

# Helpful Functions

MATLAB provides many hundreds of built-in functions. Here, we provide tables of some of them that might be helpful to you in working problems for this course and later for applying what you learn in this course<sup>1</sup>:

Table 1. Matrix-building functions

FUNCTION	RETURNS AN N-BY-M MATRIX OF
<code>zeros (N,M)</code>	zeros
<code>ones (N,M)</code>	ones
<code>eye (N,M)</code>	zeros except for the diagonal elements that are ones
<code>rand (N,M)</code>	random numbers uniformly distributed in the range from 0 to 1

Table 2. Trigonometric functions

FUNCTION	RETURN
<code>acos (x)</code>	Angle in radians whose cosine equals x
<code>acot (x)</code>	Angle in radians whose cotangent equals x
<code>asin (x)</code>	Angle in radians whose sine equals x
<code>atan (x)</code>	Angle in radians whose tangent equals x
<code>atan2 (y,x)</code>	Four-quadrant angle in radians whose tangent equals y/x
<code>cos (x)</code>	Cosine of x (x in radians)
<code>cot (x)</code>	Cotangent of x (x in radians)
<code>sin (x)</code>	Sine of x (x in radians)
<code>tan (x)</code>	Tangent of x (x in radians)

Table 3. Exponential functions

FUNCTION	RETURNS
<code>exp (x)</code>	$e$ raised to the x power
<code>log (x)</code>	Natural logarithm x
<code>log2 (x)</code>	Base-2 logarithm of x
<code>log10 (x)</code>	Base-10 logarithm of x
<code>sqrt (x)</code>	Square root of x

Table 4. Functions that work on complex numbers

FUNCTION	RETURNS
<code>abs (z)</code>	Absolute value of z
<code>angle (z)</code>	Phase angle of z
<code>conj (z)</code>	Complex conjugate of z
<code>imag (z)</code>	Imaginary part of z
<code>real (z)</code>	Real part of z

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<sup>1</sup> Tables excerpted from *Computer Programming with MATLAB*, revised edition, by J. Michael Fitzpatrick and Ákos Lédeczi, 2013.

Table 5. Rounding and remainder functions

FUNCTION	RETURNS
<code>fix(x)</code>	Round x towards zero(basically removes the decimal part)
<code>floor(x)</code>	Round x towards minus infinity
<code>ceil(x)</code>	Round x towards plus infinity
<code>round(x)</code>	Round x towards nearest integer
<code>rem(x,n)</code>	Remainder of $x/n$ (see help for case of noninteger n)
<code>sign(x)</code>	<b>1</b> if $x > 0$ ; <b>0</b> if $x$ equals <b>0</b> ; <b>-1</b> if $x < 0$

Table 6. Descriptive functions applied to a vector

FUNCTION	RETURNS
<code>length(v)</code>	Number of elements of v
<code>max(v)</code>	Largest element of v
<code>min(v)</code>	Smallest element of v
<code>mean(v)</code>	Mean of v
<code>median(v)</code>	Median element of v
<code>sort(v)</code>	Sorted version of v in ascending order
<code>std(v)</code>	Standard deviation of v
<code>sum(v)</code>	Sum of the elements of v

Table 7. Descriptive functions applied to a two-dimensional matrix

FUNCTION	RETURNS A ROW VECTOR CONSISTING OF
<code>max(M)</code>	Largest element of each column
<code>min(M)</code>	Smallest element of each column
<code>mean(M)</code>	Mean of each column
<code>median(M)</code>	Median of each column
<code>size(M)</code>	Number of rows, number of columns
<code>sort(M)</code>	Sorted version, in ascending order, of each column
<code>std(M)</code>	Standard deviation of each column
<code>sum(M)</code>	Sum of the elements of each column