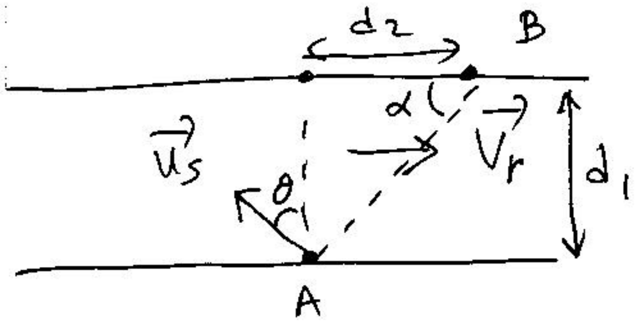
Crossing River



Want to go from A to B

① Method 1 EOM in x, y directions

$$\vec{u}_{SB} = \vec{u}_s + \vec{V}_r$$

↖ swimmer velocity rel. to river bank

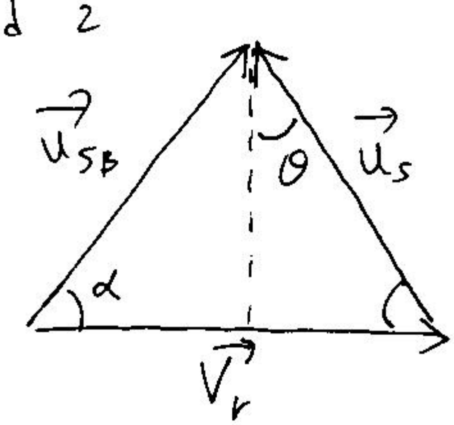
$$(u_{SB})_x = V_r - u_s \sin\theta$$
$$(u_{SB})_y = u_s \cos\theta$$
(✪)

t_c = time it takes to cross the river

$$d_2 = (u_{SB})_x \cdot t_c$$
$$d_1 = (u_{SB})_y \cdot t_c$$

⇒ ~~use ✪, and~~ eliminate t_c and use ✪ and obtain u_s

② Method 2



Ⓐ -- $u_s \sin\theta + u_{SB}\cos\alpha = V_r$

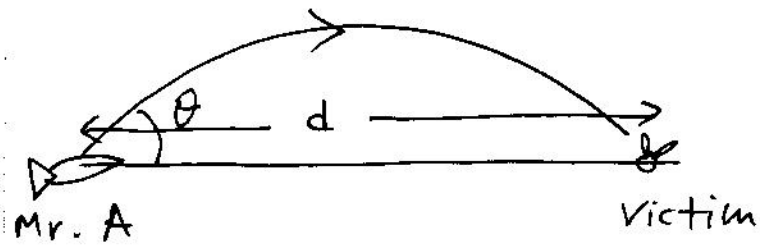
Ⓑ -- $u_{SB}\sin\alpha = u_s \cos\theta$

$$\tan\alpha = \frac{d_1}{d_2}$$

Know α, θ, Eliminate u_{SB} in Ⓐ and Ⓑ

Solve for u_s.

Archer fish



d given, θ given $\qquad t_T \equiv$ total time of trajectory

$V_0 \cos\theta \cdot t_T = d \quad \cdots (*)$

For y motion, $V_0 \sin\theta - g \cdot \left(\frac{t_T}{2}\right) = 0 \quad \cdots (**)$

(∵ top of the trajectory $V_y = 0$)

In (*), (**), eliminate t_T and can solve for V_0.

☆☆☆ Important note: Review the hammer example !!! (Ex 3.5) ("Sam's solution")

For the hammer example and the 2nd part of this problem need to use ☆☆☆☆☆☆☆☆☆☆

$$y(t) = V_0 \sin\theta \, t - \frac{1}{2} g t^2$$

→ sols folder on the course website

GPS orbit prob. (3.47)

altitude → measured from sea level

$a = R\omega^2$

R ← earth radius + altitude (altitude given)

$\omega = \dfrac{2\pi}{T}$

a is given
⇒ can know ω
⇒ can solve for T

Car and g-force prob. (3.45)

$a = \dfrac{v^2}{R}$

Centripetal force $= ma$

~~How large is a compared to g?~~

If $a = g$ ⇒ [illegible]

R is given.

What is $v = ?$

Can solve for it.