JEE MATH : From *Basics* to *MAINS + ADVANCED*

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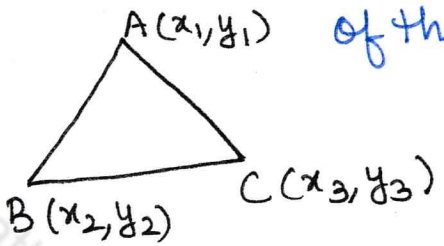
⑤ Co-ordinates of Different Centres of a Δ

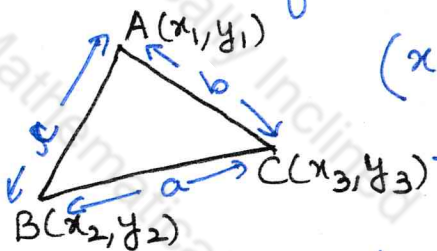
M.mpt°

A) CENTROID: Point of concurrency of the MEDIANS.



$$G\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$$

B) CIRCUMCENTRE: Point of concurrency of ⊥ bisectors of sides



$$\left(\frac{x_1\sin 2A + x_2\sin 2B + x_3\sin 2C}{\sin 2A+\sin 2B+\sin 2C}, \frac{y_1\sin 2A + y_2\sin 2B + y_3\sin 2C}{\sin 2A+\sin 2B+\sin 2C}\right)$$

C) ORTHOCENTRE: Concurrency of altitudes

$$\left(\frac{x_1\tan A + x_2\tan B + x_3\tan C}{\tan A+\tan B+\tan C}, \frac{y_1\tan A + y_2\tan B + y_3\tan C}{\tan A+\tan B+\tan C}\right)$$

D) INCENTRE: Concurrency of internal ∠ bisector

$$\left(\frac{ax_1+bx_2+cx_3}{a+b+c}, \frac{ay_1+by_2+cy_3}{a+b+c}\right)$$

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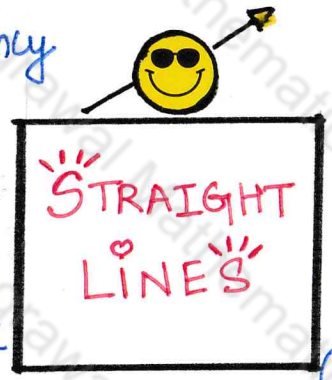

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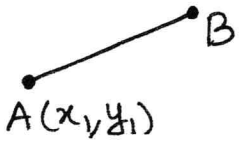
KDS ho gya!!

(I) CO-ORDINATE SYSTEM

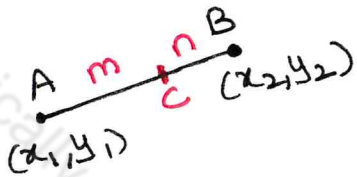
① DISTANCE FORMULA



$$AB = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$$

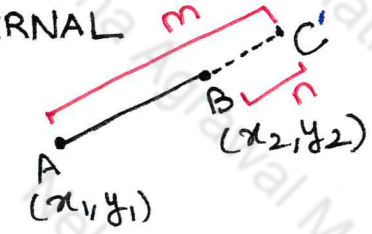
② SECTION FORMULA (CRISS CROSS SAUCE)

INTERNAL



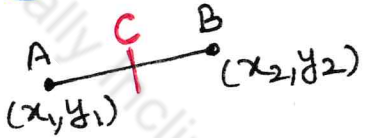
$$C\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$$

EXTERNAL



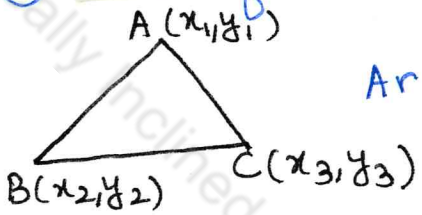
$$C'\left(\frac{mx_2-nx_1}{m-n}, \frac{my_2-ny_1}{m-n}\right)$$

③ MID-POINT FORMULA



$$C\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

④ AREA of a Δ (using Determinants)



$$Ar = \left|\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}\right| \text{ sq units}$$

Points are COLLINEAR $\Leftrightarrow$ Ar $\Delta ABC = 0$

(All fall down!!)

(IV) EQUATIONS OF A LINE (FORMS)

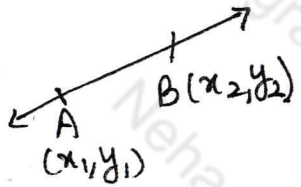
① POINT SLOPE → ALOO FORM

$y - y_1 = m(x - x_1)$ m: slope of the line

(x_1, y_1): Pt. on the line

② TWO-POINT

$y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$



③ SLOPE-INTERCEPT

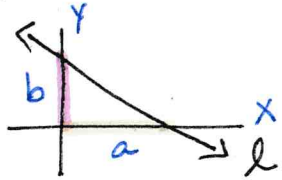
$y = mx + c$ (+ve y intercept)

$y = mx - c$ (-ve y intercept)

$y = m(x \mp d)$ ($\pm$ve x intercept)

④ INTERCEPT

$\frac{x}{a} + \frac{y}{b} = 1$

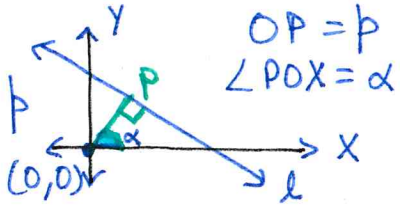


⑤ NORMAL

$x\cos\alpha + y\sin\alpha = p$

$OP = p$

$\angle POX = \alpha$



⑥ PARAMETRIC

$\frac{x - x_1}{\cos\theta} = \frac{y - y_1}{\sin\theta} = r$

r: Distance of Pt. (x, y) from (x_1, y_1) on the line

GENERAL FORM
$ax + by + c = 0$
$m = -\frac{a}{b}$

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STRAIGHT LINES

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KAS ho gya!! ♡♡

(II) ANGLE OF INCLINATION (θ)

Inclination of a line is the angle which is -

1) above the x-axis
2) +ve direction of the x-axis
3) measured in anti-clockwise direction

$0° \le \theta \le 180°$

(III) SLOPE OF A LINE : Steepness of a line

$m = \tan\theta$

θ: Inclination

$m = \frac{y_2 - y_1}{x_2 - x_1}$

SLOPE	INCLINATION
1) $m > 0$	$0° < \theta < 90°$ → ACUTE
2) $m < 0$	$90° < \theta < 180°$ → OBTUSE
3) $m = 0$	x-axis or // to x-axis
4) $m = \text{n.d.}$	$\theta = 90°$ Y-axis or // to Y-axis

RELATION b/w m and θ

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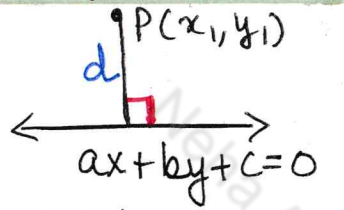
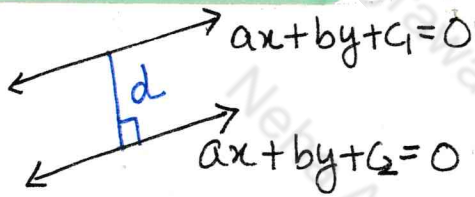
(VIII) DISTANCE of a POINT from a LINE

$$d = \left|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right|$$



DISTANCE b/w 2 Parallel LINES

$$d = \left|\frac{c_1-c_2}{\sqrt{a^2+b^2}}\right|$$



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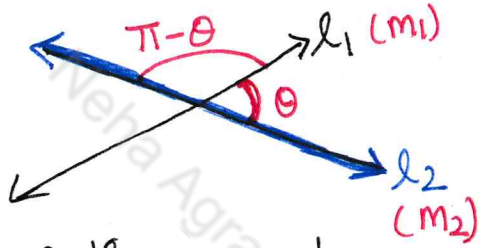
(V) ANGLE Between 2 LINES

$$\tan\theta = \left|\frac{m_1-m_2}{1+m_1m_2}\right|$$



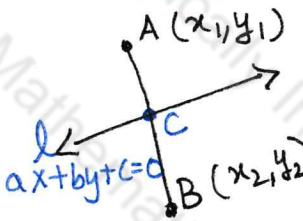
2 lines are ∥

$m_1 = m_2$

2 lines are ⊥

$m_1 \cdot m_2 = -1$

(IX) IMAGE of a POINT about a LINE



$$\frac{x-x_1}{a} = \frac{y-y_1}{b} = -2\left(\frac{ax_1+by_1+c}{a^2+b^2}\right)$$

FOOT of ⊥ i.e. C

Same $-\left(\frac{ax_1+by_1+c}{a^2+b^2}\right)$

STRAIGHT LINES

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(VI) CONDITION OF CONCURRENCY

Given lines: $a_1x+b_1y+c_1=0$

$a_2x+b_2y+c_2=0$

$a_3x+b_3y+c_3=0$

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$$

(X) FAMILY of STRAIGHT LINES

$L_1 + \lambda L_2 = 0 \quad \lambda \in R$

(XI) PAIR OF STRAIGHT LINES

- $ax^2+2hxy+by^2+2gx+2fy+c=0$

$$\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix} = 0$$

- $y=m_1x$, $y=m_2x$ rep. by $ax^2+2hxy+by^2=0$

$m_1+m_2 = -\frac{2h}{b}$, $m_1m_2 = \frac{a}{b}$

- $\tan\theta = \left|\frac{2\sqrt{h^2-ab}}{a+b}\right|$

KDS to gya!! ♥♥

(VII) EQN. of a LINE Parallel/⊥ to $ax+by+c=0$

- Parallel → $ax+by+d=0$
- Perpendicular → $bx-ay+e=0$

Use the condition given in the ques. to find d or e.

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