Transforming Linear Algebra Education with GeoGebra Applets
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Normal Form of a Line

Objectives:
1. Define and graph the general form of a line and the vector form of a line.
2. Show the line's relationship to it's general, vector, and normal forms.

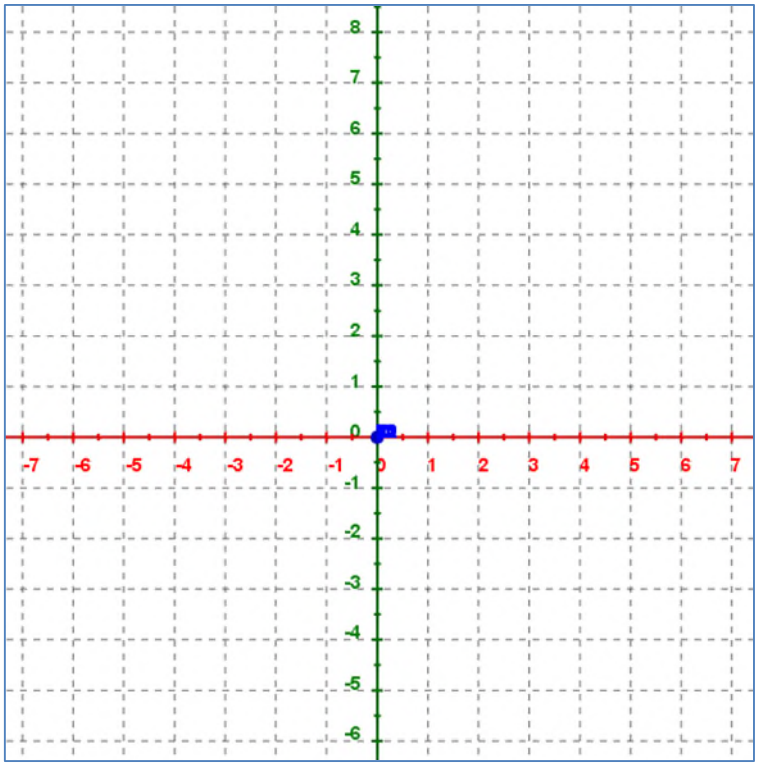
Equations of a line in $\mathbb{R}^2$

Algebraic Forms: $\vec{p}$ *is the vector form of the point* $p = (p_1, p_2)$; $\vec{x}$ *is the vector form of any point* $x = (x_1, x_2)$

General form	Vector form	Normal Form
$ax + by = c$	$\vec{x} = \vec{p} + t \cdot \vec{d}\,, \; -\infty < t < \infty$ $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} p_1 \\ p_1 \end{bmatrix} + t \cdot \begin{bmatrix} d_1 \\ d_2 \end{bmatrix}$	$\vec{n} \bullet \vec{x} = \vec{n} \bullet \vec{p}$ $\vec{n} \bullet (\vec{x} - \vec{p})$

Review: Line – Vector Form

1. On the coordinate grid, plot and label the points (1, 1) and (2,-1). Graph the line **L** defined by these points. Determine the equation of **L** and put it into the general form of a line.



2. Define the vector form of this line

$\vec{x} = \vec{p} + t \cdot \vec{d}\,, \; -\infty < t < \infty,$

For line **L**, $\vec{p}$ =

$\vec{d}$ =

Draw and label these vectors.

State the vector form of line **L.** _____

Calculate the vector $\vec{x}$, draw and label it for the following t values :

$t = 1 \rightarrow \vec{x} =$ _____

$t = 3 \rightarrow \vec{x} =$ _____

$t = -1 \rightarrow \vec{x} =$ _____

$t = -2 \rightarrow \vec{x} =$ _____

State the vector form of line **L** determined above. _____ Here: $\overrightarrow{p}$ = $\overrightarrow{d}$ =

Normal Form of a Line – two forms

Normal Form

$\vec{n} \bullet \vec{x} = \vec{n} \bullet \vec{p}$

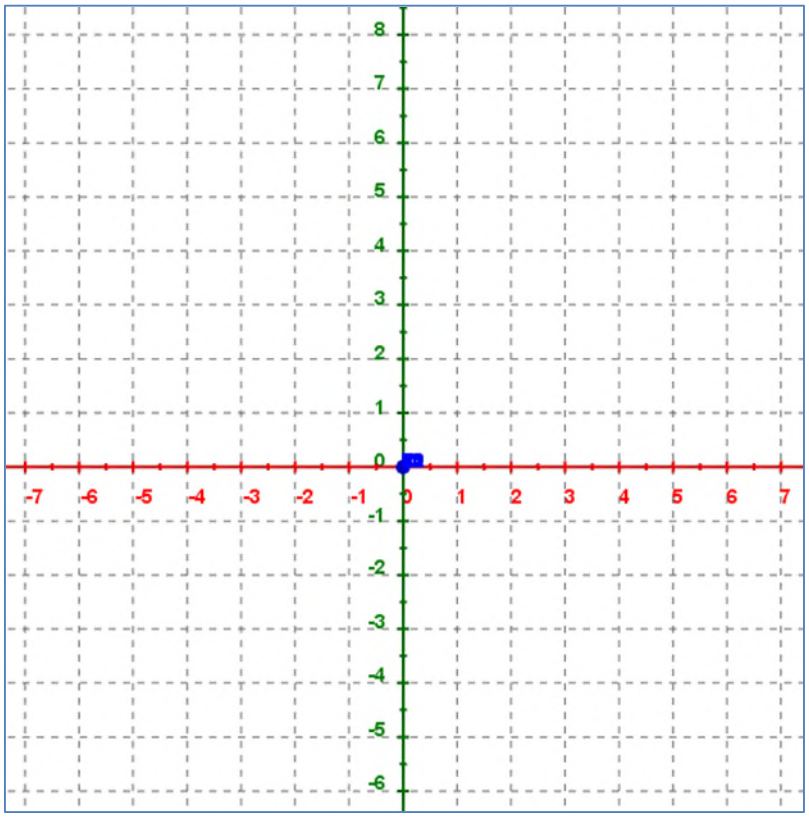
$\vec{n} \bullet (\vec{x} - \vec{p}) = 0$

If $\vec{n}$ is a normal vector to $\overrightarrow{d}$, then $\vec{n}$ =

Using $\vec{n}$ state each Normal Form of ***L***.

$\vec{n} \bullet \vec{x} = \vec{n} \bullet \vec{p}$ becomes _____ $\vec{n} \bullet (\vec{x} - \vec{p}) = 0$ becomes _____

Draw the line, graphing and labeling $\vec{n}$, $\vec{x}$, and $\vec{p}$



Explain how your results relate to the

a) General Form of ***L***.

b) Vector Form of ***L***.