Lab 8

Straight lines

Aim :

- To establish the role of coefficients and constant in the general equation of a straight line
- To explore geometrically the Normal form of a straight line
- To explore geometrically a family of straight lines

Concepts:

- General equation of a straight line
- Family of straight lines
- Normal form of a straight line

Discussion :

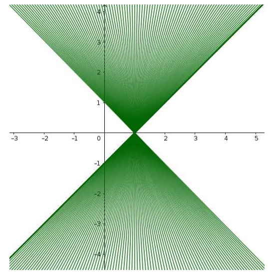
A straight line is represented as $ax + by + c = 0$ where a,b and c are constants. If c is changed, while keeping a and b fixed, the straight line will change in a particular manner. Similar situations are encountered with other constants. In this activity we explore the variations in the coefficients and constant and its effect in the geometry of straight line.
All the above mentioned activities will result in a set of straight lines having a common property. This set is called a family of straight lines.
We also discuss the family of straight lines passing through a point of intersection of given lines.

Activity 8.1 General Form of Straight Lines

Procedure:

- Create three sliders **a**,**b** and **c**
- Draw the line $ax + by + c = 0$
- Change the values of **a**,**b** and **c**
- What happens to the line if
  (i) $\mathbf{a} = 0$ (ii) $\mathbf{b} = 0$ (iii) $\mathbf{c} = 0$
  (iv) $\mathbf{a} = \mathbf{b}$ (v) $\mathbf{a} = \mathbf{-b}$

- Make the following changes and observe the corresponding changes in the line (Trace option of the line may be used).



1. Change **a** alone
2. Change **b** alone
3. Change **c** alone

Activity 8.2 Intersection of Two Lines

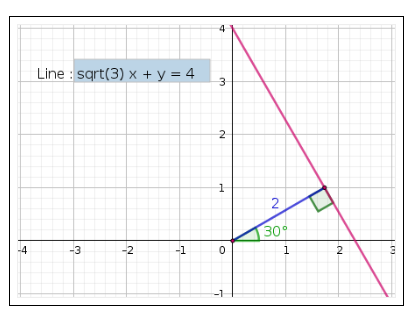
Procedure:

- Draw two lines say, $3x - 2y + 4 = 0$ and $2x + 5y - 6 = 0$
- Create a slider **k**
- Input the equation $3x - 2y + 4 + \mathbf{k}(2x + 5y - 6) = 0$
- It represents a line (why?)
- Change the value of **k**. Observe how the third line changes
- For what value of **k**, the third line coincides with the first line?

- For what value of **k**, the third line coincides with the second line?
- Edit the equations of the first two lines so that they are parallel
- What happens to the third line for different values of **k**

Activity 8.3 Normal Form

Procedure:



- To find the normal form of a line geometrically, draw the line and the perpendicular from the origin to the line(use `Perpendicular Line` tool).
- Mark the point of intersection of the perpendicular with the line.
- Hide the perpendicular line and draw a line segment from the origin to the line.

- Show the length of the perpendicular and the angle made by it with the positive direction of the x axis.
- Create an input box for the line
- save as Activity 8.3

> Using **Angle** tool we can show the angle in the following ways
>
> - Click on the positive direction of x axis and then on the line segment.(Make sure that the line segment has been drawn starting from the origin, otherwise we won't get the required angle.)
> - Take a point - say C - on the positive direction of the x axis. Using the tool click on C, the origin and the point of intersection in that order. Hide C

- Using this applet, write the normal form of the following lines
  1. $x - \sqrt{3}y - 8 = 0$
  2. $x - y - 2 = 0$
  3. $\sqrt{3}x - y + 8 = 0$
  4. $2x - 3y + 4 = 0$
  5. $x + y = 5$
  6. $5x + 2y + 3 = 0$

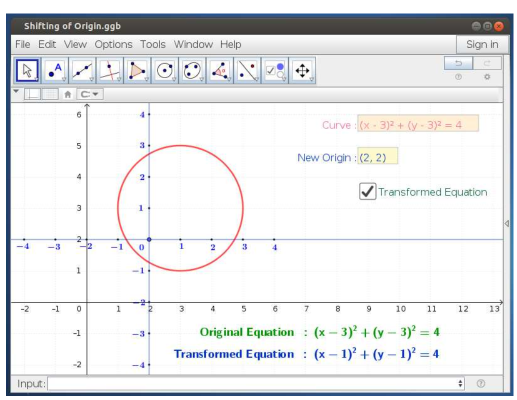
Write the equation of the lines in normal form for different values of ω and **p** (p is the distance of the line from the origin and ω is the angle made by the normal with the positive direction of x axis). Verify your answer using the above applet

Sl.No	Value of ω	Value of **p**	Equation of the line
1	$0°$	3	
2	$30°$	4	$\frac{\sqrt{3}x}{2} + \frac{y}{2} = 4$
3	$30°$	5	
4	$60°$	2	
5	$90°$	4	
6	$120°$	4	
7	$150°$	4	

Activity 8.4 Shifting of Origin

Procedure:

- Using the applet, ML 8.4
  About the applet:
  ◦ You can click and drag at the origin to shift the axes.
  ◦ You can change the curve and the origin using corresponding input boxes
  ◦ You can see the transformed equation using check box



- Shift the origin, parallel to the x axis or y axis and observe the changes in the new equation of the circle
- What should be the new origin to get the transformed equation as $x^2 + y^2 = 4$. Guess the answer and check it.
- Find the transformed equation, if the origin is shifted to the point $(1, 3)$. Check the answer.