— University of Mosul —
College of Petroleum & Mining Engineering

Mathematics I

Lecture (1)

Types of Line

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Coordinate and Geometry and Lines

Slope of Line

Coordinate Geometry and Lines

The points in a plane can be identified with ordered pairs of real numbers. We start by drawing two perpendicular coordinate lines that intersect at the origin O on each line. Usually, one line is horizontal with positive direction to the right and is called the x-axis the right the other line is vertical with positive direction upward and is called the y-axis. Any point P in the plane can be located by a unique ordered pair of numbers as follows.

Draw lines through p perpendicular to the x- and y-axes. These lines intersect the axes in points with coordinates and as shown in figure (1). Then the point p is assigned the ordered pair (a,b). The first number a is called the x-coordinate or (abscissa) of P, the second number b is called y- coordinate or (ordinate) of P. we say that P is the point with coordinates (a,b) , and we denote the point by the symbol P (a,b).

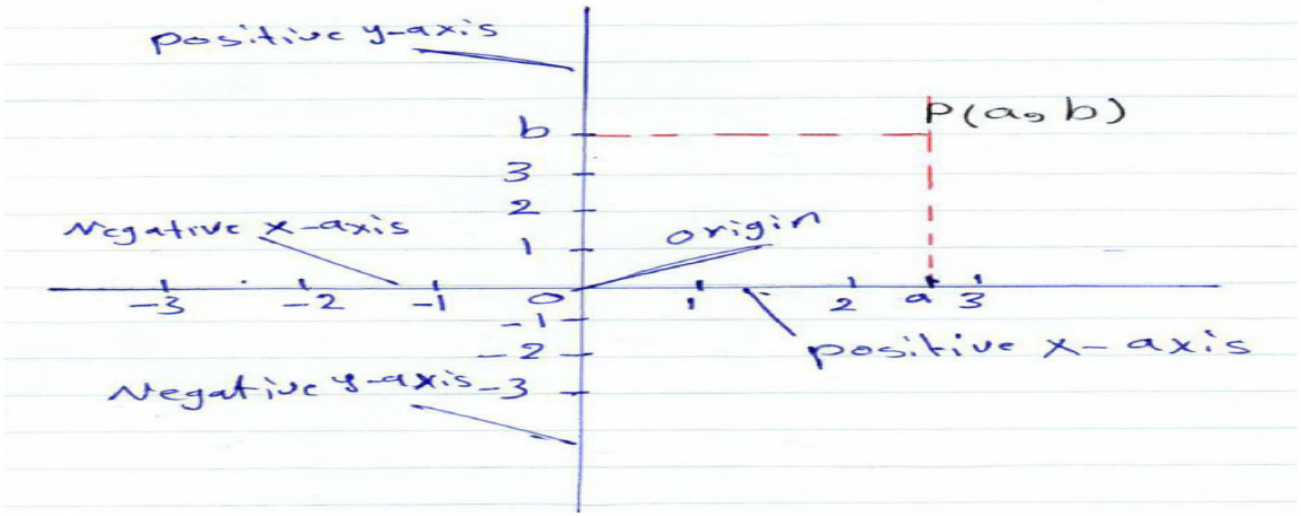


Figure (1)

Several points are labeled with their coordinates in figure (2)

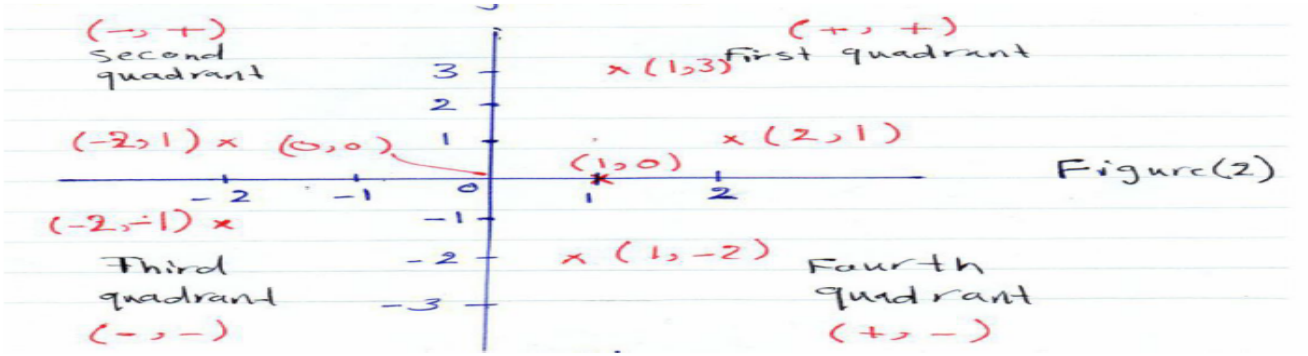


Figure (2)

This coordinate system is called the rectangular coordinate system or the cartesian coordinate system

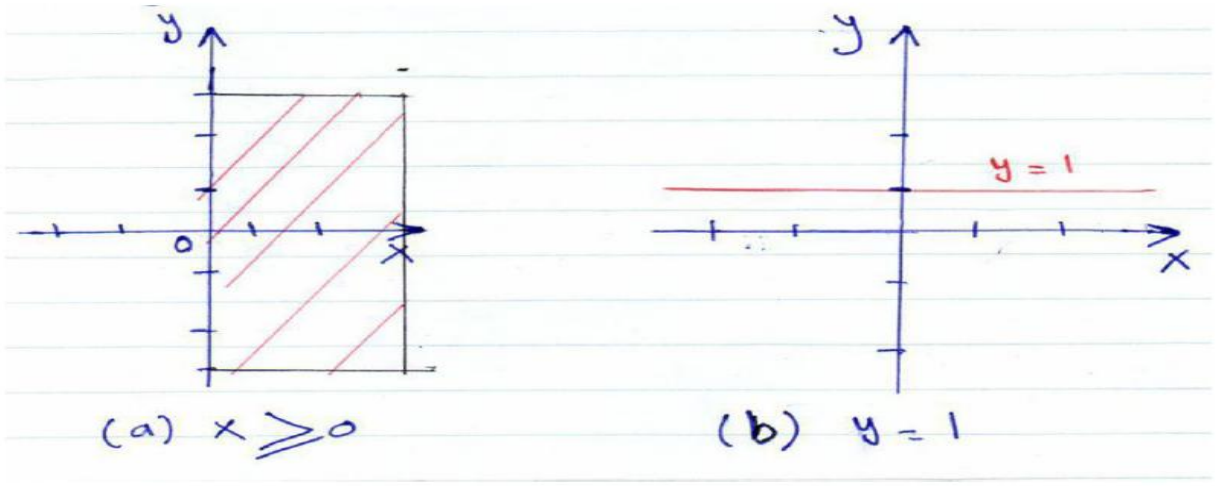
Example (1)

Describe and sketch the regions given by the following sets:

a) $(x, y)| \, x \geq 0$
b) $(x, y)| \, y = 1$
c) $(x, y)| \, |y| < 1$

Solution

a) The points whose x- coordinates are 0 or positive lie on the y- axis or to the right of it as indicated by shared region in figure (3a)



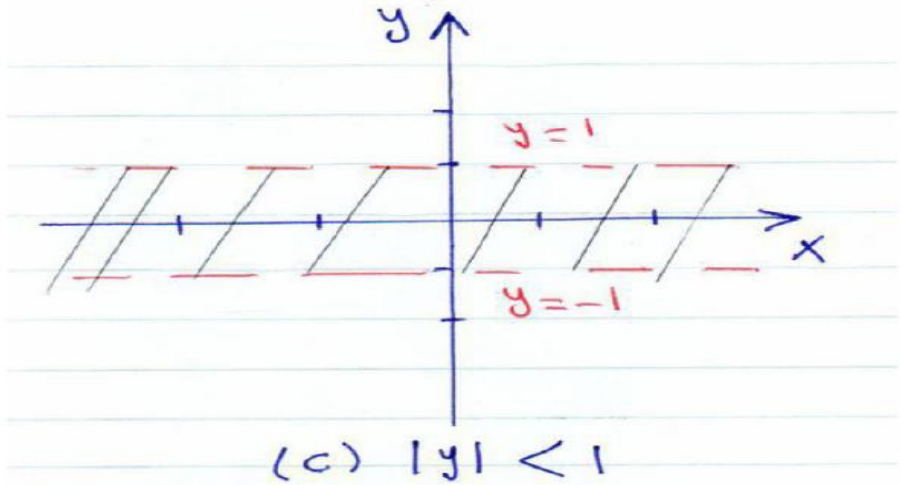


Figure (3)

b) The set of all points with y-coodinate 1 is horizontal line one unit above the x-axis figure (3b)

c) $|y| < 1$ if and only if $-1 < y < 1$
The given region consists of those points in the plane whose y-coordinates lie between -1 and 1 . figure (3 c)

Slope of straight line

Slope is measure of the steepness of the line. Given two points p_1 (x_1,y_1) and p_2 (x_2,y_2) in the plane , we call the increments $\Delta x = x_2 - x_1$ and $\Delta y = y_2 - y_1$ the run and rise, respectively, between p_1 and p_2. Two such points always determine a unique straight line (usually called simply aline) passing through them both. We call the line p_1 p_2 .

The slope of nonvertical line that passes through the points p_1 (x_1,y_1) and p_2 (x_2,y_2) is

$$m = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

As shown in figure 4

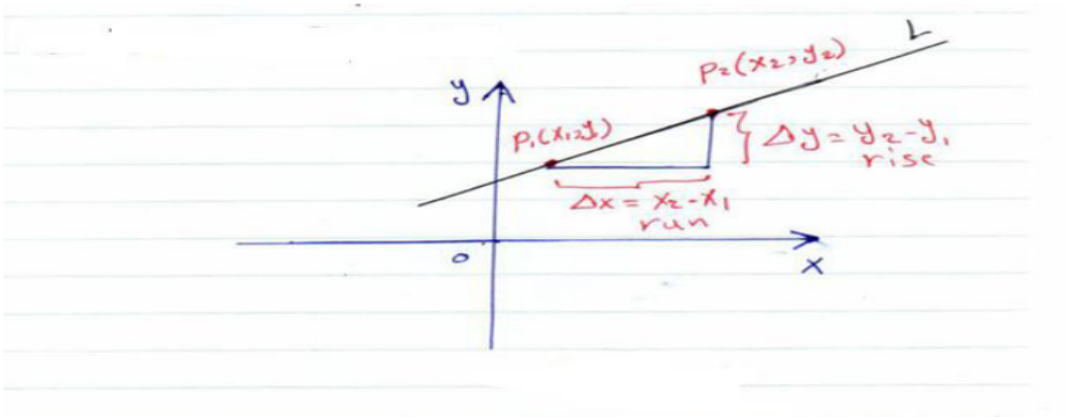


Figure (4)

Example (2)

Find the slope of the nonvertical straight line L_1 passes through the point $p_1(0,5)$ and $p_2(4,2)$ and L_2 passes $p_3(0,-2)$ and $p_4(3,6)$.

Solution

The slope of L_1 is $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{2-5}{4-0} = \frac{-3}{4}$$

The slope of L_2 is $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{6-(-2)}{3-0} = \frac{8}{3}$$

Lines L_1 & L_2 explained in figure (5)

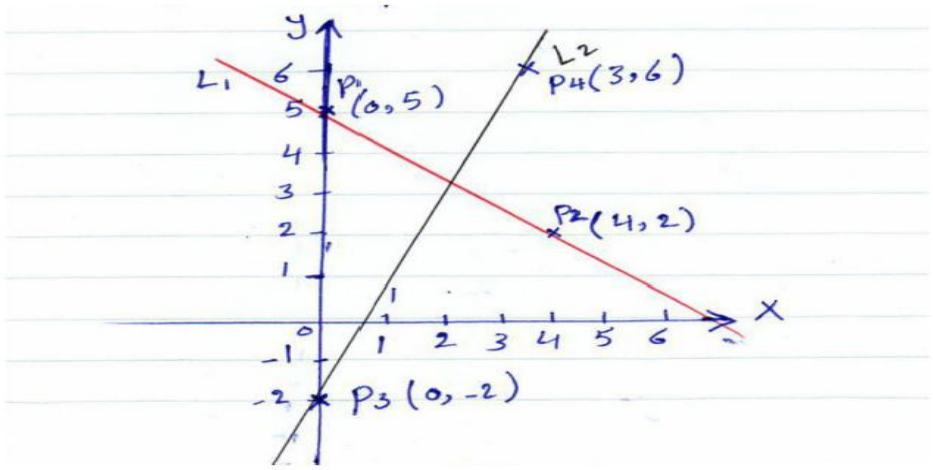
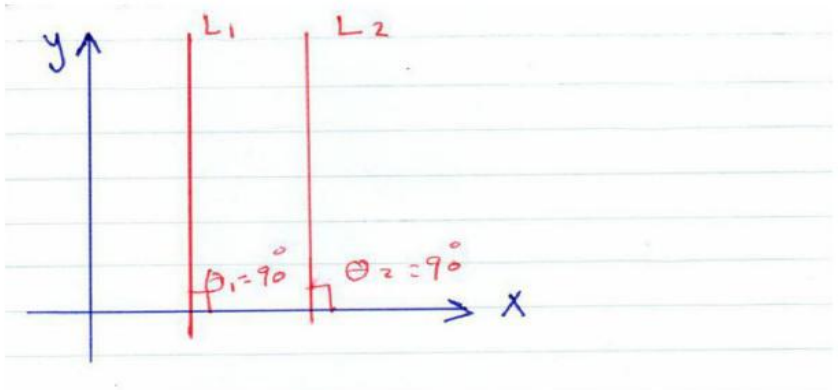


Figure (5)

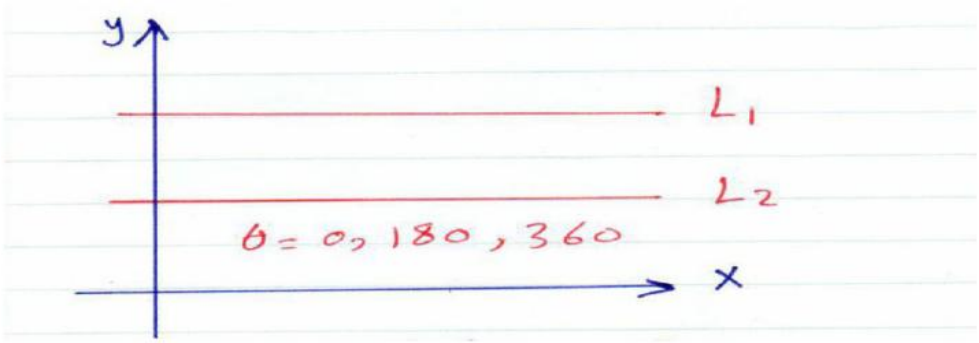
Types of the straight lines

1. **Vertical lines**



$tan\theta_1 = tan\theta_2 = \frac{sin\theta}{cos\theta} = \frac{1}{0} = \infty$ no slope

2. **Horizontal lines**



$tan\theta = \frac{sin\theta}{cos\theta} = \frac{0}{1} = 0$ (zero slope)