



# Professor David Black

## Math 1050

### Using WolframAlpha

### A Basic Guide

# Start With Basic Math – Addition

- I'll give you the type of thing you would write on your paper or type on your calculator, then I'll show you how to put it on WolframAlpha.
- Addition:  $3 + 4$

$$3+4$$

Automatic answer 

Enter what you want to **calculate** or **know**

$$3+4$$

$$3+4 = 7$$

$$3+4$$

$$3+4$$

When you push “Enter,” lots of stuff might come up. Sometimes you need to look for the one you want.



3+4

Examples Random

Input  
3 + 4

Result  
7

Number name:  
seven

Number line:

Manipulatives illustration:



Typical human computation times:

age 6: 4.8 seconds | age 8: 2.4 seconds | age 10: 1.4 seconds |  
age 18: 0.88 seconds  
(ignoring concentration, repetition, variations in education, etc.)

# Basic Math – Subtraction

- Subtraction:  $3 - 4$



- A look at the whole input area. 
- A look at the output area. 

Input:

$3 - 4$

WolframAlpha shows how it understood what you entered. This can be REALLY helpful, as you can find immediately if you typed things in wrong.

Result:

$-1$

And, of course, we have the answer, which it calls "Result."

Number name:

# Basic Math – Multiplication

- Multiplication:  $3 \times 4$  or  $3 \cdot 4$
- You can use “\*” (the asterisk)

3\*4

Input:

$3 \times 4$

Result:

12

- You can also use parentheses for multiplication

(3)(4)

Input:

$3 \times 4$

Result:

12

# Basic Math – Multiplication

## Some notes on multiplication

- WolframAlpha will *usually* understand it if you don't put the multiplication sign in between a number and a variable

The image displays three screenshots of the WolframAlpha interface, each showing a different input method for the expression  $3x - 4y$ . Each screenshot includes a top input bar, a row of icons (calculator, camera, lists, share), and a bottom 'Input:' section.

- Left screenshot:** The top bar contains  $3x - 4y$ . The bottom 'Input:' section shows  $3x - 4y$ .
- Middle screenshot:** The top bar contains  $3*x - 4*y$ . The bottom 'Input:' section shows  $3x - 4y$ .
- Right screenshot:** The top bar contains  $3(x) - 4(y)$ . The bottom 'Input:' section shows  $3x - 4y$ .

- However, sometimes WolframAlpha won't be able to understand what you're asking unless you explicitly put a multiplication sign (an asterisk or a set of parentheses.) See the next page for an example.

# Basic Math – Multiplication

## Some notes on multiplication

- I'm sorry that this uses division before I've shown you how to do it, but it gives a good example of when you have to explicitly show multiplication (either the asterisk, parentheses, or both.)

$$(3acb)/(13bdf)-14ac*3dcf = 24acfd - 7$$



Examples Random

Wolfram|Alpha doesn't understand your query

Showing instead result for query:  $ac*3, -14ac*3, (13bdf)$

$$(3*a*c*b)/(13*b*d*f)-(14*a*c)*(3*d*c*f) = 24*a*c*f*d - 7$$



Input:

$$\frac{3ac b}{13b d f} - (14ac)(3dc f) = 24acfd - 7$$

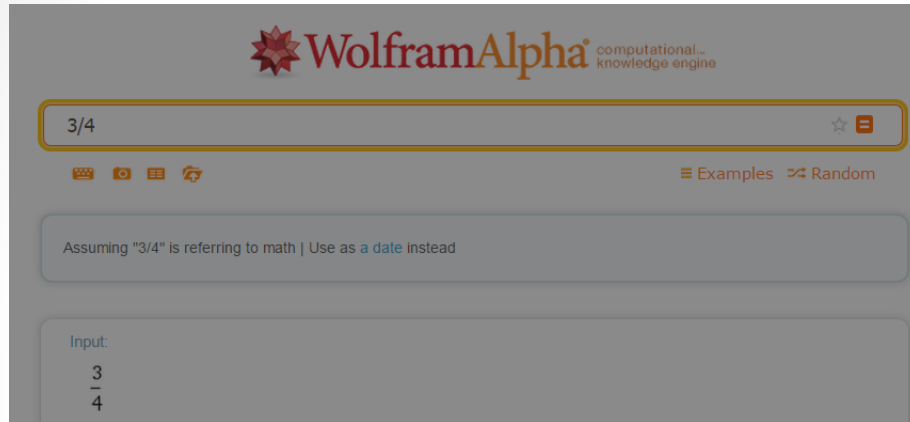
Result:

$$\frac{3ac}{13d f} - 42ac^2 d f = 24acdf - 7$$

- Using asterisks and parentheses in the second example made it so WolframAlpha can deal with it.

# Wait... a common problem

- While we're on the subject of WolframAlpha giving you problems, let me show you something that will likely happen to you.



- The screen went dark, and I can't click on anything or type anything. If I scroll down, however, I can see the following:



- What happened is that I clicked somewhere where WolframAlpha has an extra feature available IF I want to subscribe for the "Pro" version. You're welcome to do so, but for now, just click on the grey "x".

# Basic Math – Division

- Division:  $3 \div 4$  or  $\frac{3}{4}$  Use the “/” (slash)

We see a few interesting things here:

$\frac{3}{4}$

Assuming "3/4" is referring to math | Use as a [date](#) instead

If there are multiple interpretations, WolframAlpha will tell you.

Input:

$\frac{3}{4}$

Exact result:

$\frac{3}{4}$  (irreducible)

If the answer can be written as a fraction, WolframAlpha will always show you the fraction.

Decimal form:

0.75

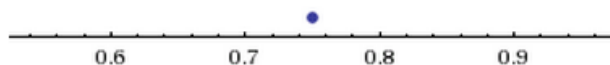
Usually, the decimal form will be shown. If not, there will be an option to “Show approximate form.”

Percentage:

75%

There will often be other information. I’ve cut off the bottom half of the results for “3/4”.

Number line:





# Basic Math – Division

## Some notes on division

- Be really careful with parentheses, especially with division. If you don't put them where they're supposed to go, it can mess with the order of operations. Here's an example.
- Imagine that we want to evaluate  $1 - \frac{2}{x-4}$  If we try

WRONG

$$1 - 2/x - 4$$

Input:

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

Result:

$$-\frac{2}{x} - 3$$

we get something that we don't want.

- One way of entering it in right is the following.

$$1 - 2/(x-4)$$

# Basic Math – Division

## Some notes on division

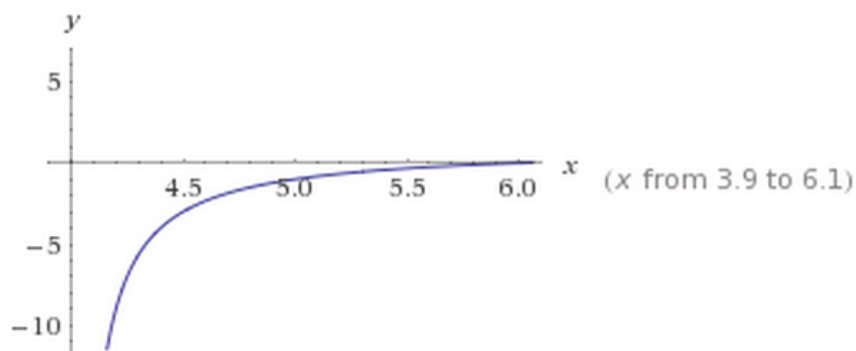
- Here's the input and result from our last entry, once again, an attempt to enter in  $1 - \frac{2}{x-4}$

$$1 - 2/(x-4)$$

Input:

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

Plots:



We can see from the “Input” box that we got what we wanted. Also, notice that a plot is automatically made.


On the next slide, I'll give you my way of making sure I don't get any division mistakes.

$$1 - (2)/(x-4)$$

- Here's a hint:

# Basic Math – Division

## Some notes on division

- Whenever I have to deal with a fraction/division, I automatically put a pair of parentheses around the numerator and another pair of parentheses around the denominator.
- In fact, I usually write out  , i.e.  $() / ()$  , before I put any

numbers or variables in. (You don't have to do it this way, but it can help a lot.)

- Let's look at an example. Consider the expression

$$\frac{1 - \frac{2}{x + 4}}{x + \frac{4}{x + 4}}$$

- There's a bunch of little mistakes waiting to happen!
- I would start with a couple of parentheses pairs right away.
- Let's do this whole thing on the next page.

# Basic Math – Division

## Some notes on division

$$\frac{1 - \frac{2}{x+4}}{x + \frac{4}{x+4}}$$

- First, the parentheses pairs for the big fraction
  - I've shown which parts will go in which parentheses.
- Next, I'll put the numbers and spaces for the other fractions:

$$(1 - ()/())/(x + ()/())$$

- Finally, I'll put those inner fractions in their parentheses (note I add spaces.)

$$(1 - (2)/(x + 4)) / (x + (4)/(x + 4))$$

- Let's see if WolframAlpha understood...

Input:

$$\frac{1 - \frac{2}{x+4}}{x + \frac{4}{x+4}}$$

Plots:

...Hooray!

# Basic Math – Exponents

- Exponentiation:  $3^4$       Use the “^” (carat, right above the 6)

The diagram illustrates the calculation of  $3^4$ . On the left, the expression  $3^4$  is shown inside a yellow rounded rectangle. To its right is a white box with a light gray border. Inside this box, the text "Input:" is in blue, followed by  $3^4$ . Below this, the text "Result:" is in blue, followed by 81. A red arrow points from a red-bordered text box to the "Input:" section. The text box contains the instruction: "Remember to look at this “Input” box to be sure you’ve really entered what you want to."

- When you’re doing fractional exponents, make sure to put parentheses around the fractions, e.g., for  $3^{4/5}$ , use

The diagram shows the expression  $3^{(4/5)}$  inside a yellow rounded rectangle, demonstrating the use of parentheses for fractional exponents.

# Basic Math – Roots (square, cubed, etc.)

- Square root:  $\sqrt{7}$

sqrt(7)

or

root(7)

or

square root of 7

Input:

$\sqrt{7}$

This is best

Decimal approximation:

More digits

2.645751311064590590501615753639260425710259183082450180368334...

Number line:

- Cubed root:  $\sqrt[3]{7}$ . You can do cubed root of 7 but it makes things a lot easier in equations with

$7^{(1/3)}$

- Other roots:

e.g.  $\sqrt[5]{29}$

$29^{(1/5)}$

Input:

$\sqrt[3]{7}$

Decimal approximation:

1.912931182772389

# Graphing

- There are a few options: “plot”, “graph”, or just type in the function

# Graphing

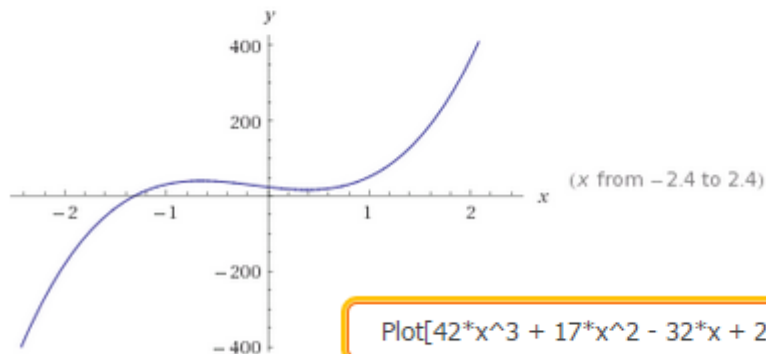
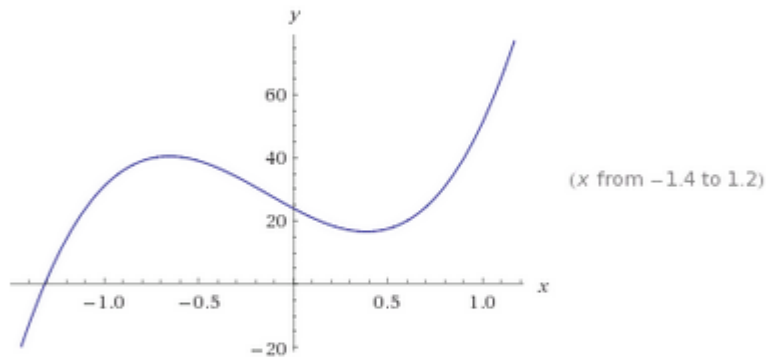
graph  $42x^3 + 17x^2 - 32x + 24$



Input interpretation:

plot  $42x^3 + 17x^2 - 32x + 24$

Plots:



Plot[ $42x^3 + 17x^2 - 32x + 24$ , {x, -5, 5}]

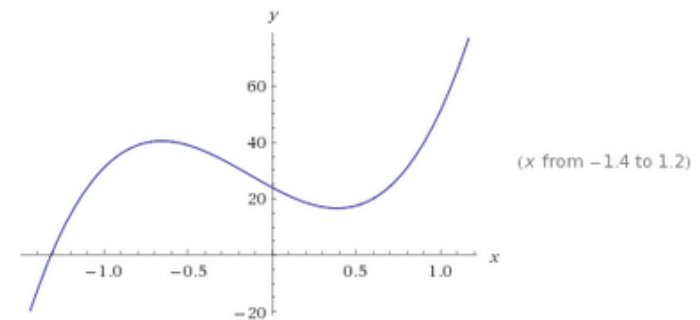
Plot[ $42x^3 + 17x^2 - 32x + 24$ ]



Input interpretation:

plot  $42x^3 + 17x^2 - 32x + 24$

Plots:





# You said “natural language input?”



graph  $42x^3 + 17x^2 - 32x + 24$  from  $x = -1$  to  $x = 1$



Examples Random

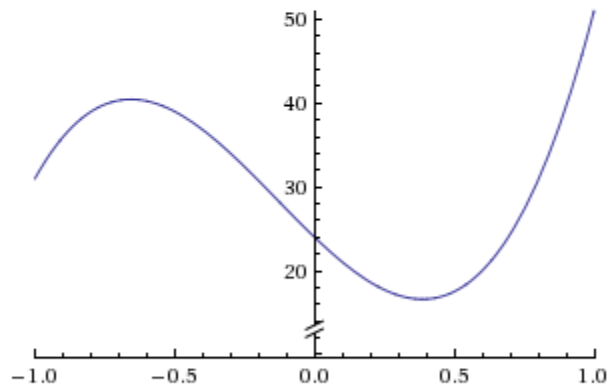
Input interpretation:

plot

$24 - 32x + 17x^2 + 42x^3$

$x = -1$  to  $1$

Plot:



Enable interactivity

Arc length of curve:

More digits

$$\int_{-1}^1 \sqrt{1 + (-32 + 34x + 126x^2)^2} dx \approx 67.7933328520\dots$$

# Tracing, or finding points on the graph

- Use “where”

# Tables

- Useful for graphing things on ALEKS or finding facts about multiple values in a function.

# Verifying Equality

- This is useful for things like factoring and simplification. Use “==”

$$21*x^2 + 26*x + 8 == (3*x+2)(7*x+4)$$



Input:

$$21 x^2 + 26 x + 8 = (3 x + 2) (7 x + 4)$$

Alternate form:

True

# Solving

- There are a few options: “Solve” or just type in the equation to be solved.

# Solving

solve  $3x+4y=9$ ,  $2x-y=1$



Examples Random

Input interpretation:

solve

$$3x + 4y = 9$$

$$2x - y = 1$$

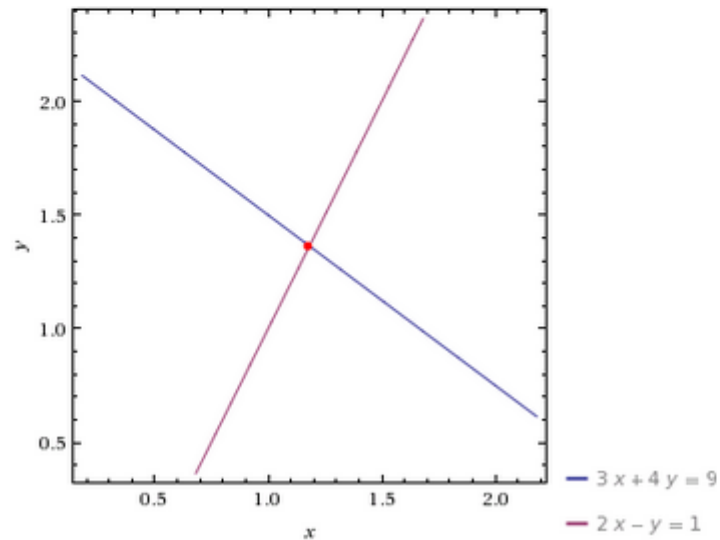
Result:

Approximate form

Step-by-step solution

$$x = \frac{13}{11} \text{ and } y = \frac{15}{11}$$

Implicit plot:



Enable interactivity

# Graphing – special parts of the graph

- Maximum:
- Root or Zeros:
- Intersection:

# Title

- Text



# Useful for Other Classes?

# Life Science



AAGCTAGCTAGC



Examples Random

Input interpretation:

AAGCTAGCTAGC (genome sequence)

Length:

12 base pairs

Amino acid sequence:

(5'–3' frame 1)

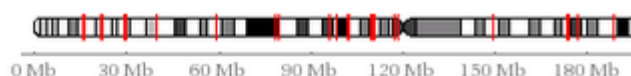
AAG	CUA	GCU	AGC
↓	↓	↓	↓
Lys	Leu	Ala	Ser

Oligonucleotide melting temperature:

48.5 °C (degrees Celsius)  
(under standard PCR conditions)

Exact matches to reference human genome:

chromosome 1 (24 matches)



positions	15 615 714	21 457 006	29 097 290
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Sulfate



Assuming "Sulfate" is an ion | Use as a [class of minerals](#) or a [word](#) instead

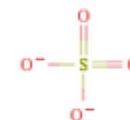
Input interpretation:

sulfate (ion)

Structure diagram:

Skeletal structure ▼

Show box



General properties:

formula

SO<sub>4</sub><sup>2-</sup>

08 January 2015

# Chemistry

NaCl

Examples Random

Input interpretation:

sodium chloride

Chemical names and formulas:

formula	NaCl
Hill formula	ClNa
name	sodium chloride

More

Structure diagram:

$\text{Na}^+ \text{Cl}^-$

Basic properties:

molar mass	58.443 g/mol
phase	solid (at STP)
melting point	801 °C
boiling point	1413 °C
density	2.16 g/cm <sup>3</sup>
solubility in water	soluble

Units »

Thermodynamic properties:

specific heat capacity c <sub>p</sub>	solid	0.8641 J/(gK)
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More

# Life Science



Galliformes



Examples Random

Input interpretation:

quails, grouse, pheasants, turkeys, domestic fowl... (animals)

Scientific name:

Galliformes

Taxonomy:

kingdom	<b>Animalia</b> (animals)
phylum	<b>Chordata</b> (chordates)
class	<b>Aves</b> (birds)
order	<b>Galliformes</b> (quails, grouse, pheasants, turkeys, domestic fowl...)

Other members of class Aves:

More

**Anseriformes** (swans, geese, ducks, screamers, waterfowl...) |

**Apodiformes** (swifts, hummingbirds...) |

**Bucerotiformes** (hornbills) | ...

(total: 22)

# Title



tell me a joke



Examples Random

# Title

- Text