

```
%% matlab求解方程和方程组
```

```
% 不同的MATLAB版本之间的语法存在不兼容的情况: https://www.zhihu.com/question/360875116/answer/937256
```

```
% 视频里面用到的是Matlab2017a版本, 如果低版本版本可能会报错。
```

```
% 更多关于Matlab求方程的介绍可看这个博客: https://blog.csdn.net/weixin\_30724853/article/details/9900
```

```
%% solve函数
```

```
%% 例题1: 求解单变量方程
```

```
clear;clc
```

```
syms x
```

```
answ = solve(sin(x) == 1, x) % 注意: 这里的等号一定要有两个, 一个等号表示赋值, 两个等号才表示左右两边相等
```

```
answ =
```

$$\frac{\pi}{2}$$

```
answ = solve(sin(x) == 1) % 只有一个符号变量x, 所以可以不指定未知数
```

```
answ =
```

$$\frac{\pi}{2}$$

```
% 也可以这样写
```

```
clear;clc
```

```
syms x
```

```
eqn = (sin(x) == 1); % eqn = sin(x) == 1;
```

```
answ = solve(eqn, x)
```

```
answ =
```

$$\frac{\pi}{2}$$

```
% 因为三角函数是周期函数, 如果要得到所有的解, 则需要加上条件
```

```
[answ, params, condions] = solve(eqn, x, 'ReturnConditions', true)
```

```
answ =
```

$$\frac{\pi}{2} + 2\pi k$$

```
params = k
```

```
condions =  $k \in \mathbb{Z}$ 
```

```
%% 例题2: 多变量方程求解
```

```
clear;clc
```

```
syms a b c x
```

```
eqn = (a*x^2 + b*x + c == 0);
```

```
answ1 = solve(eqn, x) % 将x视为未知数求解
```

```
answ1 =
```

$$\begin{pmatrix} -\frac{b + \sqrt{b^2 - 4ac}}{2a} \\ -\frac{b - \sqrt{b^2 - 4ac}}{2a} \end{pmatrix}$$

```
% -(b + (b^2 - 4*a*c)^(1/2))/(2*a)
% -(b - (b^2 - 4*a*c)^(1/2))/(2*a)
answ2 = solve(eqn, a) % 将a视为未知数求解
```

```
answ2 =
    -\frac{c + bx}{x^2}
```

```
% -(c + b*x)/x^2
```

```
%% 例题3: 方程组求解
clear;clc
syms u v a
eqn = [2*u + v == a, u - v == 1];
answ = solve(eqn, [u, v])
```

```
answ = 包含以下字段的 struct:
    u: [1x1 sym]
    v: [1x1 sym]
```

```
answ.u
```

```
ans =
    \frac{a}{3} + \frac{1}{3}
```

```
answ.v
```

```
ans =
    \frac{a}{3} - \frac{2}{3}
```

```
[answ_u, answ_v] = solve(eqn, [u, v])
```

```
answ_u =
    \frac{a}{3} + \frac{1}{3}
```

```
answ_v =
    \frac{a}{3} - \frac{2}{3}
```

```
%% solve 可能会警告
syms x
eqn = (sin(x) == x^2 - 1);
solve(eqn, x) % 警告: Cannot solve symbolically. Returning a numeric approximation instead.
```

警告: Cannot solve symbolically. Returning a numeric approximation instead.

```
ans = -0.63673265080528201088799090383828
```

```
% 画图看看  
fplot(sin(x), [-2 2]) % fplot函数可绘制表达式的图形  
hold on  
fplot(x^2 - 1, [-2 2])
```

```
%% vpasolve函数求解  
% 用vpasolve函数指定求[0 2]上的解  
syms x  
eqn = sin(x) == x^2 - 1;  
vpasolve(eqn, x, [0 2])
```

```
ans = 1.4096240040025962492355939705895
```

```
vpasolve(eqn, x, [-1 0])
```

```
ans = -0.63673265080528201088799090383828
```

```
vpasolve(eqn, x, [-10 10])
```

```
ans = 1.4096240040025962492355939705895
```

```
% vpasolve returns all solutions only for polynomial equations.  
% For nonpolynomial equations, there is no general method of finding all solutions.  
% When you look for numerical solutions of a nonpolynomial equation or system that has several  
% then, by default, vpasolve returns only one solution, if any.  
% To find more than just one solution, set random to true.  
% Now, calling vpasolve repeatedly might return several different solutions.  
vpasolve(eqn, x, 'random', true)
```

```
ans = -0.63673265080528201088799090383828
```

```
vpasolve(eqn, x, -5) % 给定搜索的起始点
```

```
ans = -0.63673265080528201088799090383828
```

```
%% 来看一个更复杂的例子  
syms x y  
eqn = [x^2 - 2*x - 3*x*y == 10, y^4 == exp(-2*x/3*y)]
```

```
eqn =
```

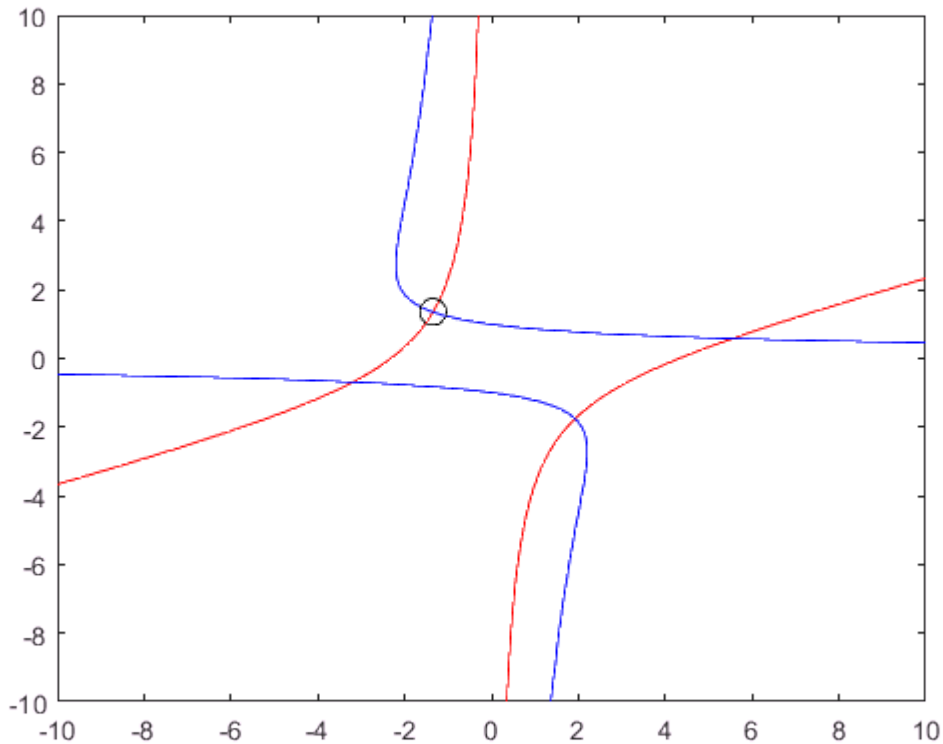
$$\left(x^2 - 3xy - 2x = 10 \quad y^4 = e^{-\frac{2xy}{3}} \right)$$

```
[answ_x, answ_y] = vpasolve(eqn, [x, y], 'random', true)
```

```
answ_x = 5.5507908156649293471065533396468  
answ_y = 0.58308190492655943867568491926493
```

```
% 画图看看
```

```
ezplot(x^2 - 2*x - 3*x*y == 10, [-10 10])
hold on
ezplot(y^4 == exp(-2*x/3*y), [-10 10])
```



```
close % 关闭图形
```

```
% ezplot函数比较鸡肋，下面这个函数比较厉害哦
```

```
fimplicit(x^2 - 2*x - 3*x*y == 10, [-10 10], 'r') % R2016b版本之后才有
```

```
hold on
```

```
fimplicit(y^4 == exp(-2*x/3*y), [-10 10], 'b') % R2016b版本之后才有
```

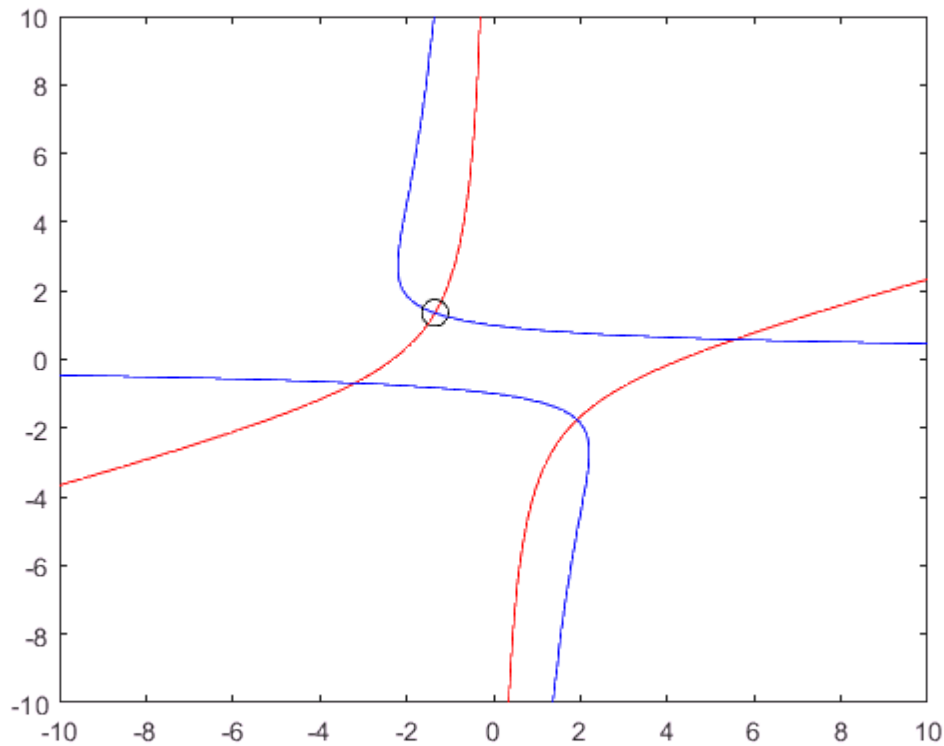
```
[answ_x, answ_y] = vpasolve(eqn, [x, y], [-4 -1; 1 5]) % 指定搜索的范围: x位于[-4 -1], y位于[1 5]
```

```
answ_x = -1.3482250407076871789036811463987
```

```
answ_y = 1.3563114446912236134053423355957
```

```
hold on
```

```
plot(answ_x, answ_y, 'ko', 'MarkerSize', 10)
```



```
% plot(double(answ_x), double(answ_y),'ko', 'MarkerSize',10) % double可以将我们的符号变量转换为数字
```

```
%% fsolve函数（求解功能最为强大哦）
```

```
% fsolve是Matlab优化工具箱中的一个函数，可专门用来求解特别复杂的方程和方程组
```

```
x0 = [0,0]; % 初始值
```

```
result_x = fsolve(@my_fun,x0)
```

Equation solved.

fsolve completed because the vector of function values is near zero as measured by the default value of the function tolerance, and the problem appears regular as measured by the gradient.

<stopping criteria details>

```
result_x =
```

```
    0.3532    0.6061
```

```
% 当然你也可以用vpasolve函数试试
```

```
clear; clc
```

```
syms x1 x2
```

```
eqn = [exp(-exp(-(x1+x2))) - x2*(1+x1^2) == 0, x1*cos(x2) + x2*sin(x1) - 0.5 == 0]
```

```
eqn =
```

$$\left(e^{-e^{-x_1-x_2}} - x_2 (x_1^2 + 1) = 0 \quad x_1 \cos(x_2) + x_2 \sin(x_1) - \frac{1}{2} = 0 \right)$$

```
[answ_x1, answ_x2] = vpasolve(eqn, [x1, x2], [0 0])
```

answ_x1 = 0.35324661959671746608371888721268

answ_x2 = 0.60608173664146473530299588999127

% % 注意：代码文件仅供参考，一定不要直接用于自己的数模论文中

% % 国赛对于论文的查重要求非常严格，代码雷同也算作抄袭

% % 视频中提到的附件可在售后群（购买后收到的那个无忧自动发货的短信中有加入方式）的群文件中下载。包括讲义、代码、

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% % 如何修改代码避免查重的方法：<https://www.bilibili.com/video/av59423231>（必看）