Origin: (0,0) x=0 y=0 -or- v=0 w=0

Target: (10,7) x=10 y=7 -or- h=10 k=7

Shoulder: 6 inches (Makes a 6 inch radius, Origin Servo)

Elbow: 4 inches (Makes a 4 inch radius)

Wrist: 4 inches (Makes a 4 inch radius, Target Servo)

To calculate slope of a line:

y=mx+b

m=(k-w)/(h-v) m=(7-0)/(10-0)=7/10 7=(7/10)(10)+b 7=7+b b=0

Slope: y=7/10x

To Calculate a point where a line intersects a circle:

(x-h)^2 + (y-k)^2=(radius)^2 radius=4

(x-10)^2 + (y-7)^2=16

Part 1: (x-10) \* (x-10) use FOIL method

x^2 – 20x + 100

Part 2: (y-7) \* (y-7) use FOIL method

y^2 – 14y + 49 substitute Slope for y…(7/10x)^2 – 14(7/10x) +49

49/100x^2 – 49/5x + 49

Combining both equations:

x^2-20x+100 + 49/100x^2 – 49/5x + 49=16

Solving…1.49x^2 – 29.8x +133=0 A=1.49 B= -29.8 C=133

Use the Quadratic equation to solve for x:

(- B +/- squareroot(B^2 – 4(A)(C))) / 2A = x

Use the A,B and C values from above to find x. There will be 2 answers. One for the plus (+) equation and one for the negative (-) equation.

x= 13.3 and x=6.7 (I only use the smaller number)

Us the Slope equation from above to solve for y… y=(7/10)(6.7) y=4.7

The point where the Slope crosses the circle is (6.7,4.7).

Use the Pythagorean theoremto calculate the distance from the origin (0,0) to the new point (6.7,4.7)…distance = squareroot(x^2 + y^2)

squareroot((6.7)^2 + (4.7)^2)=8.18

With 3 known sides of a triangle use the Side-Side-Side calculation to find all 3 angles of the triangle:

Cos(A)=(B^2+C^2-A^2)/2(B)(C)

Cos(B)=(C^2+A^2-B^2)/2(A)(C)

Cos(C)=(A^2+B^2-C^2)/2(A)(B)

A=4 (length of target servo)

B=8.18 (length of origin to new point)

C=6 (length of origin servo)

Cos(A)=66.91+36-16/98.16=0.8853 Inv Cos(0.8853)= 27.71 degrees

Angle A = 27.71degrees

Cos(B)=36+16-66.91/48= -0.3106 Inv Cos(-0.3106)=108.09 degrees

Angle B = 108.09 degrees

Angle C = 180 – Angle A – Angle B 180-27.71-108.09=44.2 degrees

Angle C = 44.2 degrees

To calculate the full angle of angle A use the target x point as length of one side of the triangle and the target y point as the second length of the triangle. Use the Pythagorean theorem to calculate the third side length of (hypotenuse ) the triangle.

Given 3 sides of a triangle, calculate the angle from the x axis to the Slope line using the Cos(A)=(B^2+C^2-A^2)/2(B)(C) formula.

Total Angle A = 27.71 + (angle from the x axis to the Slope line)