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more symbolic examples

`% ReactorLab.net`

solve 1 equation

```
clear; clc
syms x
f = x^2 - 3*x + 2
xsoln = solve(f) % solve to find x values for f(x) = 0

% alternately, can solve for f(x) = another value
xsoln2 = solve(f == 1) % symbolic solution

% convert symbolic answer to floating point
% can use built-in functions cast, double, vpa
xsoln2 = double(xsoln2)

% above, f was an expression
% another way is to specify a full equation
f2 = x^2 - 3*x + 2 == 1

% then solve it to find the x value that
% satisfies the equation
xsoln3 = solve(f2)

f =

x^2 - 3*x + 2

xsoln =

1
2

xsoln2 =
```

```

3/2 - 5^(1/2)/2
5^(1/2)/2 + 3/2

xsoln2 =

    0.3820
    2.6180

f2 =

x^2 - 3*x + 2 == 1

xsoln3 =

    3/2 - 5^(1/2)/2
    5^(1/2)/2 + 3/2

```

solve system of 2 equations

```

clear; clc
syms x1 x2
f1 = -3*x1 + 3*x2 == 2
f2 = -6*x1 + 2*x2 == 1
% polynomials shown here but can be other types

x = solve(f1,f2)

% from result
% x =    x1: [1x1 sym]
%       x2: [1x1 sym]
% we see that x is a structure
% See >> doc solve
% The solve function returns a structure when you specify a single
% output argument and multiple outputs exist.
% See >> doc structures
% A structure is an array with named fields that can contain data of
% varying types and sizes. Access data in a structure using dot
% notation of the form structName.fieldName

% pull symbolic values of x1 and x2 out of the structure x
x1val = x.x1
x2val = x.x2

% ALTERNATIVELY, since we know there are two solutions
% WE COULD HAVE WRITTEN
% [x1val x2val] = solve(f1,f2)

x1val = double(x1val) % convert symbolic answer to double
x2val = double(x2val)

```

```
f1 =  
3*x2 - 3*x1 == 2  
  
f2 =  
2*x2 - 6*x1 == 1  
  
x =  
    x1: [1x1 sym]  
    x2: [1x1 sym]
```

```
x1val =  
1/12
```

```
x2val =  
3/4
```

```
x1val =  
0.0833
```

```
x2val =  
0.7500
```

evaluate a function at specified value

```
clear; clc  
syms x  
f = 5*exp(-10/x)  
% function subs evaluates a function at specified value  
% by SUBStituting that value into the function  
val = subs(f,3) % symbolic answer  
val = double(val) % convert symbolic answer to double  
  
f =  
5*exp(-10/x)
```

```
val =  
5*exp(-10/3)
```

```
val =  
0.1784
```

evaluate function of multiple vars at value of one var

```
clear; clc  
syms x y  
f = 3*x + 4*y  
val = subs(f,x,3) % f(x,y) for x = 3
```

```
f =  
3*x + 4*y
```

```
val =  
4*y + 9
```

differentiate a function and find min or max

```
clear; clc  
syms x  
f = 4*x^2 + 3*x  
  
% plot the function  
% fplot is recommended by Matlab vs. old ezplot  
fplot(f)  
title('f(x)'); ylabel('f'); xlabel('x')  
axis([-5 5 -10 100])  
grid  
  
% differentiate f with respect to x  
dfdx = diff(f)  
  
% find values of x where df/dx = 0  
xm = solve(dfdx)  
  
% find value of f(x) at this value  
fm = subs(f,xm)
```

$f =$

$$4x^2 + 3x$$

$\frac{df}{dx} =$

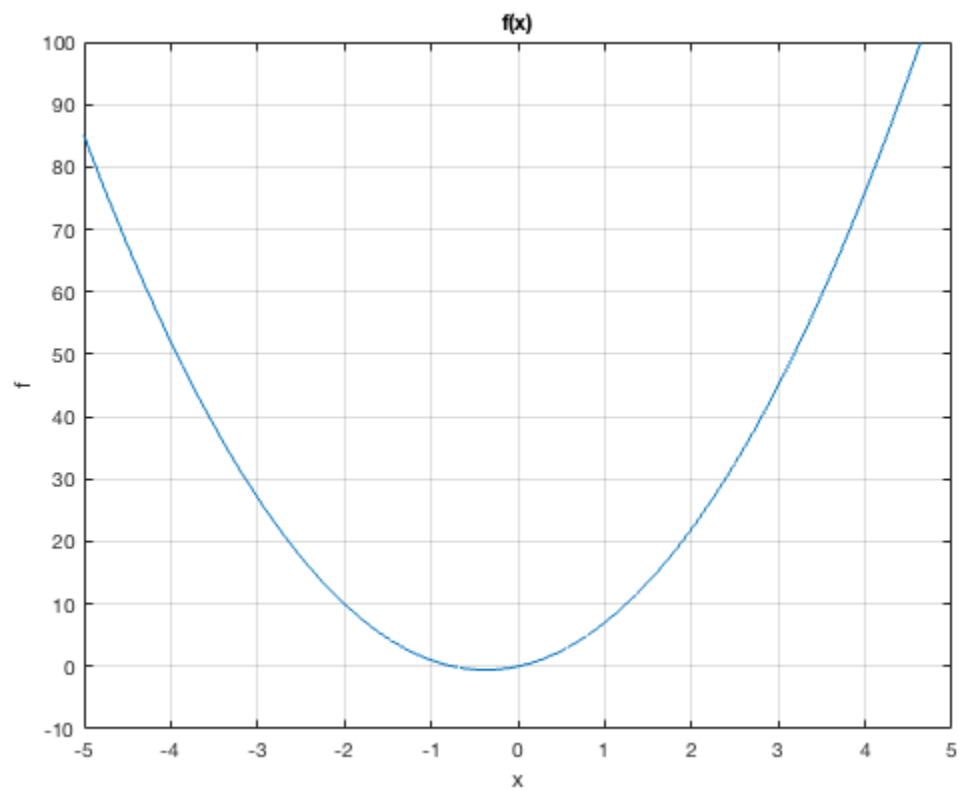
$$8x + 3$$

$x_m =$

$$-3/8$$

$f_m =$

$$-9/16$$



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