2022-2023 James E Davis Trimester 1 Geometry Week 4 Class Notes

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Completed the following assignment:

[Geometry Unit 3 Week 4 Monday Assignment]

Preview...

Tomorrow, we'll go over sections 3.4 and 3.5, which are all about slopes and the equations of lines.

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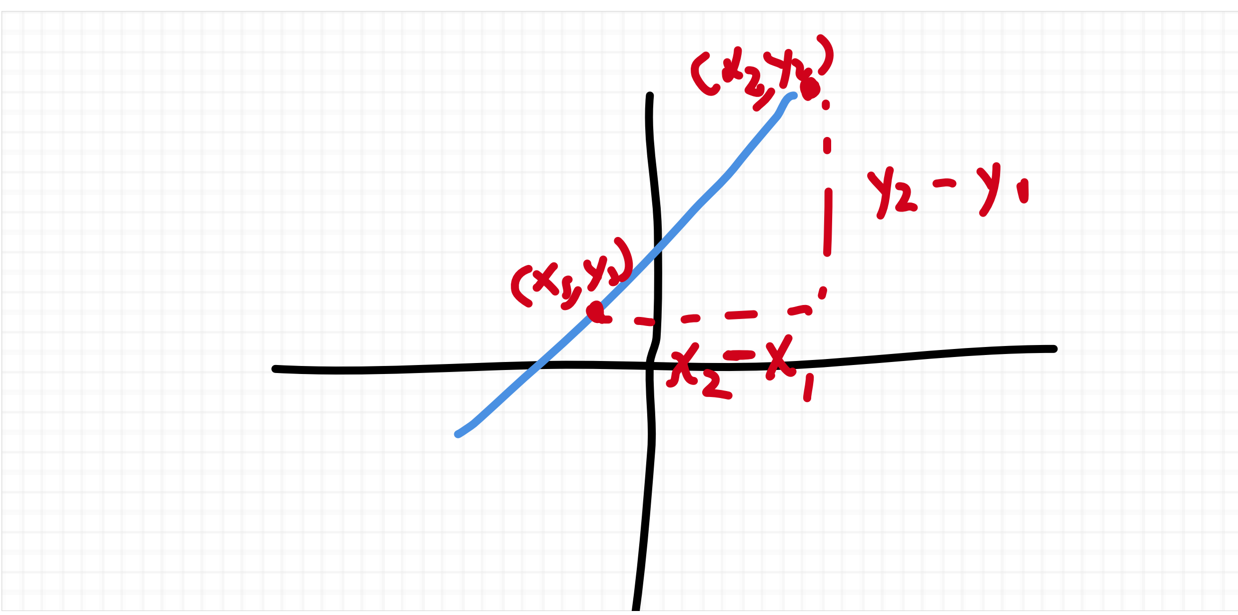
Slopes of Lines

The **slope** of a <u>nonvertical</u> line is the ratio of vertical change (rise) to horizontal change (run) between any two points of the line



Step process for finding the slope (based on the drawing of a line):

Step 1. Find your favorite two points. (it seriously could be any point!) $(x_1, y_1), (x_2, y_2)$.

Step 2. Compute the run by finding the difference $x_2 - x_1$ in the change in the x direction between the two points, compute the rise by finding the diference $y_2 - y_1$ in the change in the y direction between the two points. We then have

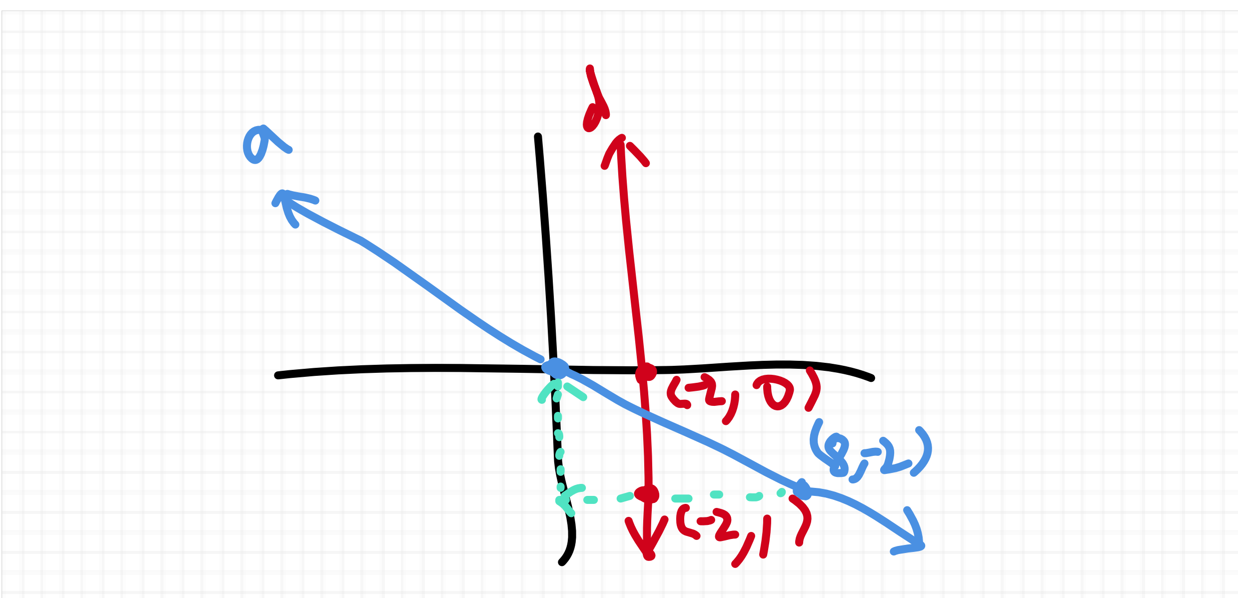
run $= x_2 - x_1$, rise $= y_2 - y_1$

Important Note: It doesn't matter which point you declare as the first point and which one as the second as long as you compute the changes consistently.

Step 3. Then compute slope m by setting it equal to the ratio of the run over the rise:

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}.$$

Example 1. Find the slope of the line a and d



$(x_1, y_1) = (0, 0),\ (x_2, y_2) = (8, -2)$
$x_2 - x_1 = 8 - 0$
$y_2 - y_1 = -2 - 0$

$$m = \frac{-2-0}{8-0} = \frac{-2}{8} = -\frac{1}{4}$$

What if we have $(x_1, y_1) = (8, -2),\ (x_2, y_2) = (0, 0)$

$x_2 - x_1 = 0 - 8$
$y_2 - y_1 = 0 - (-2)$

$$m = \frac{0-(-2)}{0-8} = \frac{2}{-8} = -\frac{1}{4}$$

Now we'll calculate the slope of d:

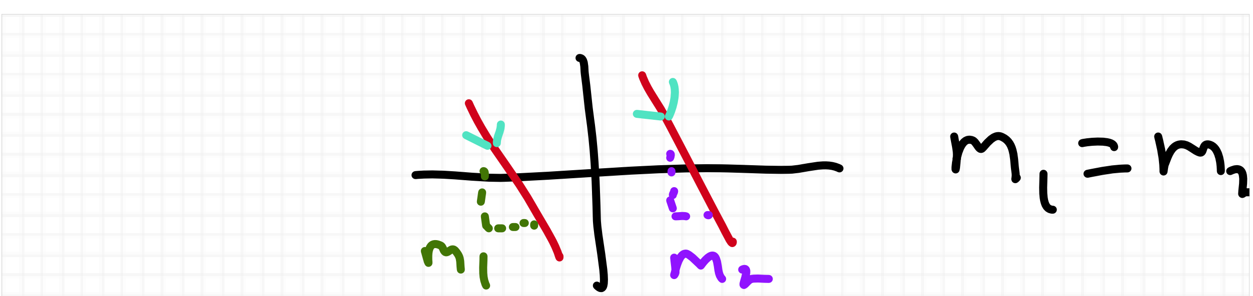
$(x_1, y_1) = (-2, 0),\ (x_2, y_2) = (-2, 1)$

$x_2 - x_1 = -2 - (-2) = 0$
$y_2 - y_1 = 1 - 0 = 1$

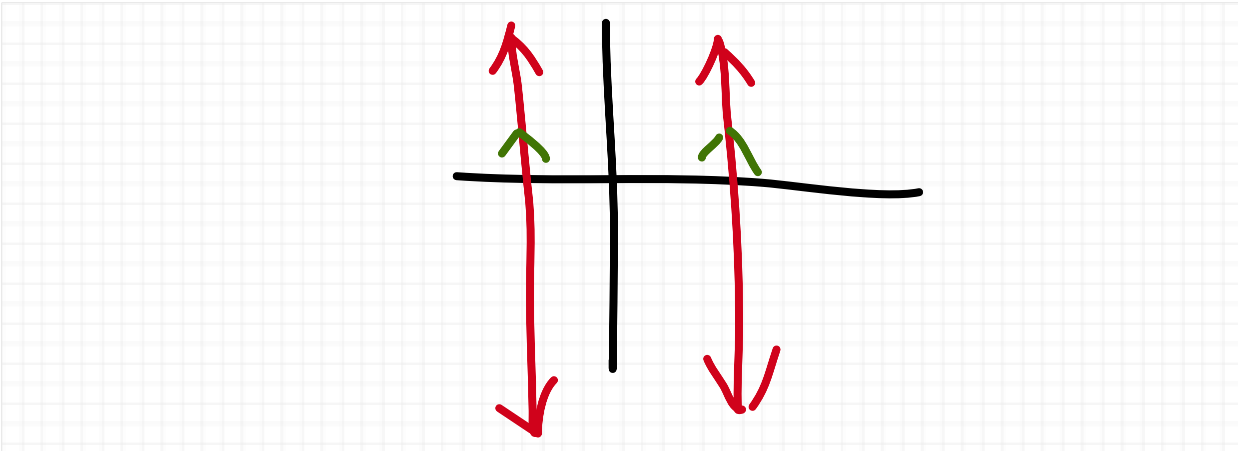
the "slope" is $m = \frac{1}{0} = \overline{\varnothing}$

WE CAN'T DIVIDE BY ZERO, and with vertical lines, we have no run, so to calculate the slope, we would have to divide by zero, but WE CAN'T DIVIDE BY ZERO, so all vertical lines are excluded from the slope club!

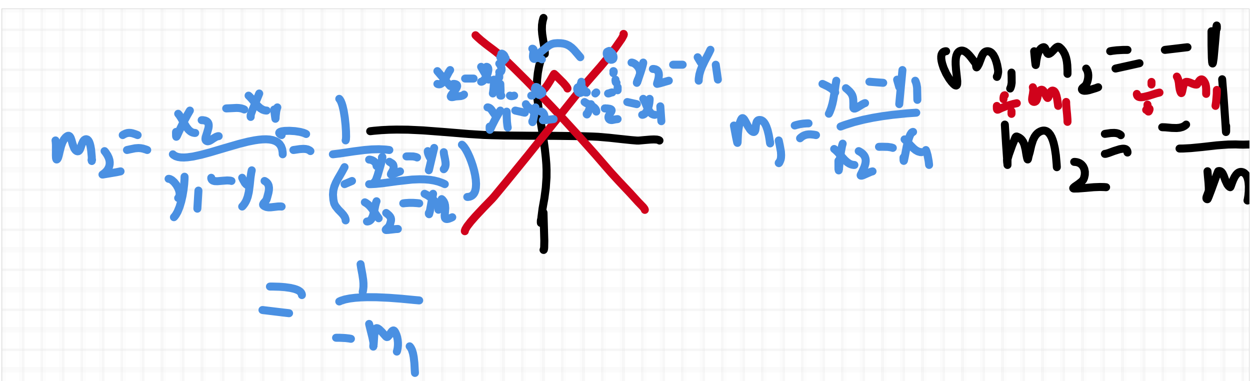
Postulate 1. In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope.



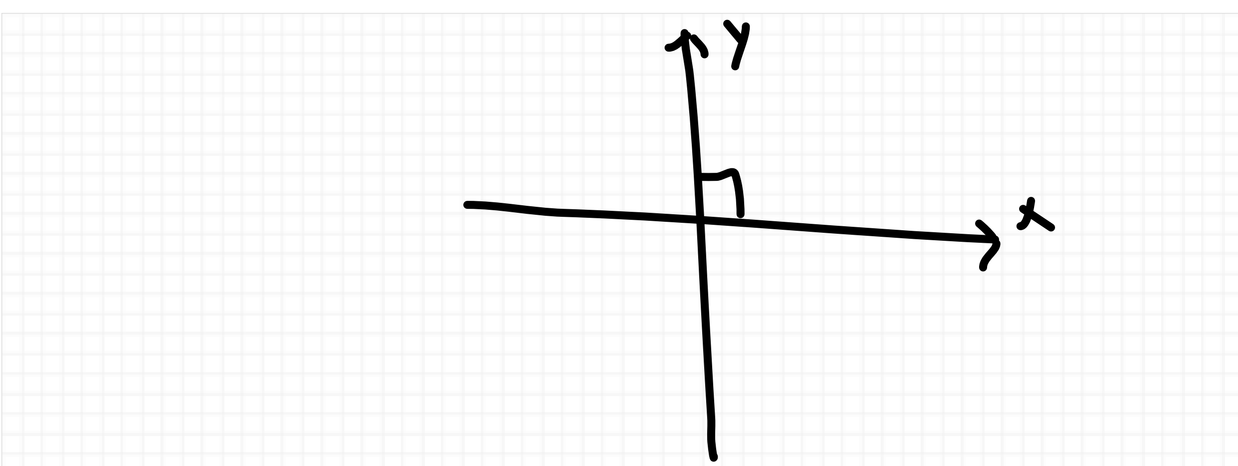
Two vertical lines are parallel



Postulate 2. In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1



Vertical lines are perpedular to horizontal lines (and vice versa)



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Slopes of Lines (Cont.)

Example 2.

Line h passes through $(3,0)$ and $(7,6)$. Graph the line perpendicular to h that passes through the point $(2,5)$.

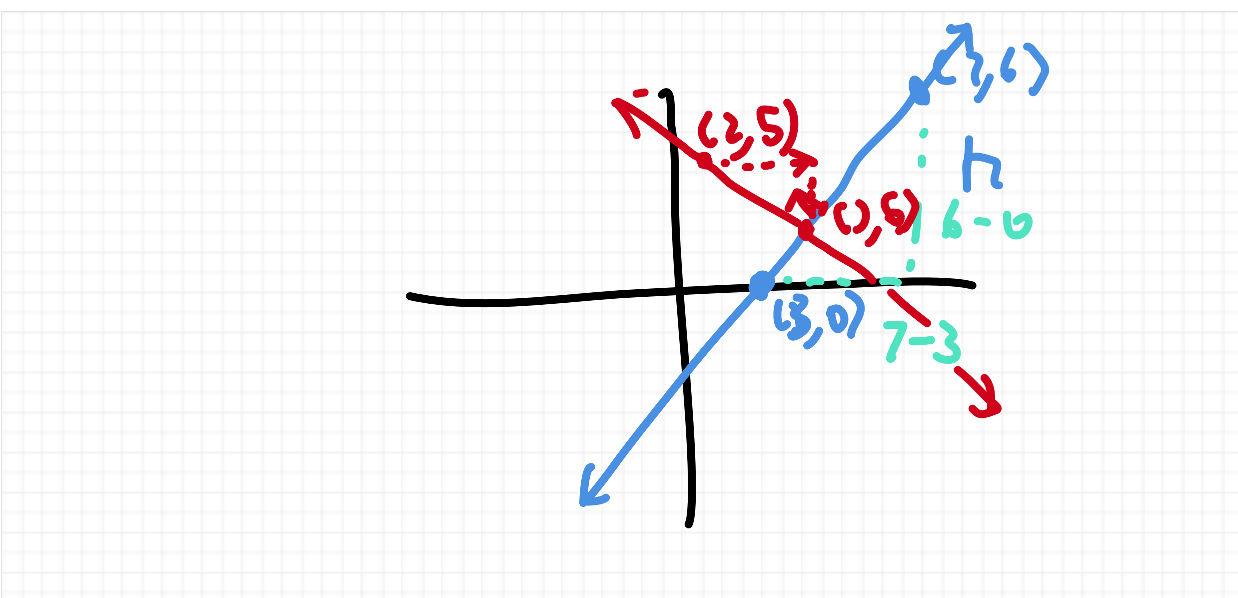
Step 1. Find the slope of m_1 of line h

$$m_1 = \frac{6-0}{7-3} = \frac{6}{4} = \frac{3}{2}$$

Step 2. Find the slope m_2 of a line perpendicular to h. Recall that this slope

$$m_2 = -\frac{1}{m_1} = -\frac{1}{\left(\frac{3}{2}\right)} = \frac{1}{1} \div \frac{3}{2} = \frac{1}{1} \cdot \frac{2}{3} = -\frac{2}{3}$$

Step 3. Use the rise and run to graph the line.



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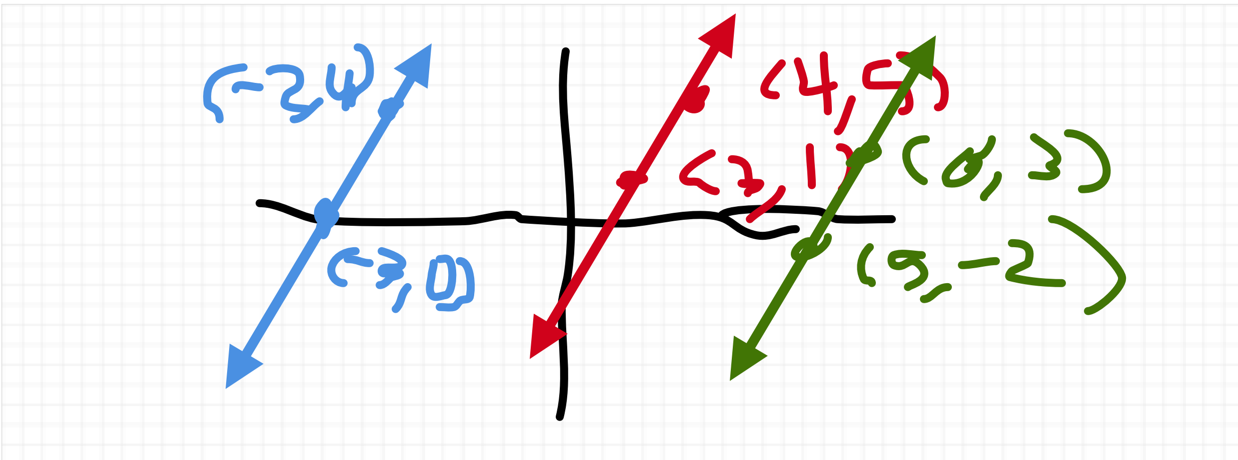
Slopes of Lines (Cont.)

Example 3. Find the slope of each line. Which lines are parallel?



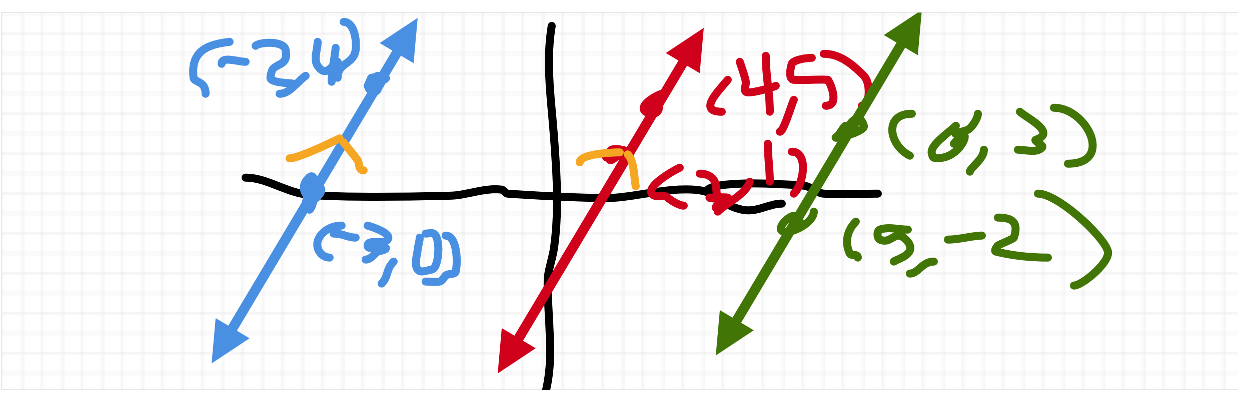
Find the slope of the blue line, the red line, and the green line.

$(-2,4),\ (-3,0)\ m_1 = \dfrac{0-4}{-3-(-2)} = \dfrac{-4}{-1} = 4$

$(4,5),\ (3,1)\quad m_2 = \dfrac{1-5}{3-4} = \dfrac{-4}{-1} = 4$

$(5,-2), (6,3)\ \ m_3 = \dfrac{3-(-2)}{6-5} = \dfrac{5}{1} = 5$

Because $m_1 = m_2$, the slopes for the blue and red line are the same, so it's not paralel to either of those two.



Equations of Lines Preview

To write an equation of a line, the following information suffices:

1. A point and the slope (the slope intercept formula, or the point-slope formula)
2. two points (the point-slope formula in a more general form)
3. Coefficents a, b, c such that $ax + by = c$

In the next section, we learn what exactly those formulas are and how to utilize them.

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Equations of Lines

1. slope-intercept formula

If we have the y-intercept $(0, b)$ and its slope m, then we have
$y = mx + b$