Slope of a Line

By **BrushMyQuant**

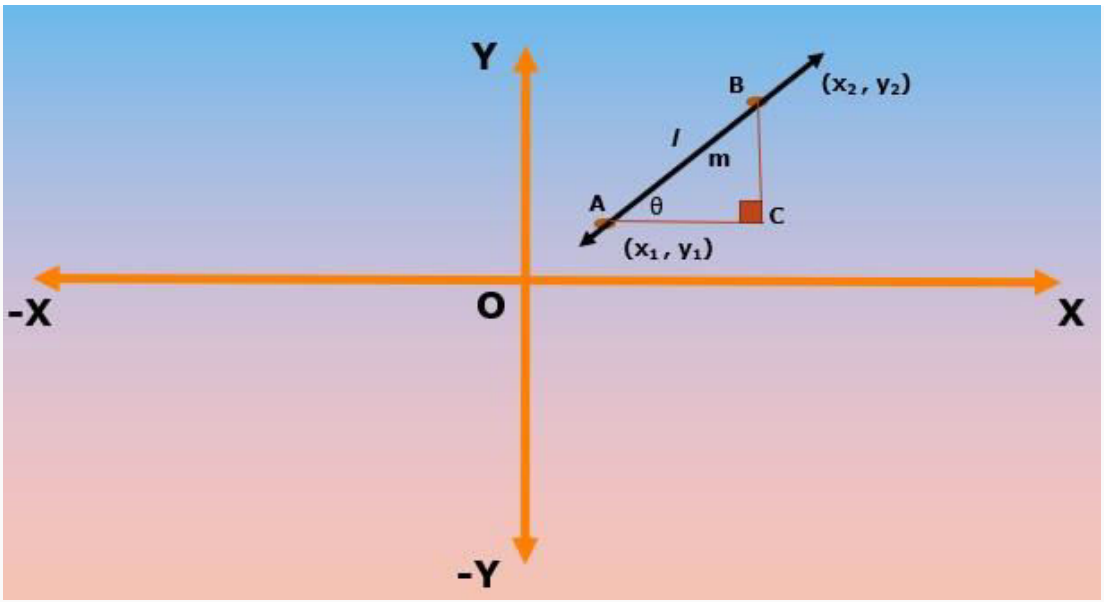
YouTube Video Link to this Post is Here

Following is covered in the video

- ¤ **Proof of Slope of a Line formula**
- ¤ **How to find slope of a Generic Line**
- ¤ **Sign of Slope of a Line**
- ¤ **Slope of Parallel and Perpendicular Lines**
- ¤ **Solved Problem : Find slope of a line given two points**
- ¤ **Solved Problem : Find slope of a line given equation of a line**
- ¤ **Solved Problem : Find value of a variable given the slope of a line**
- ¤ **Solved Problem : Find equation of a line parallel to a line and passing through a point**
- ¤ **Solved Problem : Find equation of a line perpendicular to a line and passing through a point**

Proof of Slope of a Line formula

Let's say we have a line(l) passing through two point A(x_1,y_1) and B(x_2,y_2) and having a slope of m.
Lets draw perpendicular lines as shown in the below figure to complete △ABC
Let ∠BAC = θ



Slope of a line, m = tan(Angle made by the line with positive X-Axis) = tan(θ) = Opposite Side / Adjacent Side = $BC/AC = (y_2-y_1)/(x_2-x_1)$

How to find slope of a Generic Line

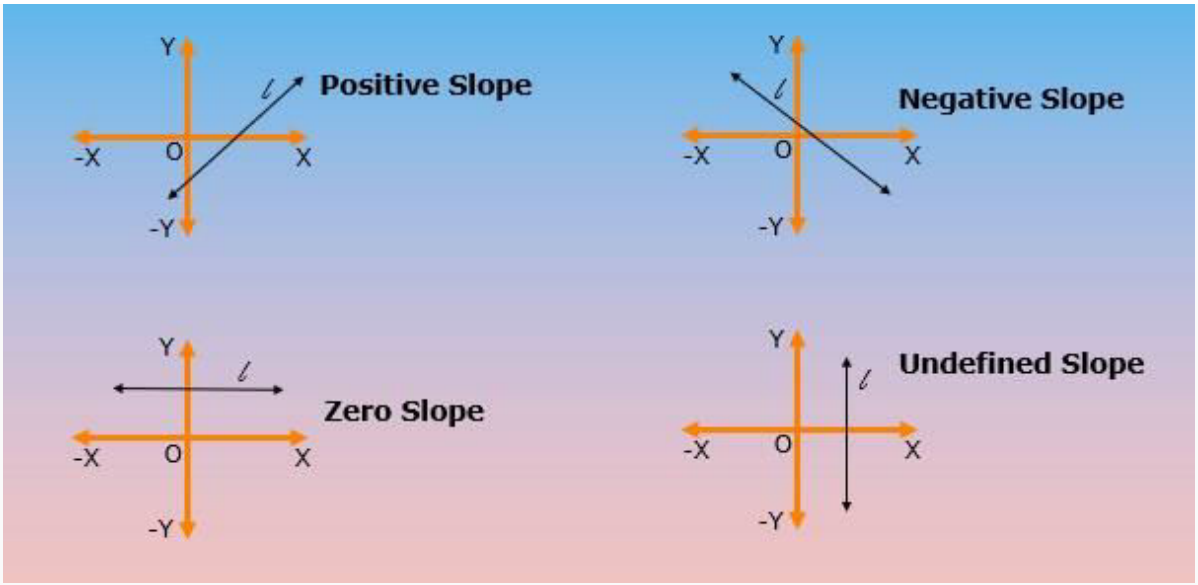
Let's say we have a generic equation of the line given by ax + by = c
=> by = -ax + c
=> $y = -(a/b)x + c/b$

Comparing above equation with generic equation of a line y = mx + b we get
$m = -a/b$

=> **Slope of the line ax + by = c**, is given by $m = -a/b$ = -Coefficient of x / Coefficient of y

Sign of Slope of a Line

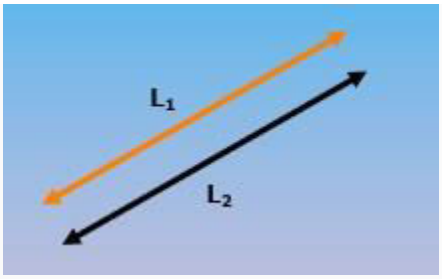
- **Positive Slope: Line tilted towards right**
- **Negative Slope: Line tilted towards left**
- **Zero Slope: Line parallel to x-axis**
- **Infinite Slope: Line parallel to y-axis**



Slope of Parallel and Perpendicular Lines

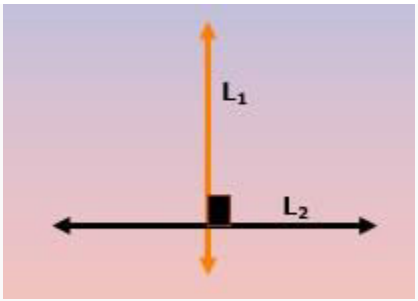
If two lines are Parallel, then their slopes will be equal.

¤ If we have two parallel lines L_1 and L_2, with below equations
¤ Line L_1 : $y = m_1x + c_1$
¤ Line L_2 : $y = m_2x + c_2$
¤ then $m_1 = m_2$



If two lines are Perpendicular, then product of their slopes will be equal to -1

¤ If we have two perpendicular lines L_1 and L_2, with below equations
¤ Line L_1 : $y = m_1x + c_1$
¤ Line L_2 : $y = m_2x + c_2$
¤ then $m_1 * m_2 = -1$



Solved Problem : Find slope of a line given two points

Q1. Find the slope of the line passing through two points (1,3) and (3,5).

Sol 1: Slope of a line is given by $m = (y_2 - y_1)/(x_2 - x_1) = (5-3)/(3-1) = 2/2 = 1$

Solved Problem : Find slope of a line given equation of a line

Q2. Find the slope of the line 2x + 3y = 5.

Sol 2: Slope of the line ax + by = c, is given by m = -Coefficient of x / Coefficient of y = -2 / 3

Solved Problem : Find value of a variable given the slope of a line

Q3. A line with slope 2 passes through the points (x,5) and (2,x). Find the value of x.

Sol 3: Slope of a line is given by $m = (y_2 - y_1)/(x_2 - x_1) = (x-5)/(2-x) = 2$ (given)

=> x - 5 = 4 - 2x
=> 3x = 9
=> x = 9/3 = 3

Solved Problem : Find equation of a line parallel to a line and passing through a point

Q4. Find the equation of the line which is parallel to the line 2x + 4y = 5 and passes through the point (2,3).

Sol 4: Equation of line 2x + 4y = 5 = −2/4 = −1/2
=> Parallel line will have the same slope = −1/2
=> Equation of the line is given by $y - y_1 = m * (x - x_1)$
=> y - 3 = (−1/2) * (x - 2)
=> 2y - 6 = -x + 2
=> x + 2y = 8 is the equation of the line parallel to 2x + 4y = 5 and passes through the point (2,3)

Solved Problem : Find equation of a line perpendicular to a line and passing through a point

Q5. Find the equation of the line which is perpendicular to the line 2x + 4y = 5 and passes through the point (2,3).

Hide Spoiler

Sol 5: Equation of line 2x + 4y = 5 = −2/4 = −1/2
=> Slope of perpendicular line, m will be given by m * −1/2 = -1
=> m = 2
=> Equation of the line is given by $y - y_1 = m * (x - x_1)$
=> y - 3 = 2 * (x – 2)

=> y – 3 = 2x - 4
=> y = 2x - 1 is the equation of the line perpendicular to 2x + 4y = 5 and passes through the point (2,3)

Hope it helps!

Thank you.