

# Matrix Theory EE5609 - Assignment 1

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03-Sep-2020  
AI20RESCH14001

**Abstract**—This document provides a solution for the problem of finding slopes of two lines, slope of one line being double of the slope of another line. and tangent of the angle between them is  $1/3$ .

## IV. CONCLUSION

The slopes  $m_1$  and  $m_2$  of Line 1 and Line 2 for the said conditions are: -

## I. PROBLEM STATEMENT

The slope of a line is double of the slope of another line. If the tangent of the angle between them is  $1/3$ , find the slopes of the lines.

$$(1, \frac{1}{2}), (2, 1)(-1, -\frac{1}{2}), (-2, -1)$$

## II. THEORY

Slope of a line is given by  $\tan \theta$ , where  $\theta$  is the angle made by the line with x-axis.

If  $(x_1, y_1)$  and  $(x_2, y_2)$  are two points on a line, slope of a line is given as:-

$$m = \tan \theta = \frac{y_2 - y_1}{x_2 - x_1}$$

Let  $m_1$  and  $m_2$  be the slopes of line 1 and line 2. The angle between the two lines can be given in terms of their slopes as follows:-

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

## III. SOLUTION

Given that slope of Line 1 is twice the slope of Line 2 .

$$m_1 = 2 \times m_2 \quad (1)$$

tangent of angle between the two lines is equal to  $\frac{1}{3}$

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right| = \frac{1}{3} \quad (2)$$

Substitution equation 1 in equation 2

$$\left| \frac{m_2 - 2 \times m_2}{1 + 2 \times m_2 \times m_2} \right| = \frac{1}{3}$$

$$\frac{|m_2|}{1 + 2|m_2|^2} = \frac{1}{3}$$

$$2|m_2|^2 - 3|m_2| + 1 = 0$$

$$|m_2| = \frac{1}{2}, 1$$

$$m_2 = \pm \frac{1}{2}, \pm 1$$

Substituting the value of  $m_2$  we get value of  $m_1 = 1, -1, 2, -2$

The slopes  $m_1$  and  $m_2$  of Line 1 and Line 2 for the said conditions are: -

$$(1, \frac{1}{2}), (2, 1)(-1, -\frac{1}{2}), (-2, -1)$$