```
%第1题
%{
原问题可以用如下cvx代码求解，在目标函数中，由于square(x)是凸函数，其内层函数为仿射函数，
易知目标函数是凸函数；在不等式约束中，norm(x)为凸函数，quad_over_lin（x,y）在y>0时为
凸函数，内层也为仿射函数。再由凸函数之和仍然为凸函数，因此不等式约束函数也是凸函数。
故问题为凸优化问题。
%}

cvx_begin
    variables x(3)
    minimize square(x(1)+x(2)) + square(x(2)-2) + x(3)^2 + 3*x(1) - 4
    subject to
        norm([0.5*x(1)+x(2) (sqrt(7)/2)*x(1) sqrt(3)*x(2) 2])+quad_over_lin(x(1)-x(2)+x(3)+1, x(1)+x(2))<=6
        x>=1;
cvx_end

%{
optimal solution: x=[1.0000;1.0000;1.0000]
optimal value: +5
%}
```

```
Calling SDPT3 4.0: 21 variables, 8 equality constraints
   For improved efficiency, SDPT3 is solving the dual problem.
------------------------------------------------------------


 num. of constraints =  8
 dim. of sdp    var  =  8,   num. of sdp  blk  =  4
 dim. of socp   var  =  5,   num. of socp blk  =  1
 dim. of linear var  =  4
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|6.9e+00|4.1e+00|1.2e+03| 2.683282e+01  0.000000e+00| 0:0:00| chol  1  1
 1|0.960|0.855|2.7e-01|6.3e-01|2.5e+02| 5.015298e+01 -3.277456e+01| 0:0:00| chol  1  1
 2|1.000|0.936|8.2e-07|4.4e-02|3.2e+01| 9.512659e+00 -1.517230e+01| 0:0:00| chol  1  1
 3|0.842|1.000|4.0e-07|4.3e-04|4.6e+00|-6.052617e+00 -1.057011e+01| 0:0:00| chol  1  1
 4|0.784|1.000|2.3e-07|4.3e-05|2.2e+00|-7.923813e+00 -1.012507e+01| 0:0:00| chol  1  1
 5|1.000|0.799|1.3e-08|1.2e-05|4.1e-01|-8.827133e+00 -9.232311e+00| 0:0:00| chol  1  1
 6|0.971|0.981|1.2e-09|6.5e-07|1.8e-02|-8.991502e+00 -9.009397e+00| 0:0:00| chol  1  1
 7|0.971|0.979|4.8e-10|5.5e-08|4.5e-04|-8.999753e+00 -9.000196e+00| 0:0:00| chol  1  1
 8|0.946|0.979|1.0e-10|1.2e-09|2.1e-05|-8.999985e+00 -9.000006e+00| 0:0:00| chol  1  1
 9|0.990|1.000|2.6e-10|2.0e-11|1.6e-06|-8.999999e+00 -9.000001e+00| 0:0:00| chol  1  1
10|1.000|1.000|1.1e-11|3.0e-11|1.5e-07|-9.000000e+00 -9.000000e+00| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   = 10
 primal objective value = -8.99999992e+00
 dual   objective value = -9.00000007e+00
 gap := trace(XZ)       = 1.52e-07
 relative gap           = 8.01e-09
 actual relative gap    = 7.95e-09
 rel. primal infeas (scaled problem)   = 1.09e-11
 rel. dual      "        "       "     = 2.99e-11
 rel. primal infeas (unscaled problem) = 0.00e+00
```

```
 rel. dual     "        "        "      = 0.00e+00
 norm(X), norm(y), norm(Z) = 9.5e+00, 5.4e+00, 8.6e+00
 norm(A), norm(b), norm(C) = 5.5e+00, 3.9e+00, 8.5e+00
 Total CPU time (secs)  = 0.22
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS: 1.3e-11  0.0e+00  3.6e-11  0.0e+00  7.9e-09  8.0e-09
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +5
```

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```
%第2题
%{
原问题可以用如下cvx代码求解，由于sum(x)是仿射函数，不等式约束函数显然为凸函数。
故问题为凸优化问题。
%}

cvx_begin
    variables x(4)
    minimize sum(x)
    subject to
        (x(1)-x(2))^2 + (x(3)+2*x(4))^4 <= 5;
        x(1) + 2*x(2) + 3*x(3) + 4*x(4) <= 6;
        x >= 0;
cvx_end

%{
optimal solution: x=[2.5528e-11;2.5528e-11;2.5528e-11;2.5528e-11]
optimal value: 1.02112e-10
%}
```

```
Calling SDPT3 4.0: 15 variables, 8 equality constraints
------------------------------------------------------------

 num. of constraints =  8
 dim. of sdp    var  =  6,   num. of sdp  blk  =  3
 dim. of linear var  =  6
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|6.5e+00|1.1e+01|1.3e+03| 2.500000e+01  0.000000e+00| 0:0:00| chol  1  1
 1|0.937|1.000|4.1e-01|1.0e-01|1.6e+02| 3.632749e+00 -9.384870e+01| 0:0:00| chol  1  1
 2|1.000|0.925|2.2e-07|1.7e-02|2.1e+01| 2.064447e+00 -1.880206e+01| 0:0:00| chol  1  1
 3|1.000|0.873|1.2e-07|3.0e-03|3.8e+00| 1.161601e+00 -2.616177e+00| 0:0:00| chol  1  1
 4|0.984|1.000|1.8e-08|1.0e-04|5.0e-01| 1.388844e-01 -3.574852e-01| 0:0:00| chol  1  1
 5|0.970|0.980|1.1e-09|1.2e-05|1.3e-02| 3.875884e-03 -9.088710e-03| 0:0:00| chol  1  1
 6|0.989|0.988|2.5e-10|1.1e-06|1.5e-04| 4.417781e-05 -9.248650e-05| 0:0:00| chol  1  1
 7|0.989|0.986|1.2e-11|1.1e-07|2.0e-06| 4.956020e-07  9.298724e-08| 0:0:00| chol  1  1
 8|1.000|0.995|6.8e-14|5.5e-10|2.9e-08| 7.402106e-09 -1.434787e-08| 0:0:00| chol  1  1
 9|1.000|0.997|4.3e-16|2.8e-12|3.9e-10| 1.021116e-10 -2.496580e-10| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   =  9
 primal objective value =  1.02111613e-10
 dual   objective value = -2.49657995e-10
 gap := trace(XZ)       = 3.90e-10
 relative gap           = 3.90e-10
 actual relative gap    = 3.52e-10
 rel. primal infeas (scaled problem)   = 4.33e-16
 rel. dual      "        "       "     = 2.76e-12
 rel. primal infeas (unscaled problem) = 0.00e+00
 rel. dual      "        "       "     = 0.00e+00
 norm(X), norm(y), norm(Z) = 7.1e+00, 1.4e+00, 2.0e+00
 norm(A), norm(b), norm(C) = 6.1e+00, 8.9e+00, 3.2e+00
 Total CPU time (secs)  = 0.17
```

```
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS: 5.5e-16  0.0e+00  3.0e-12  0.0e+00  3.5e-10  3.9e-10
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +1.02112e-10
```

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```
%第3题
%{
原问题可以用如下cvx代码求解，由于abs(x)、norm(x)、inv_pos(x)和max(x)均为凸函数，
quad_over_lin(x,y)在y>0时是凸函数，因此易知目标函数和不等式约束函数均为凸函数。故该
问题是凸优化问题。
%}

cvx_begin
    variable x(3)
    minimize abs(2*x(1)+3*x(2)+x(3)) + sum(x.*x) +norm([sqrt(2)*(x(1)+x(2)) sqrt(5)*(x(2)+1) 1])
    subject to
        quad_over_lin(x(1), x(2)) + inv_pos(x(2)) + (x(1)+2*x(2))^2 + (x(1)+x(3))^2+(x(2)+x(3))^2+8*x(3)^2 <= 7;
        max([x(1)+x(2) x(3) x(1)-x(3)]) <= 19;
        x(1) >= 0;
        x(2) >= 1;
cvx_end

%{
optimal solution: x=[1.8660e-09;1.0000;-0.4317]
optimal value: +8.5505
%}
```

```
Calling SDPT3 4.0: 40 variables, 15 equality constraints
   For improved efficiency, SDPT3 is solving the dual problem.
------------------------------------------------------------


 num. of constraints = 15
 dim. of sdp    var  = 18,   num. of sdp  blk  =  9
 dim. of socp   var  =  6,   num. of socp blk  =  2
 dim. of linear var  =  7
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|2.4e+01|2.4e+00|4.2e+03| 7.000000e+02  0.000000e+00| 0:0:00| chol  1  1
 1|0.589|0.540|9.9e+00|1.1e+00|2.4e+03| 4.902310e+02 -4.852548e+01| 0:0:00| chol  1  1
 2|1.000|0.748|1.8e-05|2.8e-01|8.4e+02| 3.019715e+02 -7.715919e+01| 0:0:00| chol  1  1
 3|1.000|0.880|1.6e-06|3.4e-02|1.7e+02| 9.610120e+01 -3.090640e+01| 0:0:00| chol  1  1
 4|0.792|0.734|3.6e-07|9.0e-03|6.4e+01| 2.881331e+01 -2.051100e+01| 0:0:00| chol  1  1
 5|1.000|1.000|5.1e-08|1.6e-06|1.9e+01| 7.165262e+00 -1.222758e+01| 0:0:00| chol  1  1
 6|0.924|0.982|8.7e-09|1.8e-07|1.3e+00|-7.589303e+00 -8.886829e+00| 0:0:00| chol  1  1
 7|0.759|1.000|2.4e-09|1.7e-08|6.5e-01|-8.045766e+00 -8.696287e+00| 0:0:00| chol  1  1
 8|0.890|0.950|1.2e-09|2.7e-09|1.1e-01|-8.470905e+00 -8.585882e+00| 0:0:00| chol  1  1
 9|0.790|1.000|9.4e-10|3.9e-10|6.2e-02|-8.512298e+00 -8.574136e+00| 0:0:00| chol  1  1
10|1.000|0.997|1.8e-14|2.0e-10|1.1e-02|-8.543800e+00 -8.555201e+00| 0:0:00| chol  1  1
11|0.925|1.000|9.9e-15|2.5e-12|3.2e-03|-8.548732e+00 -8.551977e+00| 0:0:00| chol  1  1
12|0.981|0.972|2.1e-14|1.2e-12|9.7e-05|-8.550455e+00 -8.550552e+00| 0:0:00| chol  1  1
13|0.979|0.984|2.1e-11|1.0e-12|1.8e-06|-8.550501e+00 -8.550502e+00| 0:0:00| chol  1  1
14|1.000|0.995|5.5e-12|1.5e-12|1.2e-07|-8.550501e+00 -8.550502e+00| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   = 14
 primal objective value = -8.55050148e+00
 dual   objective value = -8.55050160e+00
 gap := trace(XZ)       = 1.22e-07
```

```
 relative gap           = 6.73e-09
 actual relative gap    = 6.73e-09
 rel. primal infeas (scaled problem)   = 5.46e-12
 rel. dual     "         "        "      = 1.50e-12
 rel. primal infeas (unscaled problem) = 0.00e+00
 rel. dual     "         "        "      = 0.00e+00
 norm(X), norm(y), norm(Z) = 8.7e+00, 8.5e+00, 2.7e+01
 norm(A), norm(b), norm(C) = 1.3e+01, 3.2e+00, 3.5e+01
 Total CPU time (secs)  = 0.28
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS: 8.8e-12  0.0e+00  2.6e-12  0.0e+00  6.7e-09  6.7e-09
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +8.5505
```

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```
%第4题
%{
原问题可以用如下cvx代码求解，由于square_pos(x)是凸函数且非减，norm(x)为凸函数，
quad_over_lin(x, y)在y>0时为凸函数，因此易知目标函数和不等式约束函数均为凸函数。
故该问题是凸优化问题。
%}

cvx_begin
    variable x(3)
    minimize norm([sqrt(2)*(x(1)+x(2)) x(2) x(3) sqrt(7)]) + square_pos(sum(x.*x)+1)
    subject to
        quad_over_lin(x(1)+x(2), x(3)+1) + x(1)^8 <= 7;
        (x(1)+x(2)+x(3))^2 + 3*x(3)^2 <= 10;
        (x(1)+x(2)-x(3))^2 <= 20;
        x >= 0;
cvx_end

%{
optimal solution: x=[2.0654e-05;1.9879e-05;2.3113e-05]
optimal value: +3.64575
%}
```

```
Calling SDPT3 4.0: 46 variables, 17 equality constraints
   For improved efficiency, SDPT3 is solving the dual problem.
------------------------------------------------------------


 num. of constraints = 17
 dim. of sdp    var  = 22,   num. of sdp  blk  = 11
 dim. of socp   var  =  5,   num. of socp blk  =  1
 dim. of linear var  =  8
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.5e+01|2.2e+00|3.3e+03| 4.700000e+02  0.000000e+00| 0:0:00| chol  1  1
 1|0.810|0.852|2.9e+00|3.4e-01|8.0e+02| 3.079156e+02 -2.027614e+01| 0:0:00| chol  1  1
 2|0.980|1.000|5.7e-02|2.2e-03|1.2e+02| 1.037873e+02 -1.869720e+01| 0:0:00| chol  1  1
 3|1.000|1.000|8.4e-07|1.2e-02|5.8e+01| 3.946125e+01 -1.387843e+01| 0:0:00| chol  1  1
 4|0.893|0.892|2.6e-07|1.3e-03|7.8e+00| 2.089375e+00 -5.522621e+00| 0:0:00| chol  1  1
 5|1.000|1.000|5.4e-09|2.3e-06|3.5e+00|-9.439351e-01 -4.426463e+00| 0:0:00| chol  1  1
 6|0.953|0.945|1.7e-09|3.4e-07|2.9e-01|-3.435408e+00 -3.728517e+00| 0:0:00| chol  1  1
 7|1.000|1.000|2.4e-09|2.3e-08|1.0e-01|-3.566239e+00 -3.671235e+00| 0:0:00| chol  1  1
 8|0.923|0.913|9.5e-10|4.5e-09|1.1e-02|-3.637755e+00 -3.648671e+00| 0:0:00| chol  1  1
 9|1.000|1.000|2.9e-09|4.1e-10|4.6e-03|-3.642362e+00 -3.646922e+00| 0:0:00| chol  1  1
10|0.915|0.914|2.5e-10|3.4e-10|5.1e-04|-3.645373e+00 -3.645883e+00| 0:0:00| chol  1  1
11|1.000|1.000|5.0e-11|5.0e-11|2.0e-04|-3.645600e+00 -3.645804e+00| 0:0:00| chol  1  1
12|0.912|0.912|2.4e-11|1.4e-11|2.1e-05|-3.645735e+00 -3.645757e+00| 0:0:00| chol  1  1
13|1.000|1.000|5.9e-12|4.8e-12|8.3e-06|-3.645745e+00 -3.645753e+00| 0:0:00| chol  1  1
14|1.000|1.000|2.1e-12|1.2e-12|1.2e-06|-3.645750e+00 -3.645752e+00| 0:0:00| chol  1  1
15|1.000|1.000|7.0e-13|1.0e-12|2.6e-07|-3.645751e+00 -3.645751e+00| 0:0:00| chol  1  1
16|1.000|1.000|2.3e-13|1.0e-12|5.0e-08|-3.645751e+00 -3.645751e+00| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   = 16
 primal objective value = -3.64575127e+00
```

```
 dual   objective value = -3.64575132e+00
 gap := trace(XZ)       = 5.03e-08
 relative gap           = 6.07e-09
 actual relative gap    = 6.06e-09
 rel. primal infeas (scaled problem)   = 2.34e-13
 rel. dual     "        "       "      = 1.00e-12
 rel. primal infeas (unscaled problem) = 0.00e+00
 rel. dual     "        "       "      = 0.00e+00
 norm(X), norm(y), norm(Z) = 5.1e+00, 1.2e+01, 1.7e+01
 norm(A), norm(b), norm(C) = 9.5e+00, 2.4e+00, 2.5e+01
 Total CPU time (secs)  = 0.27
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS: 2.8e-13  0.0e+00  1.2e-12  0.0e+00  6.1e-09  6.1e-09
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +3.64575
```

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```
%第5题
%{
原问题可以用如下cvx代码求解，由于square_pos(x)是凸函数且非减，quad_over_lin(x, y)
在y>0时是凸函数，abs(x)是凸函数，凸函数的逐点最大仍是凸函数，因此易知目标函数和不等式约束函
数均为凸函数。故该问题是凸优化问题。
%}

cvx_begin
    variable x(3)
    minimize square_pos(quad_over_lin(x(1), x(2)) + quad_over_lin(x(2), x(1))) + x(1) + x(2) + abs(x(3)+5) + 10
    subject to
        square_pos(square_pos(sum(x.*x)+1)+1) + x(1)^4 + x(2)^4 + x(3)^4 <= 200;
        max([(x(1)+2*x(2))^2 + 5*x(2)^2 x(1) x(2)]) <= 40;
        x(1) >= 1;
        x(2) >= 1;
cvx_end

%{
optimal solution: x=[1.0000;1.0000;-0.7833]
optimal value: +20.2167
%}
```

```
Calling SDPT3 4.0: 63 variables, 27 equality constraints
   For improved efficiency, SDPT3 is solving the dual problem.
------------------------------------------------------------


 num. of constraints = 27
 dim. of sdp    var  = 32,   num. of sdp  blk  = 16
 dim. of socp   var  =  2,   num. of socp blk  =  1
 dim. of linear var  = 13
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.8e+01|1.3e+00|1.5e+04| 3.300000e+03  0.000000e+00| 0:0:00| chol  1  1
 1|0.764|0.829|4.2e+00|2.3e-01|4.3e+03| 1.803260e+03 -5.498848e+01| 0:0:00| chol  1  1
 2|0.941|0.892|2.5e-01|2.5e-02|5.9e+02| 3.398867e+02 -3.639762e+01| 0:0:00| chol  1  1
 3|1.000|0.684|1.6e-06|8.0e-03|2.4e+02| 1.359186e+02 -3.125906e+01| 0:0:00| chol  1  1
 4|0.886|0.874|2.3e-06|1.0e-03|5.6e+01| 2.929979e+01 -1.734770e+01| 0:0:00| chol  1  1
 5|1.000|1.000|1.5e-06|7.7e-07|1.3e+01| 1.676003e-01 -1.245034e+01| 0:0:00| chol  1  1
 6|0.851|1.000|2.4e-07|3.4e-07|3.1e+00|-8.000868e+00 -1.110762e+01| 0:0:00| chol  1  1
 7|1.000|0.592|1.1e-07|1.9e-07|2.2e+00|-8.645087e+00 -1.082972e+01| 0:0:00| chol  1  1
 8|0.819|1.000|2.4e-08|2.2e-08|8.8e-01|-9.751229e+00 -1.062676e+01| 0:0:00| chol  1  1
 9|1.000|0.669|5.5e-08|1.2e-08|5.6e-01|-9.803391e+00 -1.036154e+01| 0:0:00| chol  1  1
10|0.946|0.867|3.0e-09|8.8e-09|4.7e-02|-1.019695e+01 -1.024439e+01| 0:0:00| chol  1  1
11|0.844|1.000|4.6e-10|6.0e-10|1.2e-02|-1.020983e+01 -1.022159e+01| 0:0:00| chol  1  1
12|0.942|1.000|2.7e-11|9.3e-11|1.6e-03|-1.021573e+01 -1.021733e+01| 0:0:00| chol  1  1
13|0.961|1.000|1.4e-11|5.4e-12|1.6e-04|-1.021660e+01 -1.021676e+01| 0:0:00| chol  1  1
14|0.959|1.000|5.6e-12|2.9e-12|1.1e-05|-1.021669e+01 -1.021670e+01| 0:0:00| chol  1  1
15|1.000|1.000|1.4e-12|1.1e-12|1.9e-06|-1.021669e+01 -1.021670e+01| 0:0:00| chol  1  1
16|1.000|1.000|6.3e-13|1.0e-12|4.6e-08|-1.021670e+01 -1.021670e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   = 16
 primal objective value = -1.02166950e+01
```

```
 dual   objective value = -1.02166951e+01
 gap := trace(XZ)       = 4.60e-08
 relative gap           = 2.14e-09
 actual relative gap    = 2.07e-09
 rel. primal infeas (scaled problem)   = 6.32e-13
 rel. dual     "        "       "      = 1.00e-12
 rel. primal infeas (unscaled problem) = 0.00e+00
 rel. dual     "        "       "      = 0.00e+00
 norm(X), norm(y), norm(Z) = 1.7e+01, 1.8e+01, 2.1e+02
 norm(A), norm(b), norm(C) = 1.2e+01, 3.0e+00, 2.1e+02
 Total CPU time (secs)  = 0.22
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS: 9.5e-13  0.0e+00  1.1e-12  0.0e+00  2.1e-09  2.1e-09
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +20.2167
```

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```
%第6题
id=xxx;
rand('seed',id);
x=rand(40,1);
y=rand(40,1);
class=[2*x<y+0.5]+1;
A1=[x(find(class==1)),y(find(class==1))];
A2=[x(find(class==2)),y(find(class==2))];
plot(A1(:,1),A1(:,2),'*','MarkerSize',6)
hold on
plot(A2(:,1),A2(:,2),'d','MarkerSize',6)

%求解
e1=ones(21,1);
e2=ones(19,1);
cvx_begin
    variables w(2) b
    minimize 0.5*square_pos(norm(w))
    subject to
        A1*w+b*e1>=1;
        A2*w+b*e2<=-1;
cvx_end

%{
optimal solution: w=[28.8340;-16.3307], b=-6.3768
optimal value: +549.046
结果(the maximum-margin line separating the two classes of
points)为:w(1)*x+w(2)*y+b=0
%}

%绘制
x=0:0.2:1;
y=(-b-w(1)*x)/w(2);
plot(x,y);
hold off
```

```
Calling SDPT3 4.0: 48 variables, 7 equality constraints
   For improved efficiency, SDPT3 is solving the dual problem.
------------------------------------------------------------


 num. of constraints =  7
 dim. of sdp    var  =  2,   num. of sdp  blk  =  1
 dim. of socp   var  =  3,   num. of socp blk  =  1
 dim. of linear var  = 42
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|7.4e+01|9.8e+00|4.4e+03|-3.900000e+02  0.000000e+00| 0:0:00| chol  1  1
 1|0.060|0.094|7.0e+01|8.9e+00|4.2e+03|-4.007763e+02 -8.747660e-01| 0:0:00| chol  1  1
 2|0.520|0.465|3.4e+01|4.7e+00|2.6e+03|-2.919289e+02 -7.365447e+00| 0:0:00| chol  1  1
 3|0.491|0.239|1.7e+01|3.6e+00|2.1e+03|-2.251456e+02 -3.018941e+01| 0:0:00| chol  1  1
 4|0.543|0.185|7.8e+00|2.9e+00|1.5e+03|-1.480252e+02 -7.384399e+01| 0:0:00| chol  1  1
 5|0.457|0.761|4.2e+00|7.0e-01|4.0e+02|-1.310802e+02 -4.325195e+01| 0:0:00| chol  1  1
 6|0.355|0.307|2.7e+00|4.9e-01|2.8e+02|-5.918070e+02 -1.386375e+02| 0:0:00| chol  1  1
```

```
 7|0.436|0.352|1.5e+00|3.2e-01|4.1e+02|-4.851148e+02 -3.215384e+02| 0:0:00| chol  1  1
 8|0.253|0.552|1.2e+00|1.4e-01|2.0e+02|-6.113143e+02 -3.637455e+02| 0:0:00| chol  1  1
 9|1.000|1.000|2.1e-06|8.2e-09|2.0e+02|-3.829025e+02 -5.798868e+02| 0:0:00| chol  1  1
10|0.957|0.948|9.0e-08|4.2e-07|1.7e+01|-5.352186e+02 -5.518134e+02| 0:0:00| chol  1  1
11|0.936|0.982|5.8e-09|2.6e-08|1.5e+00|-5.477164e+02 -5.491792e+02| 0:0:00| chol  1  1
12|0.949|1.000|3.0e-10|1.4e-09|2.7e-01|-5.488103e+02 -5.490764e+02| 0:0:00| chol  1  1
13|0.972|1.000|8.6e-12|1.3e-10|2.7e-02|-5.490222e+02 -5.490493e+02| 0:0:00| chol  1  1
14|0.971|1.000|2.4e-12|1.7e-12|1.8e-03|-5.490446e+02 -5.490464e+02| 0:0:00| chol  1  1
15|1.000|1.000|3.3e-12|1.0e-12|1.2e-04|-5.490462e+02 -5.490463e+02| 0:0:00| chol  1  1
16|0.960|0.988|1.0e-12|1.0e-12|5.8e-06|-5.490463e+02 -5.490463e+02| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.49e-08
-------------------------------------------------------------------
 number of iterations   = 16
 primal objective value = -5.49046269e+02
 dual   objective value = -5.49046274e+02
 gap := trace(XZ)       = 5.81e-06
 relative gap           = 5.29e-09
 actual relative gap    = 5.29e-09
 rel. primal infeas (scaled problem)   = 1.00e-12
 rel. dual     "        "       "      = 1.01e-12
 rel. primal infeas (unscaled problem) = 0.00e+00
 rel. dual     "        "       "      = 0.00e+00
 norm(X), norm(y), norm(Z) = 8.7e+02, 1.1e+03, 1.1e+03
 norm(A), norm(b), norm(C) = 9.7e+00, 1.5e+00, 7.4e+00
 Total CPU time (secs)  = 0.24
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS: 1.0e-12  0.0e+00  3.7e-12  0.0e+00  5.3e-09  5.3e-09
-------------------------------------------------------------------

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +549.046
```