# Octave Cheat Sheet

**Throughout this document $x$ and $y$ will be either row or column vectors and $A$ will always be a matrix.**

## Basics

| | |
|---|---|
| `clc` | Clear command window |
| `clear` | Clear all variables |
| `clf` | Clear all plots |
| `close all` | Close all plots |
| `doc function` | Open help page for function |
| `% This is a comment` | Comments |
| `ctrl-c` | Abort the current operation |
| `format short` | Display 4 decimal places |
| `format long` | Display 15 decimal places |
| `disp('text')` | Print text |

## Defining and Changing Variables

| | |
|---|---|
| `a = 3` | Define variable $a$ to be 3 |
| `x = [1, 2, 3]` | Set $x$ to be the row vector $[1, 2, 3]$ |
| `x = [1; 2; 3]` | Set $x$ to be the column vector $[1, 2, 3]^T$ |
| `A = [1, 2, 3, 4;`<br>`    5, 6, 7, 8;`<br>`    9, 10, 11, 12]` | Set $A$ to be a $3 \times 4$ matrix |
| `x(2) = 7` | Change $x$ from $[1, 2, 3]$ to $[1, 7, 3]$ |
| `A(2,1) = 0` | Change $A_{2,1}$ from 5 to 0 |

## Basic Arithmetic and Functions

| | |
|---|---|
| `3*4, 7+4, 2-6, 8/3` | multiply, add, subtract and divide |
| `3^7` | Compute $3^7$ |
| `sqrt(5)` | Compute $\sqrt{5}$ |
| `log(3)` | Compute $\ln(3)$ |
| `log10(100)` | Compute $\log_{10}(100)$ |
| `abs(-5)` | Compute $|-5|$ |
| `sin(5*pi/3)` | Compute $\sin(5\pi/3)$ |
| `floor(3.8)` | Compute $\lfloor 3.8 \rfloor$ |

## Constructing Matrices and Vectors

| | |
|---|---|
| `zeros(12, 5)` | Make a $12 \times 5$ matrix of zeros |
| `ones(12, 5)` | Make a $12 \times 5$ matrix of ones |
| `eye(5)` | Make a $5 \times 5$ identity matrix |
| `eye(12, 5)` | Make a $12 \times 5$ identity matrix |
| `linspace(1.4, 6.3, 1004)` | Make a vector with 1004 elements evenly spaced between 1.4 and 6.3 |
| `logspace(1.4, 6.3, 1004)` | Make a vector with 1004 elements where the log of the spacing is evenly increasing between 1.4 and 6.3 |
| `7:15` | Row vector of $7, 8, \ldots, 14, 15$ |

## Operations on Matrices and Vectors

| | |
|---|---|
| `3 * x` | Multiply every element of $x$ by 3 |
| `x + 2` | Add 2 to every element of $x$ |
| `x + y` | Element-wise addition of two vectors $x$ and $y$ |
| `A * y` | Product of a matrix and vector |
| `A * B` | Product of two matrices |
| `A .* B` | Element-wise product of two matrices |
| `A ^ 3` | Square matrix $A$ to the third power |
| `A .^ 3` | Every element of $A$ to the third power |
| `cos(A)` | Compute the cosine of every element of $A$ |
| `abs(A)` | Compute the absolute values of every element of $A$ |
| `A'` | Transpose of $A$ |
| `inv(A)` | Compute the inverse of $A$ |
| `det(A)` | Compute the determinant of $A$ |
| `eig(A)` | Compute the eigenvalues of $A$ |
| `size(A)` | Get the size of $A$ |

## Entries of Matrices and Vectors

| | |
|---|---|
| `x(2:12)` | The 2nd to the 12th elements of $x$ |
| `x(2:end)` | The 2nd to the last elements of $x$ |
| `x(1:3:end)` | Every third element of $x$ from the first to last |
| `A(5,:)` | Get the 5th row of $A$ |
| `A(:,5)` | Get the 5th column of $A$ |
| `A(5, 1:3)` | Get the first to third elements in the 5th row |

## Plotting

| | |
|---|---|
| `plot(x,y)` | Plot $y$ versus $x$ (must be the same length) |
| `loglog(x,y)` | Plot $y$ versus $x$ on a log-log scale (both axes have a logarithmic scale) |
| `semilogx(x, y)` | Plot $y$ versus $x$ with $x$ on a log scale |
| `semilogy(x, y)` | Plot $y$ versus $x$ with $y$ on a log scale |
| `axis equal` | Force the $x$ and $y$ axes to be scaled equally |
| `title('A Title')` | Add a title to the plot |
| `xlabel('x label')` | Add a label to the $x$ axis |
| `ylabel('y label')` | Add a label to the $y$ axis |
| `legend('foo', 'bar')` | Label 2 curves for the plot |
| `grid` | Add a grid to the plot |
| `hold on` | Multiple plots on single figure |
| `figure` | Start a new plot |

## Constants

| | |
|---|---|
| `pi` | $\pi = 3.141592653589793$ |
| `NaN` | Not a number (i.e. 0/0) |
| `Inf` | Infinity |
| `realmax` | Largest positive floating-point number $1.7977 \cdot 10^{308}$ |
| `realmin` | Smallest positive floating-point number $2.2251 \cdot 10^{-308}$ |

# Octave Cheat Sheet

## For loops

```octave
for k = 1:5
    disp(k);
end
```

## While loops

```octave
k = 0;
while k < 7
    k = k + 1;
end
```

## Logicals

```octave
a = 10;   % Assign a the value of 10
a == 5    % Test if a is equal to 5
    false
a == 10   % Test if a is equal to 10
    true
a >= 5    % Test if a is greater than or equal to 5
    true
a < 11    % Test if a is less than 11
    true
a ~= 4    % Test if a is not equal to 4
    true
a > 1 && a ~= 10 % Test if a is greater than 1 AND
    false        % not equal to 10
a > 1 || a ~= 10 % Test if a is greater than 1 OR
    true         % not equal to 10
```

## Conditional Statements

```octave
if a > 10
    disp('Greater than 10');
elseif a == 5
    disp('a is 5');
else
    disp('Neither condition met');
end
```

## Functions

```octave
function output = addNumbers(x, y)
    output = x + y;
endfunction

addNumbers(10, -5)
    5
```

## Function Handles

```octave
f = @(x) sin(x.^2)./(5*x);

f(pi/2)
    0.0795
f([-pi/2, 0, pi/2])
    -0.0795 NaN 0.0795
```

## Plotting

```octave
x = linspace(-3*pi, 3*pi, 1000);
y1 = sin(x);
y2 = cos(x);

plot(x, y1, 'k-');   % Plot sin(x) as a black line
hold on              % Now we can add another curve
plot(x, y2, 'r-');   % Plot cos(x) as a red line
```

```octave
% Set the axis limits
axis([-3*pi, 3*pi, -1.5, 1.5])

% Add axis labels
xlabel('x');
ylabel('y');

% Add a title
title('A plot of cos(x) and sin(x)');

% Add a legend
legend('sin(x)', 'cos(x)');
```