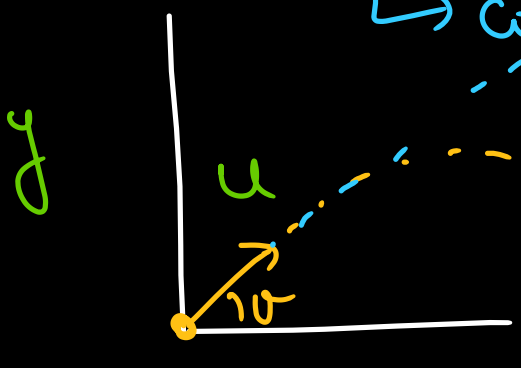
Projectile:

↳ object released in space with some initial velocity

↳ effect of gravity

Projectile motion: 2-D motion

↳ constrained to move in plane

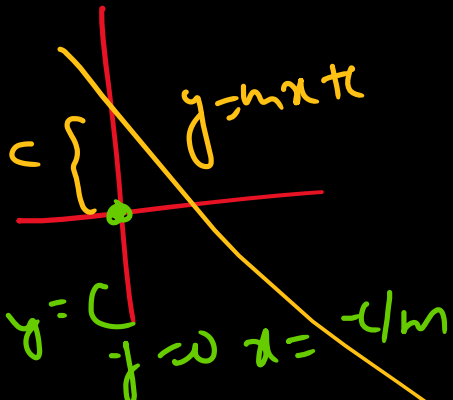


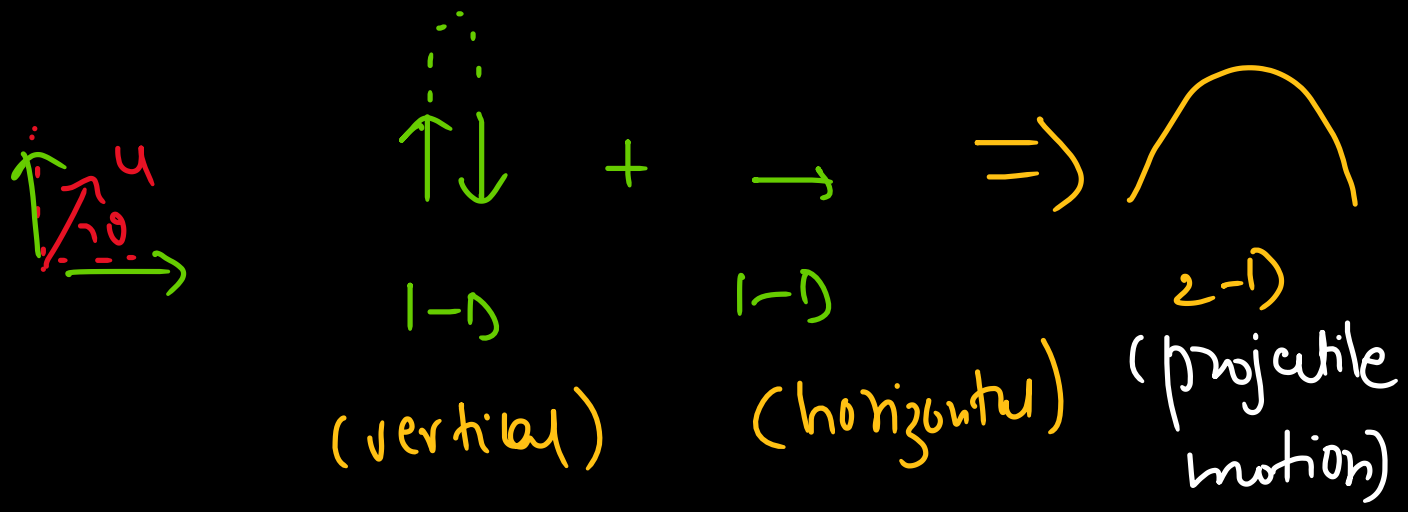
parabolic path

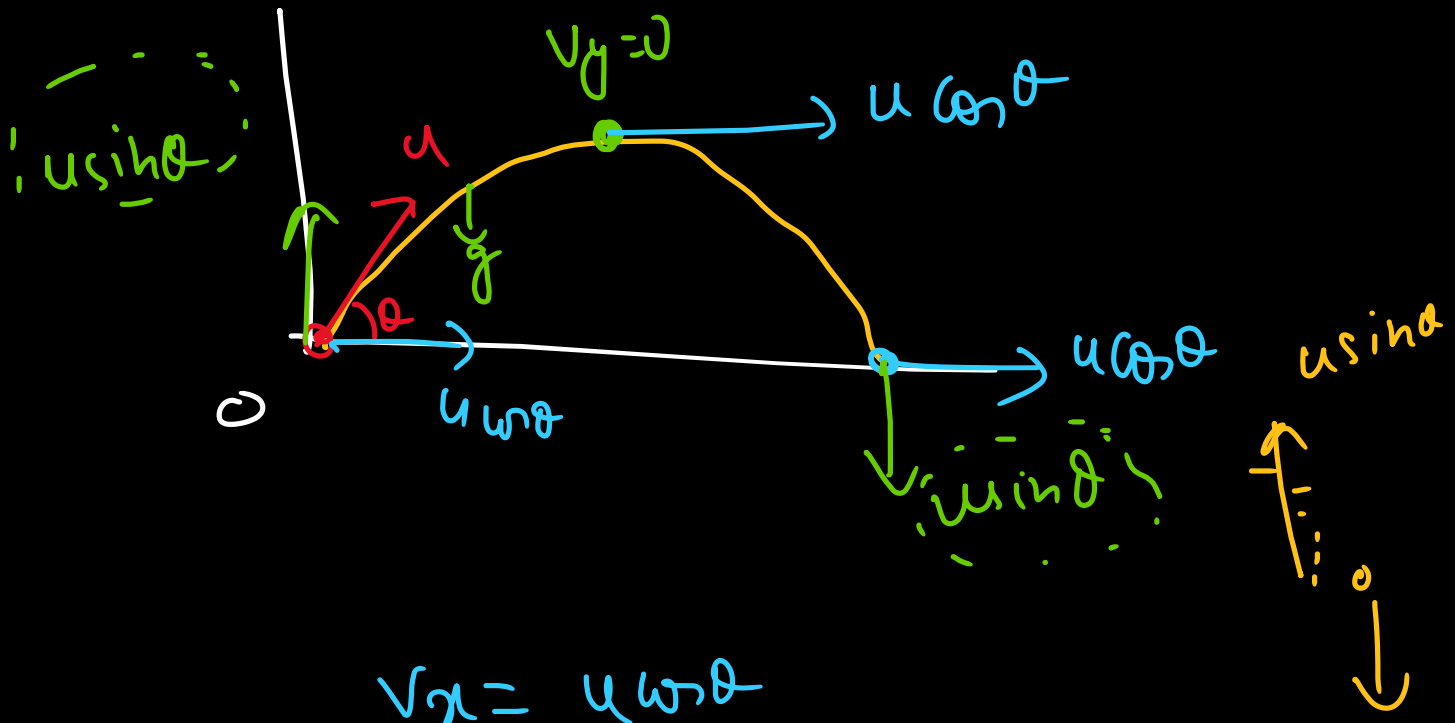
motion: projectile motion

ST line = path

$y = mx + c$



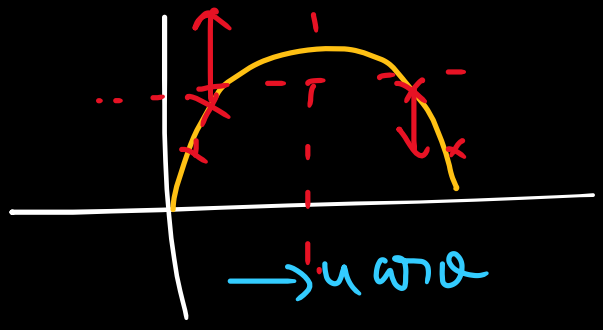




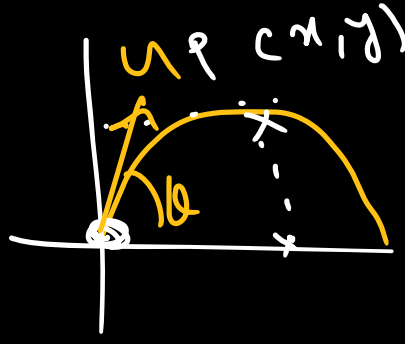
$$v_x = u\cos\theta$$

$$v_y = u\sin\theta - gt \rightarrow v_y \downarrow$$

$$v = u + at$$



1. Eqn of path of projectile



at time t,
posn of particle
is $P(x,y)$

x = horiz dist

y = vertical dist

$u\sin\theta$ ↑ → $u\cos\theta$

Horizontal

$x = x_0 + u_x t + \frac{1}{2} a_x t^2$

$x_0 = 0$, $u_x = u\cos\theta$

$a_x = 0$

$x = 0 + u\cos\theta\, t + 0$

$x = u\cos\theta\, t$

$t = \frac{x}{u\cos\theta}$

Vertical

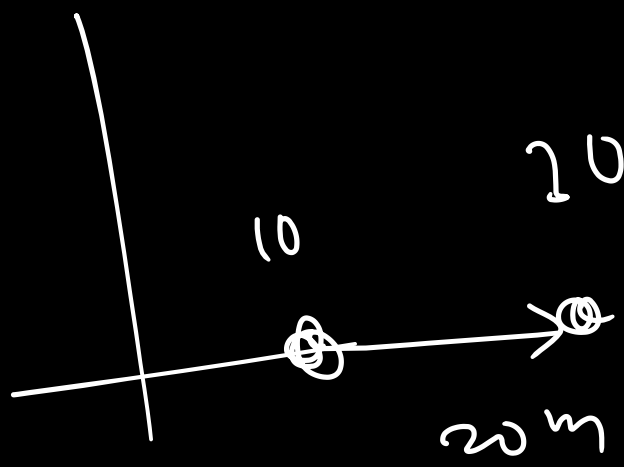
$y = y_0 + u_y t + \frac{1}{2} a_y t^2$

$y_0 = 0$, $u_y = u\sin\theta$

$a_y = -g$

$y = 0 + u\sin\theta\, t - \frac{1}{2} g t^2$

$y = u\sin\theta\, t - \frac{1}{2} g t^2$



$\Delta x = 20\,m$

$x = x_0 + \Delta x$

$10 + 20 = 30$

$$y = x\tan\theta \left(\frac{x}{u\cos\theta}\right) - \frac{1}{2} g \frac{x^2}{u^2\cos^2\theta}$$

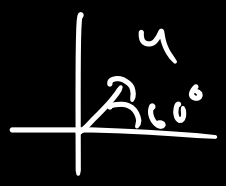
$$y = x\tan\theta - \frac{1}{2}\frac{gx^2}{u^2}\sec^2\theta$$

← eqn of projectile

Q. A body projected with velocity 20 m/s in a dirn making an angle 60° with horizontal. Detn (i) posn after 0.5s

(ii) velocity after 0.5s

$u = 20$
$\theta = 60°$



horizontal	vertical
$u_x = u\cos\theta = 20 \times \frac{1}{2}$	$u_y = u\sin\theta = 20 \times \frac{\sqrt{3}}{2}$
$= 10$	$= 10\sqrt{3}$
$a_x = 0$	$a_y = -g$

$x = u\cos\theta t$

$= 20 \times \frac{1}{2} \times \frac{1}{2}$

$= 5$

$y = u\sin\theta t - \frac{1}{2} g t^2$

$= 10\sqrt{3} \times \frac{1}{2} - \frac{1}{2} \times 10 \times \frac{1}{2} 2$

$= 10\sqrt{3} \times \frac{1}{2} - 5/4$

$= 10 \times 1.732 - 1.25$

$= 17.32 \times \frac{1}{2} 1.25 = 8.66 - 1.25$

$= 7.4$

$x = 5$

$y = 7.4$

$$v_x = u\cos\theta = 10$$

$$v_y = u\sin\theta - gt = 10\sqrt{3} - 10\times\frac{1}{2}$$

$$= 10\times 1.732 - 5$$

$$= 17.32 - 5$$

$$= \underline{\underline{12.32}}$$

$$\sqrt{v_x^2 + v_y^2} =$$