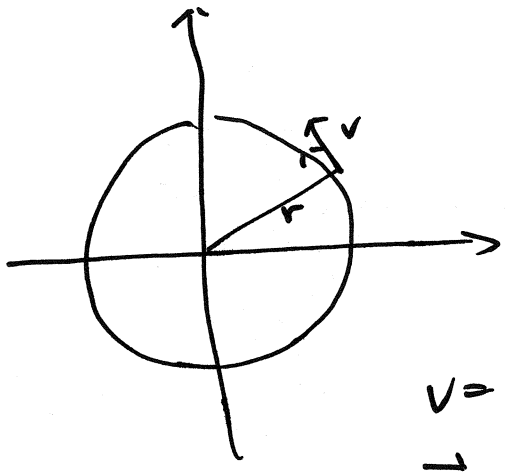
LECTURE 7

LAST TIME UNIFORM CIRCULAR MOTION



$$T = \frac{2\pi r}{v} = \frac{\text{CIRCUMFERENCE}}{\text{VELOCITY}}$$

$$T = \frac{2\pi}{\omega} \qquad \omega : \text{ANGULAR VELOCITY}$$

$$v = \omega r$$

$$\vec{a}_0 = \omega^2 r \quad \text{POINT IN IN RADIAL DIRECTION}$$

$$= -\omega^2 r \hat{r}$$

ASIDE:

1 RADIAN = 57.29°

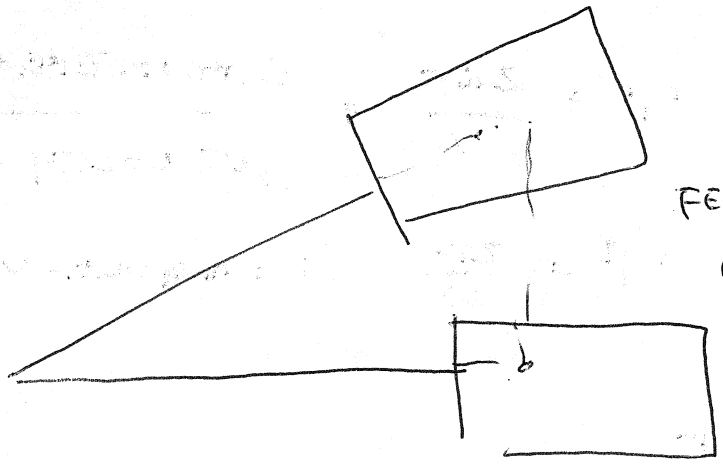
2π RAD = 360°

RADIAN : DIMENSIONLESS

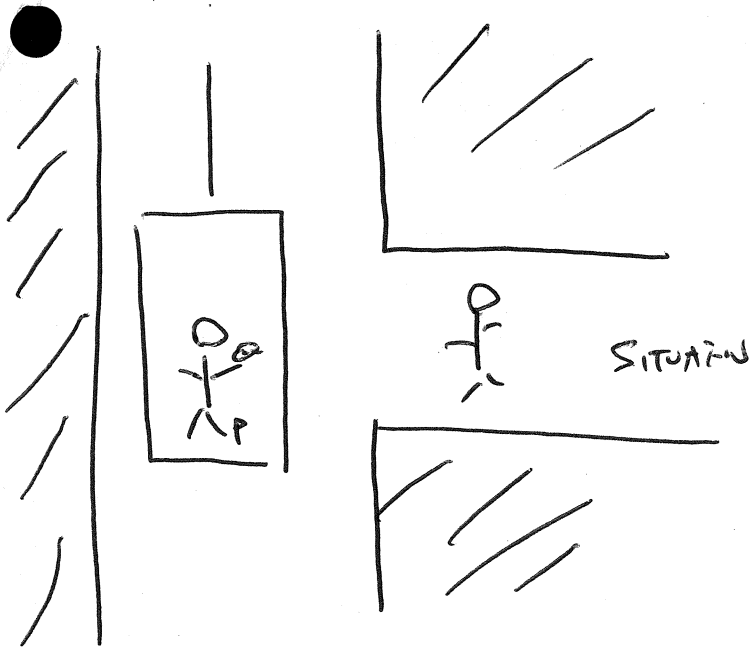
$$\text{RAD} = \frac{\text{ARC (m)}}{\text{RADIUS (m)}}$$

VEDD MIT.

PERCEIVED GRAVITY DEMO



FEELS LIKE THERE'S
OUTWARD PULL TOWARD



SITUATION

~~A~~ REST FRAME

B MOVING FRAME

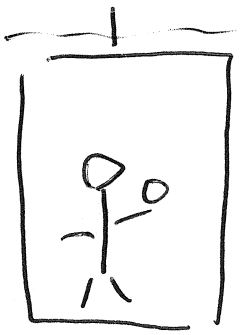
$\vec{V}_{PA} = \vec{V}_{PB} + \vec{V}_{BA}$

$\vec{V}_{PR} = \vec{V}_{PM} + \vec{V}_{MR}$

$\vec{a}_{PR} = \vec{a}_{PM} + \vec{V}_{MR}$

$\vec{a}_{PA} = \vec{a}_{PB} + \vec{a}_{BH}$

~~B~~



AT $t = 0$ PERSON LETS GO OF THE BALL

ALSO CABLE BREAKS

WHAT HAPPENS TO THE BALL

$\vec{a}_{BR} = -g\hat{k}$ = ACCELERATION OF BALL WRT REST

$\vec{a}_{ER} = -g\hat{k}$ = ACCELERATION OF ELEVATOR WRT TO REST

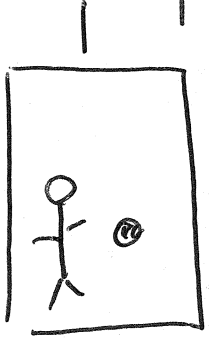
$$\vec{a}_{KB} = \vec{a}_{BE} + \vec{a}_{EK}$$

$$-g\hat{k} = -g\hat{k} + \vec{a}_{BE}$$

$$\vec{a}_{BE} = 0\hat{k}$$

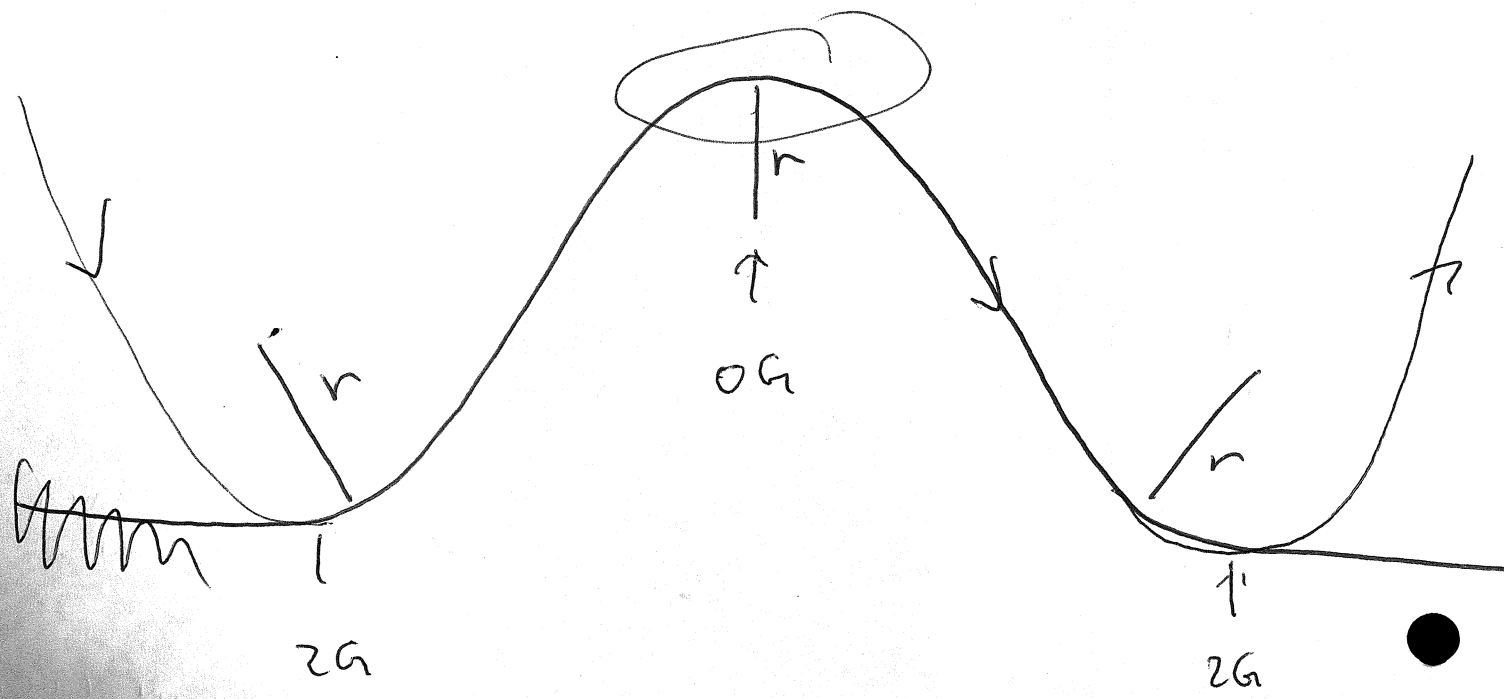
ZERO G:

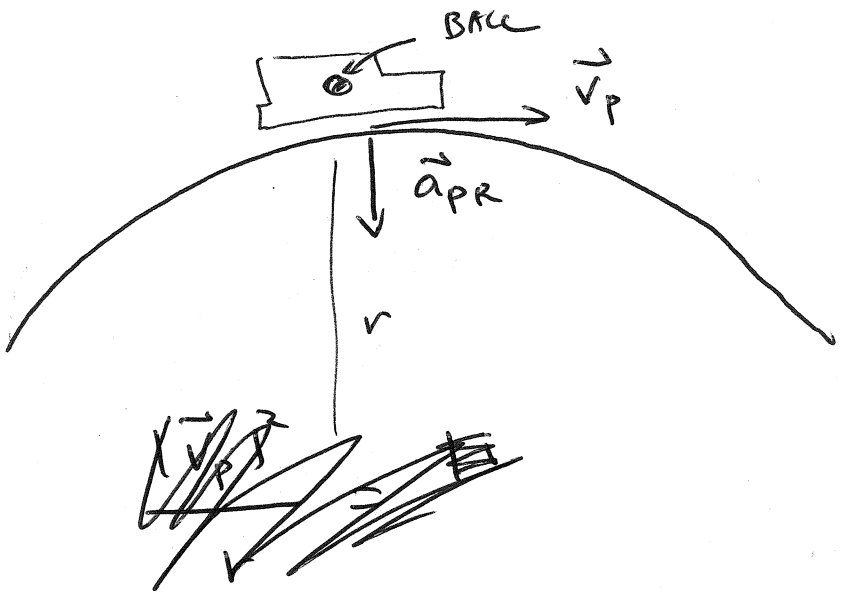
$$\vec{a}_{EK} = g\hat{k}$$



$$\vec{a}_{BK} = \vec{a}_{BE} + \vec{a}_{EK}$$

$$\vec{a}_{BE} = -2g\hat{k}$$





MAKE AIRPLANE GO FAST ENOUGH THAT

$$\frac{|v_p|^2}{r} = g$$

$$\vec{a}_p = -g\hat{k}$$

BALL DROPS AT TOP

$$\vec{a}_{BR} = -g\hat{k} = \vec{a}_{BP} + \vec{a}_{PR}$$

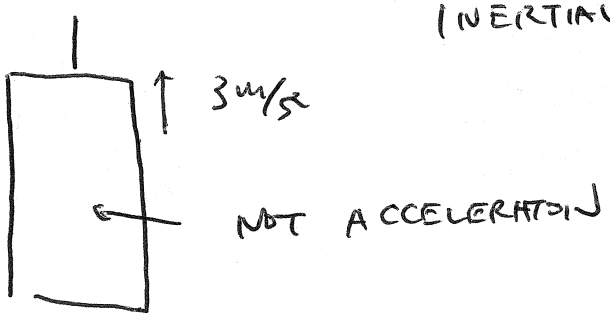
$$-g\hat{k} = \vec{a}_{BP} - g\hat{k}$$

$$\vec{a}_{BP} = 0$$

NEWTON'S FIRST LAW

IF AN OBJECT DOES NOT INTERACT WITH OTHER OBJECTS. IT IS POSSIBLE TO ~~DEE~~ IDENTIFY A REFERENCE FRAME IN WHICH THE OBJECT HAS ZERO ACCELERATION

INERTIAL FRAME ⇒ ACCELERATION



A BODY ACTED ON BY NO NET FORCE MOVES WITH CONSTANT VELOCITY

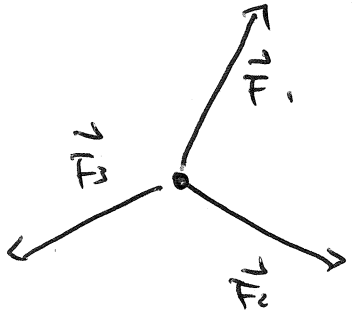
NEWTON'S SECOND LAW

$$\vec{F} = m\vec{a}$$

m : MASS

$\vec{F}$: FORCE

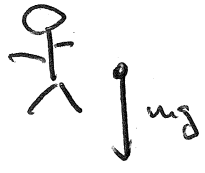
$\vec{a}$ = ACCELERATION



$$m\vec{a} = \sum_{i=1}^{3} \vec{F}_i$$

$$= \vec{F}_1 + \vec{F}_2 + \vec{F}_3$$

$\sum \vec{F}$ = NET FORCE



$$\vec{F}_g = m\vec{g} = m\vec{a}$$

NEWTON'S THIRD LAW

IF BODY B EXERTS $\vec{F}_A$ ON BODY A THEN THERE IS A FORCE $\vec{F}_B$ ACTING ON BODY B DUE TO BODY A SUCH THAT

$$\vec{F}_A = -\vec{F}_B$$