

3. STRAIGHT LINES

$(2 \times 2) + (1 \times 4) + (1 \times 7) = 15$ Marks

✂ IMP FORMULAS, KEY CONCEPTS ✂

1.1) The slope of the line $ax + by + c = 0$ is $\frac{-a}{b} = \frac{-\text{coefficient of } x}{\text{coefficient of } y}$

1.2) The x-intercept of the line $ax + by + c = 0$ is $\frac{-c}{a} = \frac{-\text{constant term}}{\text{coefficient of } x}$

1.3) The y-intercept of the line $ax + by + c = 0$ is $\frac{-c}{b} = \frac{-\text{constant term}}{\text{coefficient of } y}$

2) Equation of straight line in various forms:

Slope form is $y = mx$; slope intercept form is $y = mx + c$; Point slope form is $y - y_1 = m(x - x_1)$;

Two point form is $y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) (x - x_1)$; intercept form is $\frac{x}{a} + \frac{y}{b} = 1$;

Normal form is $x \cos \alpha + y \sin \alpha = p$; symmetric form is $\frac{x - x_1}{\cos \theta} = \frac{y - y_1}{\sin \theta}$;

Parametric equations of a line are $x = x_1 + r \cos \theta$, $y = y_1 + r \sin \theta$, r is a parameter.

3.1) The equation of the line parallel to the line $ax + by + c = 0$ and passing through (x_1, y_1) is

$$a(x - x_1) + b(y - y_1) = 0 \quad [\text{This can be taken in the form } ax + by + k = 0]$$

3.2) The equation of the line perpendicular to the line $ax + by + c = 0$ and passing through (x_1, y_1)

$$\text{is } b(x - x_1) - a(y - y_1) = 0 \quad [\text{This can be taken in the form } bx - ay + k = 0]$$

4) The ratio that the line $ax + by + c = 0$ divides $A(x_1, y_1)$ & $B(x_2, y_2)$ is $-\left(\frac{ax_1 + by_1 + c}{ax_2 + by_2 + c} \right)$

5.1) The distance between the point $P(x_1, y_1)$ and the line $ax + by + c = 0$ is $\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$

5.2) The distance between the origin $O(0, 0)$ and the line $ax + by + c = 0$ is $\frac{|c|}{\sqrt{a^2 + b^2}}$

- 5.3)** The distance between the parallel lines $ax + by + c_1 = 0$ & $ax + by + c_2 = 0$ is $\frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$
- 6)** The point of intersection of the lines $a_1x + b_1y + c_1 = 0$; $a_2x + b_2y + c_2 = 0$ is $\left(\frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}, \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1} \right)$
- 7)** If θ is the angle between the lines $a_1x + b_1y + c_1 = 0$ & $a_2x + b_2y + c_2 = 0$ then $\cos \theta = \frac{a_1a_2 + b_1b_2}{\sqrt{(a_1^2 + b_1^2)(a_2^2 + b_2^2)}}$

- 8.1)** If $Q(h, k)$ is the foot of the perpendicular from $P(x_1, y_1)$ on the line $ax + by + c = 0$ then

$$\frac{h - x_1}{a} = \frac{k - y_1}{b} = -\frac{ax_1 + by_1 + c}{a^2 + b^2}$$

- 8.2)** If $Q(h, k)$ is the image of the point $P(x_1, y_1)$ w.r.t the straight line $ax + by + c = 0$ then

$$\frac{h - x_1}{a} = \frac{k - y_1}{b} = \frac{-2(ax_1 + by_1 + c)}{a^2 + b^2}$$

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STRAIGHT LINES ⇔ SUN RAYS.

@Morning 6 am Sun Rays' Inclination $\theta = 0^\circ \Rightarrow m = 0$

8 to 8.30 సమయంలో Inclination $\theta = 30^\circ \Rightarrow m = 1/\sqrt{3}$

10 to 10.45 సమయంలో Inclination $\theta = 45^\circ \Rightarrow m = 1$

11.30 to 12.30 సమయంలో Inclination $\theta = 60^\circ \Rightarrow m = \sqrt{3}$

1 to 2 సమయంలో Inclination $\theta = 90^\circ \Rightarrow m = \infty$ (Maximum)

3 to 4 సమయంలో Inclination $\theta = 120^\circ \Rightarrow m = -1/\sqrt{3}$

Evening 6 pm inclination $\theta = 180^\circ \Rightarrow m = 0$



Straight Line Forms Vs Vishnu Murthy Avatars Vs Darwin's Evolution of Man

$ax + by + c = 0$: **General Form:** Like **Lord Vishnu:** Like '**Modern Man**'

$y = mx$: **Origin-Slope form:** మత్స్యావతారం (Fish): **Origin** of Life begins in **Water**

$y = mx + c$: **Slope-Intercept form:** కూర్మావతారం (Tortoise): Amphibian (**Water-Land**)

$(y - y_1) = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) (x - x_1)$: **Two Point Form:** వరాహావతారం (Boar with **Two Horns**): Mammals

$\frac{x}{a} + \frac{y}{b} = 1$: **Intercept Form:** నరసింహావతారం $\left(\frac{1}{2} \text{Lion} + \frac{1}{2} \text{Man} \right)$: Transformation into Man

$(y - y_1) = m(x - x_1)$: **Point-Slope Form:** వామనావతారం (**Short & Wise**): Hominidae Dwarf

$x = x_1 + \cos\theta, y = y_1 + \sin\theta$: **Parametric Form:** ధ్రువుశురామావతారం: (Axe + Jungle)

$x \cos\alpha + y \sin\alpha = p$: **Normal Form :** రామావతారం (**Normal** Mankind) : Homo sapien

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What do we do in Straight Lines?

Mostly, finding Equation of a **Straight line** using **Two Conditions (Like 2 Points)**

The same thing we do in Second Inter **Circles**, but with **Three Conditions (Like 3 Points)**

IPE POINT OF VIEW

In IPE Maths-1B, we get First VSAQ and First LAQ from Straight Lines.

(Weightage: 2VSAQ + 1SAQ + 1LAQ = 15 Marks)

Top 10 VSAQ List: P 16/11,12; 17/15, 18/20, 19/23, 21/6, 22/1,2, 23/7, 29/1

IMP. SAQ Models: Point of Intersection of Lines (P 31, 32); Image Problem (P 37).

Most Important LAQ: Circum Centre, Ortho Centre (P 39 to P 42).