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```
1) h=320;
   x=750;
   g=9.81;
   accuracy=1e-7;
   for (vo=70:2:74)
       f=@(theta) h*(cos(theta))^2+(x/2)*sin(2*theta)-(g*(x^2))/(2*(vo^2));
      fp=@(theta) -2*h*cos(theta)*sin(theta)+x*cos(2*theta);
      stepsize=pi/180;
      for (left_end_point=0:stepsize:90*pi/180)
         right_end_point=left_end_point+stepsize;
         function_left=f(left_end_point);
         function_right=f(right_end_point);
         if (function_left*function_right<0)
            guess=(left_end_point+right_end_point)/2;
            theta=newton(f,fp,guess,accuracy);
            t=(vo*sin(theta))/g+sqrt((vo^2)*((sin(theta))^2)/(g^2)+(2*h)/g);
            ymax=h+(vo^2)*((sin(theta))^2)/(2*g);
           fprintf('vo=%d theta=%.5f t=%10.5f ymax=%10.5f\n',vo,theta*180/pi,
                                                                t,ymax);
         end
         if (function_left==0)
            theta=left_end_point;
            t=(vo*sin(theta))/g+sqrt((vo^2)*((sin(theta))^2)/(g^2)+(2*h)/g);
            ymax=h+(vo^2)*((sin(theta))^2)/(2*g);
            fprintf('vo=%d theta=%.5f t=%10.5f ymax=%10.5f\n',vo,theta*180/pi,
                                                                t,ymax);
        end
      end
      fprintf('\n');
   end
```

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```
2) alpha = 47*pi/180;
   beta = 66*pi/180;
   gamma = 45*pi/180;
   delta = 79*pi/180;
   W = 350;
   G = 390;
   H = 240;
   d = [0
        0
        0
        W
        0
        0
        0
        G
        H
        0];
   a = [0  cos(alpha)   0           0            0            1  0  1  0  0
        0  sin(alpha)   0           0            0            0  0  0  1  0
        0  0           -cos(beta)   cos(gamma)   0           -1  1  0  0  0
        0  0            sin(beta)   sin(gamma)   0            0  0  0  0  0
        0  0            0           0           -cos(delta)   0 -1  0  0  0
        0  0            0           0            sin(delta)   0  0  0  0  1
        1  -cos(alpha)  cos(beta)   0            0            0  0  0  0  0
        0  -sin(alpha) -sin(beta)   0            0            0  0  0  0  0
       -1  0            0          -cos(gamma)   cos(delta)   0  0  0  0  0
        0  0            0          -sin(gamma)  -sin(delta)   0  0  0  0  0 ];
b = inv(a);
F = b*d;
F
```

3)
```
R1=4.15;
R2=3.78;
R3=2.56;
R4=3.24;
guess1 = 70*pi/180,
guess4 = 35*pi/180,
accuracy = 1e-7;
for (t3 = 85*pi/180 : pi/180 : 805*pi/180)
    f1 = @(t1,t4) R3*cos(t3) + R4*cos(t4) + R1*cos(t1) - R2;
    f2 = @(t1,t4) R3*sin(t3) + R4*sin(t4) - R1*sin(t1);
df1dt1 = @(t1,t4) -R1*sin(t1),
df1dt4 = @(t1,t4) - R4 * sin(t4);
df2dt1 = @(t1,t4) -R1*cos(t1),
df2dt4 = @(t1,t4) R4 * cos(t4),
  [t1 t4] = newton2(f1,f2,df1dt1,df1dt4,df2dt1,df2dt4,
                                              guess1, guess4, accuracy),
end
```

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4)
```
R1X = R1*cos(t1);
R3X = R3*cos(t3);
R4X = R4*cos(t4);
R1Y = R1*sin(t1),
R3Y = R3*sin(t3),
R4Y = R4*sin(t4);
line1X = [R3X+R4X  R2],
line1Y = [R1Y  0];
line2X = [0  R2];
line2Y = [0  0];
line3X = [0  R3X],
line3Y = [0  R3Y];
line4X = [R3X  R3X+R4X];
line4Y = [R3Y R1Y],
plot (line1X, line1Y, 'b', line2X, line2Y, 'k', line3X, line3Y, 'r', line4X, line4Y, 'g');
```

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5) x=2.72;

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```
y=1.43;
guessa=30*pi/180; % guess for alpha
guessb=60*pi/180; % guess for beta
guessg=20*pi/180, % guess for gamma
accuracy=1e-7;
for (z=1.4:.3:2.0)
    f1=@(a,b,g) R2*sin(a)*cos(g)+R1*sin(a+b)*cos(g)-x;
    f2=@(a,b,g) R1*sin(a+b)*sin(g)+R2*sin(a)*sin(g)-y;
    f3=@(a,b,g) R2*cos(a)+R1*cos(a+b)-z;
    df1da=@(a,b,g) R2*cos(a)*cos(g)+R1*cos(a+b)*cos(g),
    df1db=@(a,b,g) R1*cos(a+b)*cos(g);
    df1dg=@(a,b,g) -R2*sin(a)*sin(g)-R1*sin(a+b)*sin(g);
    df2da=@(a,b,g) R1*cos(a+b)*sin(g)+R2*cos(a)*sin(g);
    df2db=@(a,b,g) R1*cos(a+b)*sin(g),
    df2dg=@(a,b,g) R1*sin(a+b)*cos(g)+R2*sin(a)*cos(g),
    df3da=@(a,b,g) -R2*sin(a)-R1*sin(a+b),
    df3db=@(a,b,g) -R1*sin(a+b);
    df3dg=@(a,b,g) 0,
    [a b g]=newton3(f1,f2,f3,df1da,df1db,df1dg,df2da,
        df2db,df2dg,df3da,df3db,df3dg,guessa,guessb,
        guessg,accuracy);
    fprintf('z=%d alpha=%.5f beta=%.5f gamma=%.5f\n',
        z,a,b,g);
end
```

6) % main program

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```
t=0:0.001:30;
u0=[800 400 500 300];
options=odeset('RelTol',1e-7,'AbsTol',1e-7);
[t u]=ode45('prog6f',t,u,options);
plot(t,u(:,1),'r',t,u(:,2),'b',t,u(:,3),'g',t,u(:,4),'m');
```

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% function

```
function f = prog6f(t,uf)
A=0.004;
B=0.03;
C=0.0017;
D=0.0012;
E=0.0038;
F=0.00076;
G=0.00045;
x=uf(1);
y=uf(2);
z=uf(3);
w=uf(4);
f=zeros(4,1);
f(1)=x-x^2-B*x*y;
f(2)=-y*z-A*y+D*x*y;
f(3)=y*z-C*z;
f(4)=-w^2-E*w+F*w*y*z+G*w*x*y;
```

7) $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix}$

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$$\left[\begin{array}{ccc|ccc} 2 & 1 & 1 & 1 & 0 & 0 \\ 3 & 2 & 1 & 0 & 1 & 0 \\ 2 & 1 & 2 & 0 & 0 & 1 \end{array}\right]$$

Multiply row 1 by 1/2

$$\left[\begin{array}{ccc|ccc} 1 & 1/2 & 1/2 & 1/2 & 0 & 0 \\ 3 & 2 & 1 & 0 & 1 & 0 \\ 2 & 1 & 2 & 0 & 0 & 1 \end{array}\right]$$

Add -2 * row 1 to row 3 and add -3 * row 1 to row 2

$$\left[\begin{array}{ccc|ccc} 1 & 1/2 & 1/2 & 1/2 & 0 & 0 \\ 0 & 1/2 & -1/2 & -3/2 & 1 & 0 \\ 0 & 0 & 1 & -1 & 0 & 1 \end{array}\right]$$

multiply row 2 by 2

$$\left[\begin{array}{ccc|ccc} 1 & 1/2 & 1/2 & 1/2 & 0 & 0 \\ 0 & 1 & -1 & -3 & 2 & 0 \\ 0 & 0 & 1 & -1 & 0 & 1 \end{array}\right]$$

add $-\frac{1}{2}$ * row 2 to row 1

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 1 & 2 & -1 & 0 \\ 0 & 1 & -1 & -3 & 2 & 0 \\ 0 & 0 & 1 & -1 & 0 & 1 \end{array}\right]$$

add row 3 to row 2 and add -1 * row 3 to row 1

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 3 & -1 & -1 \\ 0 & 1 & 0 & -4 & 2 & 1 \\ 0 & 0 & 1 & -1 & 0 & 1 \end{array}\right]$$

Therefore, $inv(a) = \begin{bmatrix} 3 & -1 & -1 \\ -4 & 2 & 1 \\ -1 & 0 & 1 \end{bmatrix}$