Unit 3 – 2D Kinematics Section 3.3: Relative Velocity (Boat-River)

What's your velocity right now?

· depends on who's watching (perspective)

in reality, something huge cause Earth's hurtling
through space velocity every time we wanted to solve a problem. We can make our

lives easier by working with relative velocities.

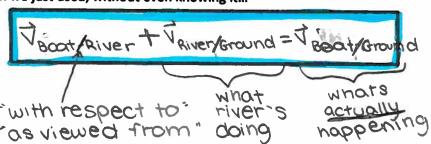
Example: In still water (e.g. on a lake), a student can debute a canoe at 3 m/s.

If they are paddling down a river that flows at 7 m/s, what is their velocity relative to the shore?

What is their velocity relative to the shore if they paddle up the river?

Here's the equation we just used, without even knowing it...

In 84111
Water"
Direction (S
called
"Heading"



B=Bood R=River G=Ground

Fun fact: This doesn't just work for \vec{v} , it works for \vec{d} and \vec{a} as well!

Example: A bullet whizzes past your head at 500 m/s north, fired from a car which soon whizzes past you at 50 m/s north. How fast was the bullet going, as viewed from the car?

R=car G=ground

$$\vec{V}_{BIR} + \vec{V}_{RIG} = \vec{V}_{BIG}$$
 $3C + 50 = 500$
 $3C = 500 - 50$
 $3C = 450$

2D Problems

Remember, for problems that are 2D (things not moving in a straight line) we use our equations with

arrows instead of numbers.

Example: You see an airplane fly overhead, moving at 90 m/s east. But the wind is blowing at 10 m/s north. What is the airplane's heading and airspeed (speed relative to the air)?

B=plane R=windlair

JBIR + JRIG = JBIG

airspeed $\begin{cases} +an6 = \frac{10}{90} \\ 6 = +an^{-1}(48) \\ 6 = 6.34^{\circ} \end{cases}$

1 BIR = 90. PWIE [P.34 , 20 E]