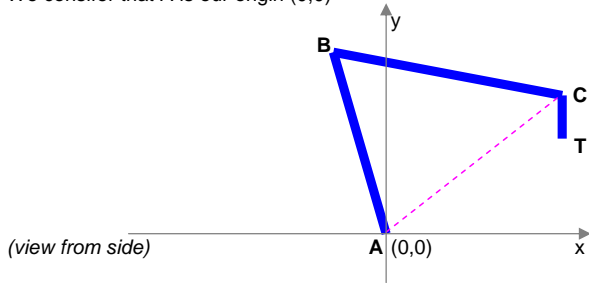


## 2D / 3DOF Inverse Kinematics

We know the lengths of AB,BC,CT  
 We know the Target coordinates T(x,y)  
 We choose the angle CT makes with the origin (t\_angle)  
 We consider that A is our origin (0,0)



start with calculating the position of C

$$C(x) = T_x + CT \cdot \cos(t\_angle)$$

$$C(y) = T_y + CT \cdot \sin(t\_angle)$$

now work on the ABC triangle

calculate the length of AC using the hypotenuse

$$AC = \sqrt{C_x^2 + C_y^2} \quad \text{B2 code : } AC = C_x \text{ HYP } C_y$$

and the angle AC is making with the x axis (ac\_angle)

$$ac\_angle = \text{atan}(C_y/C_x) \quad \text{B2 code : } ac\_angle = C_x \text{ ATAN } C_y$$

with the 3 lengths of a triangle, we can calculate all its angles

by using the law of sines [http://en.wikipedia.org/wiki/Law\\_of\\_sines](http://en.wikipedia.org/wiki/Law_of_sines)

$$\sin(A)/BC = \sin(B)/AC = \sin(C)/AB = AB \cdot BC \cdot AC / 2S$$

S is the surface of ABC, we can use Heron's formula

$$S = \sqrt{s \cdot (s - AB) \cdot (s - BC) \cdot (s - AC)}$$

s is the semiperimeter of ABC

$$s = (AB + BC + AC) / 2$$

start from the end... calculate s then S

$$\text{the law of sines gives us} \quad \sin(A) = 2S / (AB \cdot AC)$$

$$A = \text{asin}(2S / (AB \cdot AC))$$

$$B = \text{asin}(2S / (AB \cdot BC))$$

$$C = \text{asin}(2S / (AC \cdot BC))$$

now go out of this ABC triangle to have the SERVO angles

$$\text{servo\_A} = ac\_angle + A$$

$$\text{servo\_B} = B$$

$$\text{servo\_C} = t\_angle - \text{servo\_B} - \text{servo\_A}$$

That's all folks !