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Projectile Motion

Two dimension motion of the body under the constant acceleration (g) is called projectile motion.

Example:-

Motion of Rocket

Motion of football Kicked by a player.

Bullet fired by a gun.

Trajectory:-

The pathway followed by the projectile is called its trajectory. Normally **parabolic** motion form a projectile trajectory.

Time of

Flight:- $t = \frac{2V_i \sin \theta}{g}$

Range:- $\frac{V_i^2 \sin 2\theta}{g}$

Height:- $\frac{V_i^2 \sin^2 \theta}{g}$

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Velocity: Rate of change of displacement
 $= \frac{\text{displacement}}{\text{Time taken}} = \frac{\vec{d}}{t}$

ms^{-1} Kmh^{-1}

"how fast" & "in which direction"

average velocity:

$$\frac{\text{total displacement}}{\text{total time}}$$

Instantaneous Velocity:

The velocity of an object at any instant of time or at specific point. (Short interval of time).

$$\lim_{\Delta t \rightarrow 0} \frac{\Delta d}{\Delta t}$$

Uniform

Speed: Same

direction: Same

Variable

Speed: Same

direction: change

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De-Broglie

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Wave Mechanics was introduced by De-broglie.

He explains that electron behave ^{both} as waves and particles.

Quantum refers to the smallest discrete unit of a physical property like energy or matter. It

Matter is anything that has mass and takes up space.

Radian

Radian is a

Plane angle (circle) Two dimensional angle subtended at centre of circle by an arc of length equal to the radius of the circle.

In a circle there are 2π radian
 $\theta = \text{if } s = r \text{ i.e. } \frac{s}{r} = 1 \text{ rad}$

Steradian (Solid, 3 dimensional)

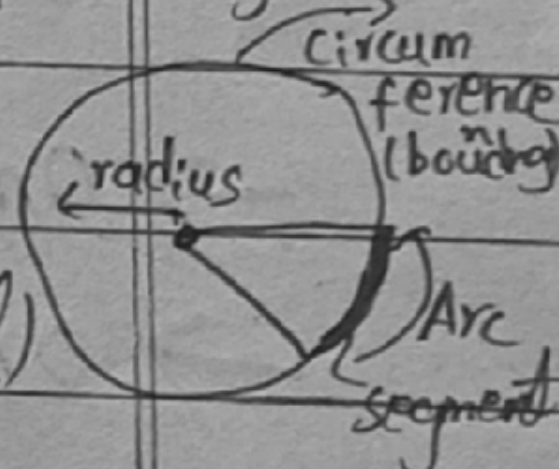
Subtended at the centre of sphere by an area of its surface equal to the square of radius of sphere

$$\theta = A$$

$$= \left\{ \frac{4\pi r^2}{r^2} \right\} r^2$$

$$\theta = 4\pi \text{ Steradian}$$

{ If sphere has an area equal to square of radius then angle is 1 Steradian }



Degree

is the unit that is used to measure angle. A circle has 360 degrees.

Revolution

A complete turn or rotation
one revolution = 360 degrees

Dimensions

→ One year is equal to = $3.2 \times 10^7 \text{ Sec}$

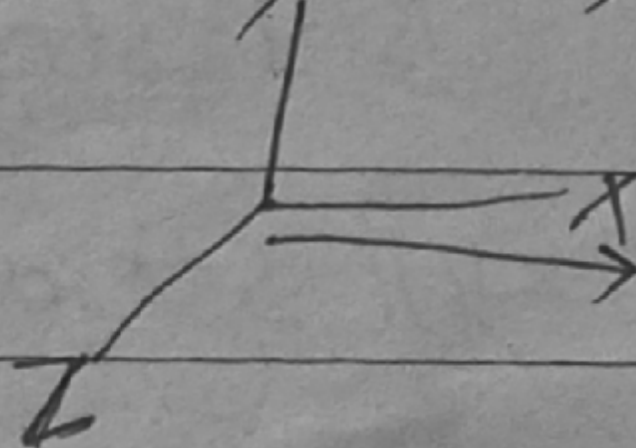
→ one dimensional motion

Motion in one coordinate only.

(x, y or z)

f(x)

P(1)



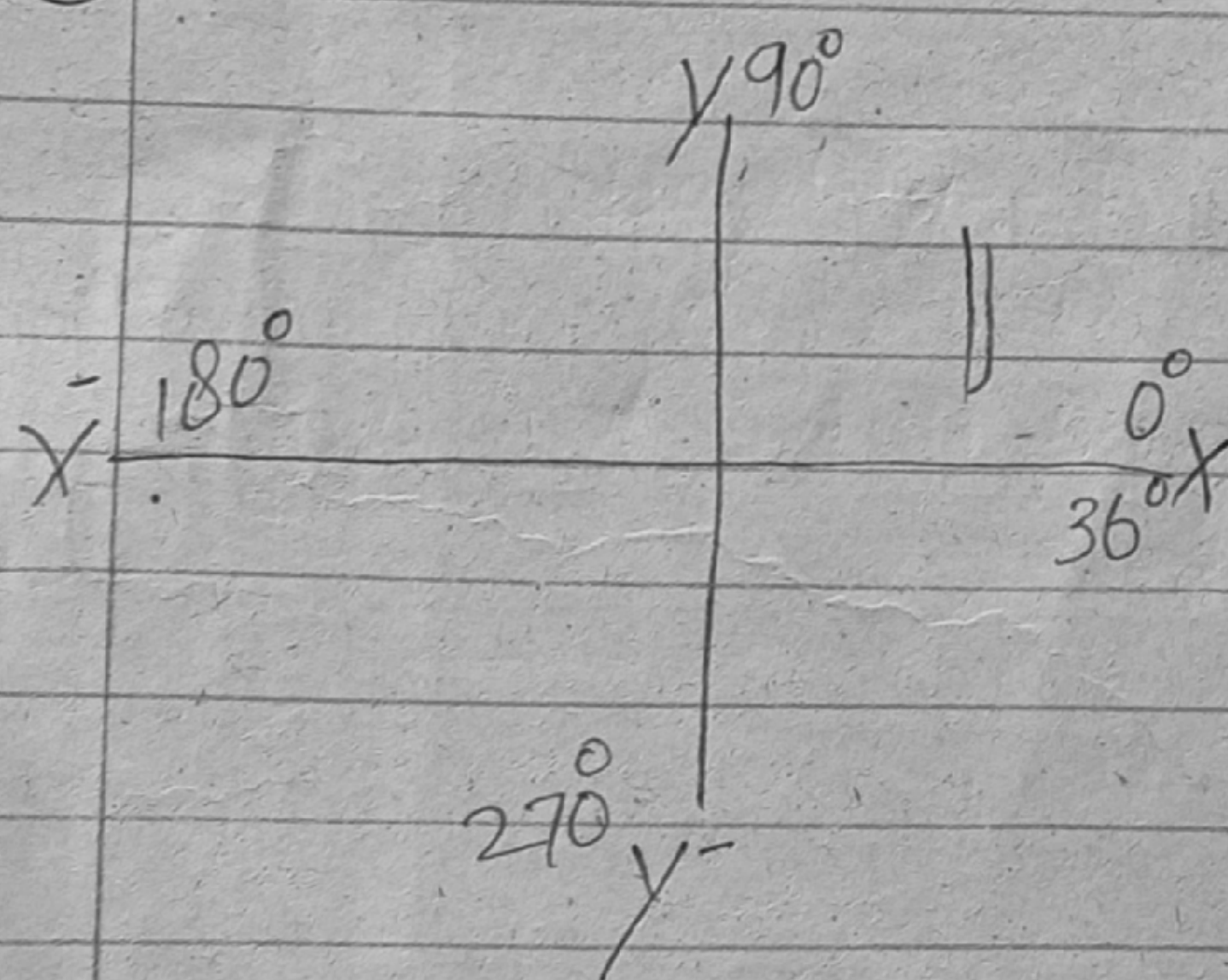
Ex: A Stone drop from the building

- ① Two forces of 60 N and 35 N acting on body resultant will be.

$$\begin{aligned}
 R &= \sqrt{(60)^2 + (35)^2} \\
 &= \sqrt{3600 + 1225} \\
 &= \sqrt{4825} \\
 &= 69.7
 \end{aligned}$$

$$\begin{array}{r}
 35 \\
 \times 35 \\
 \hline
 175 \\
 1050 \\
 \hline
 1225 \\
 3600 \\
 \hline
 4825 \\
 69.7
 \end{array}$$

- ② Quadrants:



$$\begin{array}{r}
 6 \overline{) 4825} \quad 12 \\
 \underline{36} \quad \underline{9} \\
 129 \overline{) 1225} \\
 \underline{1125} \\
 100
 \end{array}$$

- ③ Anti parallel = 180°
 ④ Parallel = 0 or 180°
 ⑤ Perpendicular = 90° (opposite direction = 270°)

The magnitude of dot and cross product of two vectors are $6\sqrt{3}$ and 6 respectively. The angle b/w them will be.

$$A = |A \cdot B|$$

$$|A \times B|$$

$$= 6\sqrt{3}$$

$$= \sqrt{3}$$

$$= 30^\circ$$

The magnitude of (.) and (x) products are equal when angle b/w them is 45°

$$\text{Projectile Range: } V_i^2 \sin 2\theta / g$$

$$\text{Projectile Height: } V_i^2 \sin^2 \theta / 2g$$

$$\text{Time of flight: } 2 \sin \theta / g$$

$$\text{Commutative: } a+b=b+a$$

$$\text{Associative: } a(b+c) \Rightarrow b+(a+c) / a(bx) = (axb)c$$

$$\text{Additive identity: } a+0=0$$

$$\text{Additive inverse: } a+(-a)=0$$

$$\text{Multiplicative identity: } axy=a$$

$$\text{" Inverse: }$$

$$\text{Distributive: } a*(b+c) = a+b+a+c$$

$$ax(bxc) = axb+axc$$

Speed: How fast the object is moving

Velocity: " " " " with specific direction

Acceleration: Rate of change of Velocity.

If $A = 2\hat{i} + \hat{j} + 3\hat{k}$ the magnitude of Vector A

$$A = \sqrt{x^2 + y^2 + z^2}$$

$$= \sqrt{2^2 + 1^2 + 3^2}$$

$$= \sqrt{4 + 1 + 9}$$

$$= \sqrt{14}$$

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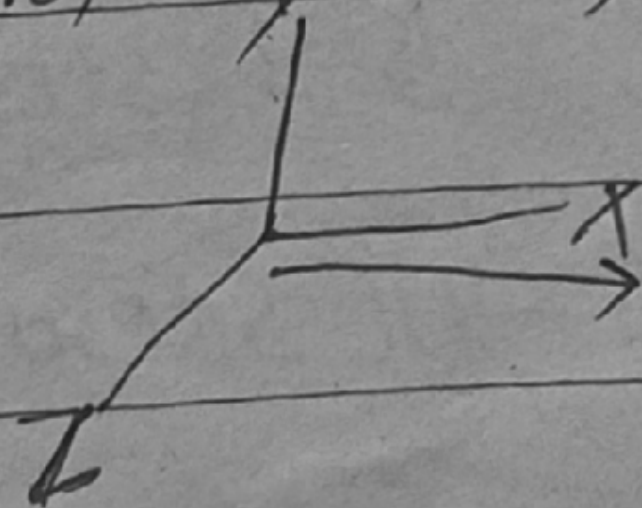
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$P(1)$



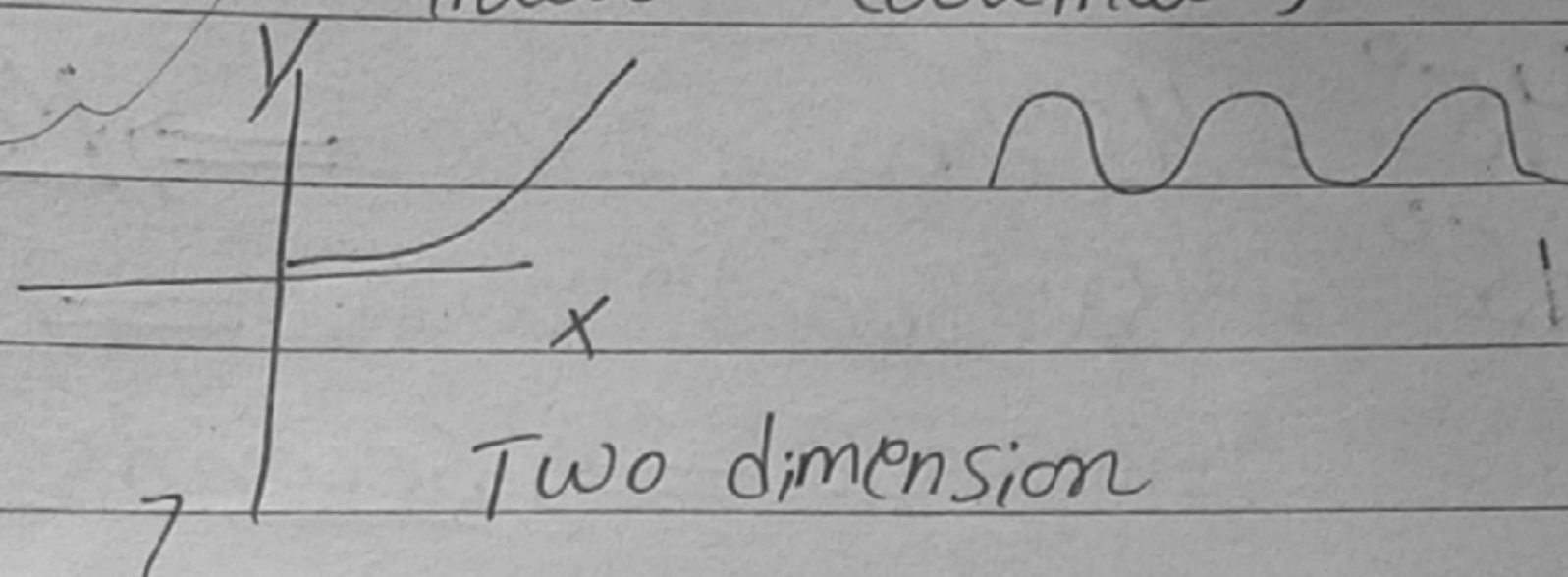
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drop from
the building

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Two dimension:-

Motion into two coordinates



Three dimension

Use of three coordinate to specify position of an object.

Ex: Kite, Aeroplane, Birds

* 1 Degree to Radians

15°

$$15 \times \frac{\pi}{180} \text{ rads}$$

$\frac{180}{12}$

$$\frac{\pi}{12} \text{ rads}$$

$\frac{12}{12}$

* Radian into degrees

$$\frac{2\pi}{3} \text{ radians}$$

$\frac{3}{6}$

$$\frac{2\pi \times 180}{3 \times \pi}$$

$$= 120 \text{ degree}$$

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Degrees to minutes & Seconds:-

$$45^\circ = 45 \times 60 = 2700 \Rightarrow \text{Minutes}$$

$$45^\circ = 45 \times (3600) / 2700 \times 60 = \\ = 162000 \Rightarrow \text{Seconds}$$

Degrees to 1. Decimals

$$\begin{array}{r} 60 \overline{) 3600} \quad 60 \\ 60 \quad 60 \quad 1 \end{array}$$

$$48^\circ 28' + 32''$$

$$48, \frac{28}{60} + \frac{32}{3600}$$

$$\left\{ \begin{array}{l} \frac{14}{28} + \frac{16}{32} \\ \frac{60}{30} \quad 3600 \end{array} \right.$$

$$\left\{ \begin{array}{l} \frac{1680 + 32}{3600} \quad 3600 \end{array} \right.$$

$$1 \text{ Rev} = 2\pi \text{ rad}$$

$$360^\circ = 2\pi \text{ radian}$$

$$180^\circ = \pi \text{ radian}$$

$$\frac{1}{2} \text{ Rev} = \pi \text{ rad.}$$

$$1 \frac{1}{4} = 2\pi + \frac{\pi}{2}$$

$$= \frac{5\pi}{2}$$

$$\begin{array}{r} 60 \\ 28 \\ 480 \\ 120 \times \\ 1680 \\ 3600 \quad 1680 \\ \hline 2 \\ 00 \quad 8712 \end{array}$$