Motion in 2 dimension
Motion in a plane

Vector

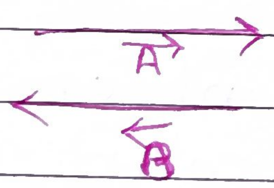
These are the quantites which have magnitude and direction also they follow vector law of addition

Tensor

These are quantites which ~~ha~~ have magnitude and direction but do not follow vector law of addition

Negative vector

If magnitude of two vector is same but direction is opposite, vector is ~~same but~~ called negative vector



Zero vector or Null vector

A vector which does not has magnitude is called zero vector

Colinear vector

The vector which either act along the same line or along parallel lines are called Colinear vector

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Coplaner vectors:

These are vectors which lies in same plane is called coplaner vector

Unit vectors : $\hat{A}$

Any vector which has magnitude ~~is~~ 1 unit is called unit vector.

Axial vector

The vectors which represent rotational effect and act along axis of rotation according to right hand screw rule

Polar vector

These are vector which has point of application or starting point is called polar vector

Vector Operations

1. Multiplication of a Vector by a scalar

$$\vec{Q} = 5\vec{P}$$

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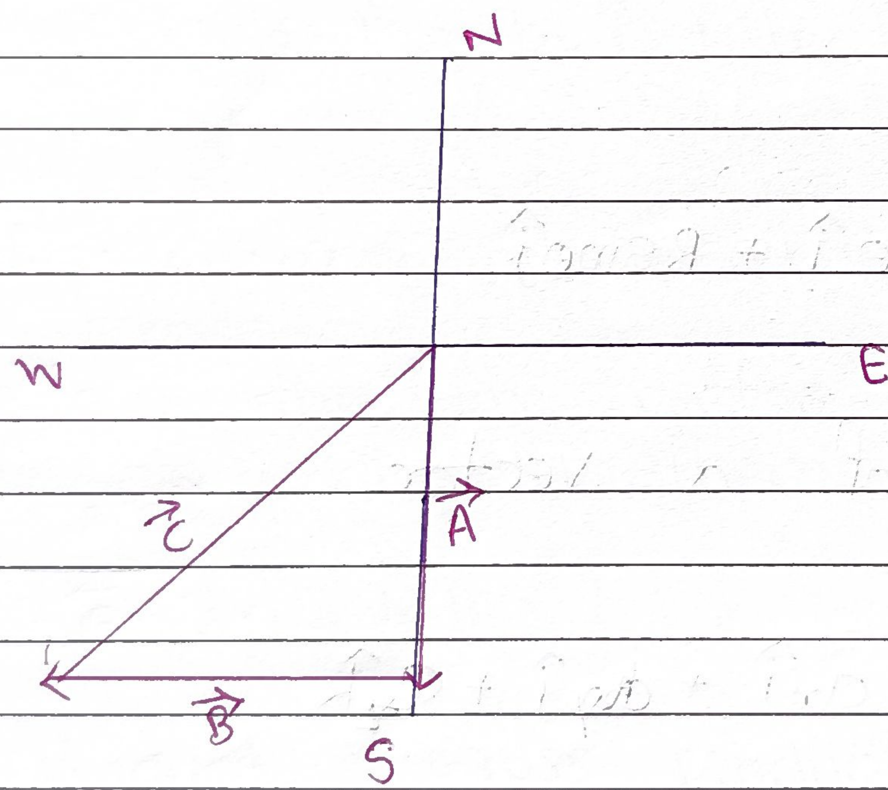
Triangle law for vector addition

$\hat{i}$ = unit vector in x - direction

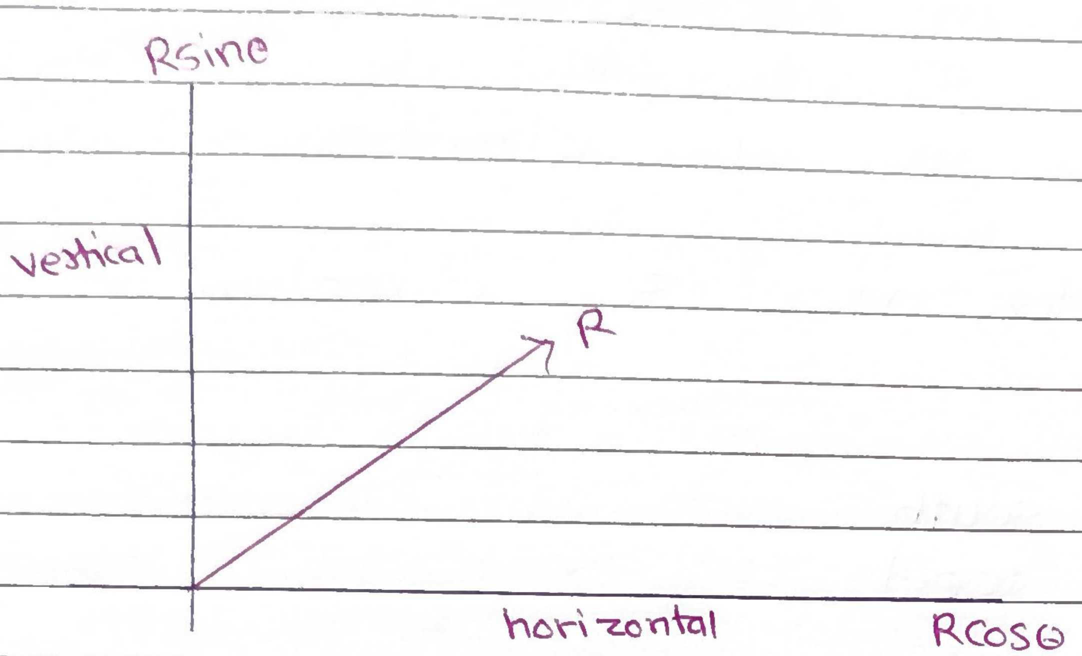
$\hat{j}$ = unit vector in y - direction

$\hat{k}$ = unit vector in z - direction

$\vec{A}$ = 6m due south
$\vec{B}$ = 8m due west



Resolution of vector



$$\vec{R} = R\cos\theta\,\hat{i} + R\sin\theta\,\hat{j}$$

Magnitude of a vector

If $\vec{A} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$

Than Magnitude is

$$\boxed{|\vec{A}| = \sqrt{a_x^2 + a_y^2 + a_z^2}}$$

Scalar Product (Dot Product

The scalar Product $\vec{P}$ and $\vec{Q}$ is written as

$$\vec{P}.\vec{Q} = PQ\cos\theta$$

where θ is the angle betn $\vec{P}$ and $\vec{Q}$

for $\vec{A} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$

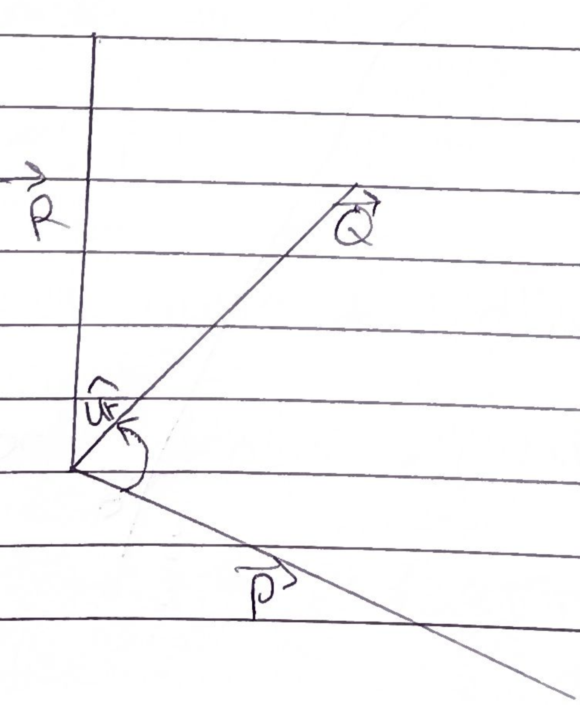
and $\vec{B} = b_x\hat{i} + b_y\hat{j} + b_z\hat{k}$

$$\vec{A}.\vec{B} = a_xb_x + a_yb_y + a_zb_z$$

If $\theta = 0$ the two vectors $\vec{P}$ and $\vec{Q}$ are parallel to each other, then

$$\hat{i}.\hat{i} = \hat{j}.\hat{j} = \hat{k}.\hat{k} = 1$$

Vector Product (Cross product



vector product
$\vec{R} = \vec{P} \times \vec{Q} = PQ\sin\alpha\ \hat{u}_r$

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the motion

Assamption.

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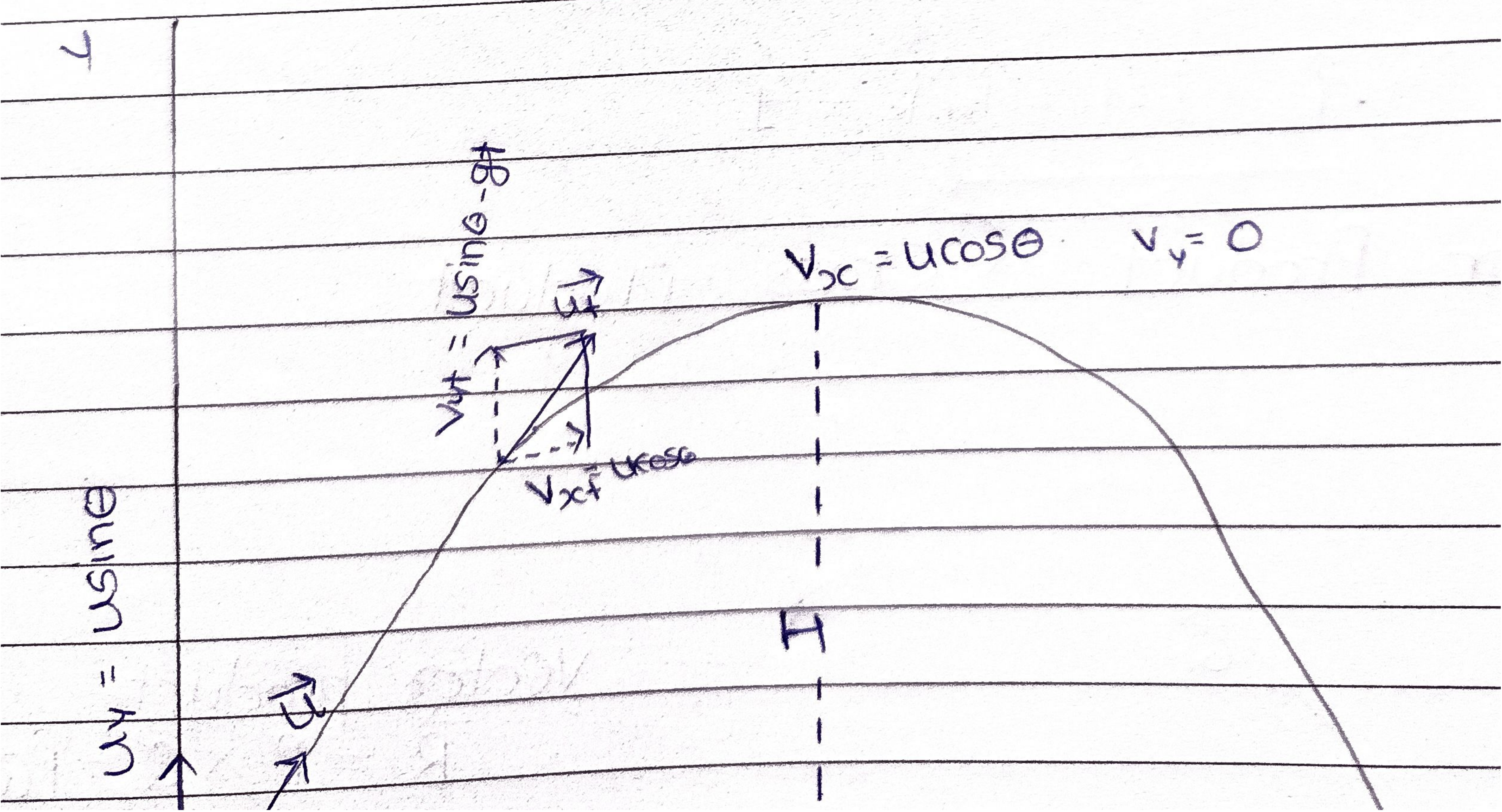
urvature and ~~motion~~ rotation of earth
hould not effect the motion



Time

$V \quad u_y = u\sin\theta$

$u_y = -g$

$\therefore u_y = 0$

$v = u_y + at$

$0 = u\sin\theta - gt$

$gt = u\sin\theta$

$t = \frac{u\sin\theta}{g}$

$\therefore T = 2t$ (it will take same time for downward journey)

$$\boxed{t = \frac{2u\sin\theta}{g}}$$

Range

$S = ut + \frac{1}{2}at^2$

for x -

$u_x = u\cos\theta$

$u_x = 0$

$u_x = u\cos\theta$

$R = u\cos\theta \pm \frac{1}{2}at^2$

$= u\cos\theta \cdot \left(\frac{2u\sin\theta}{g}\right)$

$= u^2 \frac{(2\sin\theta \cdot \cos\theta)}{g} \ldots \rightarrow$

$$\boxed{R = \frac{u^2\sin 2\theta}{g}}$$

Maximum Height

At the highest point $y = H$ and $V_y = 0$

So $V_y^2 = u_y^2 - gy$

$$H = \frac{u_y^2}{2g} \quad \text{or} \quad H = \frac{u^2 \sin^2\theta}{2g}$$

Uniform ~~Cr~~ Circular motion

When an object follows a circular path at a constant speed, the motion of the object is called uniform circular motion.