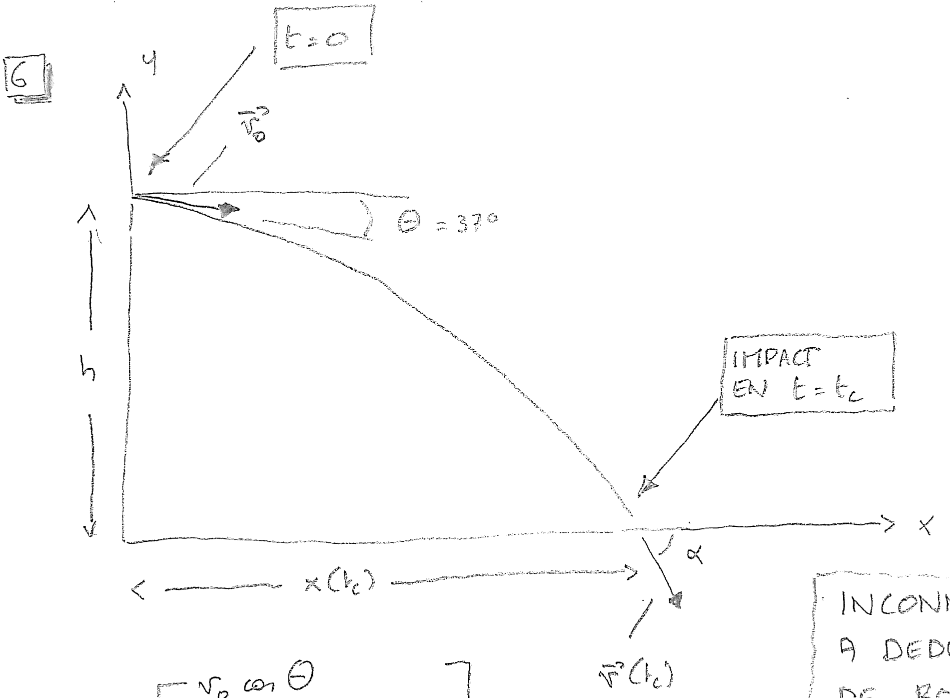
6



INCONNUE v_0.
A DEDUIRE
DE ROMEO ATTRAPE
LA CLE APRES 2 sec !

$$\vec{v}(t) = \begin{bmatrix} v_0 \cos\theta \\ -v_0 \sin\theta - gt \end{bmatrix}$$

$$\vec{x}(t) = \begin{bmatrix} 0 + v_0 \cos\theta \, t \\ h - v_0 \sin\theta \, t - g t^2/2 \end{bmatrix}$$

LA CLE TOUCHE
LE SOL EN $t = 2$

DISTANCE DE ROMEO

$$\underbrace{y(t_c)}_{0} = h - v_0 \sin\theta \, t_c - g\frac{t_c^2}{2}$$

$$\boxed{v_0 = \frac{h}{\sin\theta \, t_c} - \frac{g\, t_c}{2 \sin\theta}} \longrightarrow \boxed{x(t_c) = v_0 \cos\theta \, t_c}$$

IL FAUT
SAVOIR
OBTENIR
L'EXPRESSION
SYMBOLIQUE !

$\frac{[m]}{[s]}$ CHECK DIMENSION $\left[\frac{m}{s^2}\right][s]$

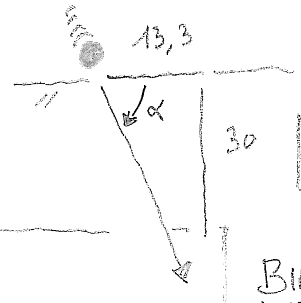
VALEURS NUMERIQUES

$$v_0 = \frac{40-20}{2\sin\theta} = 16{,}6 \text{ m/s}$$

$$x(t_c) = \underbrace{16{,}6 \times \cos(\theta)\, 2}_{26{,}5 \text{ m}}$$

VITESSE D'IMPACT

$$\vec{v}(t_c) = \begin{bmatrix} v_0 \cos\theta \\ -v_0 \cos\theta - g t_c \end{bmatrix} = \begin{bmatrix} 13{,}3 \\ -30 \end{bmatrix}$$

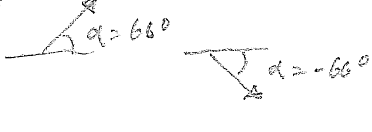


$$\alpha = \underbrace{\operatorname{arctg}\left(\frac{v_y}{v_x}\right)}_{-66°}$$

$$\boxed{\alpha = 66°}$$

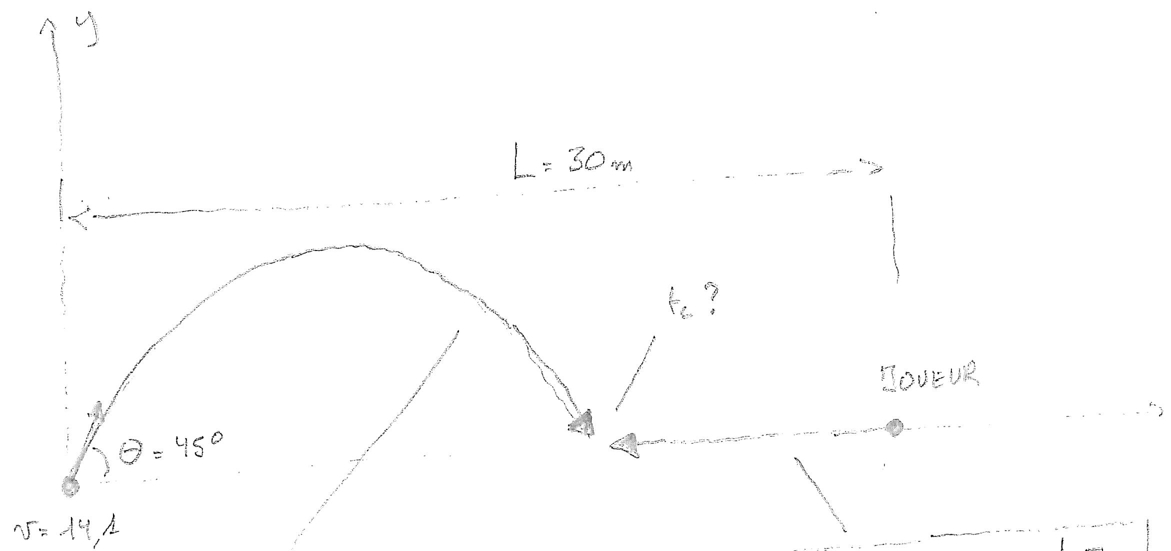
LA VALEUR
NUMERIQUE
SANS LE DESSIN
EST AMBIGUE !

C'EST NEGATIF
CAR C'EST UN ANGLE
VERS LE BAS !



BIEN
INTERPRETER
GEOMETRIQUEMENT !

7



$$\vec{x}(t) = \begin{bmatrix} v \cos\theta \, t \\ v \sin\theta \, t - g\frac{t^2}{2} \end{bmatrix}$$

$$\vec{x_J}(t) = \begin{bmatrix} L - u_J t \\ 0 \end{bmatrix}$$

u_J NORME DE LA VITESSE DU JOUEUR

$$\underline{v} = \begin{bmatrix} -u_J \\ 0 \end{bmatrix}$$

$\boxed{\text{• TEMPS D'IMPACT ?}}$

$$\underbrace{y(t_c)}_{=0} = v \sin\theta \, t_c - g\frac{t_c^2}{2}$$

$$t_c\underbrace{\left(v \sin\theta - g\, t_c/2\right)} = 0$$

LE POINT DE DEPART !

$[\frac{m}{s}][\frac{s^2}{m}]$ OK CHECK DIMENSION

$$\boxed{t_c = \frac{2 v \sin\theta}{g}}$$

$$\underbrace{v \sin\theta}$$

$$\boxed{t_c = \frac{20}{10} = 2 \text{ sec}}$$

$\boxed{\text{• VITESSE DU JOUEUR POUR ATTRAPER LA BALLE ?}}$

$$\underbrace{v \cos\theta \, t_c}_{x(t_c)} = \underbrace{L - u_J t_c}_{x_J(t_c)}$$

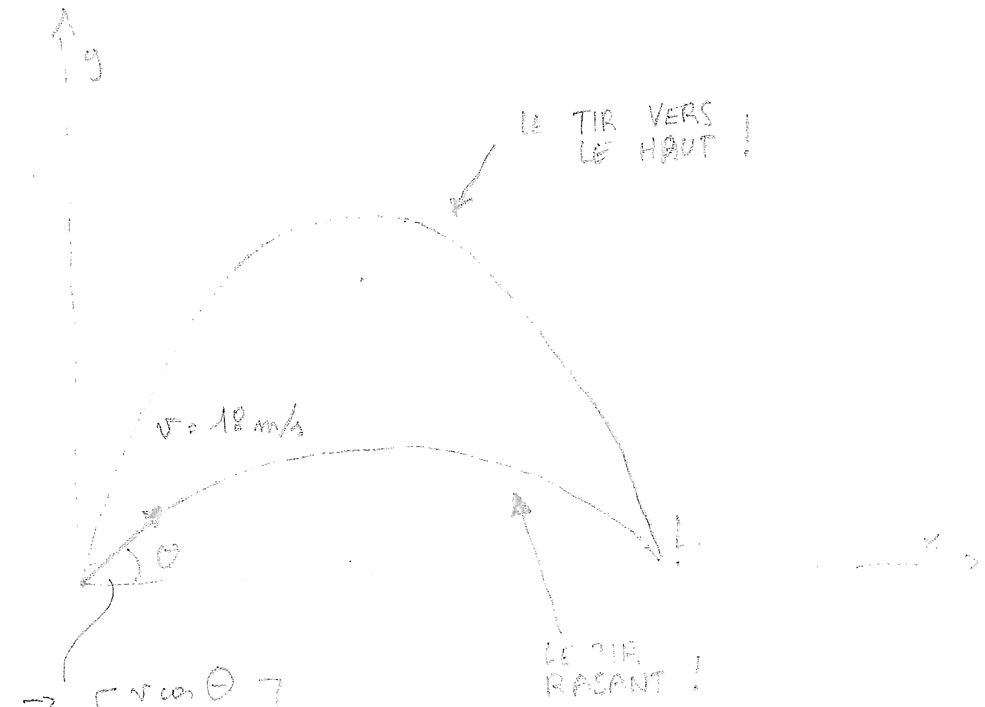
POSITION DE LA BALLE !

POSITION DU JOUEUR

$$u_J = \frac{Lg}{2 v \sin\theta} - v\cos\theta$$

$$\boxed{u_J = \underbrace{\frac{L}{t_c}}_{30/2} - \underbrace{v \cos\theta}_{10}}$$

$$\boxed{u_J = 5 \text{ m/s}}$$



$$\vec{v} = \begin{bmatrix} v\cos\theta \\ v\sin\theta \end{bmatrix}$$

$$\underbrace{\vec{x}(t_c)}_{\begin{bmatrix} L \\ 0 \end{bmatrix}} = \begin{bmatrix} v\cos\theta\, t_c \\ -g\frac{t_c^2}{2} + v\sin\theta_c\, t_c \end{bmatrix}$$

2 EQUATIONS
AVEC 2 INCONNUES t_c et θ

$$\begin{cases} L = v\cos\theta\, t_c & (1) \\ 0 = -g\frac{t_c^2}{2} + v\sin\theta\, t_c & (2) \end{cases}$$

EN REMPLACANT DANS (2) $\underbrace{t_c = \frac{L}{v\cos\theta}}_{\text{OBTENU A PARTIR DE (1)}}$

$$\frac{gL^2}{2v^2\cos^2\theta} = \frac{\sin\theta}{\cos\theta}L$$

$$\frac{gL}{2v^2\cos\theta} = \sin\theta$$

$$\frac{gL}{v^2} = \underbrace{2\sin\theta\cos\theta}_{\sin(2\theta)}$$

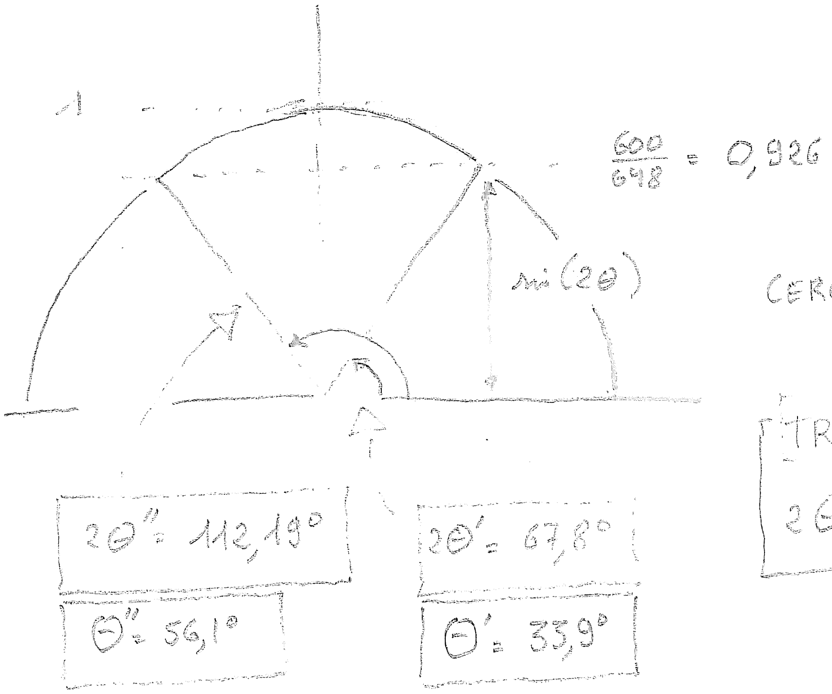
CHECK DIMENSION

$\left[\frac{m}{s^2}\right]\left[m\right]\left[\frac{s^2}{m^2}\right]$ ok !

$$\frac{600}{648} = \sin(2\theta)$$

$$\boxed{\theta = \underbrace{\frac{1}{2}\arcsin\left(\frac{600}{648}\right)}_{32^\circ}}$$

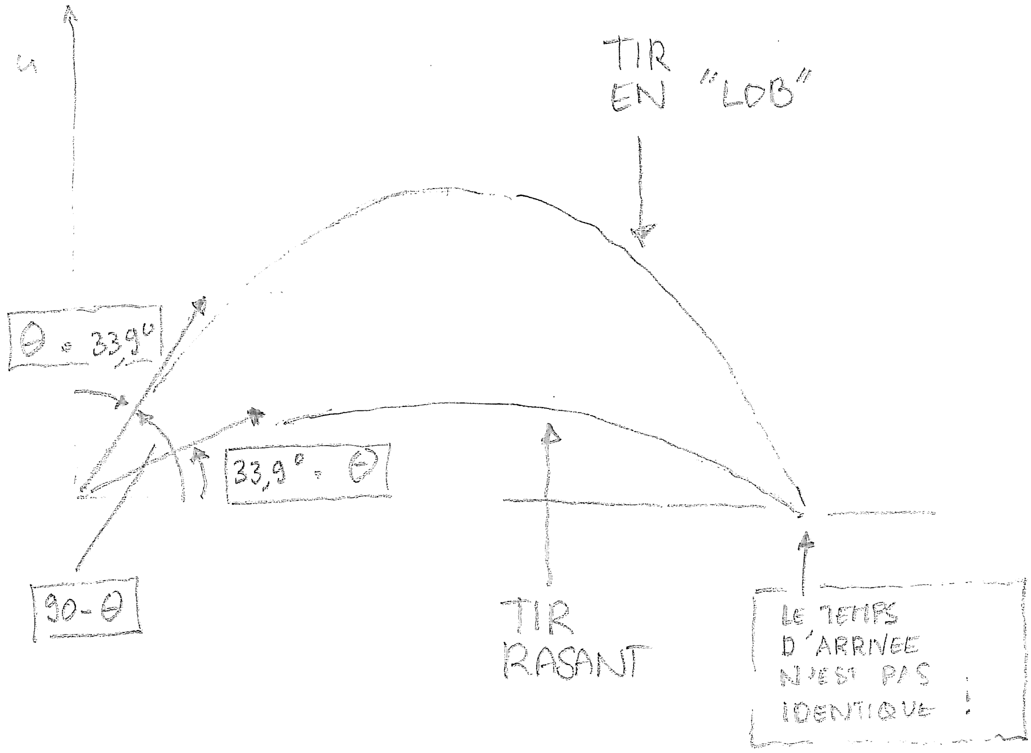
ET LE DEUXIEME ANGLE ?



CERCLE TRIGONOMETRIQUE

TRIGONOMETRIE !

$2\theta'' = 180 - 2\theta'$!



$\cos(56°) < \cos(33°)$ $\quad t_c = \frac{L}{v \cos\theta}$

LE TIR EN "LOB" PRENDRA PLUS DE TEMPS QUE LE TIR "RASANT" !