Transforming Linear Algebra Education with GeoGebra Applets

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Line – General and Normal Forms

Objectives:

1. Define and graph the general form of a line and the normal form of a line.
2. Show the relationship between the general and normal forms of a line.

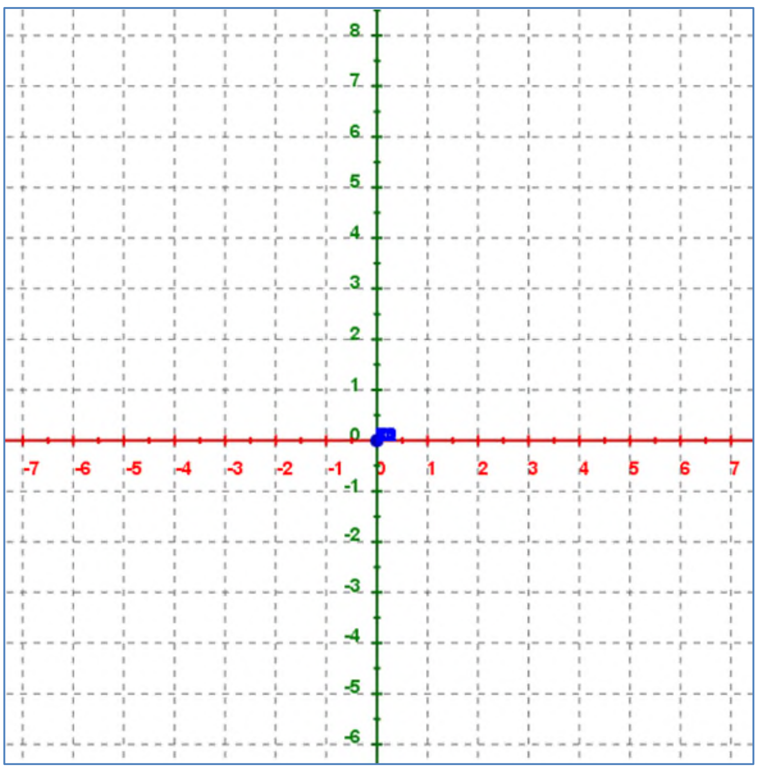
Equations of a line in $\mathbb{R}^2$

Algebraic Forms: $\vec{\boldsymbol{p}} = \begin{bmatrix} \boldsymbol{p_1} \\ \boldsymbol{p_2} \end{bmatrix}$ is the vector form of the point $\boldsymbol{p} = (\boldsymbol{p_1}, \boldsymbol{p_2})$

$\vec{\boldsymbol{x}} = \begin{bmatrix} \boldsymbol{x_1} \\ \boldsymbol{x_2} \end{bmatrix}$ is the vector form of any point $\boldsymbol{x} = (\boldsymbol{x_1}, \boldsymbol{x_2})$

General form of a line: $ax + by = c$

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.



Find and state the slope of this line.

$\boldsymbol{m} =$

Define the direction vector $\vec{\boldsymbol{d}}$ from point (1, 1) to point (2,-1)

Graph and label this vector on the line **L.**

$\vec{\boldsymbol{d}} =$

Normal form of a line: $\vec{n}\bullet\vec{x} = \vec{n}\bullet\vec{p}$ **or** $\vec{n}\bullet(\vec{x}-\vec{p}) = 0$

If $\vec{n}$ is a normal vector (i.e., perpendicular) to $\overrightarrow{d}$, then $\vec{n}\bullet\overrightarrow{d} = 0$

Find a vector $\vec{n}$, that makes this equation true for the vector $\overrightarrow{d}$ defined from point (1, 1) to point (2, -1).

If point $= (\mathbf{1}, \mathbf{1})$, then $\vec{p} = \begin{bmatrix}\mathbf{1}\\ \mathbf{1}\end{bmatrix}$

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

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

Explain how your results relate to the **General Form** of L.

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