1.2 - Straight Lines

**Slope:** the steepness of a line

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

where \((x_1, y_1)\) and \((x_2, y_2)\) are points on a line not parallel to the y-axis.

- If the points lie on a line parallel to the y-axis, then they are on a **vertical line** where the slope is **undefined**. Why?

- For all other lines, what is going on?

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**Different Types of Slopes of Lines:**

**Notice:**
- **Vertical Lines:** \(x\) doesn’t change no matter what \(y\) is, so \(m\) is undefined and the equation is of the form \(x = c\)
- **Horizontal Lines:** \(y\) doesn’t change no matter what \(x\) is, so \(m = 0\) and the equation is of the form \(y = c\)
- \(m > 0\): line rises from left to right
- \(m < 0\): line falls from left to right
**Ways of Expressing Lines**

**POINT-SLOPE FORM**
*Needed:* a point \((x_1, y_1)\) on the line and the slope, \(m\), of the line
*Formula:* \(y - y_1 = m(x - x_1)\)

*Ex:*

**SLOPE-INTERCEPT FORM**
*Needed:* the slope, \(m\), of the line and the \(y\)-intercept (where the line crosses the \(y\)-axis)
*Formula:* \(y = mx + b\)

This is the form needed when using the calculator.

*Ex:* Find the equation of the line through the points \((1,3)\) and \((2,5)\).

What is the \(y\)-intercept of the line?
What is the \(x\)-intercept?

Intercepts are important and can help find a viewing window when graphing on the calculator.
GENERAL FORM: $Ax + By + C = 0$

**Parallel Lines**: have the same slope ($m_1 = m_2$)

**Perpendicular Lines**: have negative reciprocal slopes

($m_1 m_2 = -1, m_1 = -1/m_2$)

Thus, you can determine if lines are parallel, perpendicular, or neither by finding the slope-intercept forms of the lines and comparing slopes.

Ex: Find a line through (4,5) and perpendicular to the line $3x + 2y = 7$.

Ex: Find a line through (4,5) and parallel to the line $3x + 2y = 7$. 