1. Draw $z = \sin(\sqrt{x^2 + y^2})$, $0 \leq x \leq 6$, $0 \leq y \leq 9$
>> help mesh

MESH  3-D mesh surface.
MESH(X,Y,Z,C) plots the colored parametric mesh defined by
four matrix arguments. The view point is specified by VIEW.
The axis labels are determined by the range of X, Y and Z,
or by the current setting of AXIS. The color scaling is determined
by the range of C, or by the current setting of CAXIS. The scaled
color values are used as indices into the current COLORMAP.

MESH(X,Y,Z) uses C = Z, so color is proportional to mesh height.

MESH(x,y,Z) and MESH(x,y,Z,C), with two vector arguments replacing
the first two matrix arguments, must have length(x) = n and
length(y) = m where [m,n] = size(Z). In this case, the vertices
of the mesh lines are the triples (x(j), y(i), Z(i,j)).
Note that x corresponds to the columns of Z and y corresponds to
the rows.

MESH(Z) and MESH(Z,C) use x = 1:n and y = 1:m. In this case,
the height, Z, is a single-valued function, defined over a
gometrically rectangular grid.

MESH returns a handle to a SURFACE object.

AXIS, CAXIS, COLORMAP, HOLD, SHADING and VIEW set figure, axes, and
surface properties which affect the display of the mesh.

See also SURF, MESHC, MESHZ, WATERFALL.

>> surf(x,y,z);
>> xlabel('x'); ylabel('y');
>> zlabel('z'); title('sin(sqrt(x^2 + y^2))');

![fig.2](image-url)
>> % draw the same graph without for loop
>> x = 0:.1:6; y = 0:.1:9;
>> X = x(ones(length(y), 1), :);
>> size(X)
ans =
    91   61

>> Y = y(ones(length(x), 1), :)’;
>> size(Y)
ans =
    91   61

>> Z = sin(sqrt(X.^2 + Y.^2));
>> mesh(X, Y, Z)
>> close

2. Examples of sensitivity analysis with respect to volatility and stock prices

>> help blsprice

BLSPRICE Black-Scholes put and call pricing.

[CALL, PUT] = BLSPRICE(SO, X, R, T, SIG, Q) returns the value of
call and put options using the Black-Scholes pricing formula. SO is
the current asset price, X is the exercise price, R is the risk-free
interest rate, T is the time to maturity of the option in years, SIG
is the standard deviation of the annualized continuously compounded
rate of return of the asset (also known as volatility), and Q is the
dividend rate of the asset. The default Q is 0.

Note: This function uses normcdf, the normal cumulative
distribution function in the Statistics Toolbox.

For example, the current price an asset is $100, the exercise price
of the option is $95, the risk-free interest rate is 10%, the time
to maturity of the option is .25 years, and the standard deviation
of the asset is 50%. Using this data,

    call = blsprice.m(100, 95, .1, .25, .5, 0)

returns a call option price of $13.70.

Reference: Bodie, Kane, and Marcus, Investments, page 681.

See also BLSIMPV, BLSDELTA, BLSGAMMA, BLSLAMBDA, BLSTHETA, BLSRHO.

>> S = 10:10:200; X = 100; R = .1; T = 1; sig = .1:.1:.9; Q = .025;
>> [call, put] = blsprice(S, X, R, T, sig, Q);
Matrix dimensions must agree.

Error in ==> /packages/matlab_5/toolbox/finance/finance/blsprice.m
On line 34  ==> if any(so <= 0 | x <= 0 | r < 0 | t <= 0 | sig < 0)

>> newS = S(ones(length(sig), 1), :);
>> newsig = sig(ones(length(S), 1), :);'
>> [call, put] = blsprice(newS, X, R, T, newsig, Q);
>> subplot(2,1,1); mesh(newS, newsig, call);
>> title('Call Option'); xlabel('Stock Price');
>> ylabel('Volatility'); zlabel('Option Price');
>> subplot(2,1,2); mesh(newS, newsig, put);
>> title('Put Option'); xlabel('Stock Price');
>> ylabel('Volatility'); zlabel('Option Price');
>> orient tall

fig.3
3. Comparing European and American call options

>> clear;
>> help binprice

BINPRICE Binomial put and call pricing.
[PR,OPT] = BINPRICE(SO,X,R,T,DT,SIG,FLAG,Q,DIV,EXDIV)
prices an option using a binomial pricing model. SO is the underlying
asset price, X is the option exercise price, R is the risk-free
interest rate, T is the option’s time until maturity in years, DT
is the time increment within T, SIG is the assets volatility, FLAG
specifies whether the option is a call (flag = 1) or a put (flag = 0),
Q is the dividend rate, DIV is the dividend payment at an ex-dividend
date, EXDIV. EXDIV is specified in number of periods. All inputs to
this function are scalar values except DIV and EXDIV which are 1-by-n
vectors. For each dividend payment, there must be a corresponding
ex-dividend date. By default q, div, and EXDIV equal 0. If a value
is entered for the dividend rate q, DIV and EXDIV should equal 0 or
not be entered. If values are entered for DIV and EXDIV, set Q = 0.

[P,O] = binprice(52,50,.1,5/12,1/12,.4,0,0,2.06,3.5) returns
the asset price and option value at each node of the binary
tree.

P =

52.0000   58.1367   65.0226   72.7494   79.3515   89.0642
0   46.5642   52.0336   58.1706   62.9882   70.6980
0   0   41.7231   46.5981   49.9992   56.1192
0   0   0   37.4120   39.6887   44.5467
0   0   0   0   31.5044   35.3606
0   0   0   0   0   28.0688

O =

4.4404    2.1627    0.6361         0         0         0
0    6.8611    3.7715    1.3018         0         0
0   0    10.1591    6.3785    2.6645         0
0   0   0    14.2245   10.3113    5.4533
0   0   0   0    18.4956   14.6394
0   0   0   0   0    21.9312

See also BLSPRICE.

Reference: Options, Futures, and Other Derivative Securities,

>> S = 100; X = 95; R = .1; T = .1; sig = .3; Q = 0;
>> EuCall = blsprice(S, X, R, T, sig, Q)
EuCall =

7.3832

>> dt = [.05 .025 .01 .005 .0025 .001 .0005 .00025];
>> j = 1;
>> for DT = dt
[pr, opt] = binprice(S, X, R, T, DT, sig, 1, Q);
AmCall(j) = opt(1,1); j = j + 1; end;
>> subplot(2,1,1); plot(dt, abs(EuCall - AmCall));
>> title('Comparison of European Call and American Call');
>> xlabel('Time step'); ylabel('Difference');
>> subplot(2,1,2); loglog(dt, abs((EuCall - AmCall)/EuCall));
>> xlabel('Time Step'); ylabel('Relative Error - log-log scal');
>> axis([.00025 .05 -inf inf]);
>> orient tall

![Graph of Comparison of European Call and American Call](fig.4)