Position calculation of a 5 bar linkage with extension

```
int  A1x=-16, A1y=144, A2x=16, A2y=144;          // coordinates of servos and target
int  a1=128, a11=80, a2=80, c1=32, c2=32, g=32;      // bars length
float n;
float d1=abs(A1y-Py);
float d2=abs(A2y-Py);
float e1=abs(A1x-Px);
float e2=abs(A2x-Px);
float b1=sqrt((d1*d1)+(e1*e1));
float b2=sqrt((d2*d2)+(e2*e2));
    n=((b1*b1)+(c1*c1)-(a1*a1))/(2*b1*c1);
float A_12=acos(n);
    n=((g*g)+(b1*b1)-(b2*b2))/(2*b1*g);
float A_13=acos(n);
float A_11=PI-A_12-A_13;
float B_11=(PI/2)-A_11;
    n=((a1*a1)+(c1*c1)-(b1*b1))/(2*a1*c1);
float B_12=acos(n);
float B_13=PI-B_11-B_12;
float f1=sin(B_13)*a11;
float j1=cos(B_13)*a11;
float k1=sin(B_11)*c1;
float m1=cos(B_11)*c1;
float Ux=A1x+f1-k1;
float Uy=A1y-j1-m1;
float d3=abs(A2y-Uy);
float e3=abs(A2x-Ux);
float b3=sqrt((d3*d3)+(e3*e3));
float A_21=asin(d3/b3);
    n=((b3*b3)+(c2*c2)-(a2*a2))/(2*b3*c2);
float A_22=acos(n);
float S1=A_11*57.296;           // S1 servo position in degree
float S2=(A_21+A_22)*57.296;        // S2 servo position in degree
```
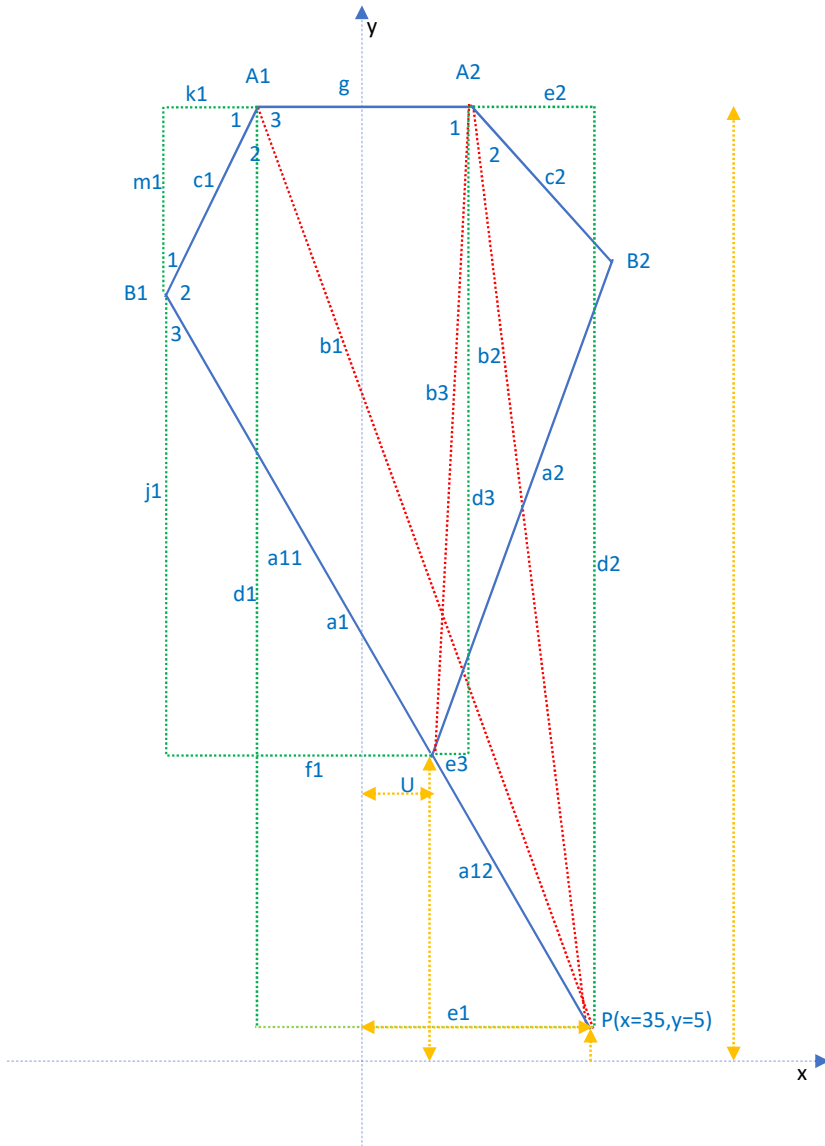
Program results OK

```
InverseKinematicsRight
Position to reach : Px=35  Py=5
d1=139.00  e1=51.00  b1=148.06
d2=139.00  e2=19.00  b2=140.29
A_11=64  A_12=46  A_13=70  total=180
B_11=26  B_12=123  B_13=31  total=180
m1=28.76  k1=14.04  Ux=10.61
j1=68.90  f1=40.65  Uy=46.34
d3=97.66  e3=5.39  b3=97.81
A_21=87  A_22=48
S1=64  S2=135
```


A1   g   A2   e2
k1   1 3   1
c1   2   2   c2
m1
B1   1   B2
2
3   b1   b2
b3
j1
a2
a11   d3
d1
a1   d2
e3
f1   U
a12
e1   P(x=35,y=5)
x   y

Position calculation of a 5 bar linkage with extension

```
int  A1x=-16, A1y=144, A2x=16, A2y=144;          // coordinates of servos and target
int  a1=128, a11=80, a2=80, c1=32, c2=32, g=32;      // bars length
float n;
float d1=abs(A1y-Py);
float d2=abs(A2y-Py);
float e1=abs(A1x-Px);
float e2=abs(A2x-Px);
float b1=sqrt((d1*d1)+(e1*e1));
float b2=sqrt((d2*d2)+(e2*e2));
    n=((b1*b1)+(c1*c1)-(a1*a1))/(2*b1*c1);
float A_12=acos(n);
    n=((g*g)+(b1*b1)-(b2*b2))/(2*b1*g);
float A_13=acos(n);
float A_11=PI-A_12-A_13;
float B_11=(PI/2)-A_11;
    n=((a1*a1)+(c1*c1)-(b1*b1))/(2*a1*c1);
float B_12=acos(n);
float B_13=PI-B_11-B_12;
float f1=sin(B_13)*a11;
float j1=cos(B_13)*a11;
float k1=sin(B_11)*c1;
float m1=cos(B_11)*c1;
float Ux=A1x+f1-k1;
float Uy=A1y-j1-m1;
float d3=abs(A2y-Uy);
float e3=abs(A2x-Ux);
float b3=sqrt((d3*d3)+(e3*e3));
float A_21=asin(d3/b3);
    n=((b3*b3)+(c2*c2)-(a2*a2))/(2*b3*c2);
float A_22=acos(n);
float S1=A_11*57.296;              // S1 servo position in degree
float S2=(A_21+A_22)*57.296;          // S2 servo position in degree
```
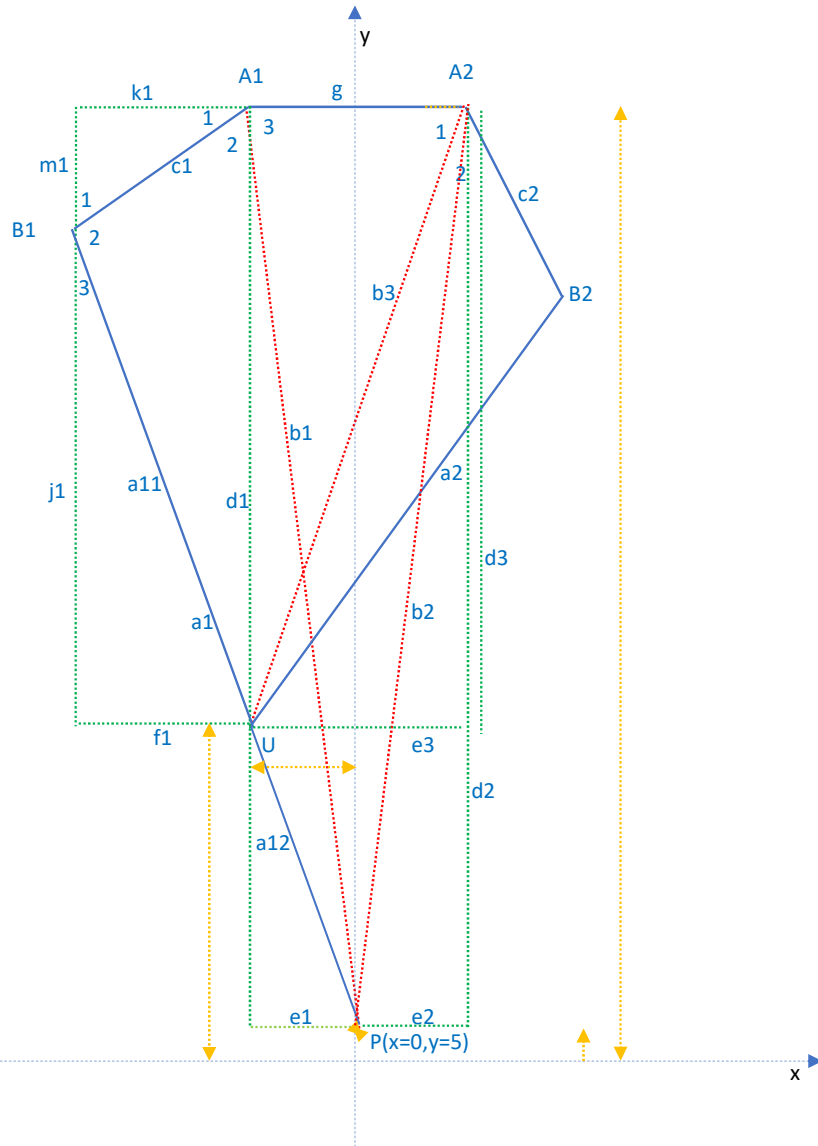
Program results OK

InverseKinematicsRight
Position to reach : Px=0 Py=5
d1=139.00 e1=16.00 b1=139.92
d2=139.00 e2=16.00 b2=139.92
A_11=35 A_12=62 A_13=83 total=180
B_11=55 B_12=105 B_13=19 total=180
m1=18.20 k1=26.32 Ux=-15.87
j1=75.50 f1=26.45 Uy=50.30
d3=93.70 e3=31.87 b3=98.97
A_21=71 A_22=46
S1=35 S2=117

Position calculation of a 5 bar linkage with extension

```
int  A1x=-16, A1y=144, A2x=16, A2y=144;          // coordinates of servos and target
int  a1=128, a11=80, a2=80, c1=32, c2=32, g=32;       // bars length
float n;
float d1=abs(A1y-Py);
float d2=abs(A2y-Py);
float e1=abs(A1x-Px);
float e2=abs(A2x-Px);
float b1=sqrt((d1*d1)+(e1*e1));
float b2=sqrt((d2*d2)+(e2*e2));
    n=((b1*b1)+(c1*c1)-(a1*a1))/(2*b1*c1);
float A_12=acos(n);
    n=((g*g)+(b1*b1)-(b2*b2))/(2*b1*g);
float A_13=acos(n);
float A_11=PI-A_12-A_13;
float B_11=(PI/2)-A_11;
    n=((a1*a1)+(c1*c1)-(b1*b1))/(2*a1*c1);
float B_12=acos(n);
float B_13=PI-B_11-B_12;
float f1=sin(B_13)*a11;
float j1=cos(B_13)*a11;
float k1=sin(B_11)*c1;
float m1=cos(B_11)*c1;
float Ux=A1x+f1-k1;
float Uy=A1y-j1-m1;
float d3=abs(A2y-Uy);
float e3=abs(A2x-Ux);
float b3=sqrt((d3*d3)+(e3*e3));
float A_21=asin(d3/b3);
    n=((b3*b3)+(c2*c2)-(a2*a2))/(2*b3*c2);
float A_22=acos(n);
float S1=A_11*57.296;              // S1 servo position in degree
float S2=(A_21+A_22)*57.296;          // S2 servo position in degree
```
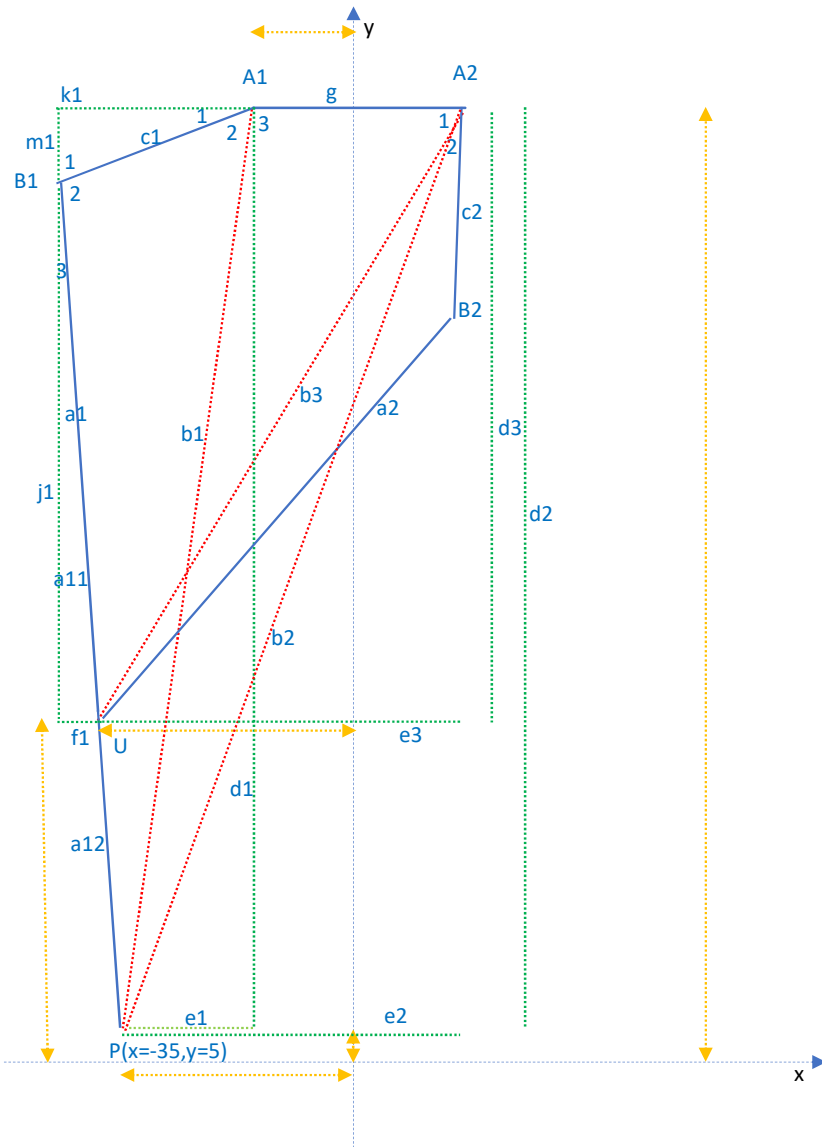
Program results OK

InverseKinematicsRight
Position to reach : Px=-35 Py=5
d1=139.00 e1=19.00 b1=140.29
d2=139.00 e2=51.00 b2=148.06
A_11=21 A_12=61 A_13=98 total=180
B_11=69 B_12=106 B_13=5 total=180
m1=11.46 k1=29.88 Ux=-39.08
j1=79.71 f1=6.80 Uy=52.83
d3=91.17 e3=55.08 b3=106.52
A_21=59 A_22=29
S1=21 S2=88

Position calculation of a 5 bar linkage with extension


```
int  A1x=-16, A1y=144, A2x=16, A2y=144;        // coordinates of servos and target
int  a1=80, a21=80, a2=128, c1=32, c2=32, g=32;        // bars length
float n;
float d1=abs(A1y-Py);
float d2=abs(A2y-Py);
float e1=abs(A1x-Px);
float e2=abs(A2x-Px);
float b1=sqrt((d1*d1)+(e1*e1));
float b2=sqrt((d2*d2)+(e2*e2));
    n=((b2*b2)+(c2*c2)-(a2*a2))/(2*b2*c2);
float A_22=acos(n);
    n=((g*g)+(b2*b2)-(b1*b1))/(2*b2*g);
float A_23=acos(n);
float A_21=PI-A_22-A_23;
float B_21=(PI/2)-A_21;
    n=((a2*a2)+(c2*c2)-(b2*b2))/(2*a2*c2);
float B_22=acos(n);
float B_23=PI-B_21-B_22;
float f2=sin(B_23)*a21;
float j2=cos(B_23)*a21;
float k2=sin(B_21)*c2;
float m2=cos(B_21)*c2;
float Ux=A2x-f2+k2;
float Uy=A2y-j2-m2;
float d3=abs(A1y-Uy);
float e3=abs(A1x-Ux);
float b3=sqrt((d3*d3)+(e3*e3));
float A_13=acos(d3/b3);
    n=((b3*b3)+(c1*c1)-(a1*a1))/(2*b3*c1);
float A_12=acos(n);
float A_14=A_12-A_13;
float A_11=(3.14159/2)-A_14;
float S1=A_11*57.296;              // S1 servo position in degree
float S2=(A_22+A_23)*57.296;        // S2 servo position in degree
```
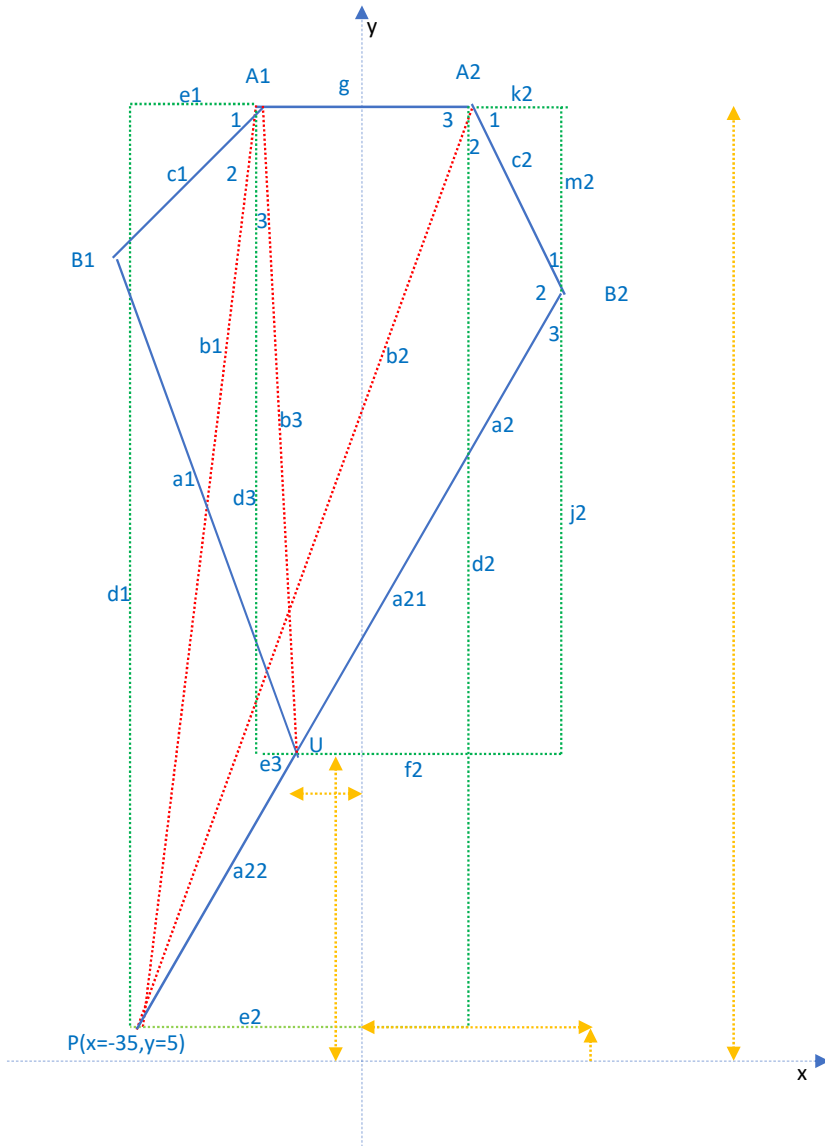
Program results OK

InverseKinematicsLeft
Position to reach : Px=-35 Py=5
d1=139.00 e1=19.00 b1=140.29
d2=139.00 e2=51.00 b2=148.06
A_21=64 A_22=46 A_23=70 total=180
B_21=26 B_22=123 B_23=31 total=180
Ux=-10.61 m2=28.76 k2=14.04
Uy=46.34 j2=68.90 f2=40.65
d3=97.66 e3=5.39 b3=97.81
A_11=45 A_12=48 A_13=3 A_14=45
S1=45 S2=116

Position calculation of a 5 bar linkage with extension

```
int  A1x=-16, A1y=144, A2x=16, A2y=144;          // coordinates of servos and target
int  a1=80, a21=80, a2=128, c1=32, c2=32, g=32;        // bars length
float n;
float d1=abs(A1y-Py);
float d2=abs(A2y-Py);
float e1=abs(A1x-Px);
float e2=abs(A2x-Px);
float b1=sqrt((d1*d1)+(e1*e1));
float b2=sqrt((d2*d2)+(e2*e2));
    n=((b2*b2)+(c2*c2)-(a2*a2))/(2*b2*c2);
float A_22=acos(n);
    n=((g*g)+(b2*b2)-(b1*b1))/(2*b2*g);
float A_23=acos(n);
float A_21=PI-A_22-A_23;
float B_21=(PI/2)-A_21;
    n=((a2*a2)+(c2*c2)-(b2*b2))/(2*a2*c2);
float B_22=acos(n);
float B_23=PI-B_21-B_22;
float f2=sin(B_23)*a21;
float j2=cos(B_23)*a21;
float k2=sin(B_21)*c2;
float m2=cos(B_21)*c2;
float Ux=A2x-f2+k2;
float Uy=A2y-j2-m2;
float d3=abs(A1y-Uy);
float e3=abs(A1x-Ux);
float b3=sqrt((d3*d3)+(e3*e3));
float A_13=acos(d3/b3);
    n=((b3*b3)+(c1*c1)-(a1*a1))/(2*b3*c1);
float A_12=acos(n);
float A_14=A_12-A_13;
float A_11=(3.14159/2)-A_14;
float S1=A_11*57.296;          // S1 servo position in degree
float S2=(A_22+A_23)*57.296;        // S2 servo position in degree
```

Program results OK

InverseKinematicsLeft
Position to reach : Px=0 Py=5
d1=139.00 e1=16.00 b1=139.92
d2=139.00 e2=16.00 b2=139.92
A_21=35 A_22=62 A_23=83 total=180
B_21=55 B_22=105 B_23=19 total=180
Ux=15.87 m2=18.20 k2=26.32
Uy=50.30 j2=75.50 f2=26.45
d3=93.70 e3=31.87 b3=98.97
A_11=63 A_12=46 A_13=19 A_14=27
S1=63 S2=145