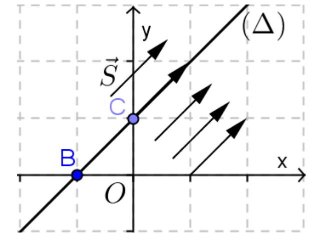
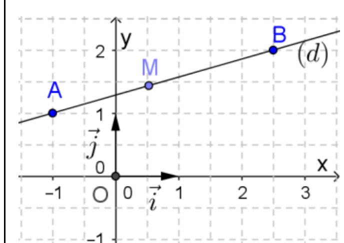
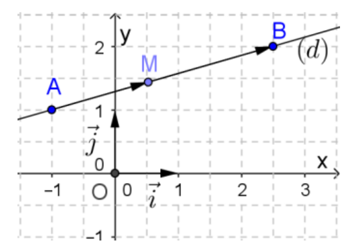
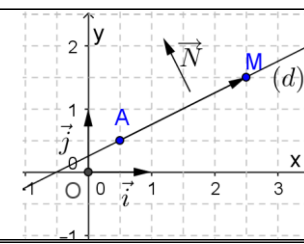
- A direction vector $\vec{S}$ of any straight line (Δ) is a ***non-zero*** vector having the same direction (*parallel* or *confounded*) as (Δ).
- A straight line (Δ) admits an infinite number of ***non-zero*** direction vectors collinear with $\vec{S}$.
- To determine the intersection of a straight line with:
  1) $x-axis$: (x-intercept) Substitute $y=0$.
  2) $y-axis$: (y-intercept) Substitute $x=0$.
- To determine an equation of a straight line it is ***sufficient*** to have ***one*** of the following ***combinations***:



Given information	*Formula used and steps to follow*
Any two points $A(x_A;y_A)$ and $B(x_B;y_B)$ A point $A(x_A;y_A)$ and a slant (leading coefficient or director coefficient)	✓ Take any point $M(x,y)$ on the given straight line. Now, points A, B & M are collinear, Then $a_{(AM)}=a_{(AB)}$ Thus, $\dfrac{y-y_A}{x-x_A}=\dfrac{y_B-y_A}{x_B-x_A}$ $\dfrac{y-y_A}{x-x_A}=m$ OR $y-y_A=m(x-x_A)$ 
Any point $A(x_A;y_A)$ and a director vector $\vec{S}(x',y')$	1. Take any point $M(x,y)$ on the given straight line. 2. Form the vector: $\overrightarrow{AM}(x-x_A,y-y_A)$ 3. Since $\vec{S}$ & $\overrightarrow{AM}$ are collinear then: ***<u>In cartesian</u>***: $\dfrac{X_{\overrightarrow{AM}}}{X_{\vec{S}}}=\dfrac{Y_{\overrightarrow{AM}}}{Y_{\vec{S}}}$ ***<u>In parametric</u>***: $\overrightarrow{AM}=t\vec{S}$ 
Any point $A(x_A;y_A)$ and a normal vector $\vec{N}(a;b)$	1. Take any point $M(x,y)$ on the given straight line. 2. Form the vector: $\overrightarrow{AM}(x-x_A,y-y_A)$ 3. Since $\vec{N}$ & $\overrightarrow{AM}$ are perpendicular (orthogonal) then: $\vec{N}.\overrightarrow{AM}=0$ OR $a(x-x_A)+b(y-y_A)=0$ 

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Different types of equation of a straight line and their properties					
Form	*Equation*	*Director vector*	*Normal vector*	*Slant*	*Find a point on the st. line*
Cartesian	$ux+vy+w=0$	$\vec{S}(-v;u)$	$\vec{N}(u;v)$	$\frac{-u}{v}$	Take any value for x then find y
Reduced	$y=mx+b$	$\vec{S}(1;m)$	$\vec{N}(m;-1)$	m	Take any value for x then find y
Parametric	$\begin{cases} x=at+x_A \\ y=bt+y_A \end{cases}$	$\vec{S}(a;b)$	$\vec{N}(-b;a)$	$\frac{b}{a}$	Take any value for the parameter to find x and y
Special	$x=cst=r.$	$\vec{S}(0;1)=\vec{j}$	$\vec{N}(1;0)=\vec{i}$	No slope	Any point of the form $(r;y)$
	$y=cst=n.$	$\vec{S}(1;0)=\vec{i}$	$\vec{N}(0;1)=\vec{j}$	Zero slope	Any point of the form $(x;n)$

❖ How to interchange between forms of a straight line?

To modify an equation of a straight line from:

To change from	Cartesian to parametric	parametric to Cartesian
Procedure	1st - Step: Replace one of the variables by any parameter " ***t*** ". 2nd- Step: Find the other variable in terms of this parameter.	Just eliminate the parameter " ***t*** " by any way possible: - ***Elimination.*** - ***Substitution.*** - ***Comparison.***
Example	$(d): 2x-y+5=0$ 1st - step: Let $x=t$. 2nd - step: Replace $x=t$ in equation of (d) $2t-y+5=0$ Hence, $y=2t+5$. Thus, the parametric form of straight line is, $(d):\begin{cases} x=t \\ y=2t+5 \end{cases}$	$(d):\begin{cases} x=t-4 \\ y=t+5 \end{cases}$ By elimination: $(d):\begin{cases} x=t-4 \\ (y=t+5)(-1) \quad add \end{cases}$ To get: $(d): x-y=-9$

Relative positions of two straight lines in different forms

Form	*Equations*	*If*	*Then, the straight lines*
Cartesian	$(d_1): ux + vy + w = 0.$ $(d_2): u'x + v'y + w' = 0.$	$\frac{u}{u'} \neq \frac{v}{v'}$	$(d_1)\&(d_2)$ *are* ***intersecting***.
		$\frac{u}{u'} = \frac{v}{v'} \neq \frac{w}{w'}$ ***OR*** $\vec{S}_1 = k\vec{S}_2$	$(d_1)\&(d_2)$ *are* ***parallel***.
		$\frac{u}{u'} = \frac{v}{v'} = \frac{w}{w'}$	$(d_1)\&(d_2)$ *are* ***confounded***.
Reduced	$(R_1): y = mx + b.$ $(R_2): y = m'x + b'.$	$m \neq m'$	$(R_1)\&(R_2)$ are ***intersecting***.
		$m = m'$ *and* $b \neq b'.$	$(R_1)\&(R_2)$ are ***parallel***.
		$m = m'$ *and* $b = b'.$	$(R_1)\&(R_2)$ are ***confounded***.
Parametric	$(P_1): \begin{cases} x = at + x_A \\ y = bt + y_A \end{cases}$ $(P_2): \begin{cases} x = a't + x_B \\ y = b't + y_B \end{cases}$	$\frac{a}{a'} \neq \frac{b}{b'}.$	$(P_1)\&(P_2)$ are ***intersecting***.
		$\frac{a}{a'} = \frac{b}{b'} \neq \frac{x_A - x_B}{y_A - y_B}.$	$(P_1)\&(P_2)$ are ***parallel***.
		$\frac{a}{a'} = \frac{b}{b'} = \frac{x_A - x_B}{y_A - y_B}.$	$(P_1)\&(P_2)$ are ***confounded***.

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