# Hands-on Math

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<u>Intro</u>

1.  How long have you been a TypeWell transcriber?

    Less than 1 year
    1-2 years
    2-4 years
    4-6 years
    More than 6 years

2.  How many of you have done the Math Mode tutorial?

3. How much math have you studied?

   Math
   Algebra
   Geometry
   Trigonometry
   Calculus
   More …

   Science
   Chemistry
   Physics
   Etc...

   Other
   Accounting
   Economics
   Other ...

4. What have you transcribed (of the above)?

5. What was/is your comfort level transcribing in each?

   Awful       Struggled   Okay        Fine        Easy
   |_____|_____|_____|_____|

## Outline

1. Basics/tips/tricks
2. Interwoven with theory
3. Lots of hands-on practice
4. Transcribe a real lecture, analyze your transcript for accuracy/readability

<u>Basics/intro</u>

Math Mode tutorial: Alt + <u>m</u> [<u>M</u>ath]  then <u>a</u> [M<u>a</u>th Tutorial]

≈1,000 math/science symbols
(Blue color doesn't cross the link to reader laptop)

Caps Lock to toggle into/out of Math Mode

## Arithmetic symbols on the home row

| | |
|---|---|
| *pl* | + |
| *mn* **or** *mns* | - |
| *eq* | = |
| | |
| *tm* **or** *tms* **or** *x*{*space*}{*comma*} | × |
| .{*space*}{*comma*} **or** *tms*{*space*}{*comma*} | · (As in $x \cdot y = z$) |
| *dvd* **or** *div* **or** /{*space*}{*comma*} | ÷ |

## Simple fractions on the home row

*half*        ½

*qrtr*        ¼

*eghj*          ⅛

(note: don't try to use Turbo abbreviations!)

## Practice toggling into/out of Math Mode

A half of something is written like this: ½

¼ is pronounced "one quarter" or "one fourth"

One half of an apple plus another quarter of the apple makes three quarters of the apple.  That's written like this:

$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$

If you divide 4 by 2, you get $4 \div 2 = 2$

What would you get if you multiplied 4 by 3?  $4 \times 3 = 12$  So the answer is 12.

## Using Math Mode abbreviations without going into Math Mode

**Ctrl is your best friend!**

Use Ctrl + {space bar}.

NOTE:  Ctrl + {space} automatically eliminates the space.  Use {space}{space} to start a new word after the symbol.

| | |
|---|---|
| 75o{Ctrl}{space} | 75° |
| 15deg{Ctrl}{space}C | 15°C |
| 120e={Ctrl}{space} | 120€ |
| L-{Ctrl}{space}145 | £145 |
| 45c/{Ctrl}{space} | 45¢ |
| 28cnts{Ctrl}{space} | 28¢ |
| half{Ctrl}{space} | ½ |
| D{Ctrl}{space} | Δ |
| ohm{Ctrl}{space} | Ω |

## Comma-cycling in Math Mode

Ctrl + {comma} will comma-cycle the whole keystroke sequence.  Just {comma} will cycle just the last letter.

Try:
$div\{space\}\{comma\}\{comma\}\{comma\}\{comma\}\{comma\}$

See:

$\div \quad div \quad di\vee \quad di\downarrow \quad di\breve{} \quad d\check{i} \quad \div$

Try:
$half\{space\}\{comma\}\{comma\}\{comma\}\{comma\}$

See:

½          $half$          $hal\varphi$          $hal\Phi$          ½

NOTE:  Don't use $.half$  The "dot" won't keep it from expanding because it's not regular TypeWell mode!

## More complicated fractions

     Ctrl + h "high"
     Ctrl + n "normal"
     Ctrl + l     "low"

These are especially useful for fractions containing variables:

$${}^{ax^2}/_y \qquad {}^2/_y \qquad {}^x/_3$$

vs.

$$ax^2 / y \qquad 2/y \qquad x/3$$

But with just numbers, / will generally automatically make it look right.

5/11      $\frac{5}{11}$
2/5      $\frac{2}{5}$
*etc.*

<u>And now, a word from our sponsors: Formatting for Ease of Comprehension and Readability!</u>

a. If I have 5 pieces of pie and I give 4 of them away, I have 1 left. $\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$

b. If I have 5 pieces of pie and I give 4 of them away, I have 1 left. [On board.]

$\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$

c. If I have 5 pieces of pie [$\frac{5}{5}$] and I give 4 of them away [$\frac{5}{5} - \frac{4}{5}$] I have one 1 left [$\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$]

d. If I have 5 pieces of pie:

$\frac{5}{5}$

And I give away 4 pieces:

$\frac{5}{5} - \frac{4}{5}$

I will have 1 piece left:

$\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$

## Complex fractions

*frac* **or** *frc*

_____

(Don't try /*{space}{comma}{comma}*; it won't get you what you want.)

$$\frac{2y - 3}{4x^2 + 2}$$

**Arrow keys are your best friend!**

Use the arrow keys to move around the fraction.

On the bar, use the End key or Ctrl {right arrow} to get to the end of the line:

$$\underline{\hspace{3cm}} \; (x^2)$$

Use Ctrl {left arrow} **twice** (or more) to get to the front of the line (if you only do it once the frac bar will move):

$$(2x) \; \dfrac{\underline{\hspace{3cm}}}{2x^2}$$

**Shift + Enter is your best friend!**

Use Shift + Enter to get to the very end of the equation to begin normal transcribing again.

<u>"All over"</u>

Ex: "$x^2$ plus $2y^2$ all over $y^4$"

$$\frac{x^2 + 2y^2}{y^4}$$

$x^2 + 2y^2$

{semicolon} 3 times to highlight, Ctrl x to cut

*frac*

$$\frac{\phantom{x^2 + 2y^2}}{y^4}$$

{Up arrow} to get to the numerator; Ctrl + v to "Velcro" the $x^2 + 2y^2$ in place:

$$\frac{x^2 + 2y^2}{y^4}$$

Or Ctrl + u to underline, then Ctrl + u again (or {space}, or {right arrow}) to un-underline, {enter} to get to the denominator.

$$\frac{x^2 + 2y^2}{y^4}$$

Make it look "right" by adding spaces in front of the numerator and denominator.

$$\frac{x^2 + 2y^2}{y^4}$$

## Using Ctrl+u or Ctrl+u+{tab} for more complicated multi-layer fraction problems

$$\frac{x^2 + 2y^2}{y^4} + \frac{4x^2 - y}{y^3}$$

Use Ctrl u to underline portions for complex fractions, with or without the frac template:

$$\frac{\dfrac{2x + 14}{^3\!/_2\, y}}{\dfrac{3x^2}{2}}$$

$$\frac{\dfrac{4x^2}{3} - \dfrac{28x}{4}}{\dfrac{6y^2}{2} + \dfrac{x}{y}}$$

## And now a timely word from our sponsors: Transcribe the Lecture, not just the Math!

○ Math is a *written* language, not a spoken language

○ Spoken "Mathlish" is way of pronouncing/transliterating the symbols to allow us to talk about them

○ Students are expected to take notes in class (from the board and the reader laptop)

○ The Math is already visible on the board
   - When/how to use [On board.]
   - [On board.] with no reference point is not useful

○ Time is limited

○ We are hired to make auditory information accessible visually

○ Include just enough math for the explanations to make sense
   - Realtime vs. transcript as study notes

○ Just because you *can* show the math doesn't mean you *should*

○ When in doubt, type it out (in words)

Transcribe the following mini lecture

Simplify:

$$\frac{4x^2y + 2y^2}{6y^4}$$

Factor out 2y from each term.

Discussion

1. How much English explanation did you include?
   ("factor out 2y"; "the 2y's cancel")

2. How much math did you include?  Partial equations for reference?

3. Did you skip or condense the middle step?

4. Did you use [On board.] ?

## Superscripts/subscripts

Automatic:

$$2x^2y^4 + 4x^2y^3$$

Comma cycle to get $x_2$ etc:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Automatic:

$H_2SO_4$

$Na^+$

$Cl^-$

Comma-cycle:

$2^{-4}$

Use Ctrl + h for complex superscripts or those with letters:

$x^{n-1} + 14$

(Use {space}{space} or Ctrl + n after $x^{n-1}$ to return to "normal" level for the $+$)

## Squared, cubed

52 {*space*}{*comma*}{*comma*}{*comma*}   $5^2$
**Or** 5*sqrd* **or** 5*sq*   $5^2$

53{*space*}{*comma*}{*comma*}{*comma*}   $5^3$
**Or** 5*cbd*   $5^3$

Use Ctrl{space} if not in Math Mode

<u>Complex exponents</u>

**Words are important!**

"$x$ raised to the $n$ cubed power, minus $y$ to the $n$ squared"

$$x^{n^3} - y^{n^2}$$

Use Ctrl + h twice (once per "higher" level)

Or use $n2$ Ctrl$\{space\}$ to get $n^2$ as an exponent.

**Words are not everything!**

"$x$ raised to the $n$ squared minus 4"

$x^{n^2\text{-}4}$

$x^{n^2} - 4$

"$x$ to the $n$ to the $x$ times $m$"

$x^{n^{x}m}$

$x^{n^x} \cdot m$

Use Ctrl + l to drop down one level; {space}{space} drops down a level also, but leaves you with an extra space!

$x^{n^{x}m}$

$x^{n^{x}\ m}$

Use Ctrl + {space} to make a fraction in the exponent (NOTE: you still need to use Ctrl + h to get to the exponent position):

$x^{2/3}$

## Square (and other) roots

*sqrt*    √

*root*    √

*cbrt*    $\sqrt[3]{\phantom{x}}$

Comma-cycle *sqrt* and *root* to get

$$\sqrt{\phantom{xxxxx}}$$

Try:

$$\sqrt{16}$$

$$=$$

$$\sqrt{(4)(4)}$$

$$= \sqrt{4} \cdot \sqrt{4}$$

$$= 2 \cdot 2$$

$$= 4$$

<u>Try the following.</u>

*Hint* left-arrow *three times* to get outside the radical

Remember: **Shift + Enter is your best friend!** It will get you to the end of everything you've typed.

$$= \frac{\sqrt{25x^2}}{x\sqrt{(5)^2}}$$

$$= 5x$$

Use $\sqrt{}$ only for single obvious items under the radical. $x\sqrt{(5)^2}$ is too ambiguous.

## Formatting

Use {enter}{enter} to allow more space before the $=$.  Then up-arrow *twice* and {Delete} (NOT backspace!) to remove the gap above the radical bar:

$$\sqrt{25x^2}$$

$$=\qquad \sqrt{\phantom{25x^2}}$$

After inserting the $x$ outside the radical, up-arrow and {space}{space} to scoot the bar back in place to the right:

$$x\sqrt{\phantom{25x}}$$

Vs.
$$x\sqrt{\phantom{25}}$$

## Roots other than 2

**Arrow keys are your best friend!**

Left-arrow twice to change the index (small number showing which root):

$$\sqrt[3]{\phantom{xxxxxxx}}$$

Up-arrow and {space}{space} to move the radical bar over:

$$\sqrt[3]{\phantom{xxxxxxx}}$$

Example:

$$\sqrt[3]{125x}$$

$$=$$

$$\sqrt[3]{5^3x} \qquad \text{(Use } 5cbd \text{ to get } 5^3\text{)}$$

$$=$$

$$5\,\sqrt[3]{x}$$

Lots of arrowing, spacing, deleting to make it look right.  Or:

$5\{space\}cbrt$ Ctrl$\{space\}x$

$5\sqrt[3]{x}$

## Inequalities, etc.

○ abbreviate the Mathlish words

○ build the symbol (in the order it is written in math)

○ approximate what it looks like, then comma-cycle

| | |
|---|---|
| *gj* or *gt* | $>$ |
| *lj* or *lt* | $<$ |
| *nlj* or *nlt* or $</$ | $\not<$ |
| *ngj* or *ngt* or $>/$ | $\not>$ |

Don't include an abbreviation for "than" in the following:

| | |
|---|---|
| *ge* or $>=$ | $\geq$ |
| *ne* or $=/$ | $\neq$ |
| *nle* or $<=/$ | $\not\leq$ |

More:

| | |
|---|---|
| *pm* **or** +- | $\pm$ |
| =? | $\stackrel{?}{=}$ |
| *aprx* **or** ~~ | $\approx$ |
| *union* **or** *unn* **or** U{*space*}{*comma*} **or** *cup* | $\cup$ |
| *intrsct* **or** U{*space*}{*comma*}{*comma*} **or** *cap* | $\cap$ |
| *inf* | $\infty$ |
| *jrfr* **or** :. **or** .: | $\therefore$ |
| *angl* | $\angle$ |

## Some common Greek letters

| | |
|---|---|
| D{*space*}{*comma*} | Δ |
| *psi* **or** *y* {*space*}{*comma*} | ψ |
| *j*{*space*}{*comma*} **or** *jta* | θ |
| S{*space*}{*comma*} | Σ |
| *omga*{*space*}{*comma*} **or** W{*space*}{*comma*} **or** *ohm* | Ω |

<u>Transcribe the following lecture</u>

NOTE: use Ctrl + space to get the formula to look right (to avoid unnecessary spaces)

Volume of a cylinder

$V = \pi r^2 h$

$d = 6 \ in$
$h = 7 \ in$

Discussion

1. Did you include all the relevant English explanation?
   (Mathlish of any of the variables?)
   (Units of measurement, etc.)

2. How much math did you include?  Partial equations for reference?

3. What middle steps did you skip/condense?  (Avoid the temptation to copy down too much!)

4. For what parts, and how, did you use [On board.]?
   (When/how did you refer to the diagram?)

5. Does the transcript make sense?  Complete sentences? Accurate?

Surface Area of a cylinder

$d = 8\,ft$
$h = 5\,ft$

Components:

○ Top (area of a circle $A = \pi r^2$)
○ Bottom (area of a circle $A = \pi r^2$)
○ Surrounding "wall" (area of a rectangle $A = l \times w$)

The length $l$ is the circumference $C$ of the circle: $C = \pi d$
The width $w$ is the height $h$ of the cylinder

## Discussion

1.  Did you include all the relevant English explanation?

2.  How much math did you include?

3.  What middle steps did you skip/condense?

4.  For what parts did you use [On board.]?

5.  Does the transcript make sense?  Complete sentences? Accurate?

## Quadratic formula

*qdrtc* (The Turbo abbreviation *qdtc* won't expand!)

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Arrows are your best friend!**

Practice moving around the formula using the arrow keys:

$2x^2 - 3x - 2 = 0$

$a = 2$
$b = $ -3
$c = $ -2

NOTE: At this level of math, words like "*all over* 2a" are less important because the students are fluent enough in the written language of Math.

NOTE: Watch the radical line! Scoot it over with {space}{space}{space}.

NOTE: Use Ctrl + {left arrow} to get to the front of a line (once the cursor is on that line)

<u>And now a word from our sponsors: Copying and pasting an equation to save time</u>

Use {semicolon} to highlight, Ctrl + c to Copy.

NOTE:  If you overshoot while highlighting, Tab to retreat one spot.

**Remember your best friend Shift + Enter!**

Use Ctrl + v to Velcro what you copied; arrow keys to move around.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

.
.
.

$$\frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-2)}}{2(2)}$$

$$= \frac{3 \pm \sqrt{9 - 4(-4)}}{4}$$

.

.

.

$$= \frac{3 \pm \sqrt{9 - (-16)}}{4}$$

.

.

.

$$= \frac{3 \pm \sqrt{9 + 16}}{4}$$

$$= \frac{3 \pm \sqrt{25}}{4}$$

$$= \frac{3 \pm 5}{4}$$

$$= \frac{8}{4} = 2$$

*Or*

$$= \frac{-2}{4} = \frac{-1}{2}$$

## Scientific notation

6.2*e*8 **or** 6.2*x*108      $6.2 \times 10^8$

4.8*e*-14 **or** 4.8*x*10-14   $4.8 \times 10^{-14}$

## Math Mode PAL

Quick mouse-free PALing:

○ Highlight the math that you want the new abbreviation to expand to.

○ While still in Math Mode, Ctrl a to get immediately into the Add New Abbreviation screen of the Math Mode PAL.

○ Type abbreviation

○ The expansion you highlighted automatically appears in "New Expansion" field.

○ Hit Enter to get immediately back to your transcript (or Tab to the "Cancel" button to cancel).

If you didn't have an expansion highlighted:

○ While in Math Mode, Ctrl a to open Math Mode PAL

○ Tab once to "New" button, and hit Enter

(or combine these two steps with *Ctrl a Ctrl n*, or hold down *Ctrl* while typing *an*)

○ Type desired abbreviation in "Abbreviation" field

○ Tab once to "New Expansion" field and type in desired expansion

○ Hit Enter to get to the Math PAL list

○ Esc, or Ctrl a, or Alt q to Quit out of the PAL (or Tab to the "Close" button, Enter to select)

**The Tab key is your best friend!**

To delete an abbreviation, open your PAL and arrow down to highlight the unwanted abbreviation on the list.

Tab 3 times to "Delete" button, press Enter.  Voilà!  It's gone!

Then Alt q to Quit out of PAL (or Esc, or Ctrl a, or Tab to "Close" button and Enter).
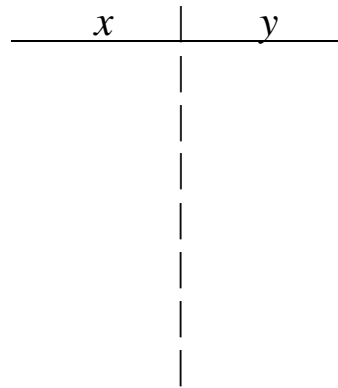
## Some suggested PAL abbreviations

| | |
|---|---|
| *fx* | $f(x)$ |
| *gx* | $g(x)$ |

*xty*

.

$$\begin{array}{c|c} x & y \\ \hline \end{array}$$

*limx*          $\lim_{x \to 0}$

## What do you do when you find yourself in over your head?

○ Don't do it!  Be a conscientious professional!!

You don't know what you don't know!  You have no way of realizing what information you're missing/misunderstanding/conflating!

○ The same principle applies to *any* content you don't understand: computer science, economics, etc.  It's too easy to get things backwards, mix things up, leave things out because you don't have a "hook" upon which to hang the words.

IF you are in an emergency sub situation, etc.:

○ Acknowledge your limitations!!

○ <u>Use your team!!</u>

○ <u>Use the board!!</u>

Particularly in math, since it's a written language, you can get a lot of clues from what is written on the board. <u>Watch</u> while you listen. <u>Look</u> at what symbols go with the spoken words.

Examples:

"co-sign thayta" = $cos\theta$
"inverse function" = $f^{-1}(y)$

○ Remember that the student knows more than you do. Highly detailed incorrect transcribing is worse/more confusing than cryptic but accurate "notes."

○ You don't have to be able to *do* the math to transcribe it. BUT you do have to be able to *recognize* it and accurately interpret the words/symbols.

## More templates
(note: some of these don't work perfectly in Windows 8)

*sum*{*space*}{*comma*}          $\sum_{i=0}{}^{n}$

*sum*{*space*}{*comma*}{*comma*}

$$\sum_{i=0}^{n}$$

*lim*{*space*}                    $\lim_{i\to 0}$

*lim*{*space*}{*comma*}

$$\lim_{i\to 0}$$

*int* **or** *intgrl*                    $\int$

*intgrl*{*space*}{*comma*}        $\int_{0}^{\infty}$

*intgrl*{*space*}{*comma*}{*comma*}

$$\int_{0}^{\infty}$$

## Letters from other languages

○ Build them based on component parts

*façade*        *c, {space}{comma}* **or** *c,* Ctrl*{space}*

*mañana*  *n~ {space}{comma}* **or** *n~* Ctrl*{space}*

*résumé*        *e' {space}{comma}* **or** *e'* Ctrl*{space}*

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