% Comments HW3_Problem5

%% Comments:
% 1. There is no need to define A and F as symbolic variables. Since they are
% computed by symbolic variables, they automatically become symbolic.
% But put A,F in the syms list do no harm to the program.
%
% 2. Do not use pi as a variable. This will take away the number 'pi' we
% needed in calculation of circle related geometrical data.
%
% 3. How many point does this statement TH=[0.087266:1.48353] define ?
%
% There are many ways to define angles from 5 to 85 degrees
% e.g.,
% TH=linspace(5,85,100); * pi/180; % NOTE: we need pi here !!!
%
% 4. WE have to substitute one symbolic variable at a time.

% Problem5 Original codes (do not work)
syms th A p1 p2 p3 p4 p5 F % (1)
s=sin(th);
c=cos(th);
A=[c 1 0 0 0 0 s 0 0 1; 0 0 2*s 0 0 0 0 -c c 1 0; 0 0 0 0 s s 0 0]; % (1)
F=[0;0;0;1;0;0]; % (1)
p=[p1;p2;p3;p4;p5];
EQ=(A*p)-F
Ps= Solve(EQ(1),EQ(2),EQ(3),EQ(4),EQ(5),p1,p2,p3,p4,p5)
pi=[Ps.p1;Ps.p2;Ps.p3;Ps.p4;Ps.p5] % (2)
%theta: 5-85 degrees
TH=[0.087266:1.48353] % (3)
PI=SUBS(pi,th,TH) % (4)
figure
plot(TH,PI)

% Problem5 Corrected codes (Assuming the data are correct)
syms th p1 p2 p3 p4 p5 % (1)
s=sin(th);
c=cos(th);
A=[c 1 0 0 0 0 s 0 0 1; 0 0 2*s 0 0 0 0 -c c 1 0; 0 0 0 0 s s 0 0]; % (1)
F=[0;0;0;1;0;0]; % (1)
p=[p1;p2;p3;p4;p5];
EQ=(A*p)-F
Ps= Solve(EQ(1),EQ(2),EQ(3),EQ(4),EQ(5),p1,p2,p3,p4,p5)
pi=[Ps.p1;Ps.p2;Ps.p3;Ps.p4;Ps.p5] % (2)
% theta: 5-85 degrees
TH=linspace(5,85,100); * pi/180; % NOTE: we need pi here !! % (3)
% Plot PI
i=1;
PTH=SUBS(pth(i),th,TH); % (4)
figure
plot(TH,PTH)

% Use a loop to plot all forces
% Note that the following codes have problem with P5, since it it a
% constant
figure
hold on
for i=1:5;
    PTH=SUBS(pth(i),th,TH);
    plot(TH,PTH) % (4)
end

% Correction of the above bug
THd=TH*180/pi;
figure
hold on
for i=1:5;
    PTH=SUBS(pth(i),th,TH); % (4)
    if length(PTH)==1;
        PTH=PTH*(THd.*0);
    end
    plot(THd,PTH)
    text(THd(5+10*i),PTH(5+10*i),['\bfP_\text{',int2str(i),'\text{]}'])
end
xlabel('\bfAngle(degrees)')
ylabel('\bfTruss member force')
title('\bfTruss member forces vs Angle(degrees)')
grid on

% Alternative Solution of a system of linear equations
P=inv(A)*F (a)

\[ p = \begin{bmatrix}
\frac{1}{2}\cos(th) \div \sin(th) \\
-\frac{1}{2}\sin(th) \\
\frac{1}{2}\sin(th) \\
-\cos(th) \div \sin(th) \\
\frac{1}{2}
\end{bmatrix} 
\]

\[ \text{pth} = \begin{bmatrix}
\frac{1}{2}\cos(th) \div \sin(th) \\
-\frac{1}{2}\sin(th) \\
\frac{1}{2}\sin(th) \\
-\cos(th) \div \sin(th) \\
\frac{1}{2}
\end{bmatrix} 
\]

ckeck=P-pth = 0
0
0
0
0

* These are the location To put the text (problem dependent)
Figure A

\(P_s\) not plotted correctly.
Figure B

Truss member forces vs Angle (degrees)