLUS NUMBERS LIST

plus 1	plus 7	plus 1 sixth	plus infinity
plus 2	plus 8	plus 1 third	plus pi over 2
plus 3	plus 9	plus 2 pi	plus pi over 3
plus 4	plus 1 fifth	plus 3 pi over 2	plus pi over 4
plus 5	plus 1 fourth	plus 3 pi over 4	plus pi over 6
plus 6	plus 1 half	plus 5 pi over 6	plus pi

DECORATION LIST

bar

hat

tilde

DIGIT LIST

+ [plus]	1	6
- [minus]	2	7
-[negative]	3	8
. [point]	4	9
0 [zero] through 9	5	

HOrdDERIV LIST

second derivative
third derivative
fourth derivative
fifth derivative
sixth derivative
seventh derivative
eighth derivative
ninth derivative

ROOT LIST	SQCUBE LIST	PRIME LIST
cube		
fourth	cube	
fifth	cubed	double prime
sixth	square	prime
seventh	squared	triple prime
eighth		
ninth		

TRIG LIST

arc cosine
arc cotan
arc cotangent
arc secant
arc sine
arc tan
arc tangent
cosecant square
cosecant squared
cosecant
cosine square
cosine squared
cosine
cosine theta
cotan squared
cotan
cotangent squared
cotangent
hyperbolic cosine squared
hyperbolic cosine
hyperbolic cotangent squared
hyperbolic cotangent
hyperbolic sine squared
hyperbolic sine
hyperbolic tangent squared
hyperbolic tangent
inverse cosine
inverse cotan
inverse cotangent
inverse sine
inverse tangent
secant squared
secant
sine square
sine squared
sine
tan squared
tangent squared
tangent

NUMARG LIST

pi
2 pi
3 pi
4 pi
5 pi
6 pi
7 pi
8 pi
9 pi
3 pi over 2
3 pi over 4
5 pi over 6
pi over 2
pi over 3
pi over 4
pi over 6
numbers (zero) thru 20

"**TYPE**" **short word/phrases commands** (c)

You say:	**You get**:	**You say**:	**You get**:
type and	and	type is	is
type as	as	type odd	odd
type but	but	type on	on
type cap but	But	type or	or
type cap example	Example	type otherwise	otherwise
type cap hence	Hence	type since	since
type cap if	If	type then	then
type cap let	Let	type thus	thus
type cap let x equal	Let X equal	type to	to
type cap now	Now	type variance	Var
type cap so	So	type when	when
type cap then	Then	type whenever	whenever
type cap theorem	Theorem	type where	where
type cap therefore	Therefore		
type cap thus	Thus		
type covariance	Cov		
type even	even		
type for all	for all		
type for every	for every		
type for	for		
type Hence	Hence		
type if and only if	if and only if		
type if	if		
type in	in		

TRIG COMMANDS (c)

SAY	GET	SAY	GET
arc cosine	$\arccos$	hyperbolic cotangent	$\coth$
arc cotan	arccot	hyperbolic sine squared	$\sinh^2$
arc cotangent	arccot	hyperbolic sine	$\sinh$
arc secant	arcsec	hyperbolic tangent squared	$\tanh^2$
arc sine	$\arcsin$	hyperbolic tangent	$\tanh$
arc tan	$\arctan$	inverse cosine	$\cos^{-1}$
arc tangent	$\arctan$	inverse cotan	$\cot^{-1}$
cosecant squared	$\csc^2$	inverse cotangent	$\cot^{-1}$
cosecant square	$\csc^2$	inverse sine	$\sin^{-1}$
cosecant	$\csc$	inverse cotangent	$\cot^{-1}$
cosine square	$\cos^2$	secant squared	$\sec^2$
cosine squared	$\cos^2$	secant	$\sec$
cosine	$\cos$	sine squared	$\sin^2$
cotan squared	$\cot^2$	sine square	$\sin^2$
cotan	$\cot$	sine	$\sin$
cotangent squared	$\cot^2$	tan squared	$\tan^2$
cotangent	$\cot$	tangent squared	$\tan^2$
hyperbolic cosine squared	$\cosh^2$	tangent	$\tan$
hyperbolic cosine	$\cosh$		
hyperbolic cotangent squared	$\coth^2$		

STATISTIC COMMANDS FOR NATURALLYSPEAKING (c)

# Denotes you **MUST** use the International Alphabet for letter(s).

YOU SAY	YOU GET
binomial mean	$\mu = n \cdot \theta$
binomial probability	$P[X = k] = \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$
binomial standard deviation	$\sigma = \sqrt{n \cdot \theta(1-\theta)}$
binomial sum	$P[a \le X \le b \mid n, \theta] = \sum_{k=a}^{b} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$
chi square critical value	$\frac{1}{2^{\frac{\nu}{2}}\Gamma(\frac{\nu}{2})} \int_a^\infty t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$
chi square probability	$P[a \le X \le b] = \frac{1}{2^{\frac{\nu}{2}}\Gamma(\frac{\nu}{2})} \int_a^b t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$
degrees of freedom	ν
denominator degrees of freedom	ν_2
# f critical value	$\frac{\Gamma(\frac{\nu_1+\nu_2}{2})}{\Gamma(\frac{\nu_1}{2})\Gamma(\frac{\nu_2}{2})} (\frac{\nu_1}{\nu_2})^{\frac{\nu_1}{2}} \int_a^\infty \frac{t^{\frac{(\nu_1-2)}{2}}}{(1+(\frac{\nu_1}{\nu_2})t)^{\frac{(\nu_1+\nu_2)}{2}}} dt =$
# f p value	p value = $P[F \ge a \mid \nu_1, \nu_2] = \frac{\Gamma(\frac{\nu_1+\nu_2}{2})}{\Gamma(\frac{\nu_1}{2})\Gamma(\frac{\nu_2}{2})} (\frac{\nu_1}{\nu_2})^{\frac{\nu_1}{2}} \int_a^\infty \frac{t^{\frac{(\nu_1-2)}{2}}}{(1+(\frac{\nu_1}{\nu_2})t)^{\frac{(\nu_1+\nu_2)}{2}}} dt$
# f probability	$P[a \le F \le b \mid \nu_1, \nu_2] = \frac{\Gamma(\frac{\nu_1+\nu_2}{2})}{\Gamma(\frac{\nu_1}{2})\Gamma(\frac{\nu_2}{2})} (\frac{\nu_1}{\nu_2})^{\frac{\nu_1}{2}} \int_a^b \frac{t^{\frac{(\nu_1-2)}{2}}}{(1+(\frac{\nu_1}{\nu_2})t)^{\frac{(\nu_1+\nu_2)}{2}}} dt$
greek nu sub one	ν_1
greek nu sub two	ν_2
mu	μ
normal confidence interval for mu	$CI = \left(m - z\frac{\sigma}{\sqrt{n}}, m + z\frac{\sigma}{\sqrt{n}}\right)$
normal confidence interval for the mean	$CI = \left(m - z\frac{\sigma}{\sqrt{n}}, m + z\frac{\sigma}{\sqrt{n}}\right)$
# normal p value	p value = $\frac{1}{\sqrt{2\pi}} \int_{\lvert z \rvert}^\infty e^{-\frac{1}{2}t^2} dt$
normal probability	$P[a \le X \le b \mid \mu, \sigma] = \frac{1}{\sqrt{2\pi}\sigma} \int_a^b \exp\{-\frac{1}{2 \cdot \sigma^2}(t-\mu)^2\} dt$
normal critical value	$\frac{1}{\sqrt{2\pi}\sigma} \int_a^\infty \exp\{-\frac{1}{2 \cdot \sigma^2}(t-\mu)^2\} dt$
numerator degrees of freedom	ν_1

probability binomial equal or greater than alpha $P[X \geq a|n,\theta] = \sum_{k=a}^{n} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$

probability binomial equal or less than alpha $P[X \leq a|n,\theta] = \sum_{k=0}^{a} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$

probability binomial equals alpha $P[X = a|\theta,n] = \frac{n!}{a!(n-a)!} \cdot \theta^a (1-\theta)^{n-a}$

probability binomial equals zero $P[X = 0] = (1-\theta)^n$

probability binomial greater than or equal to alpha $P[X \geq a|n,\theta] = \sum_{k=a}^{n} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$

probability binomial greater than zero $P[X > 0] = 1 - (1-\theta)^n$

probability binomial less than or equal to alpha $P[X \leq a|n,\theta] = \sum_{k=0}^{a} \frac{n!}{k!(n-k)!} \cdot \theta^k (1-\theta)^{n-k}$

probability chi square equal or greater than alpha $P[X \geq a] = \frac{1}{2^{\frac{\nu}{2}}\Gamma\left(\frac{\nu}{2}\right)} \int_a^{\infty} t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$

probability chi square equal or less than alpha $P[X \leq a] = \frac{1}{2^{\frac{\nu}{2}}\Gamma\left(\frac{\nu}{2}\right)} \int_0^{a} t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$

probability chi square greater than or equal to alpha $P[X \geq a] = \frac{1}{2^{\frac{\nu}{2}}\Gamma\left(\frac{\nu}{2}\right)} \int_a^{\infty} t^{\frac{\nu}{2}-1} e^{-\frac{t}{2}} dt$

probability chi square less than

or equal to alpha $P[X \le a] = \frac{1}{2^{\frac{v}{2}}\Gamma(\frac{v}{2})}\int_0^a t^{\frac{v}{2}-1}e^{-\frac{t}{2}}dt$

probability f equal or greater

than alpha $P[F \ge a|v_1, v_2] = \frac{\Gamma(\frac{v_1+v_2}{2})}{\Gamma(\frac{v_1}{2})\Gamma(\frac{v_2}{2})}(\frac{v_1}{v_2})^{\frac{v_1}{2}}\int_a^\infty \frac{t^{\frac{(v_1-2)}{2}}}{(1+(\frac{v_1}{v_2})t)^{\frac{(v_1+v_2)}{2}}}dt$

probability f equal or less

than alpha $P[F \le a|v_1, v_2] = \frac{\Gamma(\frac{v_1+v_2}{2})}{\Gamma(\frac{v_1}{2})\Gamma(\frac{v_2}{2})}(\frac{v_1}{v_2})^{\frac{v_1}{2}}\int_0^a \frac{t^{\frac{(v_1-2)}{2}}}{(1+(\frac{v_1}{v_2})t)^{\frac{(v_1+v_2)}{2}}}dt$

probability f greater than or

equal to alpha $P[F \ge a|v_1, v_2] = \frac{\Gamma(\frac{v_1+v_2}{2})}{\Gamma(\frac{v_1}{2})\Gamma(\frac{v_2}{2})}(\frac{v_1}{v_2})^{\frac{v_1}{2}}\int_a^\infty \frac{t^{\frac{(v_1-2)}{2}}}{(1+(\frac{v_1}{v_2})t)^{\frac{(v_1+v_2)}{2}}}dt$

probability f less than or

equal to alpha $P[F \le a|v_1, v_2] = \frac{\Gamma(\frac{v_1+v_2}{2})}{\Gamma(\frac{v_1}{2})\Gamma(\frac{v_2}{2})}(\frac{v_1}{v_2})^{\frac{v_1}{2}}\int_0^a \frac{t^{\frac{(v_1-2)}{2}}}{(1+(\frac{v_1}{v_2})t)^{\frac{(v_1+v_2)}{2}}}dt$

probability normal equal or greater

than alpha $P[X \ge a|\mu, \sigma] = \frac{1}{\sqrt{2\pi}\sigma}\int_a^\infty \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\}dt$

probability normal equal or less

than alpha $P[X \le a|\mu, \sigma] = \frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^a \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\}dt$

probability normal greater than or

equal to alpha $P[X \ge a|\mu, \sigma] = \frac{1}{\sqrt{2\pi}\sigma}\int_a^\infty \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\}dt$

probability normal less than or

equal to alpha $P[X \le a|\mu, \sigma] = \frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^a \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\}dt$

probability t equal or greater

than alpha $P[T \ge a] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\Gamma(\frac{v}{2})}\int_a^\infty \left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du$

probability t equal or less than

alpha $P[T \le a] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\Gamma(\frac{v}{2})}\int_{-\infty}^a \left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du$

probability t greater than or

equal to alpha $P[T \ge a] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\Gamma(\frac{v}{2})}\int_a^\infty \left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du$

probability t less than or equal

to alpha $P[T \le a] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\Gamma(\frac{v}{2})}\int_{-\infty}^a \left(1+\frac{u^2}{v}\right)^{-\frac{v+1}{2}}du$

probability uniform equal or greater than alpha $P[X \geq a] = \frac{(d)-(a)}{(d)-(c)}$

probability uniform equal or less than alpha $P[X \leq a] = \frac{(a)-(c)}{(d)-(c)}$

probability uniform greater than or equal to alpha $P[X \geq a] = \frac{(d)-(a)}{(d)-(c)}$

probability uniform less than or equal to alpha $P[X \leq a] = \frac{(a)-(c)}{(d)-(c)}$

probability z equal or greater than alpha $P[Z \geq a] = \frac{1}{\sqrt{2\pi}} \int_a^{\infty} e^{-\frac{1}{2}t^2} dt$

probability z equal or less than alpha $P[Z \leq a] = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{a} e^{-\frac{1}{2}t^2} dt$

probability z greater than or equal to alpha $P[Z \geq a] = \frac{1}{\sqrt{2\pi}} \int_a^{\infty} e^{-\frac{1}{2}t^2} dt$

probability z less than or equal to alpha $P[Z \leq a] = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{a} e^{-\frac{1}{2}t^2} dt$

review standard deviation of x bar Sigma X bar= $\frac{\sigma_x}{\sqrt{n}}$

review t statistic $t = \frac{(m-\mu)\sqrt{n}}{s}$, where $m = \overline{x}$.

review z statistic $z = \frac{(m-\mu)\sqrt{n}}{\sigma}$, where $m = \overline{x}$.

sierra squared s^2

standard normal probability $P[a \leq Z \leq b] = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{1}{2}t^2} dt$

t confidence interval for mu $CI = \left(m - t\frac{s}{\sqrt{n}}, m + t\frac{s}{\sqrt{n}}\right)$

t confidence interval for the mean $CI = \left(m - t\frac{s}{\sqrt{n}}, m + t\frac{s}{\sqrt{n}}\right)$

t critical value $\frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})} \int_t^{\infty} \left(1 + \frac{u^2}{v}\right)^{-\frac{v+1}{2}} du$

t p value p value = $P[T \geq a] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})} \int_a^{\infty} \left(1 + \frac{u^2}{v}\right)^{-\frac{v+1}{2}} du$

t probability $P[a \leq X \leq b] = \frac{\Gamma(\frac{v+1}{2})}{\sqrt{v\pi}\,\Gamma(\frac{v}{2})} \int_a^b \left(1 + \frac{t^2}{v}\right)^{-\frac{v+1}{2}} dt$

t statistic $t = \frac{(m-\mu)\sqrt{n}}{s}$

uniform probability $P[a \leq X \leq b | c, d] = \frac{(b)-(a)}{(d)-(c)}$

what's the mean of a binomial $\mu = n \cdot \theta$

what's the standard deviation of a binomial $\sigma = \sqrt{n \cdot \theta(1-\theta)}$

x bar $\overline{x}$

z critical value $\frac{1}{\sqrt{2\pi}} \int_z^{\infty} e^{-\frac{1}{2}t^2} dt$

New Commands for ScientificNotebook 5.5

File Menu
import non-ScientificNotebook LaTex

Compute Menu, Combine
combine arctan
combine hyperbolic trig functions

Compute Menu, Rewrite
rewrite sin
rewrite cos
rewrite cosine
rewrite arcsin
rewrite arc cos
rewrite arc cosine
rewrite arc tan
rewrite arc cot
rewrite arc cotan

Compute Menu, Calculus
plot approximate integral animated

Compute Menu, Plot 3d
plot 3 delta implicit

Compute Menu, Plot 2D Animated
plot 2 delta rectangular animated
plot 2 delta polar animated
plot 2 delta implicit animated
plot 2 delta parametric animated
plot 2 delta conformal animated
plot 2 delta vector field animated

Compute Menu, Plot 3D Animated
plot 3 delta rectangular animated
plot 3 delta cylindrical animated
plot 3 delta spherical animated
plot 3 delta implicit animated
plot 3 delta tube animated
plot 3 delta gradient animated
plot 3 delta vector field animated

Accessing the MathTalk manual WITH voice commands

The MathTalk manual is divided into 3 parts: Tutorial, Help Documents, Pictionary.

Say **"mathtalk learning module"** for voice commands that access MathTalk.
* The MathTalk Demo CD shows features of MathTalk.
* To move up/down within all documents, say "page up", "page down", "move down 1", "move down 4", "move down 10", "move up 1", "move up 4", "move up 10", etc.

MathTalk Tutorial:
Say **"helpful definitions"** to open the Tutorial portion of the manual at this heading (which is 5 paragraphs down from the top of the document). Say **"top of document"** to move to the beginning of the Tutorial.
Say **"tutorial search"** for a list of voice commands that access Topics in the Table of Contents.

MathTalk Pictionary:
The Pictionary is a list of 'stand alone' MathTalk commands (i.e. commands without variables).
Say **"pictionary search"** for a list of voice commands accessing the Pictionary.
Say **"go to 1 commands"** to open the Pictionary at the beginning.

Help Documents:
Some of the previous information is listed in this portion of the manual.
Additionally, find:
1. *Replace Letter or Symbol* – say **"replace help"**; there find '**replace example**' for text help and see Demo CD for '**replace video**'.
2. *List of Sentence Commands* - say **"sentence command examples", "variable menu"** for variable lists, and **"sample commands"** (one of the Quick Reference laminates included in MathTalk).
3. *Type Commands List* - say **"go to type commands"** for a list of entering 1-2 words of Text.
4. *Trig Commands* – say **"trig list"**.
5. *Statistics Commands* – say **"statistics commands"**. In this menu you will find **"available statistics commands"** and **"statistics tutorial"**. **"Statistical overview"** will open the Tutorial to the Statistics topic.
6. *Trouble Shooting in MathTalk* – say **"trouble shooting"**.
7. *Technical Support* – say **"technical support"**.

* To access the International Alphabet, say **"international alphabet"** (second Quick Reference laminate included in MathTalk).
To reference this topic in the Tutorial, say **"using international alphabet"**. Then say **"page down"** to view both the International Alphabet and Greek Alphabet.

TROUBLE SHOOTING IN MATHTALK (c)

1. Command doesn't respond?
   A. Has MathTalk been activated? If it has, you will see the MathTalk icon in the tray at the bottom of the screen.
      See Load Instructions.
   B. Make sure the ScientificNotebook window is activated. You may do this with a ButtonClick or by saying "**button click**". Be sure that the cursor is **not** on the microphone symbol when saying "button click"!
   C. When turning on NaturallySpeaking, generally the first command takes somewhat longer to execute.
   D. On rare occasions, Dragon Naturally Speaking may cease to recognize commands. If this happens, close and reopen Scientific Notebook.
   E. If Dragon Naturally Speaking does not recognize a command, you will see a red ! in front of the mode indicator. You must wait until the red ! disappears to voice a command.

2. Is your computer running slowly? When operating MathTalk, close DragonPad, and have nothing running except a) the DragonBar and b) MathTalk with ScientificNotebook. * Check recommended RAM for your Dragon version.

3. Recognition not optimum?
   A. Is the Dragon Bar "*red* " when you speak in your normal voice? The Dragon Bar should be "green" when you speak in your normal voice. Try moving the microphone further from your mouth.
   B. Commands are misunderstood?
      1) Speak the MathTalk command and wait for it to execute before continuing.
      2) Be sure to speak distinctly and enunciate each and every syllable of each and every word.
      3) Review "Rules for Correcting" – see Table of Contents, Tutorial.

4. If text is typed in "red", not "black", say "**text mode**" before entering text.

5. Check tech notes on web site www.mathtalk.com

TECHNICAL SUPPORT

Technical Support can be obtained as follows:

1. Technical support is available via E-Mail at mathtalk@mathtalk.com or via fax at 817.719.9207.
Please send a written description of the request.

2. The majority of past requests for technical support have been the result of not following instructions, particularly the MathTalk Install Instructions.

Please read the instructions and complete the recommended training before requesting tech support.

3. For updates and helpful information, check "Tech Notes" on our website www.mathtalk.com .

PICTIONARY

MATHTALK PICTIONARY

# Indicates MUST use International Alphabet for letter(s)

You say:	You get:
1 over 2 pi	$\frac{1}{2\pi}$
1 over pi	$\frac{1}{\pi}$
1 over square root of 2 pi	$\frac{1}{\sqrt{2\pi}}$
100 percent	Changes screen size to 100%.
150 percent	Changes screen size to 150%.
2 by 2 system	Sets up 2 by 2 linear system.
# 2 d graph menu	Opens 2 d graph menu.
# 2 d plot menu	Opens 2 d plot menu.
# 2 d plot	Executes 2 d plot command.
# 2 d rectangular plot	Executes 2 d rectangular plot command.
# 2 d rectangular	Executes 2 d rectangular command.
# 2 d wave equation	$\frac{\partial^2 u}{\partial t^2} - c^2\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right] = 0$
2 element column vector	$\begin{pmatrix} \square \\ \square \end{pmatrix}$
2 element row vector	$\begin{pmatrix} \square & \square \end{pmatrix}$
# 2 i's paren	$ii)$
2 lines	Enters two blank lines.
2 pi over 3	$\frac{2\pi}{3}$
2 tabs	Moves cursor two tab keys.
200 percent	Changes screen size to 200%.
3 by 3 system	Sets up 3 by 3 linear system.
# 3 d graph menu	Opens 3 d graph menu.
# 3 d graph	Executes 3 d graph.
# 3 d heat equation	$\frac{\partial u}{\partial t} - k\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right] = 0$
# 3 d plot menu	Opens 3 d plot menu.
# 3 d plot	Executes 3 d plot command.

# 3 d rectangular plot	Executes 3 d rectangular plot command.
# 3 d wave equation	$\frac{\partial^2 u}{\partial t^2} - c^2\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right] = 0$
3 element column vector	$\begin{pmatrix} \square \\ \square \\ \square \end{pmatrix}$
3 element row vector	$\begin{pmatrix} \square & \square & \square \end{pmatrix}$
3 halves	$\frac{3}{2}$
# 3 i's parens	$iii)$
3 lines	Enters three blank lines.
3 tabs	Moves cursor 3 tab keys.
300 percent	Changes screen size to 300 %.
400 percent	Changes screen size to 400 %.
4th power	$\square^4$
4th root	$\sqrt[4]{\square}$
50 percent	Changes screen size to 50 %.
5th power	$\square^5$
5th root	$\sqrt[5]{\square}$
6th power	$\square^6$
6th root	$\sqrt[6]{\square}$
75 percent	Changes screen size to 75%.
7th power	$\square^7$
7th root	$\sqrt[7]{\square}$
85 percent	Changes screen size to 85 %.
8th power	$\square^8$
8th root	$\sqrt[8]{\square}$
9th power	$\square^9$
9th root	$\sqrt[9]{\square}$
# a matrix	$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{pmatrix}$
# a r operator	$1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p$
# a r process	$X_t - \phi_1 X_{t-1} - \phi_2 X_{t-2} - \cdots - \phi_p X_{t-p} = a_t$

about scientific notebook	Information about ScientificNotebook.
absolute value	$\lvert\square\rvert$
acre	acre
add expression	In graphing, say when adding expression. Say “mupad graphs” to view document.
add item	Say in Items Plotted dialog box.
additive union	$\biguplus$
additive union menu	Opens additive union menu.
adjugate	Executes adjugate in Compute Menu.
align center	Aligns center.
align here	Aligns cursor. Use only in display box.
align left	Aligns left.
ampersand	&
angle	$\angle$
angle bar angle	$\langle \vert \rangle$
angle bracket vbar	$\langle\square\vert$
angle brackets	$\langle\square\rangle$
angle with arc	$\measuredangle$
angstrom	Å
apostrophe	′
apply tag	Opens Apply Tag in Tools Menu.
approximately	$\approx$
approximately equal	$\cong$
approximate integral	Brings up choice of numerical routines on approximate integral.
argument	arg
arithmetic progression	$a + (a + d) + (a + 2d) + \cdots + [a + (n - 1)d]$
arrange icons	Choice in Windows Menu.
as	:: Ex. $x : y :: 2 : 3$
asterisk	$*$
average	Finds the average of a given data set.

# b 2 t	$B_2[f(x)]$
# b 2 transform	$\dfrac{\begin{vmatrix} 0 & f(x) & f'(x) \\ f(x) & f'(x) & f''(x) \\ f'(x) & f''(x) & f'''(x) \end{vmatrix}}{\begin{vmatrix} f'(x) & f''(x) \\ f''(x) & f'''(x) \end{vmatrix}}$
# b 3 t	$B_3[f(x)]$
# b 3 transform	$\dfrac{\begin{vmatrix} 0 & f(x) & f^{(1)}(x) & f^{(2)}(x) \\ f(x) & f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) \\ f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) \\ f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) & f^{(5)}(x) \end{vmatrix}}{\begin{vmatrix} f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) \\ f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) \\ f^{(3)}(x) & f^{(4)}(x) & f^{(5)}(x) \end{vmatrix}}$
backspace	Backspaces 1 time.
backspace 2	Backspaces 2 times.
backspace 3	Backspaces 3 times.
backspace 4	Backspaces 4 times.
backspace 5	Backspaces 5 times.
bar	Puts a bar over preceding symbol or letter.
	Ex. say “charlie”, “bar”. Get: $\overline{c}$
beginning of line	Moves cursor to beginning of line.
belongs to	$\in$
bessel function	$\sum_{k=0}^{\infty} \frac{(-1)^k \left(\frac{t}{2}\right)^{n+2k}}{k!\Gamma(n+k+1)}$
# beta a b	$B(a, b)$
beta function	$\int_0^1 x^{a-1}(1-x)^{b-1}dx$
beta hat	$\widehat{\beta}$
big integral with joint scripts	$\int_{\square}^{\square}$
big integral with limits	$\int_{\square}^{\square}$

big integral $\int$

big intersection $\bigcap$

big union $\bigcup$

bigger font Sets font to defined bigger font for text.

binomial Opens choice menu for binomial function.

binomial coefficient n x $\binom{n}{x}$

binomial coefficient $\binom{\square}{\square}$

binomial menu Opens menu of choices for binomial function.

body math Formatting command.

body text Formatting command.

bold off Turns bold off.

bold on Turns bold on.

both double arrows $\Leftrightarrow$

bottom brace $\underbrace{\square}$

bottom label $\underset{\square}{\square}$

bottom labeled both arrows $\underset{\square}{\leftrightarrow}$

braces $\{\square\}$

bracket matrix Opens matrix dialog box.

brackets menu Opens brackets menu.

brackets $[\square]$

bravo 2 tango $B_2[f(x)]$

bravo 2 transform $\dfrac{\begin{vmatrix} 0 & f(x) & f'(x) \\ f(x) & f'(x) & f''(x) \\ f'(x) & f''(x) & f'''(x) \end{vmatrix}}{\begin{vmatrix} f'(x) & f''(x) \\ f''(x) & f'''(x) \end{vmatrix}}$

bravo 3 tango $B_3[f(x)]$

bravo 3 transform $\dfrac{\begin{vmatrix} 0 & f(x) & f^{(1)}(x) & f^{(2)}(x) \\ f(x) & f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) \\ f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) \\ f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) & f^{(5)}(x) \end{vmatrix}}{\begin{vmatrix} f^{(1)}(x) & f^{(2)}(x) & f^{(3)}(x) \\ f^{(2)}(x) & f^{(3)}(x) & f^{(4)}(x) \\ f^{(3)}(x) & f^{(4)}(x) & f^{(5)}(x) \end{vmatrix}}$

bravo square minus
4 alpha charlie $b^2 - 4ac$

break spacing Spacing command.

bullet •

button click Executes “button click”.

c d f $P[X \leq x]$

c dots $\cdots$

calculus iterate Iterate command from Calculus Menu.

calculus menu Opens Calculus Menu.

cap foxtrot of x y and z $F(x,y,z)$

cascade windows Cascade in Windows Menu.

cauchy Executes New Definition in Compute Menu.

ceiling brackets $\lceil \square \rceil$

center dots $\cdots$

center text Centers line and the following lines.

center this Same as “center text” and “align center”.

centered dot •

change digits in display Lets you set number of digits displayed in computations.

change font Opens change font dialogue box.

change matrix form Puts string of symbols in matrix form.

change series order Say to change order of number of terms in infinite series representation of function or in ODE series solution.

change variable In Compute, Calculus Menu.

characteristic polynomial Say with cursor in or immediately following the matrix.

check equality	Checks correctness of an equality.
check spelling	Checks spelling.
chi square	χ^2
circle	○
circle cross	⊗
circle dot	⊙
circle dot menu	Opens dialog box to customize this symbol.
circle menu	Opens Operator Menu.
circle minus	⊖
circle plus	⊕
circle plus menu	Opens dialog box to customize this symbol.
circle slash	⊘
circle times menu	Opens dialog box to customize this symbol.
circle times	⊗
clear definitions	Clears the definition file.
close all	Closes all open files.
close file	Closes file.
close menu	Closes bring down menu.
closed open interval	[□)
collect polynomial	Collects like terms.
collect terms	Simplifies like terms.
colon	:
column basis	Computes column basis.
column matrix	Takes you to matrix dialog box with columns set at 1.
column vector	Same as “column matrix”.
combine exponential	Say with cursor in/immediately following expression.
combine logs	Say with cursor in/immediately following expression.
combine powers	Say with cursor in/immediately following expression.
combine trig functions	Say with cursor in/immediately following expression.
comma	,

companion matrix	Say with cursor in or immediately following the matrix.
composition	◦
computations	Opens Compute Menu.
computations menu	Opens Compute Menu.
compute adjugate	Say with cursor in/immediately following expression.
compute characteristic polynomial	Say with cursor in/immediately following expression.
compute cholesky decomposition	Say with cursor in/immediately following expression.
compute column basis	Say with cursor in/immediately following expression.
compute condition number	Say with cursor in/immediately following expression.
compute correlation	Say with cursor in/immediately following expression.
compute covariance	Say with cursor in/immediately following expression.
compute determinant	Say with cursor in/immediately following expression.
compute eigen values	Say with cursor in/immediately following expression.
compute eigen vectors	Say with cursor in/immediately following expression.
compute fraction free gaussian elimination	Say with cursor in/immediately following expression.
compute Gaussian elimination	Say with cursor in/immediately following expression.
compute hermite normal form	Say with cursor in/immediately following expression.
compute hermitian transpose	Say with cursor in/immediately following expression.
compute Hessian	Say with cursor in/immediately following expression.
compute interpret	Executes Interpret in Compute Menu.
compute inverse	Say with cursor in/immediately following expression.
compute jordan form	Say with cursor in/immediately following expression.
compute menu	Opens Compute Menu.
compute minimum polynomial	Say with cursor in/immediately following expression.
compute norm	Say with cursor in/immediately following expression.
compute rank	Say with cursor in/immediately following expression.
compute row basis	Say with cursor in/immediately following expression.
compute settings	Opens dialog box in Computation Settings.
compute singular value decomposition	Say with cursor in/immediately following expression.

compute singular values	Say with cursor in/immediately following expression.
compute smith normal form	Say with cursor in/immediately following expression.
compute spectral radius	Say with cursor in/immediately following expression.
compute stack matrix	Say with cursor in/immediately following expression.
compute trace	Say with cursor in/immediately following expression.
compute transpose	Say with cursor in/immediately following expression.
computing techniques	Takes you to Help, Computing Techniques.
concantenate	Matrix command. Calculates the concantenate.
condition number	Say with cursor in/immediately following the matrix.
conditional probability	$P[\vert]$
contour integral	$\oint$
contour integral menu	Opens Operator Menu.
contour integral with lower limit	$\oint_{\square}$
contour integral with subscript	$\oint_{\square}$
coproduct	$\coprod$
coproduct menu	Opens menu to customize this symbol.
coproduct with joint scripts	$\coprod_{\square}^{\square}$
coproduct with limits	$\coprod_{\square}^{\square}$
coproduct with lower limit	$\coprod_{\square}$
coproduct with subscript	$\coprod_{\square}$
copy as internal format	Executes Copy As Internal Format in File Menu.
copy this	Copies selected materials.
copy to beginning of line	Copies from cursor to beginning of line. No need to select.
copy to end of line	Copies from cursor to end of line. No need to select.
copy to beginning of line	Copies from cursor to beginning of line. No need to select.
copy to end of line	Copies from cursor to end of line. No need to select.

corresponds to	$\sim$
cross partial	$\frac{\partial^2 f}{\partial y \partial x}$
cross product	$\otimes$
cube root	$\sqrt[3]{\square}$
cubed	$\square^3$
decoration menu	Opens decoration menu.
define equal	Sets the two expressions equal in MuPad.
define menu	Opens Define Menu.
define mupad name	Opens this dialog box.
# define t statistic	$t = \frac{(m-\mu)\sqrt{n}}{s}$, where $m = \overline{x}$.
# define z statistic	$z = \frac{(m-\mu)\sqrt{n}}{\sigma}$, where $m = \overline{x}$.
definite integral	$\int_{\square}^{\square}$
definite sum	$\sum_{\square}^{\square}$
definiteness tests	Opens menu to check definiteness of a Matrix.
definition	Item tag.
definitions menu	Opens Definitions Menu.
degrees	$^\circ$
del squared	∇^2
del	∇
delete	Deleted 1 character to **RIGHT** of cursor OR **SELECTED** characters.
delete break	Deletes page break.
delete key	Deletes 1 character to right of cursor.
delete next character	Deletes 1 character to right of cursor.
delete next 2 -10 characters	Deletes 2-10 characters to right of cursor.
delete previous character	Deletes 1 characters to left of cursor.
delete previous 2-10 characters	Deletes 2-10 characters to left of cursor.
delete rest of line	Deletes from cursor to end of line.
delete that	Deletes selected materials.
delta x-ray	dx
delta yankee	dy

derivative open ended	$\frac{d}{dx}$
determinant	Say with cursor in/immediately following the matrix. Calculates the determinant of matrix.
diagonal dots	$\ddots$
differentiate implicitly	Differentiates implicitly.
display equation	Sets off equation.
distributed as	$\sim$
divide	Same as divide polynomial.
divided by	$\div$
divide polynomial	Divides two polynomials.
document info	Document info in File Menu.
document manager	Opens Document Manager dialog box.
dollar sign	$
double integral	$\iint$
double integral menu	Opens symbol dialog box to customize symbol.
double integral with lower limit	$\iint_{\square}$
double integral with subscript	$\iint_{\square}$
double prime	$''$
double under bar	$\underline{\square}$
double vertical bars	$\|\square\|$
down double arrow	$\Downarrow$
dual simplex	MuPad command to produce dual of a linear system.
# e x p	exp
edit menu	Opens Edit Menu.
eigen values	Say with cursor in or immediately following matrix.
eigen vectors	Say with cursor in or immediately following matrix.
element of	$\in$
emphasized font	Activates that text tag.
empty set	$\emptyset$
end determinant	Moves out of determinant when cursor is at last element.

end display	Moves out of display equation.
end exponent	Ends the exponent.
end fraction	Ends the fraction.
end key	Presses the End Key.
end limits	Moves out of upper or lower limit.
end line segment	Moves out from under line segment indicator.
end matrix	Moves out of matrix.
end of document	Moves to end of document.
end of line	Moves cursor to end of the line.
end ray	Moves out from under line ray indicator.
end subscript	Ends subscript.
end superscript	Ends superscript.
end system	Extend right.
end this	Ends Particular math “box”.
end upper limit	Ends upper limit.
enter data	Sets up column matrix to enter data.
enter key	Presses Enter Key.
equal	=
equal or greater than	≥
equal or less than	≤
equals	=
equivalent	≡
erase 2 lines	Erases line cursor is on and line above.
erase 3 lines	Erases line cursor is on and two lines above.
erase graph	Erases selected graph.
erase line	Erases line the cursor is on.
erase rest of line	Erases part of line to left of cursor.
erase review binomial distribution	Erases same.
erase review uniform distribution	Erases same.
erase to beginning of line	Erases to beginning of line.
escape	Presses Escape Key.
escape key	Presses Escape Key.

evaluate	Cursor must be in/directly to right of math to be evaluated.
evaluate numerically	Same as above.
evaluate this	Same as above.
even	Same as above.
# exact ode	Cursor must be in ODE or directly to right . Gives MuPad solution.
exam builder	Opens Exam builder dialog box.
expand	Expands an algebraic expression.
expanding left brace	$\{\square$
expanding left bracket	$[\square$
expanding left parenthesis	$(\square$
expanding right brace	$\square\}$
expanding right bracket	$\square]$
expanding right parenthesis	$\square)$
expected value	$E[\square]$
expected value of theta hat	$E[\widehat{\theta}]$
exponent	Puts cursor in exponent position on preceding symbol.
exponential	$\exp$
export document as	Opens that dialog box.
export documents as	Opens that dialog box.
export settings	Opens that dialog box.
# foxtrot of x y and z	$f(x,y,z)$
factor	Factors algebraic expressions.
factor this	Factors algebraic expressions.
factorial	!
field menu	Opens Field Menu from Insert Menu.
fifth derivative exponent notation	$f^{(5)}(x)$
file menu	Opens File Menu.

fill matrix	Matrix command. Calculates the fill matrix.
find all solutions	Finds solutions of an equation.
find extrema	Finds minimums & maximums of a function. Cursor needs to be in/directly right of function.
find max	See “find extrema” command.
find min	See “find extrema” command.
find numeric solution	Solves numerically.
find roots	Finds roots of equation.
find solution	Finds all solutions of an equation analytically.
find this	Opens “find” dialog box to search for words, symbols.
find word	Opens “find” dialog box to search for words, symbols.
first derivative	$\frac{dy}{dx}$
first derivative exponent notation	$f^{(1)}(x)$
first derivative of y with respect to x	$\frac{dy}{dx}$
fit curve	Cursor must be in data.
fit polynomial	Cursor must be in data.
fit regression line	Cursor must be in data.
five spaces	Moves cursor 5 spaces.
for all	$\forall$
for any	$\forall$
for every	for every
formula	Opens Formula dialog box for inserting a formula.
four element column vector	$\begin{bmatrix} \square \\ \square \\ \square \\ \square \end{bmatrix}$
four element row vector	$\begin{bmatrix} \square & \square & \square & \square \end{bmatrix}$
fourier transform	$\int_{-\infty}^{\infty} \exp(-2\pi ift)$
four spaces	Moves cursor 4 spaces.
fourth derivative exponent notation	$f^{(4)}(x)$
fraction	$\frac{\square}{\square}$
fraction free gaussian elimination	Operates this function in Compute, Matrices Menu.

# g c d	$\gcd$
gamma matrix	$\begin{pmatrix} \gamma_0 & \gamma_1 & \cdots & \gamma_{n-1} \\ \gamma_1 & \gamma_0 & \cdots & \gamma_{n-2} \\ \vdots & \vdots & \ddots & \vdots \\ \gamma_{n-1} & \gamma_{n-2} & \cdots & \gamma_0 \end{pmatrix}$
gamma of one half	$\Gamma\left(\frac{1}{2}\right)$
gaussian elimination	Cursor must be in matrix or to immediate right.
gegenbauer polynomial	$\sum_{k=0}^{[n/2]} \frac{(-1)^k (v)_{n-k} (2x)^{n-2k}}{k!(n-2k)!}$
gegenbauer nu	$C_n^{\nu}(x)$
general determinant	Opens menu to set up determinant.
general information	Opens general information index.
general matrix	Places cursor in matrix dialog box & puts the matrix you choose inside. $(\square)$
general quadratic	$ax^2 + bx + c$
general root	$\sqrt[\square]{}$
generate random numbers	Places cursor in random number generator dialog box.
get help	Opens ScientificNotebook Help.
go author	In Go Menu, Links.
go beginning	Use only in linked documents. Goes to 1st document.
go bibliography	In Go Menu, Links.
go contents	In Go Menu, Links.
go copyright	In Go Menu, Links.
go disclaimer	In Go Menu, Links.
go editor	In Go Menu, Links.
go end document	Use only in linked documents. Goes to last document.
go glossary	In Go Menu, Links.
go history back	In Go Menu.
go history forward	In Go Menu.
go index	In Go Menu, Links.

go links menu	In Go Menu.
go menu	Opens Go Menu.
go next document	In Go Menu, Links.
go next section	In Go Menu.
go parent document	In Go Menu, Links.
go previous document	In Go Menu, Links.
go previous section	In Go Menu, Links.
go publisher	In Go Menu, Links.
go to beginning of line	Places cursor at beginning of line.
go to marker	In Go Menu.
go to paragraph	In Go Menu.
go top of document	Cursor moves to top of document.
go trademark	In Go Menu, Links.
go view history	In Go Menu.
gradient	∇
graph cylindrical	Graphs in cylindrical coordinates.
graph data	Graphs data.
graph implicit	Graphs implicit.
graph parametric	Graphs in parametric coordinates.
graph polar	Graphs in polar coordinates.
graph polynomial	Graphs in polynomial coordinates.
graph regression line	Graphs regression line.
graph spherical	Graphs in spherical coordinates.
graph this	Graphs function. Cursor must be in or immediately right of function.
greater than	$>$
greater than or equal to	$\geq$
greatest lower bound	$\inf$
hat	Say “alpha”, “hat”. Get $\hat{a}$
heading 1	Section Body Tag. See ScientificNotebook.
heading 2	Same as “heading 1”.
heading 3	Same as “heading 1”.

heading 4	Same as “heading 1”.
heading 5	Same as “heading 1”.
help contents	Contents in Help Menu.
help index	Index in Help Menu.
help index menu	Index in Help Menu.
help menu	Opens Help Menu.
help search	Search in Help Menu.
# hermite n	$H_n(x)$
hermite normal form	Computes Hermite matrix.
hermite polynomial	$\sum_{k=0}^{[n/2]} \frac{(-1)^k n!(2x)^{n-2k}}{k!(n-2k)!}$
hermitian transpose	Computer Hermitian Transpose matrix.
hessian	Computes Hessian matrix.
hollow dot	$\circ$
hollow dot line segment	$\overset{\circ}{\square}\!\!-\!\!\overset{\circ}{\square}$
horizontal spacing	Opens horizontal spacing dialog box.
hundred	00
hypergeometric series	$1+\sum_{n=1}^{\infty} \frac{(a)_n (b)_n z^n}{(c)_n n!}$
hypertext link	Opens Hypertext Link dialog box.
hyphen	-
# i omega	$i\omega$
identically equal	$\equiv$
identity matrix	$\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 1 \end{pmatrix}$
imaginary	$\Im$
implicit differentiation	Differentiates implicitly.
import contents	Opens Import Contents dialog box.
import fragment	Opens Import Fragment dialog box.
import picture	Opens Import Picture dialog box.
inf key	$\inf$

infinity	∞
infinity key	∞
insert column	Inserts one column.
insert formula	Opens Formula dialog box in Insert Menu.
insert html	Opens that dialog box.
insert hypertext link	Opens that dialog box.
insert marker	Opens that dialog box.
insert matrix	Opens that dialog box.
insert menu	Opens Insert Menu.
insert note	Opens that dialog box.
insert one line	Inserts 1 line.
insert row	Inserts one row.
insert two lines	Inserts 2 lines.
# insert x y	With cursor next to or in data set, inserts "x" and "y" as heading for 2 column data set.
integral menu	Opens menu for customizing this symbol.
integral with joint scripts	$\int_{\square}^{\square}$
integral with limits	$\int_{\square}^{\square}$
integral with lower limit	$\int_{\square}$
integral with subscript	$\int_{\square}$
integral	$\int$
integrand	Moves cursor from upper limit to integrand.
integrate by parts	Say with cursor in integrand.
interpret	Interprets possibility ambiguous expressions.
intersection	∩
intersection menu	Opens menu to customize intersection symbol.
intersection with joint scripts	$\bigcap_{\square}^{\square}$
intersection with limits above and below	$\bigcap_{\square}^{\square}$
intersection with limits	$\bigcap_{\square}^{\square}$

inverse	Say with cursor in or immediately to right. of matrix.
inverse matrix	Computes the inverse of the matrix.
inverse triangle	∇
is an element of	$\in$
is it positive definite	Answers question. Can be used with cursor in matrix or next to it.
is to	:
italics off	Turns off italics.
italics on	Turns on italics.
iterate	Opens iterate dialog box.
# j n	$J_n(t)$
# j omega	$j\omega$
# j one half	$J_{\frac{1}{2}}(t)$
# j zero	$J_0(t)$
jacobian	Calculates Jacobian of vector of functions.
joint scripts	$\begin{matrix}\square \\ \square\end{matrix}$
jordan form	Calculates Jordan form of a matrix.
# l dots	…
label above	$\overset{\square}{\square}$
label axis	Opens label menu axis.
label below	$\begin{matrix}\square \\ \square\end{matrix}$
label menu	Opens label position dialog box.
laguerre alpha	$L_n^{(a)}(x)$
laguerre polynomial	$\sum_{k=0}^{n} \frac{(-1)^k (1+a)_n x^k}{k!(n-k)!(1+a)_k}$
laplace equation in a cube	$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$
laplace equation in a rectangle	$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$
# laplace o d e	Compute ODE menu command.
laplace transform	$\int_0^\infty e^{-st}$
large coproduct	$\coprod$

large coproduct with joint scripts	$\coprod_{\square}^{\square}$
large coproduct with limits	$\underset{\square}{\overset{\square}{\coprod}}$
large coproduct with lower limit	$\underset{\square}{\coprod}$
large coproduct with subscript	$\coprod_{\square}$
large coproduct	$\coprod$
large integral	$\int$
large integral with joint scripts	$\int_{\square}^{\square}$
large integral with limits	$\int$
large integral with over limits	$\overset{\square}{\underset{\square}{\int}}$
large intersection with joint scripts	$\bigcap_{\square}^{\square}$
large intersection with limits	$\underset{\square}{\overset{\square}{\bigcap}}$
large intersection with over limits	$\underset{\square}{\overset{\square}{\bigcap}}$
large intersection	$\bigcap$
large product	$\prod$
large union with joint scripts	$\bigcup_{\square}^{\square}$
large union with limits	$\underset{\square}{\overset{\square}{\bigcup}}$
large union	$\bigcup$
larger font	Makes font larger.
larger	Enlarges to 150%.
largest intersection with joint scripts	$\bigcap_{\square}^{\square}$
largest intersection with limits	$\underset{\square}{\overset{\square}{\bigcap}}$

largest intersection	$\bigcap$
largest union	$\bigcup$
largest union with joint scripts	$\bigcup_{\square}^{\square}$
largest union with limits	$\overset{\square}{\underset{\square}{\bigcup}}$
largest union with lower limit	$\underset{\square}{\bigcup}$
largest union with subscript	$\bigcup_{\square}$
least upper bound	$\sup$
left angle bracket	$\langle\square]$
left arrow over	$\overleftarrow{\square}$
left arrow with bottom label	$\underleftarrow{\square}$
left arrow with top label	$\overset{\square}{\leftarrow}$
left arrow	$\leftarrow$
left bar	$\vert\square$
left brace only	$\{\square$
left bracket only	$[\square$
left bracket right paren	$[\square)$
left double arrow	$\Leftarrow$
left double bar	$\Vert\square$
left double v bar	$\Vert\square$
left expanding brace	$\{\square$
left expanding bracket	$[\square$
left expanding parenthesis	$(\square$
left implies	$\Leftarrow$
left joint scripts	$\square_{\square}^{\square}$
left left bracket only	$[[$
left over arrow	$\overleftarrow{\square}$
left parenthesis right bracket	$(\square]$
left parenthesis	$($
left ray	$\overleftarrow{\square}$

left slanted line	$\diagdown$
left subscript	$\square_{\square}$
left superscript	$^{\square}\square$
left triangle	$\triangleleft$
left v bar	$\left\vert\square\right.$
left left expanding bracket	$[[\square$
legendre polynomial first kind	$\sum_{k=0}^{n} \frac{(n+k)!}{(n-k)!(k!)^2 2^k}(x-1)^k$
legendre rodriques formula	$P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$
less than or equal to	$\leq$
less than	$<$
lim inf key	$\liminf$
# limit as n and m go to infinity	$\lim_{n,m\to\infty}$
# limit as x goes to x naught	$\lim_{x\to x_0}$
limit inferior	$\liminf$
limit superior	$\limsup$
limit	$\lim_{\square}$
line integral	$\oint$
line segment	.—.
linear system	Say when you wish to enter linear system.
log	$\log$
logical and menu	Opens menu to customize the symbol.
logical and	$\wedge$
logical not	$\neg$
logical or	$\vee$
logical or menu	Opens menu to customize the symbol.
lower limit	Places lower limit box on preceding symbol.
# m a operator	$1-\theta_1 B-\theta_2 B^2-\cdots-\theta_q B^q$
# m a process	$X_t = a_t-\theta_1 a_{t-1}-\theta_2 a_{t-2}-\cdots-\theta_q a_{t-q}$
marker	Opens Marker dialog box.
math mode	Sets MathTalk in math mode for math entry.

math name	Opens dialog box to select name of standard mathematical functions.
math to braille	Opens Duxbury Braille Translator (if installed).
matrices menu	Opens Matrix Menu.
matrix	Opens box to define matrix dimensions.
matrix column basis	Computes column basis for a matrix.
matrix condition number	Computes condition number of a matrix.
matrix determinant	Computes the determinant.
matrix inverse	Computes the inverse.
matrix menu	Opens Matrix Menu.
matrix norm	Say with cursor in matrix.
max	$\max$
maximize document	Maximizes document.
maximize simplex	Say with cursor in data.
maximum	$\max$
mean deviation	Say with cursor in data.
mean	Say with cursor in data.
median	Say with cursor in data.
member of	$\in$
midpoint rule	Say only in approximate integral box.
min	$\min$
minimize simplex	Say only with cursor within system of equations.
minimum	$\min$
minimum polynomial	Say only with cursor in matrix.
minus	$-$
minus infinity	$-\infty$
mixed partial	$\frac{\partial^2 f}{\partial y \partial x}$
mod	$\mod$
mode	Calculates mode of a given set of data.
moment	Opens Moment dialog box.
move down 1	Moves cursor down one line.
move one word left	Moves cursor one word left.
move one word right	Moves cursor one word right.

move out	Moves cursor out of mathematical “box”, such as “exponent”, “fraction”, “subscript”, etc.
move this	Moves selected text and symbols.
move right/left 1-5	Moves cursor right/left 1-5 characters.
move up/down 1-5	Moves cursor up/down 1-5 lines.
much larger	Sets screen at 200%.
much smaller	Sets screen at 50%.
multiple integral menu	Opens menu allowing symbol customization.
mupad graphs	Shows examples of MuPad graphing.
mupad settings	Opens Settings in Compute.
# n choose x	$\binom{n}{x}$
natural log	$\ln$
negative	$-$
new definition	Opens MuPad box to select new definition.
new file	Opens a new file.
new paragraph	Enters two lines.
new window	Opens New window in Window Menu.
next element	Moves to next position in a matrix.
next line	Inserts new line and stays in Math Mode.
no break	Removes page break.
norm	$\|\square\|$
normal	Opens Apply Tag dialog box.
normal mode	Sets Normal in Apply Tag.
# normal c d f	$P[X \le x] = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2}\, dt$
normal density	$\frac{1}{\sqrt{2\pi}\sigma} \exp\{-\frac{1}{2\sigma^2}(x-\mu)^2\}$
normal distribution function	$\Phi(x)$
normal font	Sets font at style you have defined as normal.
normal integral	$\frac{1}{\sqrt{2\pi}\sigma} \int_{-\infty}^{x} \exp\{-\frac{1}{2\cdot\sigma^2}(t-\mu)^2\} dt$
normal mu sigma square	$N(\mu, \sigma^2)$
normal screen	Sets screen at 100%.
normal subgroup	$\triangleleft$
normal tag	Opens Tag, Apply, selects Normal.

normal zero one density	$\frac{1}{\sqrt{2\pi}\,\sigma}e^{-\frac{1}{2}t^2}$
not a member of	$\notin$
not an element of	$\notin$
not equal	$\neq$
not in	$\notin$
note pad	Brings up Note dialog box. (See Help, Notes.)
# november choose x	$\binom{n}{x}$
november derivative	$\frac{d^n y}{dx^n}$
nullspace basis	Computes nullspace basis of a matrix.
number equation	Opens dialog box to number equation.
number sign	#
numbering help	Opens number equation help.
numerator	When in a fraction, moves cursor to numerator.
# o d e series solution order	To define order of ODE series solution.
# one d heat equation	$\frac{\partial u}{\partial t} - k\frac{\partial^2 u}{\partial x^2} = 0$
# one d wave equation	$\frac{\partial^2 u}{\partial t^2} - c^2\frac{\partial^2 u}{\partial x^2} = 0$
# one half x square	$\frac{1}{2}x^2$
one over pi	$\frac{1}{\pi}$
one over square root of two pi	$\frac{1}{\sqrt{2\pi}}$
one over two pi	$\frac{1}{2\pi}$
open closed interval	$(\square]$
open file	Opens open file in dialog box.
open location	Opens Location in File Menu.
open quote	“
operator menu	Opens Operator choice box.
order powers	Orders polynomial by power.
orthogonal test	Test for orthogonality of a matrix.
orthogonality test	Test for orthogonality of a matrix.
out all	Moves to end of line.
over	In fraction, moves cursor from numerator to denominator.
over bar	$\overline{\square}$

over brace	$\overbrace{\square}$
over dot	$\dot{\square}$
over double dot	$\ddot{\square}$
over hat	$\hat{\square}$
over label	$\overset{\square}{\square}$
over script	$\overset{\square}{\square}$
over tilde	$\tilde{\square}$
over triple dot	$\dddot{\square}$
overlay polynomial	See Tutorial. Overlays a polynomial on the data.
# p d f	$f_X(x\|\theta)$
# p l u decomposition	Say with cursor in matrix.
# p n of x	$P_n(x)$
page break	Inserts a page break.
page setup	Opens Page Setup menu.
parallel to	$\|$
parens	$(\square)$
parentheses	$(\square)$
partial	∂
partial derivative	$\frac{\partial y}{\partial x}$
partial fractions	Performs MuPad partial fraction routine.
# partial of cap f of x and y with respect to x	$\frac{\partial F(x,y)}{\partial x}$
# partial of cap f of x and y with respect to y	$\frac{\partial F(x,y)}{\partial y}$
# partial of foxtrot of x and y with respect to x	$\frac{\partial f(x,y)}{\partial x}$
# partial of foxtrot of x and y with respect to y	$\frac{\partial f(x,y)}{\partial y}$
paste special	Paste menu command.
paste this	Performs paste.
permanent	Matrix command.

perpendicular	⊥
# plot 2 d data	Plots 2 d data in rectangular coordinates.
# plot 2 d menu	Opens 2 d menu.
# plot 2 d rectangular	Plots 2 d data in rectangular coordinates.
plot approximate integral	Opens plot approximate integral.
plot conformal	Plot command.
plot cylindrical	Plots in cylindrical coordinates.
plot data	Plot 2 d data in rectangular coordinates.
plot gradient	Plot gradient command.
plot implicit	Plot implicit command.
plot parametric	Plot parametric command.
plot phase plane	MuPad plot menu.
plot points	MuPad plot menu.
plot polar	2 d plot command..
plot spherical	3 d plot command
plot this	2 d rectangular plot command.
plot tube	3 d plot command.
plot vector field	3 d plot command.
plus	+
plus or minus	±
point	.
polynomial menu	Opens polynomial menu.
positive definite	Answers question. Can only be used with cursor in/next to matrix.
pound sign	#
power series	Calculates power series of a function.
precedes	≺
preview 10	In Print Preview, moves to 10th page. The page that you are on counts as page 1.
preview 15	See “preview 10”.
preview 2	See “preview 10”.
preview 3	See “preview 10”.

preview 4	See “preview 10”.
preview 5	See “preview 10”.
preview 6	See “preview 10”.
preview 7	See “preview 10”.
preview 8	See “preview 10”.
preview 9	See “preview 10”.
prime	$'$
print document	Opens print dialog box.
print preview	Opens print preview.
print this	Opens Print menu.
probability	$P[\square]$
product	$\prod$
product menu	Opens Product menu.
product with joint scripts	$\prod_{\square}^{\square}$
product with limits	$\prod_{\square}^{\square}$
product with lower limit	$\prod_{\square}$
product with subscript	$\prod_{\square}$
proper subset	$\subset$
proper superset	$\supset$
proportional to	$\propto$
put here	Places copied selection at cursor.
put it here	Places copied selection at cursor.
# q e d	**Q**.**E**.**D**.
# q r decomposition	Calculates the Q R decomposition of matrix.
quadratic equation	$ax^2 + bx + c = 0$
quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
quantile	Calculates quantities of a data base.
radical	$\sqrt{\square}$
random matrix	Opens random matrix choice box.
random number generator	Opens Random Numbers dialog box.
random numbers	Opens Random Numbers dialog box.
random sample	$X_1 X_2 \cdots X_n$

range one two	$1, 2, \cdots,$
range zero one two	$0, 1, 2, \cdots,$
range zero plus or minus	$0, \pm 1, \pm 2, \cdots,$
rank	Say with cursor in matrix.
rational canonical form	Calculates rational canonical form of a matrix.
reduced row echelon form	Matrix command.
reference library	Opens ScientificNotebook Reference Library.
remove number	Removes number from equations typed in "display mode".
replace next character	With cursor to immediate left of character, selects 1 character to right of cursor and places it in Replace Dialog box. See Tutorial.
replace next two characters	With cursor to immediate left of characters, selects 2 characters to right of cursor,places them in Replace Dialog box. See Tutorial.
replace text	Replace Dialog box. See Tutorial.
reshape	Opens Reshape Matrix dialog box.
restore definitions	MuPad Command.
reverse normal subgroup	Say with cursor in matrix.
review arithmetic progression	$a + (a + d) + (a + 2d) + \cdots + [a + (n - 1)d]$
review average	Reviews definition of sample mean.
review binomial distribution	Reviews definition of binomial distribution.
review binomial formula	$(a + x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2!}a^{n-2}x^2 + \cdots + x^n$
review binomial squared	$(x + y)^2 = x^2 + 2xy + y^2$
review definition of the derivative	Reviews definition of the derivative.
review difference of two cubes	$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$
review difference of two squares	$x^2 - y^2 = (x + y)(x - y)$
review equation of a line	Reviews definition of the equation.
review geometric progression	$a, ar, ar^2, \cdots, ar^{n-1}$
review quadratic formula	$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
# review r m s	Reviews definition of the "root mean square".

review sample mean	Reviews definition of sample mean.
review standard deviation of x bar	Sigma X bar= $\frac{\sigma_x}{\sqrt{n}}$
review standard deviation	Reviews definition of standard deviation.
review sum of a geometric progression	$S = a + ar + ar^2 + \cdots + ar^{n-2} + ar^{n-1} = \frac{a-ar^n}{1-r}$
review sum of an arithmetic progression	Reviews sum of an arithmetic progression.
review sum of two cubes	$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$
review taylor series	$f(x) = f(a) + \frac{(x-a)f'(a)}{1!} + \frac{(x-a)^2}{2!}f''(a) + \cdots$
review trinomial squared	$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2xz + 2yz$
review uniform distribution	Reviews definition of a Uniform probability.
rewrite equations as matrix	Brings up System Variable dialog box for such.
rewrite exponential	Rewrites as exponential.
rewrite factorial	Rewrites as factorial.
rewrite float	Rewrites as float.
rewrite gamma	Rewrites as gamma.
rewrite logarithm	Rewrites as logarithm.
rewrite matrix as equations	Rewrites matrix as equations.
rewrite menu	Opens Rewrite Menu.
rewrite polar	Rewrites as polar.
rewrite rational	Rewrites as rational.
rewrite rectangular	Rewrites as rectangular.
rewrite sin and cos	Rewrites as sin and cos.
rewrite sinh and cosh	Rewrites as sinh and cosh.
rewrite tan	Rewrites as tan.
right angle bracket	$\rangle$
right arrow	$\rightarrow$
right arrow over	$\overrightarrow{\square}$
right arrow under	$\underrightarrow{\square}$
right arrow with bottom label	$\overrightarrow{\square}$
right arrow with top label	$\underrightarrow{\square}$
right bar	$\square\vert$

right brace	}
right bracket	]
right bracket only	□]
right diagonal dots	⋱
right double arrow	⇒
right double bar	□‖
right double v bar	□‖
right expanding brace	□}
right expanding bracket	□]
right expanding parenthesis	□)
right implies	⇒
right left bracket	]□[
right paren	)
right parenthesis	)
right parenthesis only	□)
right ray	$\vec{\square}$
right right bracket	□]]
right slanted line	⁄
right v bar	□|
roots	Finds roots of a polynomial.
row basis	In Compute menu. Use with cursor in matrix.
row matrix	Sets up a row matrix.
row vector	Sets up a row matrix.
rug menu	Opens Decorations Menu for symbols that go above and below.
rule spacing	Opens dialog box to customize spacing.
sample mean	Calculates “sample mean” of given data set.
sample median	Calculates “sample median” of given data set.
sample mode	Calculates “sample mode” of given data set.
# sample s d	Calculates sample standard deviation for given set of data. Cursor must be in/at end of data.
sample standard deviation	Same as “standard deviation”.

sample variance	See as “sample mean”.
save all	Opens Save for all open files.
save as	Opens Save As dialog box.
save definition	Saves MuPad definition.
save file	Saves file.
save file as	Opens Save As dialog box.
save fragment	Opens Save Fragment dialog box.
save math as	Save math in ScientificNotebook/docs for math that will be opened in Duxbury for translation into braille.
save this	Opens Save file.
scalar field	**F**
scalar potential	Computes Scalar Potential.
screen appearance	Opens Note dialog box which allows you to put notes and hints in margin.
script fee	φ
# script L	ℓ
script theta	θ
second derivative exponent notation	$f^{(2)}(x)$
second partial	∂^2
seconds	$''$
select all	Selects all.
select following screen	Selects following screen.
select next 2 characters	Selects next (right of cursor) 2 characters.
select next 3-10 characters	Selects that number of next characters.
select next character	Same as above.
select previous 2 characters	Selects previous (left of cursor) 2 characters. for copying/deleting.
select previous 3-10 characters	Selects that number of previous characters.
select previous character	Same as above.
select to beginning of line	Selects from cursor to beginning of line.
select to end of document	Selects from cursor to end of document.

select to end of line	Selects from cursor to end of line.
select to start of line	Selects from cursor to beginning of line.
semicolon	;
send this	Send in File Menu.
sequence one two three	$1, 2, 3, \cdots$
sequence zero one two	$0, 1, 2 \cdots$
sequence zero plus or minus one	$0, \pm 1, \pm 2, \cdots$
series solution	MuPad ODE menu command.
set alignment	See SnBk Help on alignment.
set basis variables	Say with cursor in matrix.
set digits displayed	Opens dialog box for setting number of digits displayed.
set font	Opens dialog box to change font.
show definitions	Show Definitions in Compute Menu.
show pictionary	Opens Pictionary.
show properties	In Edit Menu, Properties.
similar to	~
simplex dual	Say with cursor on linear system. Calculates the dual system
simplex feasible	Say with cursor on linear system. Determines if a solution exists.
simplex menu	Opens Compute simplex Menu.
simplify	MuPad command to simplify by expression.
simplify this	MuPad command to simplify by expression.
simpson rule	Opens Approximate Integral dialog box for Simpson.
single quote	'
singular value decomposition	Gives singular value decomposition of matrix.
singular values	Calculates singular value of a matrix.
slash	/
smaller	Sets screen at 85%.
smaller font	Makes font smaller.
smith normal form	Calculates this form of a given matrix.
solid dot	·

solution Solution:

solve Place cursor in or directly following equation.

solve equation Place cursor in or directly following equation.

solve exactly Place cursor in or directly following equation.

solve integer Gives integer solutions only.

solve menu Opens solve choice box in Compute Menu.

solve numerically Solves numerically.

solve o d e Say with cursor in or following ODE.

solve o d e exactly Gives exact solution if closed form exists.

solve o d e laplace Solves ODE by this method.

solve o d e menu Opens MuPad ODE menu.

solve o d e numerically Say with cursor in or following equation.

solve p d e Say with cursor in or following PDE.

solve recursion Say with cursor in or following recursion.

sort polynomial Arranges polynomial in descending powers.

spaces five Moves cursor 5 spaces.

spacing menu Opens spacing menu.

square $\square^2$

square quartered $\boxplus$

square root $\sqrt{\square}$

square root of x square plus y square $\sqrt{x^2+y^2}$

square shape $\square$

square with diagonals $\boxtimes$

square with dot $\dot{\square}$

square with horizontal bar $\boxminus$

squared $\square^2$

standard deviation In Compute menu, Standard Deviation.

standard normal critical value $\frac{1}{\sqrt{2\pi}}\int_z^\infty e^{-\frac{1}{2}t^2}dt$

standard normal density $\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}t^2}$

standard normal integral $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^x e^{-\frac{1}{2}t^2}dt$

standard normal p value	p value = $\frac{1}{\sqrt{2\pi}} \int_{\lvert z \rvert}^{\infty} e^{-\frac{1}{2}t^2} dt$
standardize simplex	Say with cursor in matrix.
start of line	Moves cursor to start of line.
statistics menu	Opens Statistics menu in Compute.
style	Opens Style Menu.
style editor	Opens Style Menu.
style menu	Opens Style Menu.
subscript	$\square_{\square}$
subset	$\subseteq$
such that	$\ni$
sum	$\sum$
sum with joint scripts	$\sum_{\square}^{\square}$
sum with limits	$\sum_{\square}^{\square}$
sum with lower limit	$\sum_{\square}$
sum with subscript	$\sum_{\square}$
summation	$\sum$
# summation cap x	$\sum X_i$
# summation cap x square	$\sum X_i^2$
# summation cap x y	$\sum X_i Y_i$
summation cap yankee	$\sum Y_i$
summation cap yankee square	$\sum Y_i^2$
summation menu	Opens dialog box to customize this symbol.
summation with joint scripts	$\sum_{\square}^{\square}$
summation with limits	$\sum_{\square}^{\square}$
summation with lower limit	$\sum_{\square}$
summation with subscript	$\sum_{\square}$
# summation x	$\sum x_i$
# summation x square	$\sum x_i^2$
# summation x y	$\sum x_i y_i$

# summation y	$\sum y_i$
# summation y square	$\sum y_i^2$
superior	$\sup$
superscript	$\square^{\square}$
system of equations	Opens box so you just answer how many equations in the system.
# t probability	$P[a \leq X \leq b] = \frac{\Gamma(\frac{\nu+1}{2})}{\sqrt{\nu\pi}\,\Gamma(\frac{\nu}{2})} \int_a^b \left(1 + \frac{t^2}{\nu}\right)^{-\frac{\nu+1}{2}} dt$
# t statistic	$t = \frac{(m-\mu)\sqrt{n}}{s}$
tab	Tabs and keeps you in Math Mode.
tab key	Tabs and keeps you in Math Mode.
tag appearance	Opens this option in Tag Menu.
tag apply	Opens this option in Tag Menu.
tag function key	Opens this option in Tag Menu.
tag menu	Opens Tag Menu.
taylor series	Gives the Taylor series expression.
text mode	Set MathTalk in Text Mode for dictation.
text open quote	“
the set of all x-ray such that	$\{x\|\}$
thick space	Inserts a thick space.
thin space	Inserts a thin space.
third derivative exponent notation	$f^{(3)}(x)$
three spaces	Moves cursor 3 spaces.
tile horizontally	Window choice menu.
tile vertically	Window choice menu.
times asterisk	$*$
times dot	$\cdot$
# times x	$\times$
times	$\times$
toggle math mode	Clicks “math mode” on in toolbar.
toggle text	Clicks “text mode” on in toolbar.
tools action	Action in Tools Menu.

tools automatic substitution	Selects automatic substitution in Tools Menu.
tools menu	Opens Tools Menu.
tools spelling	Opens spell check in tools menu.
tools user setup	Opens user setup in Tools Menu.
top brace	$\overbrace{\square}$
top label	$\overset{\square}{\square}$
top labeled both arrows	$\underset{\leftrightarrow}{\square}$
top labeled left arrow	$\underset{\leftarrow}{\square}$
top labeled right arrow	$\underset{\rightarrow}{\square}$
top of document	Moves cursor to top of document.
train commands	Opens dialog box to enter and train command.
train initial commands	Opens training of initial MathTalk commands.
train math commands	Brings up list of math commands for training.
transforms fourier	Calculates Fourier – in Transforms menu in Compute.
transforms inverse fourier	Calculates Inverse Fourier – in Transforms menu in Compute.
transforms inverse laplace	Calculates Inverse Laplace – in Transforms menu in Compute.
transforms laplace	Calculates Laplace – in Transforms menu in Compute.
transforms menu	Opens Transforms menu in Compute.
transpose	Cursor must be in or immediately right of matrix.
transpose matrix	Cursor must be in or immediately right of matrix.
trapezoid rule	Say with cursor in the integrand.
triangle abc	$\overset{B}{\underset{A}{\triangle}}_{C}$
triangle on the right	$\triangleright$
triple integral	$\iiint$
triple integral menu	Opens dialog box to customize this symbol.
triple integral with lower limit	$\underset{\square}{\iiint}$
triple integral with subscript	$\iiint_{\square}$
triple prime	$'''$

type and	and
type as	as
type but	but
type cap but	But
type cap example	Example
type cap Hence	Hence
type cap if	If
type cap let	Let
# type cap let x equal	Let x equal
type cap now	Now
type cap so	So
type cap then	Then
type cap theorem	Theorem
type cap therefore	Therefore
type cap thus	Thus
type covariance	Cov
type even	even
type for	for
type for all	for all
type for every	for every
type if	if
type if and only if	if and only if
type in	in
type is	is
type let	let
type odd	odd
type on	on
type or	or
type otherwise	otherwise
type since	since
type text	Clicks “text mode” for entering text.
type then	then
type thus	thus

type to	to
type variance	Var
type when	when
type whenever	whenever
type where	where
undefine	Undefines a previous definition in MuPad definitions.
under bar	$\underline{\square}$
under brace	$\underbrace{\square}$
under double bar	$\underline{\underline{\square}}$
under script	$\square_{\square}$
underline off	Turns off underline.
underline on	Turns on underline.
undo deletion	Undoes deletion.
undo that	Undoes deletion.
union	$\cup$
union menu	Opens dialog box with choices for style, size, union.
union with joint scripts	$\bigcup_{\square}^{\square}$
union with limits	$\bigcup$
union with lower limit	$\bigcup_{\square}$
union with subscript	$\bigcup_{\square}$
unit name	Opens Unit Menu.
up arrow	$\uparrow$
up double arrow	$\Uparrow$
upper limit	Moves cursor from lower limit to upper limit.
# v bar	$\vert$
# v bar a to b	$\vert_a^b$
# v bar angle bracket	$\vert\rangle$
# v bar with limits	$\vert_{\square}^{\square}$
# v dots	$\vdots$

variance	Computes sample variance. Cursor must be in or at end of data.
vector calculus	Opens Vector Calculus Menu in Compute.
vector curl	Calculates Curl.
vector divergence	Calculates Divergence.
vector gradient	Calculates Gradient.
vector hessian	Calculates Hessian.
vector laplacian	Calculates Laplacian.
vector potential	Calculates the vector potential.
vector scalar potential	Calculates the scalar potential.
vector set basis variables	Allows resetting of basic vector variables.
vector wronskian	Calculates Wronskian.
vertical arrow	↓
vertical bar	|
vertical bar with limits	|□
vertical dots	⋮
vertical spacing	Opens dialog box to customize vertical spacing.
view 100 percent	Sets screen at 100%.
view 200 percent	Sets screen to 200 %.
view 300 percent	Sets screen to 300%.
view 400 percent	Sets screen to 400%.
view custom	Allows you to customize screen view size.
view helper lines	Toggles helper lines off and on.
view input boxes	Toggles input boxes, i.e. the small boxes that show where limits go, for example. Without this on, you won't be prompted visually on the screen where certain symbols go. It's a good idea to always have this on.
view invisibles	Shows markers that aren't normally shown.
view marker fields	Toggles Marker Fields in View Menu.
view menu	Opens View Menu.

view refresh	Clicks Refresh in View Menu.
view status bar	Toggles Status bar in View Menu.
view tool bars	Opens Toolbar Menu.
web site	Web site in Help Menu.
window menu	Opens Window Menu.
# x matrix	$\begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{pmatrix}$
# x minus i y	$x - iy$
# x plus i y	$x + iy$
# z point one	$z_{.1} = 1.282$
# z point zero one	$z_{.01} = 2.326$
# z point zero five	$z_{.05} = 1.645$
# z point zero two five	$z_{.025} = 1.960$
# z statistic	$z = \frac{(m-\mu)\sqrt{n}}{\sigma}$
zero vector	$\underset{\rightarrow}{0}$
zoom in	Enlarges text in Preview in File Menu.
zoom out	Makes text smaller in Preview in File Menu.