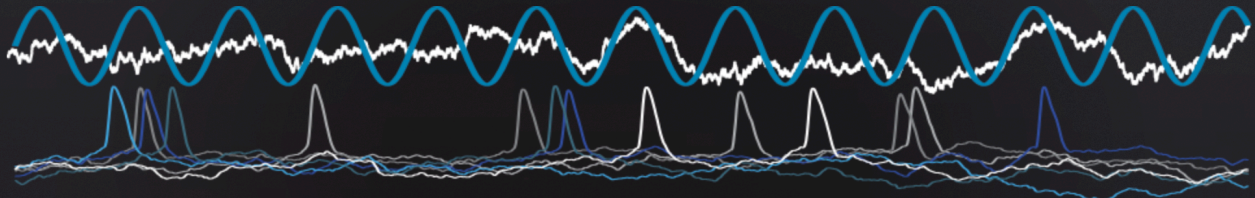


PRINCIPLES OF COMPUTATIONAL NEUROSCIENCE



AN INTRODUCTORY COURSE OFFERED TO
(UNDER)GRAD NEUROSCIENCES STUDENTS AT UNITS AND SISSA, TRIESTE (ITALY).

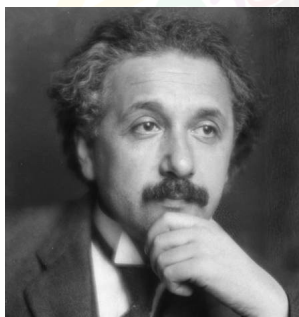
Blended Learning - Self Study Module
Mathematical Refresher

elementary math refresher



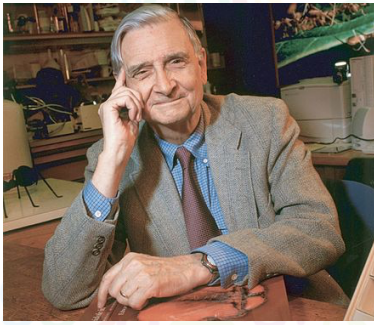
Richard Feynman
Nobel prize winner, 1965

“To those who do not know mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty, of nature. ... If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in.”



Albert Einstein
Nobel prize winner, 1921

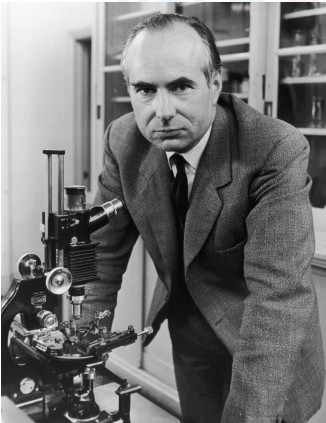
“How can it be that mathematics, being after all a product of human thought independent of experience, is so admirably adapted to the objects of reality?”



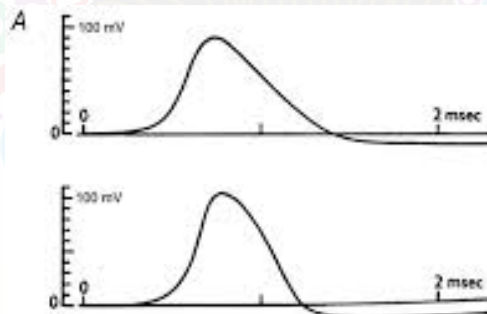
Edward O. Wilson
"father of biodiversity and
of sociobiology"

"During my decades of teaching biology at Harvard, I watched sadly as bright undergraduates turned away from the possibility of a scientific career, fearing that, without strong math skills, they would fail.

This mistaken assumption has deprived science of an immeasurable amount of sorely needed talent."



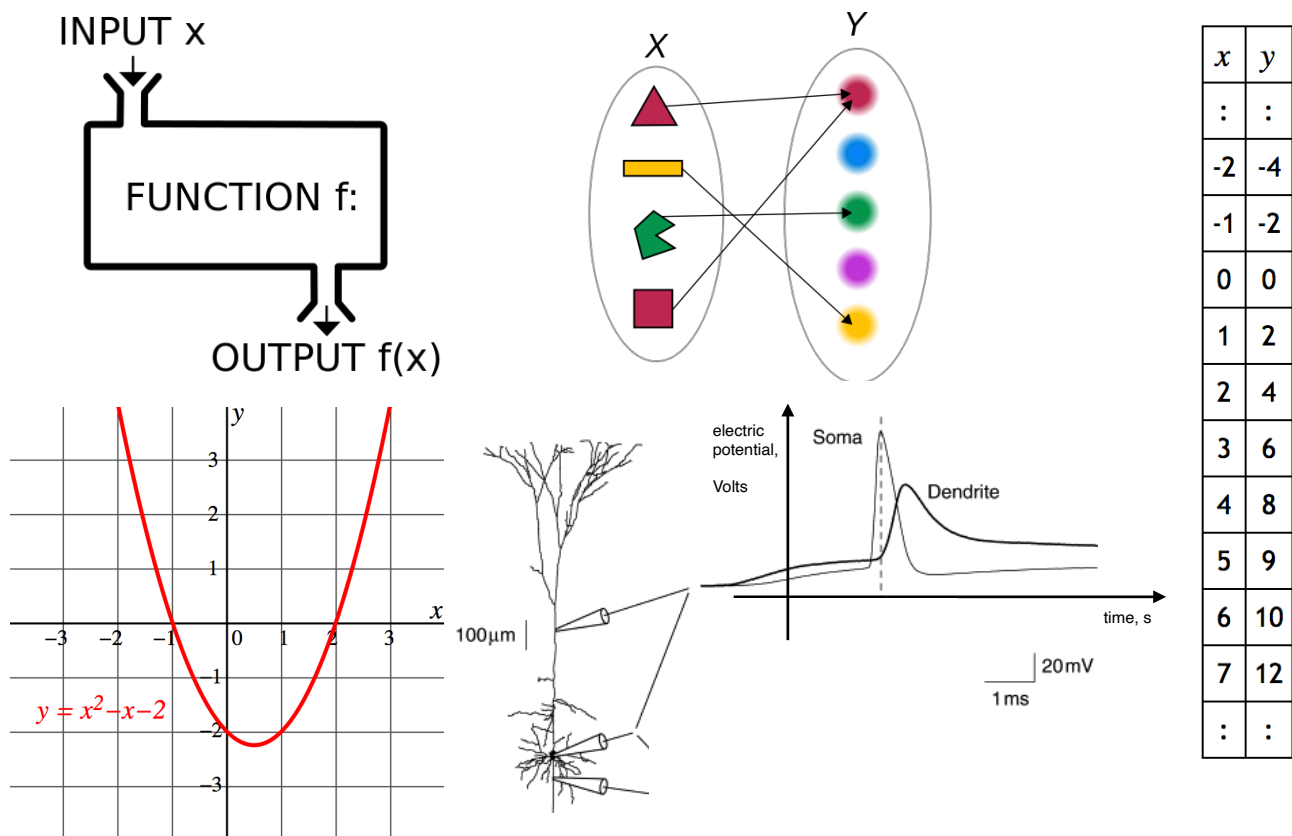
Andrew Huxley - Nobel prize winner, 1963



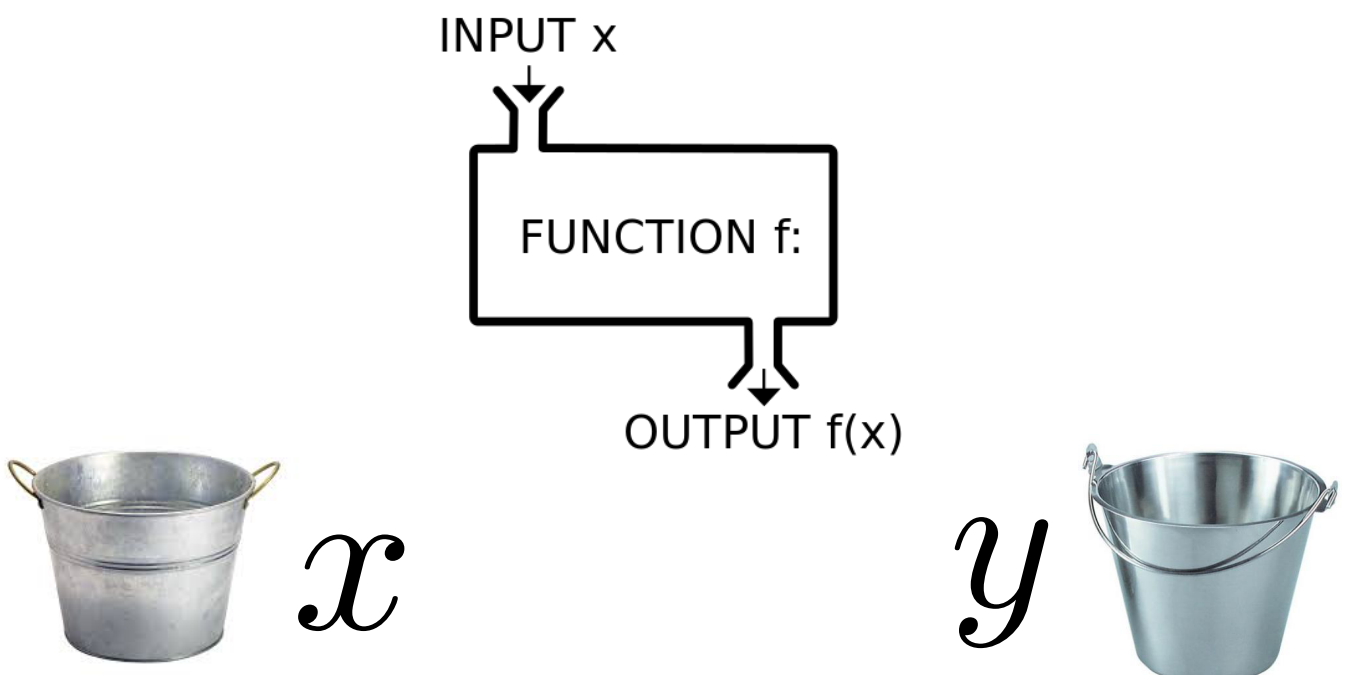
elementary math refresher

- (Mathematical) **functions** of one variable
- The **graph** of a function
- Adding or multiplying by a constant: how does the graph change?
- Straight lines, exponentials, logarithms,...

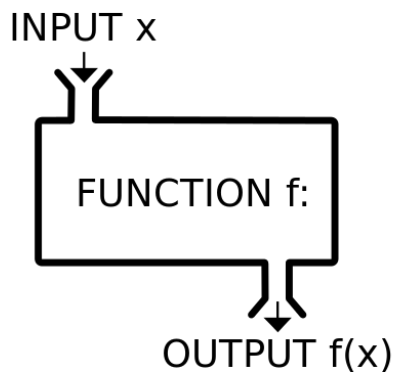
Functions of one variable



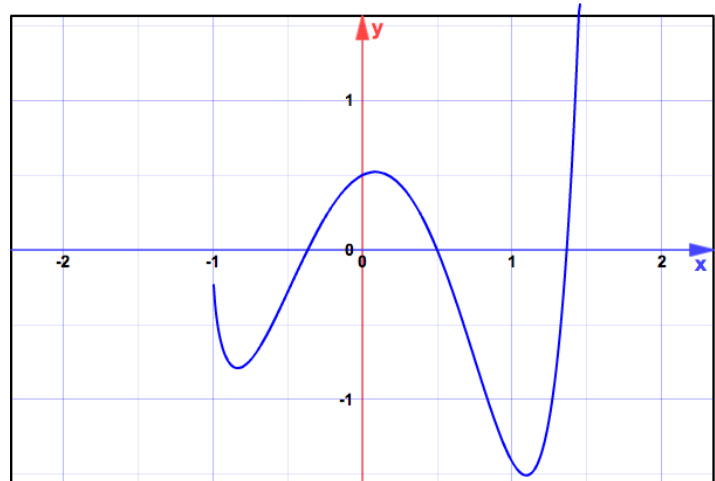
Independent & dependent mathematical variables



The graph of a function



$$f(x) = \frac{(4x^3 - 6x^2 + 1) \sqrt{x+1}}{2-x}$$

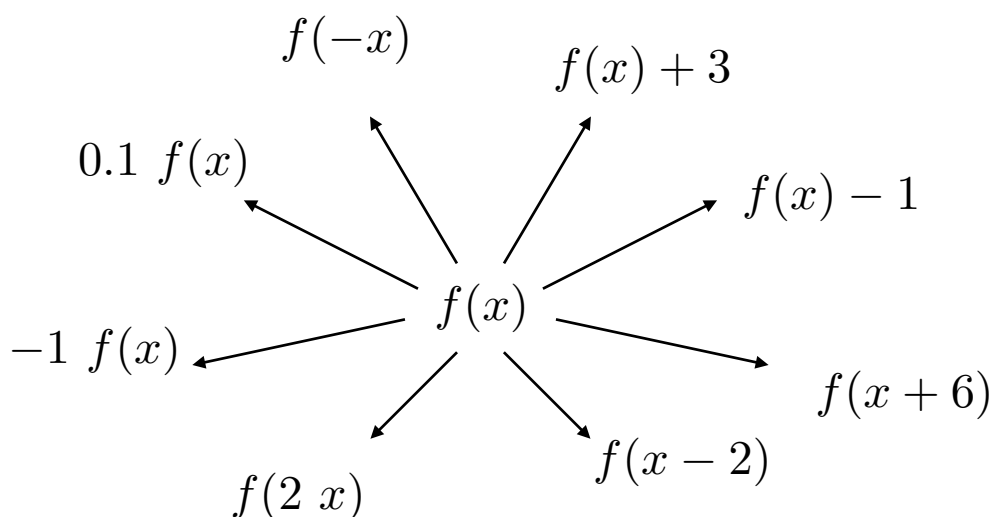


$$(4x^3 - 6x^2 + 1) \cdot \sqrt{x+1} / (2-x)$$

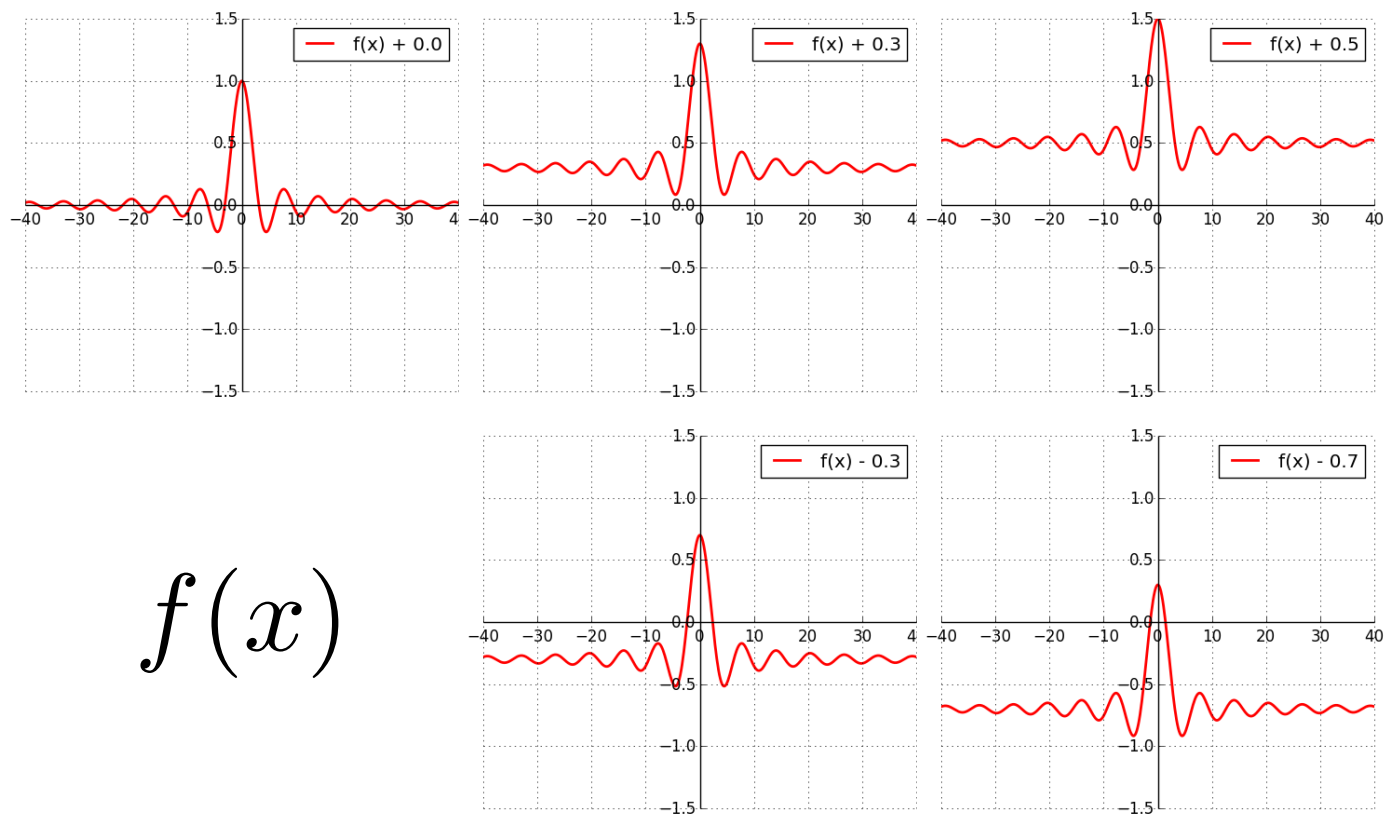
<http://www.mathsisfun.com/data/function-grapher.php>

The graph of a function

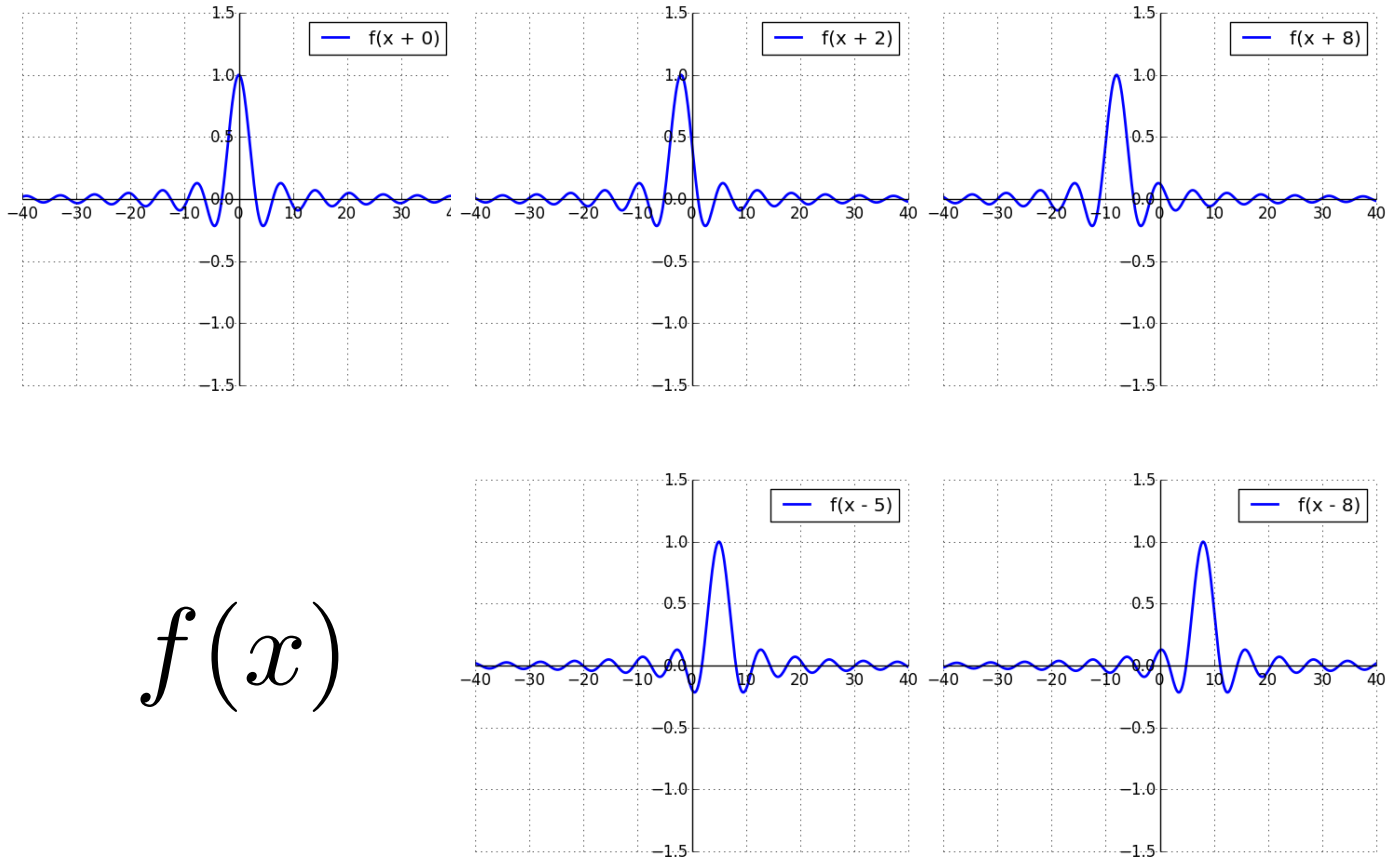
- Adding or multiplying by a constant: how does the graph change?



Adding a constant

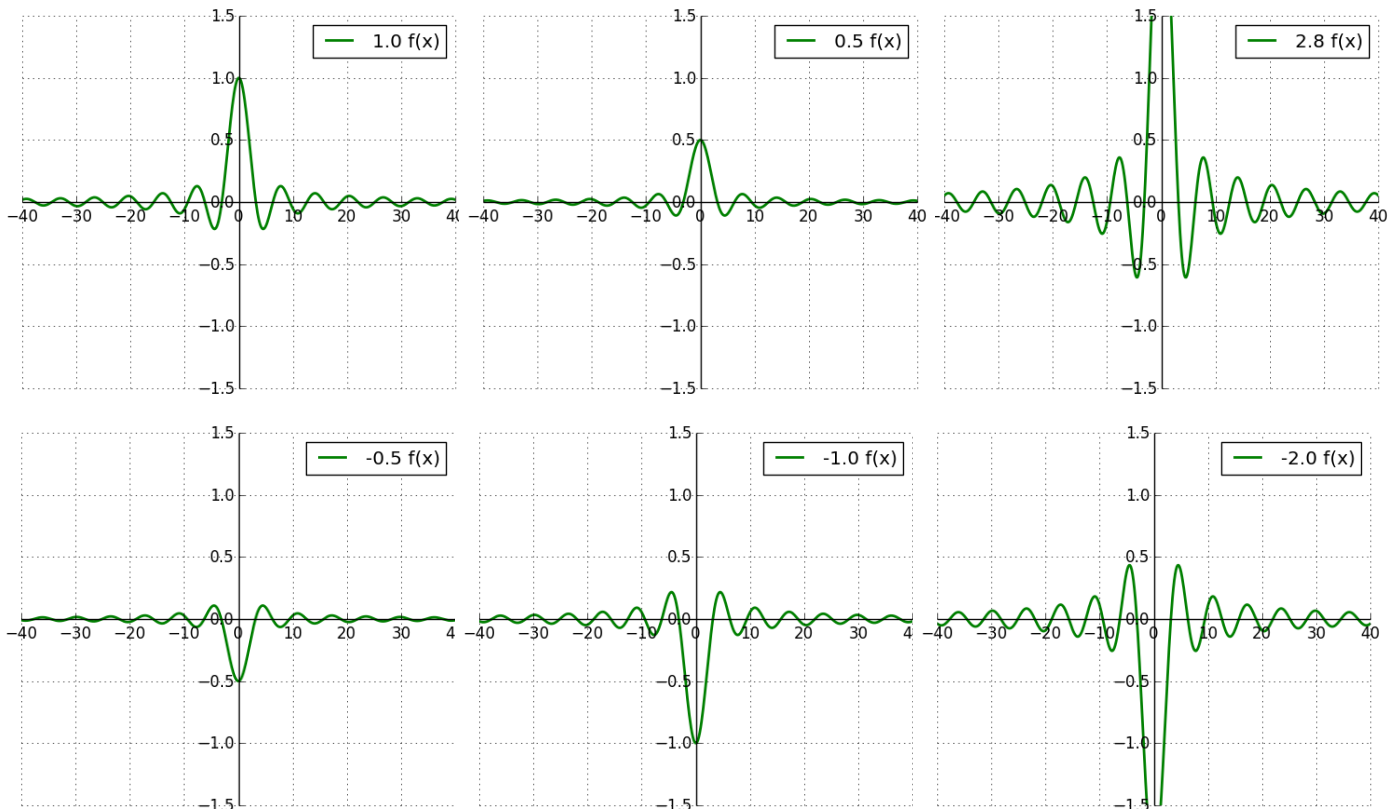


Adding a constant (“inside”)

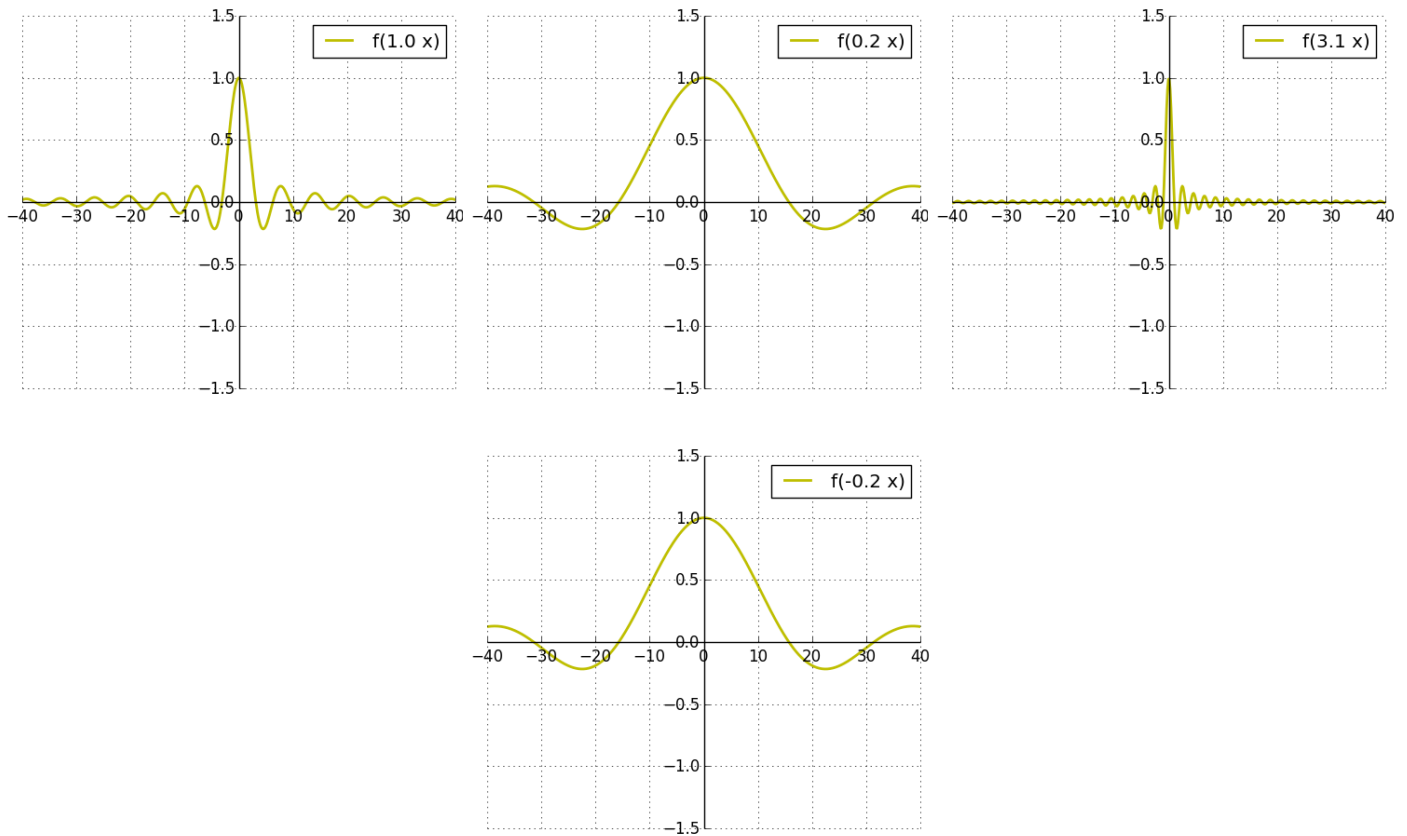


$f(x)$

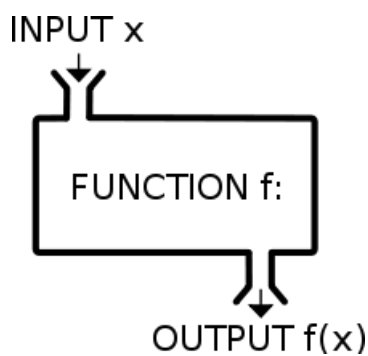
Multiplying by a constant



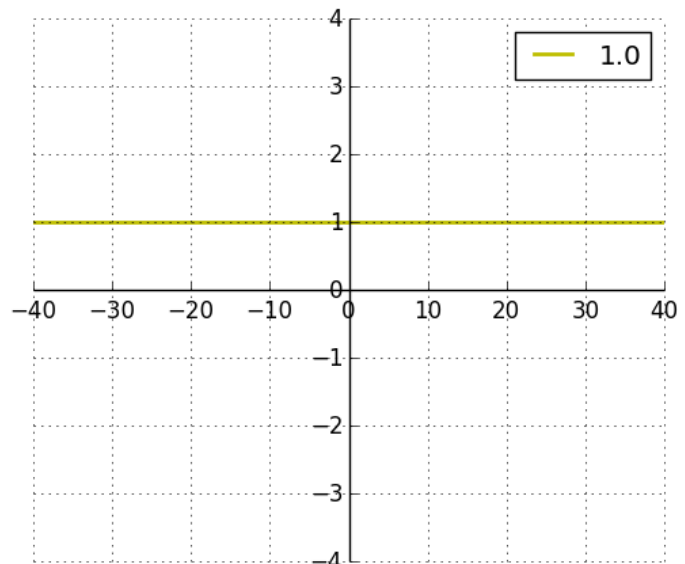
Multiplying by a constant (“inside”)



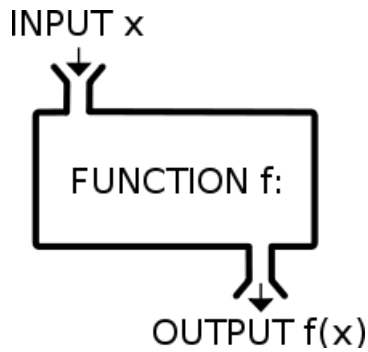
The constant function



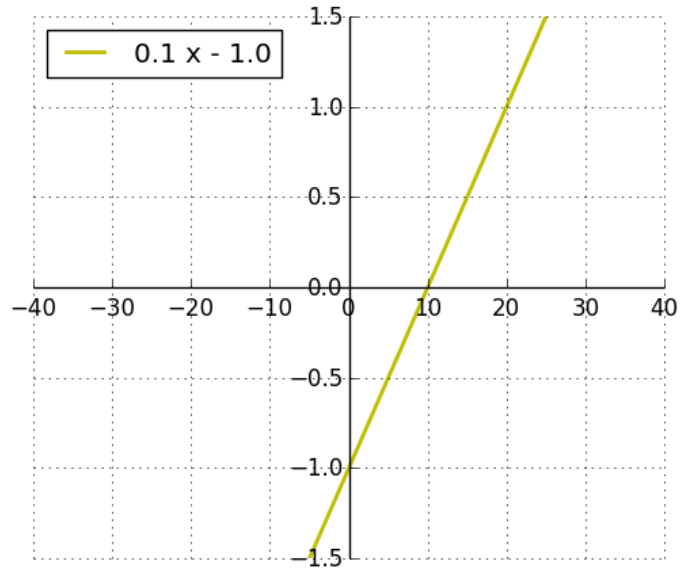
$$f(x) = a$$



The straight line



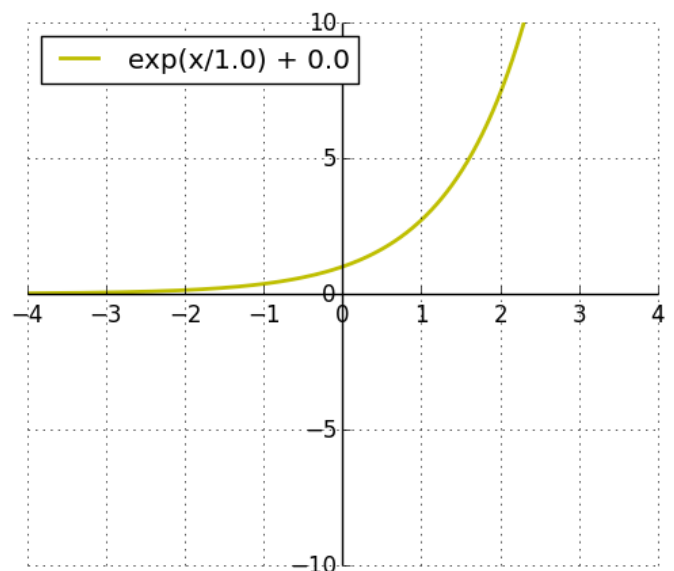
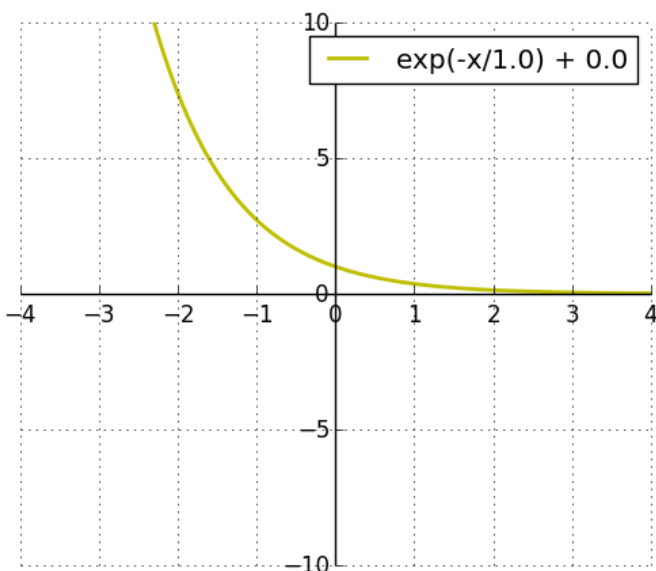
$$f(x) = mx + a$$



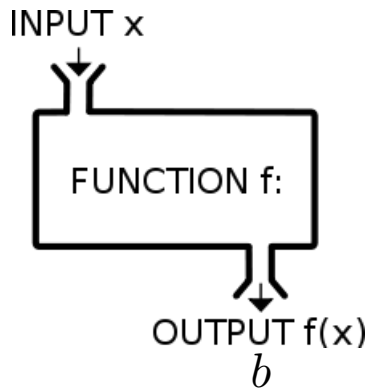
The exponential function

$$f(x) = e^{x/c} + a$$

$$e = 2.718281828459045235360287471\dots$$

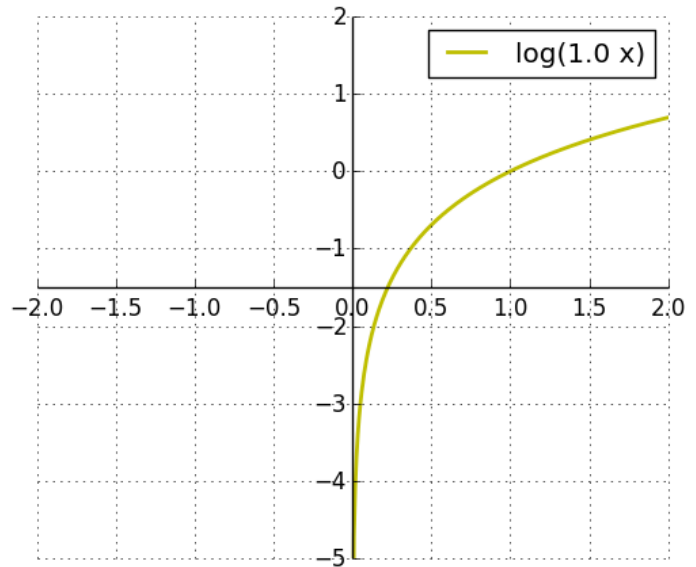


Logarithms and their properties



$$f(x) = \log_a(x)$$

$$a^b = x$$



$$\ln(x^n) = n \ln(x)$$

$$\ln(a) + \ln(b) = \ln(ab)$$

$$\ln(a) - \ln(b) = \ln(a/b)$$

Logarithms and their properties

$$\ln(a) + \ln(b) = \ln(ab)$$

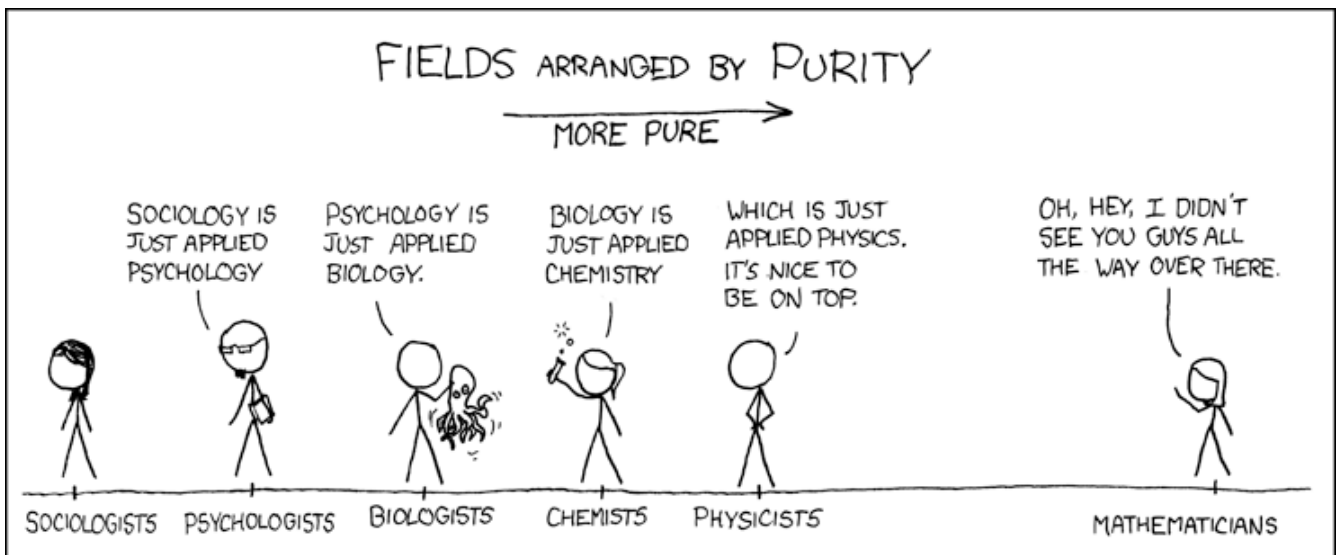
$$e^{\ln(a)+\ln(b)} = e^{\ln(ab)}$$

$$e^{\ln(a)} e^{\ln(b)} = e^{\ln(ab)}$$

$$ab = ab$$

elementary math *refresher*

- (Mathematical) **functions** of one variable
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- Adding or multiplying by a constant: how does the graph change?
- Straight lines, exponentials, logarithms,...





- <https://www.khanacademy.org/math/algebra-home/alg-functions>
- <https://www.mathsisfun.com/calculus/introduction.html>
- http://www-math.mit.edu/~djk/calculus_beginners/
- <https://www.khanacademy.org/math/calculus-home>

Terry Moore:

Why is 'x' the unknown?

TED2012 · 3:57 · Filmed Feb 2012

 53 subtitle languages 

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