1 About me

- My name is Joe.
- My office is in the Math Tower, 2-118.
- My MLC hours are on Tuesday, 1pm to 3pm.
- My email is mailto:jdfadams@math.sunysb.edu.
- My website is http://math.sunysb.edu/~jdfadams.

2 Functions and variables

We start with two sets; for example, we could consider the sets

\[ A = \text{the set of all people}, \]

and

\[ B = \text{the set of all integers} = \{\ldots, \ldots, -2, -1, 0, 1, 2, \ldots\}. \]

We should pick one of our sets to be the \textbf{domain}, and the other set will be our \textbf{codomain}. In this example, let’s say that \( A \) is the domain, and \( B \) is the codomain. Next, we decide on a rule that associates an element of the codomain to each element of the domain. Here is an example: If \( \odot \) is a person in the set \( A \) of all people, we could choose the rule

\[ h: \odot \mapsto \text{the age of } \odot \text{ in years, rounded to the nearest whole number}. \]
We’ve given our rule the name $h$. Such a rule is called a **function**. Whenever we talk about a function, we should also know its domain and codomain. These three things must always be considered together. Here’s another example: Let’s take the domain

$$\mathbb{R} = \text{the set of all real numbers},$$

the codomain

$$\mathbb{R}_{\geq 0} = \text{the set of all real numbers that are not negative},$$

and the rule

$$g : \oplus \mapsto 2^{\log|\oplus|}.$$  

Now, $g$ stands for the rule that associates to every real number $\oplus$ the non-negative real number $2^{\log|\oplus|}$. For example,

$$g(3) = 2^{\log 3}.$$  

If $x$ is a real number, then

$$g(x) = 2^{\log|x|}$$

is a real number. Often, people will call things “variables.” In the previous equation, they might call $x$ a variable. This is not useful language; remember that a “variable” is just a (possibly unspecified) element of some set. There is nothing magical about it, but whenever you want to talk about a “variable,” you should have in mind a particular set and know that your “variable” is just an element of that set. For example, if you are asked to “solve for the variable $x$” in

$$x^2 - 2x = -1,$$

you should understand that $x$ is just a real number (i.e., $x$ is an element of the set of real numbers), and the real number $x$ satisfies the equation $x^2 - 2x = -1$.

### 3 Logarithms

Here are some important rules about logarithms: Assume that $a$ and $b$ are positive real numbers; then

$$\log(ab) = \log(a) + \log(b),$$
and
\[\log(1/b) = -\log b.\]
Together, these imply
\[\log(a/b) = \log a - \log b.\]
We also have
\[\log(a^b) = b \log a.\]
The inverse of a logarithm is an exponential. Remember that when we write log, we have a particular base of the logarithm in mind; log usually means base 10, ln means base \(e\), and \(\log_5\) means base 5. Here is an useful trick: If \(x\) is a real number and \(w\) is a positive number, then
\[w^x = 10^{x\log w} = e^{x\ln w} = 3^{x\log_3 w}.\]
Also,
\[w^w = e^{w\ln w}.\]

4 Some trigonometry
You should know the functions \(\sin : \mathbb{R} \to [-1, 1]\) and \(\cos : \mathbb{R} \to [-1, 1]\) very well. You should be able to recall easily the values of \(\sin\) and \(\cos\) at the real numbers 0, \(\pi/6\), \(\pi/4\), \(\pi/3\), and at each of these numbers plus any multiple of \(\pi/2\). Have a look at the illustrations at [http://en.wikipedia.org/wiki/Unit_circle](http://en.wikipedia.org/wiki/Unit_circle).