Class Notes – Lecture 7 15 September 2009

Relative Position Vector

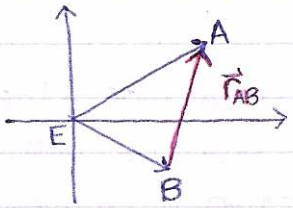
Position of car A relative to car B given by the vector subtraction equation

$\vec{r}_{AE}$: position of the car A measured by E

$\vec{r}_{BE}$: position of car B measured by E

$\vec{r}_{AB}$: position of car A measured by car B

$\vec{r}_{AB} = \vec{r}_{AE} - \vec{r}_{BE}$



for car B, he is stationary, and sees different than E, A move further right they both mov

rotate $\vec{r}_{BE}$ (it becomes negative) in order to add vectors

Relative Velocity

$\vec{v}_{AB} = \vec{v}_{AE} - \vec{v}_{BE}$; $\frac{\Delta \vec{r}_{AB}}{\Delta t} = \frac{\Delta \vec{r}_{AE}}{\Delta t} - \frac{\Delta \vec{r}_{BE}}{\Delta t}$

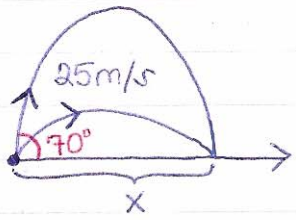
For any set of indices, $\vec{v}_{AB} = -\vec{v}_{BA}$

Classical Mechanics

Describes the relationship between the motion of objects in our everyday world and the forces acting on them

Conditions when CM doesn't apply: very tiny objects (< atomic sizes); objects moving near the speed of light

71.



a) the sum of the angles must be 90° ; Ans = 20°

b) Snowball #1 :

$v_{1yi} = 25\sin(70°)$ — y component initial v

$\Delta y = 0$ — from ground to the ground

$a = -9.8\ m/s^2$

for x direction, $v = d/t$

$\Delta y = v_0 t + \frac{1}{2}at^2$

$0 = 25\sin(70°)t - \frac{1}{2}(9.8)t^2$

$t = 25\sin(70°) / 4.9$

$t_1 = 4.79\ sec$

Snowball #2 :

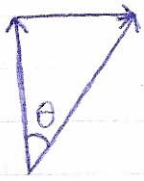
$v_{2yi} = 25\sin(20°)$

$t = 25\sin(20°) / 4.9$

$t_2 = 1.74\ sec$

Wait time : $4.79 - 1.74 = 3.05\ sec$

Ex. 3.10.



Boat (B)
River (R)
Observer (E)

$\vec{v}_{BR} = 10\ km/hr\ N$

$\vec{v}_{RE} = 5\ km/hr\ E$

1st index — remaining index

$\vec{v}_{BE} = \vec{v}_{BR} - \vec{v}_{ER}$ — subscripts end in same index

$= \vec{v}_{BR} - (-\vec{v}_{RE})$

$= \vec{v}_{BR} + \vec{v}_{RE}$

$= 10 + 5$