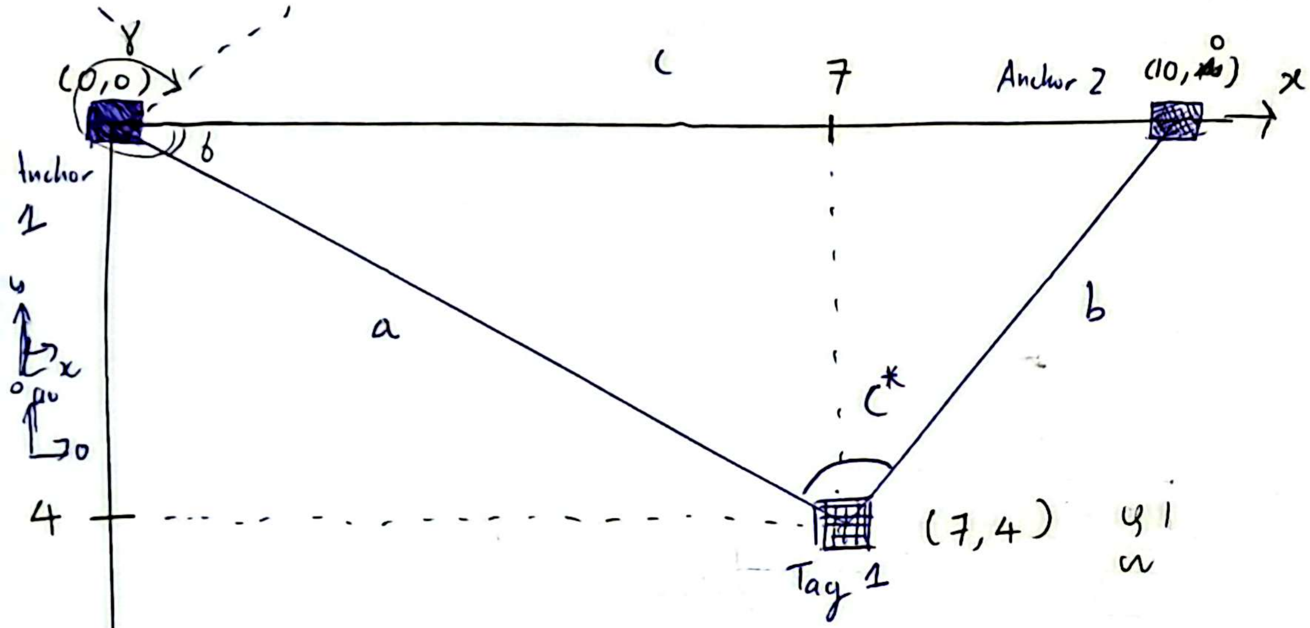
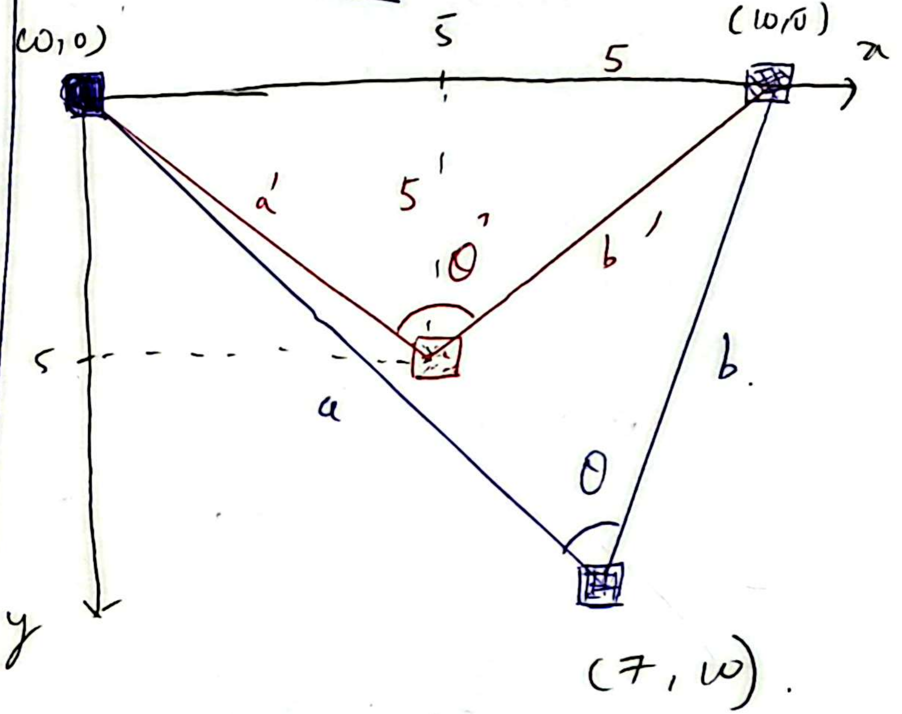



$c^2 = a^2 + b^2 - 2ab\cos C$

$(10)^2 = (\sqrt{65})^2 + (5)^2 - 2(\sqrt{65})(5)\cos C^*$

$C^* = \cancel{82.37497^\circ}\ 97.12502^\circ$




$v = f\lambda$, assume $v$ = speed of light @ $\approx 3\times10^8\ ms^{-1}$

Let $f = 6.5\ GHz = 6.5\times10^9\ Hz$

$\lambda = \dfrac{3\times10^8}{6.5\times10^9} = 0.046154\ m$


$a = \sqrt{7^2+4^2} = \sqrt{65}$

$b = \sqrt{3^2+4^2} = 5$

Round trip time Vs. one-way time.

$a' = b' = \sqrt{50}$, $c' = c = 10$

$\boxed{\theta'} = 90^\circ$, for $a' = b' = \sqrt{50}$, $v = 3\times10^8\ ms^{-1}$,

$\boxed{ToF} = \dfrac{\sqrt{50}}{3\times10^8} = 2.35702\times10^{-8}\ s$

$a = \sqrt{149}$, $b = \sqrt{109}$

$ToF_A = \dfrac{\sqrt{149}}{3\times10^8} = 4.06875\times10^{-8}\ s$

$ToF_B = 3.48010\times10^{-8}\ s$

$\theta = 51.69126^\circ$

Logic:

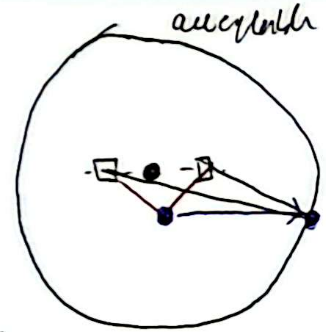
if $ToF_{A/B} > ToF$ → move a certain way (towards)

if $ToF_{A/B} < ToF$ → move away

check parameters: $\theta' = \theta$, $ToF_A = ToF_B = ToF$

additional checks: $\alpha' = \alpha$, $\beta' = \beta$

acceptable radius $= r^*$



if within $r^*$, instruction: pivot.

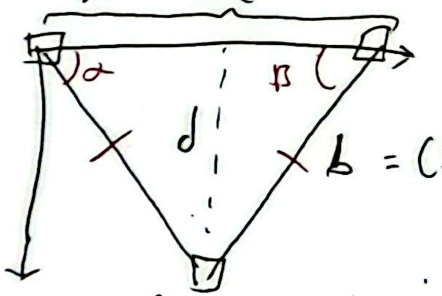
↳ obey $\theta$, $\alpha$, $\beta$ values. $\boxed{\text{Always!}}$

BUT; ToF comparison only applies for $r \geq r^*$.

$\boxed{\alpha = \beta}$

$\boxed{r^*}$: for $\cancel{\theta = \theta'}$, $\cancel{\alpha = \alpha'}$, $\cancel{\beta = \beta'}$

(basically, only when shoulders are aligned).



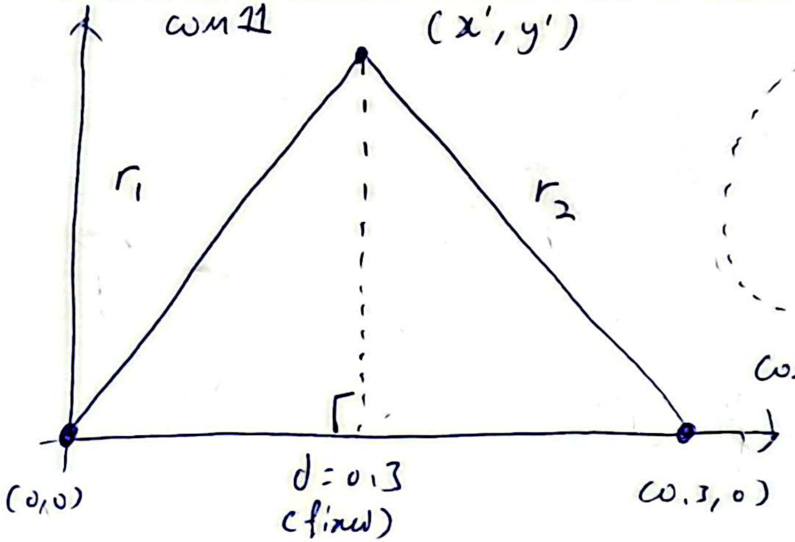


$b = (3 \times 10^8) \times ToF_B$

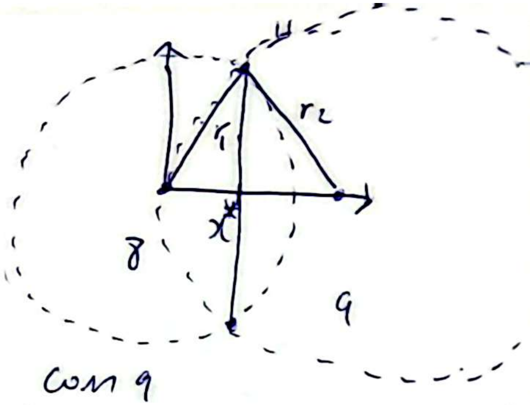
condition for aligned shoulders: $\alpha = \beta$.

$\sin\beta = \frac{d}{b}$, $d = b \sin\beta = (3\times10^8)(ToF_B)(\sin\beta)$

- for $d \leq r^*$ (say we set $r^*$ to 1 m), only $\alpha = \beta$.
- for $d > r^*$, $\alpha = \beta$, and $\theta = \theta'$ $\alpha = \alpha'$, $\beta = \beta'$, $ToF_A = ToF_B = ToF$









unit vector$_{8\to9}$ $= \left(\frac{x_9 - x_8}{d}, \frac{y_9 - y_8}{d}\right) = (1, 0)$.

com 8 circle: $(x-0)^2 + (y-0)^2 = r_1^2$ — ①

com 9 circle: $(x-3)^2 + (y-0)^2 = r_2^2$ — ②

① − ②: $x^2 + y^2 - x^2 + 6x - 9 - y^2 = r_1^2 - r_2^2$

$6x = [(r_1^2 - r_2^2) + 9]$, $x = \frac{r_1^2 - r_2^2 + 9}{6}$

or generally, $x^* = \frac{r_1^2 - r_2^2 + d^2}{2d}$, where $x$ is the x-coord of the intersection of both circles, which is also x-coord of com 11.

say cos vector was (4,3).



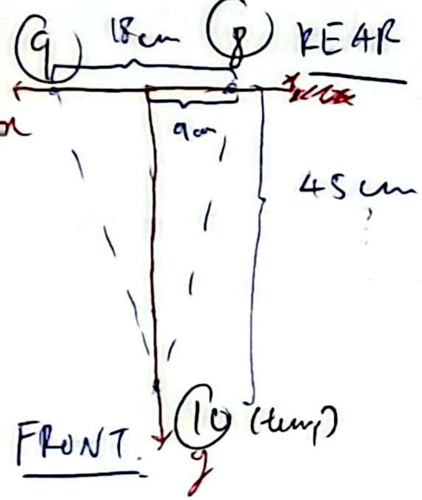
unit vector$_{AB}$ $= \left(\frac{4}{5}, \frac{3}{5}\right) = (0.8, 0.6)$

$ppx = -exy = \left(-\frac{3}{5}\right)$, $ppy = exx = \left(\frac{4}{5}\right)$

$\perp$ unit vector $= (-0.6, 0.8)$.

probs need calc. every angle w/ cos rule y deviation: 45 cm

x-deviation: 9 cm.




$Ax + By = C$

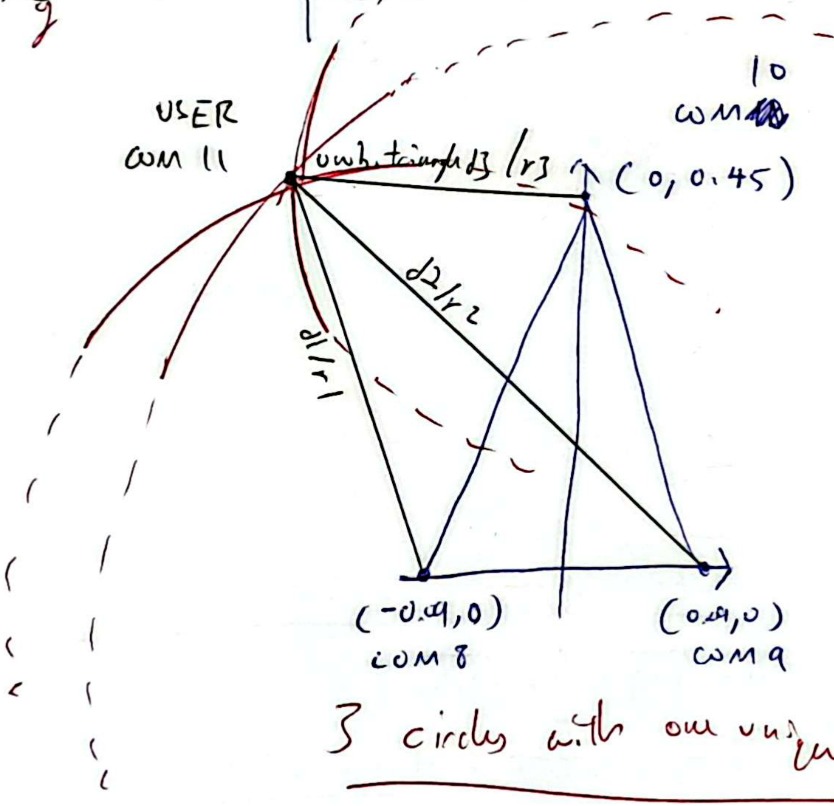
$Dx + Ey = F$

$$\begin{bmatrix} A & B \\ D & E \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} Ax + By \\ Dx + Ey \end{bmatrix} = \begin{bmatrix} C \\ F \end{bmatrix}$$

$2\times2 \quad 2\times1$

$[A \quad B][x] = [Ax + Bx] = [C]$

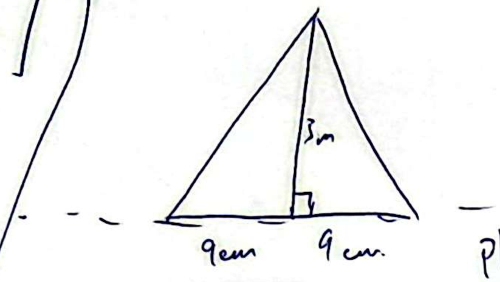
$1\times2 \quad 1\times1$

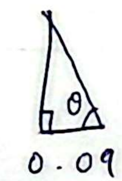



3 circles with one unique solution

Ideal Triangle Scenario

COM 8, 9, 11.




$\tan\theta = \frac{3}{0.09}$

$\theta = 88.281642°$

test 2.5 m.

Baseline.

$\tan\theta = \frac{2.5}{0.09}$

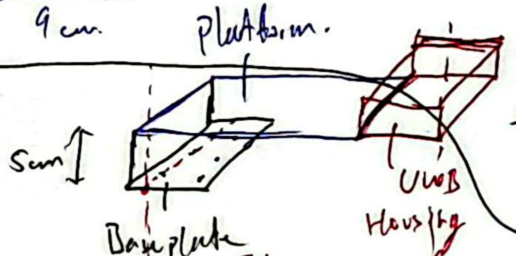
$\theta = 87.93824°$

$\tan\theta = \frac{2}{0.09}$

$\theta = 87.4.$

Mounting Bases.

(1) Single Row

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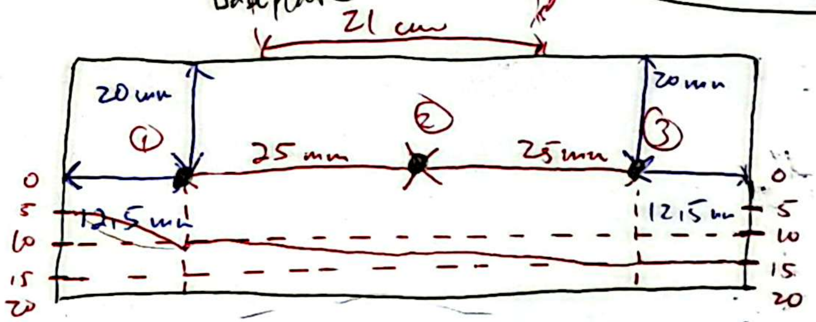
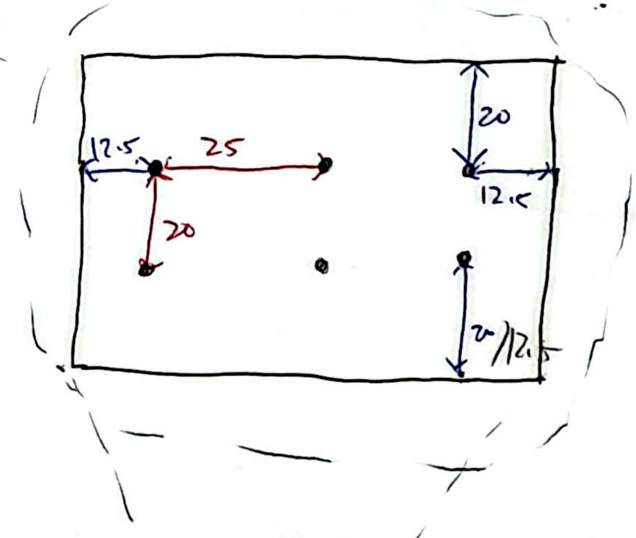
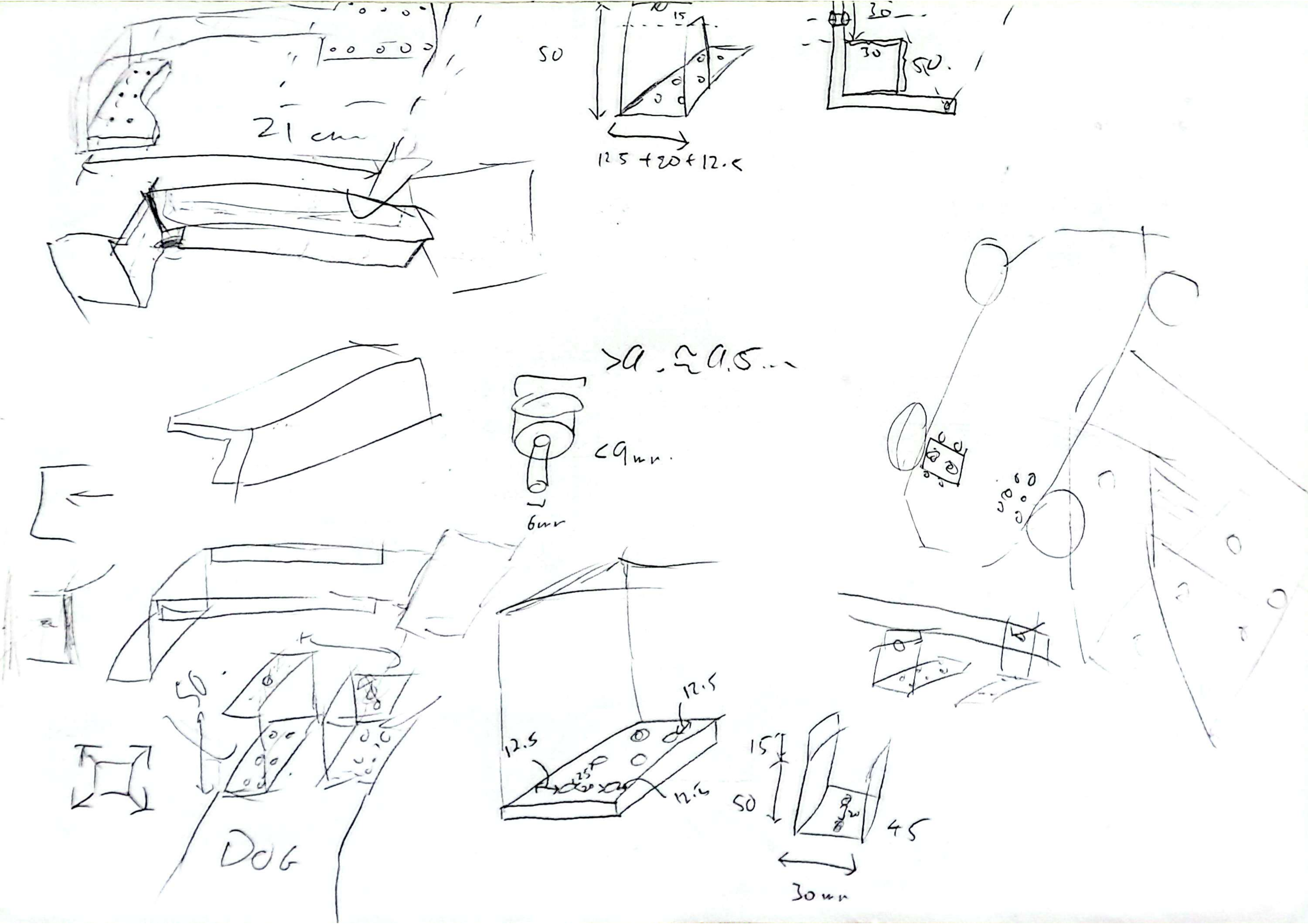



curve from -10 to -15

hole (1) to (3)

(2) Dual Row




21 cm
50
15
12.5 + 20 + 12.5
30
30
50.
>9 . ≈9.5..
<9mm.
6mm
50.
12.5
12.5
12.5
DOG
15
50
45
30mm