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Solving Equations

2.1 Algebraic Equations

By using Symbolic Toolbox, you can find solutions of algebraic equations with or without using numerical values. If you need to solving equations, you can use the command solve. For example, to find the solution of $x^3+x^2+x+1=0$ you write:

```
>> solve('x^3+x^2+x+1=0')
```

and Matlab give you the answer in the form

```
ans =
[ -1]
[  i]
[ -i]
```

That means the three solutions for the equation are 1, j, and –j.

```
>>solve('sin(x)+x=0.1')
ans =
5.001042187833512e-2
```

For example, let us solve the equation $3x^2-8x+2=0$.

```
>> solve('3*x^2-8*x+2=0','x')
ans =
[ 4/3+1/3*10^(1/2)]
[ 4/3-1/3*10^(1/2)]
```

In expressions with more than one variable, we can solve for one or more of the variables in terms of the others. Here we find the roots of the quadratic ax^2+bx+c in x in terms of a, b and c. By default solve sets the given expression equal to zero if an equation is not given.

```
>> solve('a*x^2+b*x+c','x')
ans =
[ 1/2/a*(-b+(b^2-4*a*c)^(1/2))]
[ 1/2/a*(-b-(b^2-4*a*c)^(1/2))]
```

You can solve more than one equation simultaneously. For example suppose that we need to solve the system $x^2+ x+ y^2 = 2$ and $2x-y = 2$. We can type:

>> [x,y] = solve('x^2+ x+ y^2 = 2', '2*x-y = 2')

And get the solutions

x =

[2/5]

[1]

y =

[-6/5]

[0]

This means that there are two points which are (2/5, -6/5) and (1, 0).

For example to find the value of x and y from the equations: $5x+10y=46$ and $28x+32y=32$, you write:

>> [x,y]=solve('5*x+10*y=46', '28*x+32*y=32')

And you get the following result screen:

x =

-48/5

y =

47/5

>> [x,y]=solve('log(x)+x*y=0', 'x*y+5*y=1')

x =

.8631121967939437

y =

.1705578823046945

Now let's find the points of intersection of the circles $x^2+y^2=4$ and $(x-1)^2+(y-1)^2=1$.

>>[x,y]=solve('x^2+y^2=4','(x-1)^2+(y-1)^2=1')

x=

[5/4-1/4*7^(1/2)]

[5/4+1/4*7^(1/2)]

y=

[5/4+1/4*7^(1/2)]

[5/4-1/4*7^(1/2)]

You can solve an equation in two variables for one of them. For example:

>> solve('y^2+2*x*y+2*x^2+2*x+1=0', 'y')

ans =

[-x+i*(x+1)]

[-x-i*(x+1)]

In same way if you have more then two equations you can use the same command to solve them for example:

```
[x,y,z]=solve('x+y+z=1','x+2*y-z=3','2*x-2*z=2')
x =
1/2
y =
1
z =
-1/2
```