

2.2 Variables and Values

Reading Assignment

Please read chapter 1 of *Physical Modeling in MATLAB*, by Allen B. Downey [[DOWNEY11](#)].

2.2.1 Command Window Calculator

The characters `>>` in the Command Window is MATLAB's prompt where commands, such as running a function or math calculation may be entered.

```
>> 2 + 1
ans =
    3
```

Or if we want to save the result to a variable for future reference:

```
>> x = 2 + 1
x =
    3
```

Tip: The keyboard arrow keys may be used to retrieve previously entered commands.

Variable

When a value is given a name, it becomes a *variable*. Variables are used to store results and to feed information to future computations. The name given to a variable is called an *identifier*, which just means that we made up the name. The rules for what is a valid identifier are covered later.

Assignment Statement

Storing data in a variable with an equal sign `=` is formally called an *assignment statement* in computer science terminology. Some data value is assigned to be held in a variable.

`ans`

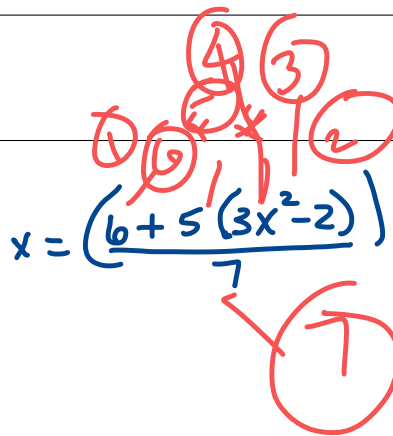
MATLAB knows that users might perform a calculation without saving the result to a variable, but later want to use the result. So any result not saved to a variable is automatically stored in a variable called `ans`. **NOTE:** Only the most recent unsaved result is saved in `ans`.

Table 2.1: Math Operators

Operator	Function
+	Addition
-	Subtraction
*	Multiplication
/	Division
^	Exponent

The order of operations is what you would expect from basic algebra: multiplication and division happen before addition and subtraction. If you want to override the order of operations, you can use parentheses.

```
>> 2 * (3-4) / 5
ans =
    -0.4000
```



The following is the order of operations.

1. parentheses, brackets
2. exponents, roots
3. multiplication, division
4. addition, subtraction

Caution: A common error for beginning programmers is leaving out the * for multiplication.

2.2.2 Pre-defined Constants

Table 2.2: Math Constants

Name	Meaning
eps	Floating-point relative accuracy
flintmax	Largest consecutive integer in floating-point format
i	Imaginary unit
j	Imaginary unit
Inf	Infinity
pi	Ratio of circle's circumference to its diameter
NaN	Not-a-Number

2.2.3 Identifier Names

A few simple rules govern identifier names for variables and functions.

- Can only contain letters, numbers, and underscores
- Can only start with letters
- Are case-sensitive
- Can be between 1 and 63 characters long
- Can not be one of MATLAB's keywords

Incorrect	Correct
X-Y	XY
month&year	monthYear
1987value	value1987
CO2 conc	CO2_conc

What is a keyword?

Look up the function `iskeyword` in the MATLAB documentation.

2.2.4 Calling Functions

MATLAB has functions for any calculation you can imagine and a lot more.

```
>> sin(1)
ans =
    0.8415
```

This command is an example of a function call. The name of the function is `sin`, which is the usual abbreviation for the trigonometric sine. The value in parentheses is called the *argument*. All the trig functions in MATLAB work in radians, but there is a set of trig function ending with a 'd' that use angles in degrees. These include `sind`, `cosd`, `tand`, etc.

Some functions take more than one argument, in which case they are separated by commas. For example, `atan2` computes the inverse tangent, which is the angle in radians between the positive x-axis and the point with the given y and x coordinates.

```
>> atan2(1,1)
ans =
    0.7854
```

Caution: A common error is to leave out the parentheses around the arguments of a function.

2.2.5 Numeric Data Types

- Default numeric data type is *double* floating point (64 bits).
- Supports very large positive or negative numbers and numbers very close to zero.

```
>> big1 = 9.578942e50
big1 =
9.5789e+50
>> small = 1.07124e-122
small =
1.0712e-122
```

- May have some errors associated with how data is stored in the computer as binary numbers.
- Other numeric data types, such as signed integers and unsigned integers are available if needed. See [Cast function](#).
- MATLAB treats all numeric data as a matrix (discussed later). Scalar values are thus reported as having a size of 1x1.

```
>> a = 5
a =
    5
>> whos
Name      Size      Bytes  Class      Attributes
a         1x1         8  double
```

Look it Up!

Use MATLAB's Documentation facility to look up the **format** command. How can it be applied? What affect does it have on the number of digits of accuracy that MATLAB stores for variables?

2.2.6 Clearing Variables

The **clear** command removes all variables from the Workspace. Specific variables may also be removed:

```
>> clear x
```

Note: Now, complete the homework assignment *Entering Basic Equations* using MATLAB Grader.
