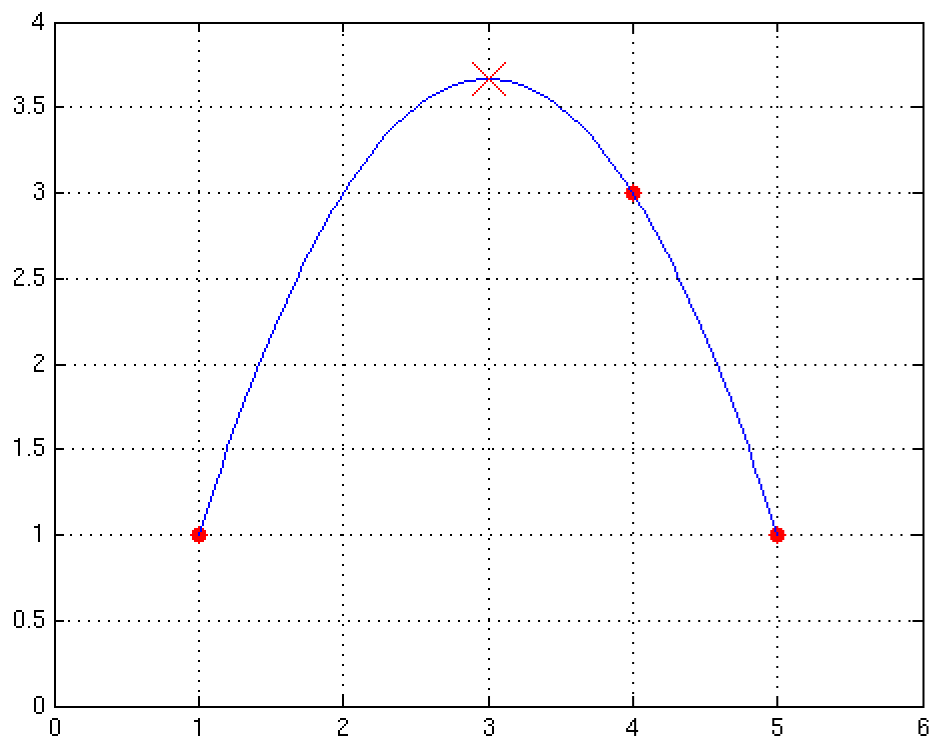
Interpolation i Matlab

Dag Lindbo, 2011-01-31

```
clear all, close all

X = [1 4 5]';
Y = [1 3 1]';

% ekvationssystemet
c = [ones((size(X))) X X.^2]\Y
f = @(x) c(1) + c(2)*x + c(3)*x.^2;

% derivera: df = c(2) + 2*c(3)*x = 0 =>
xmax = -c(2)/(2*c(3))

x = linspace(1,5,100);
plot(X,Y,'r.',x,f(x),'b',xmax,f(xmax),'rx','MarkerSize',20),
axis([0 6 0 4]), grid on
```

```
c =
  -2.333333333333333
   4.000000000000000
  -0.666666666666667
xmax =
     3
```

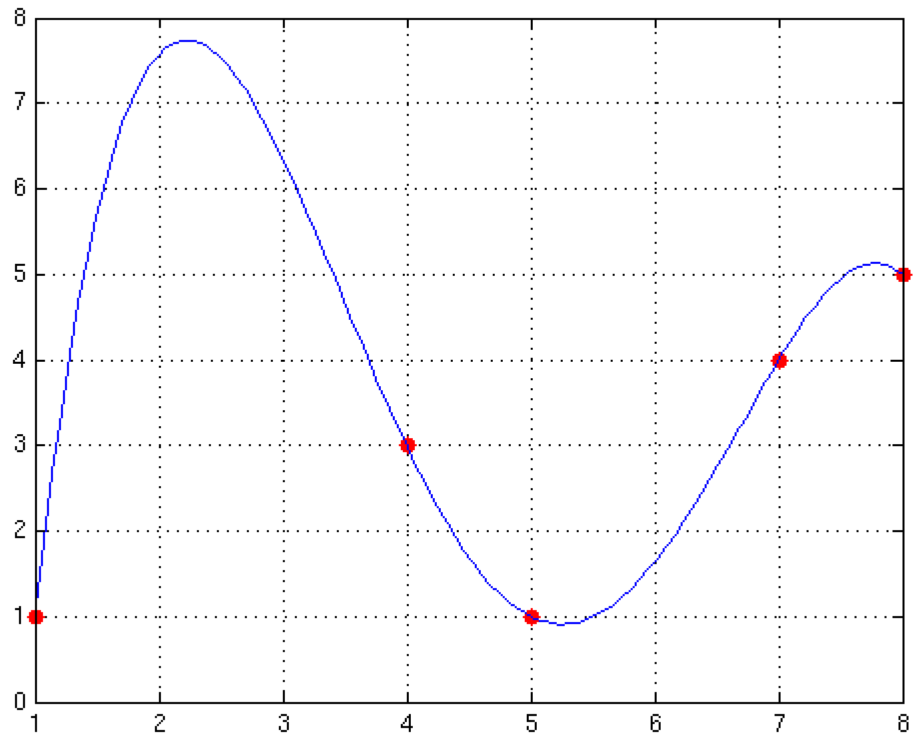


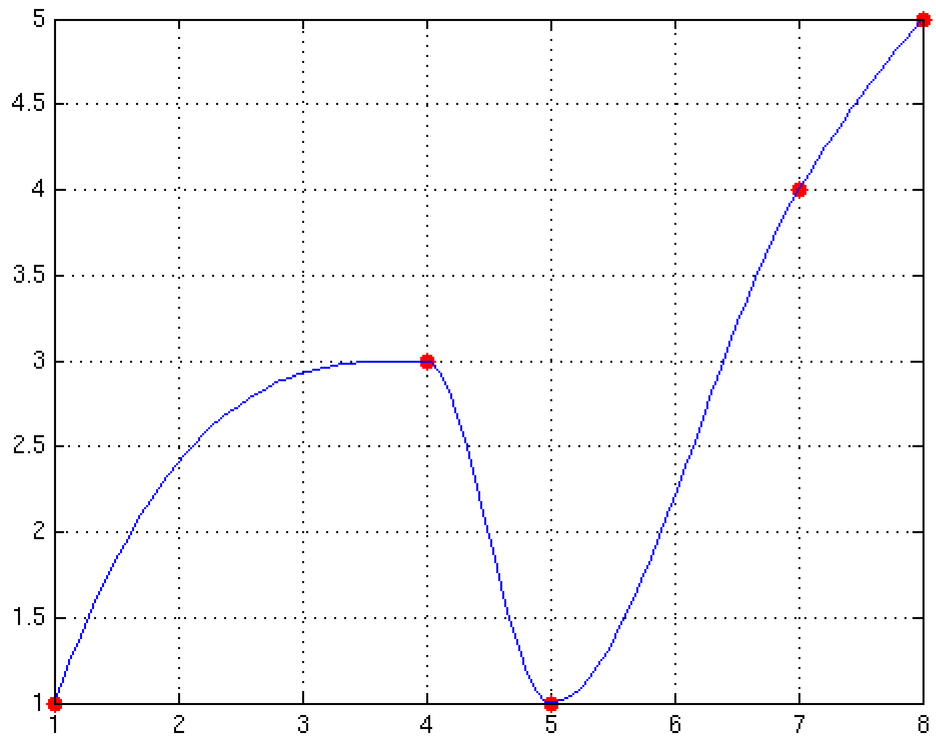
Med inbyggda funktioner

```
X = [1 4 5 7 8]';
Y = [1 3 1 4 5]';

% anpassa polynom
c = polyfit(X,Y,4)
x = linspace(1,8,100);
y = polyval(c,x); % evaluera polynomet i punkterna x

figure()
plot(X,Y,'r.',x,y,'MarkerSize',20), grid on

% styckvis kubisk
help pchip

figure()
c = pchip(X,Y)
y = ppval(c,x);
plot(X,Y,'r.',x,y,'MarkerSize',20), grid on
```

```
c =
  Columns 1 through 3
  -0.091269841269840   1.857142857142832 -12.757936507936355
  Columns 4 through 5
  33.214285714285381 -21.222222222222076
 PCHIP  Piecewise Cubic Hermite Interpolating Polynomial.
    PP = PCHIP(X,Y) provides the piecewise polynomial form of a certain
    shape-preserving piecewise cubic Hermite interpolant, to the values
    Y at the sites X, for later use with PPVAL and the spline utility UNMKPP.
    X must be a vector.
    If Y is a vector, then Y(j) is taken as the value to be matched at X(j),
    hence Y must be of the same length as X.
    If Y is a matrix or ND array, then Y(:,...,:,j) is taken as the value to
    be matched at X(j),  hence the last dimension of Y must equal length(X).

    YY = PCHIP(X,Y,XX) is the same as YY = PPVAL(PCHIP(X,Y),XX), thus
    providing, in YY, the values of the interpolant at XX.

    The PCHIP interpolating function, p(x), satisfies:
    On each subinterval,  X(k) <= x <= X(k+1),  p(x) is the cubic Hermite
       interpolant to the given values and certain slopes at the two endpoints.
    Therefore, p(x) interpolates Y, i.e., p(X(j)) = Y(:,j), and
        the first derivative, Dp(x), is continuous, but
        D^2p(x) is probably not continuous; there may be jumps at the X(j).
    The slopes at the X(j) are chosen in such a way that
       p(x) is "shape preserving" and "respects monotonicity". This means that,
    on intervals where the data is monotonic, so is p(x);
    at points where the data have a local extremum, so does p(x).

  Comparing PCHIP with SPLINE:
    The function s(x) supplied by SPLINE is constructed in exactly the same way,
    except that the slopes at the X(j) are chosen differently, namely to make
    even D^2s(x) continuous. This has the following effects.
    SPLINE is smoother, i.e., D^2s(x) is continuous.
    SPLINE is more accurate if the data are values of a smooth function.
    PCHIP has no overshoots and less oscillation if the data are not smooth.
    PCHIP is less expensive to set up.
    The two are equally expensive to evaluate.

    Example:

      x = -3:3;
```

```
      y = [-1 -1 -1 0 1 1 1];
      t = -3:.01:3;
      plot(x,y,'o',t,[pchip(x,y,t); spline(x,y,t)])
      legend('data','pchip','spline',4)

    Class support for inputs x, y, xx:
       float: double, single

    See also INTERP1, SPLINE, PPVAL, UNMKPP.

    Reference page in Help browser
       doc pchip

c =
      form: 'pp'
    breaks: [1 4 5 7 8]
     coefs: [4x4 double]
    pieces: 4
     order: 4
       dim: 1
```





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