Lesson 4.2/4.4 Graphing Part 2

Monday, December 9, 2024 4:30 PM

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MCA lesson 4.2 and 4....

Graphs and Functions

4.2 Graphs of Equations in Two Variables

4.4 Slope and Graphs of Linear Equations

What You Will Learn

- Sketch graphs of equations using the point-plotting method.
- Find and use *x*- and *y*-intercepts as aids to

- Find and use *x*- and *y*-intercepts as aids to sketching graphs.
- Test graphs for symmetry.
- Use the verbal problem-solving method to write an equation and sketch its graph.

What You Will Learn

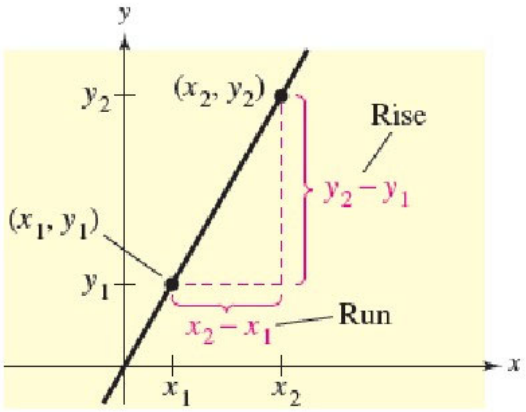
- Determine the slope of a line through two points.
- Write linear equations in slope-intercept form and graph the equations.
- Use slopes to determine whether lines are parallel, perpendicular, or neither.

The Slope of a Line 1

The slope m of a non vertical line that passes through the points (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{Change in } y}{\text{Change in } x} = \frac{\text{Rise}}{\text{Run}}$$

where $x_1 \neq x_2$.



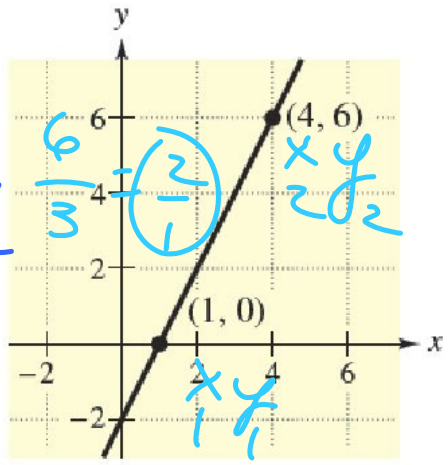
The Slope of a Line 3

Determine the slope for both graphs.

rise / run

$\frac{y_2 - y_1}{x_2 - x_1}$

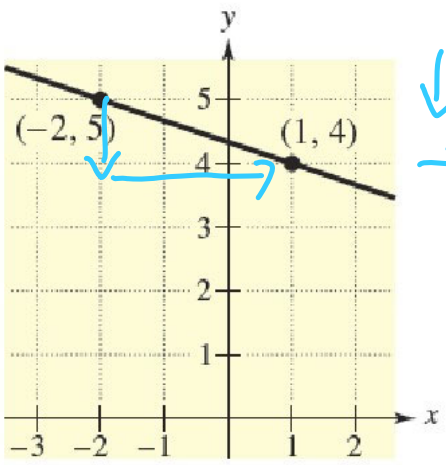
$\frac{6-0}{4-1}$



$\frac{6}{3} = \frac{2}{1}$

x_2, y_2

x_1, y_1



$-\frac{1}{3}$

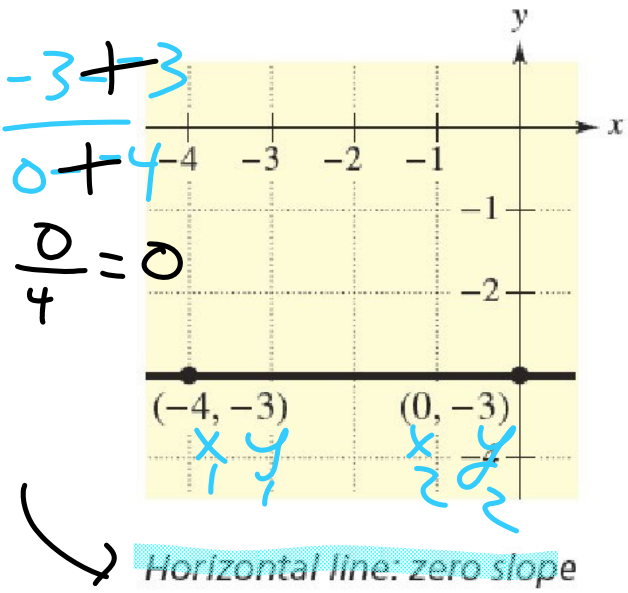
Line rises: positive slope

Line falls: negative slope

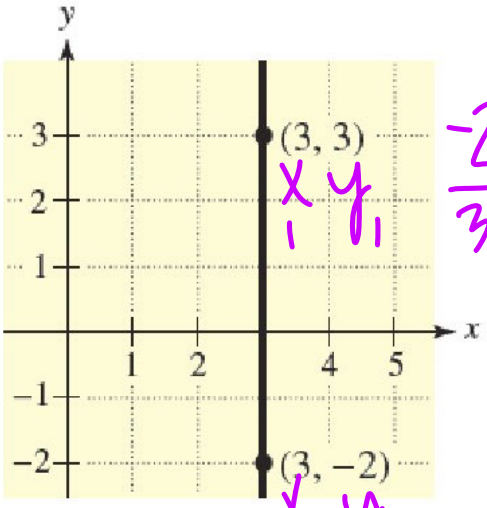
Line rises: positive slope

Line falls: negative slope

The Slope of a Line 4



Horizontal line: zero slope



Vertical line: undefined slope

Example 1 – Sketching the Graph of an Equation

Sketch the graph of $3x + y = 5$.

Solution: Begin by solving the equation for y, so that y is isolated on the left.

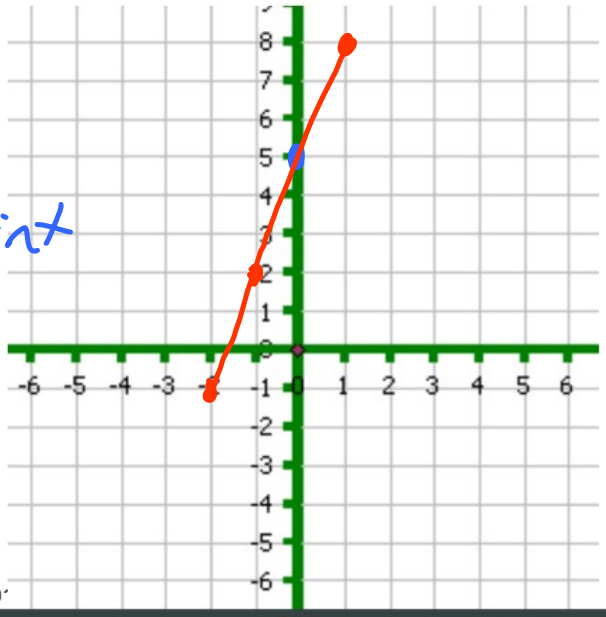
Solution: Begin by solving the equation for *y*, so that *y* is isolated on the left.

$y = -3x + 5$

$y = mx + b$

slope → $-\frac{3}{1}$ Rise / Run $\frac{3}{-1}$

y-int



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Slope as a Graphing Aid 1

Sketch the graph: $3x - 2y = 4$ Rewrite in slope-intercept form.

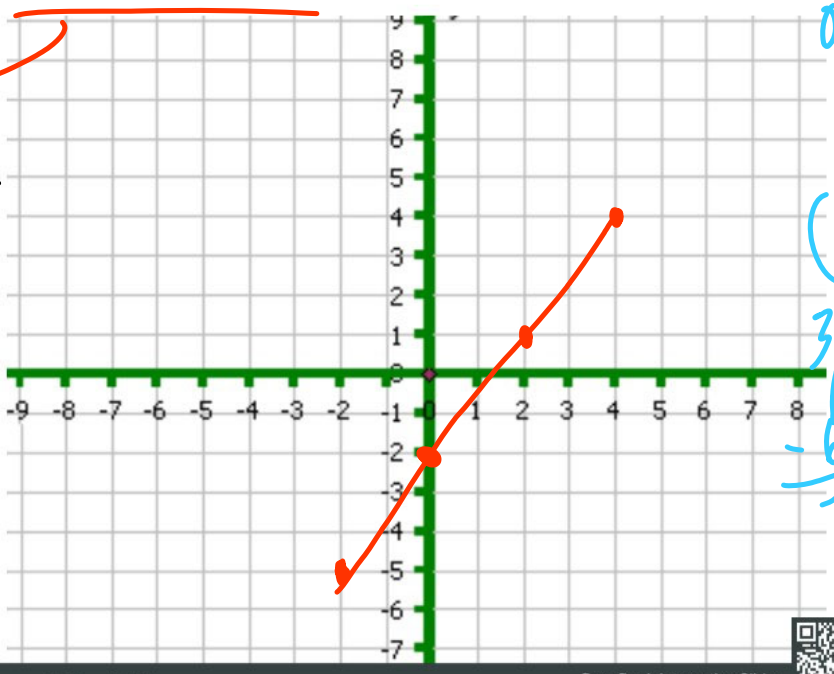
$y = mx + b$

$-3x \quad -3x$

$-2y = -3x + 4$

$\frac{-2y}{-2} = \frac{-3x}{-2} + \frac{4}{-2}$

$y = \frac{3}{2}x - 2$



$3(0) - 2y = 4$

$0 - 2y = 4$

$y = -2$

$(0, -2)$

$3(2) - 2y = 4$

$6 - 2y = 4$

$-6 \quad -6$

$-2y = -2$

$y = 1$

$(2, 1)$

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Parallel and Perpendicular Lines 1

You know from geometry that two lines in a plane are **parallel** if they do not intersect, and two lines in a plane are **perpendicular** if they intersect at right angles.

//

Parallel Lines and Perpendicular Lines

$y = 3x + 2$

$y = 3x - 4$

Parallel Lines: Two distinct nonvertical lines are parallel if and only if they have the same slope.

Perpendicular Lines: Two lines are perpendicular if and only if their slopes are negative reciprocals of each other. That is.

$-\frac{4}{5}$ $\frac{5}{4}$ $\frac{3}{1}$ $-\frac{1}{3}$

$$m_1 = -\frac{1}{m_2}.$$

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Example 5 – Parallel and Perpendicular Lines

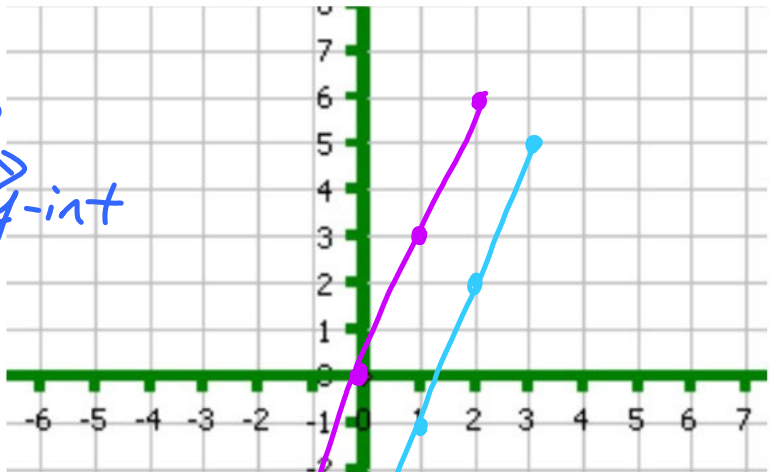
Graph the lines $y = 3x$ and $y = 3x - 4$

$y = 3x + 0$

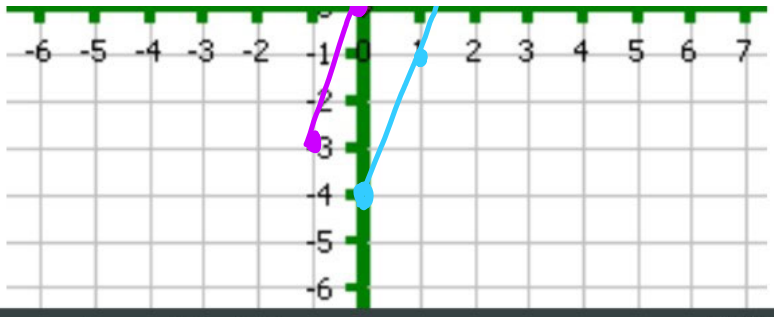
$y = mx + b$

slope $\frac{\text{rise}}{\text{run}}$

y-int



parallel lines - same slope $\frac{3}{1} : \frac{3}{1}$



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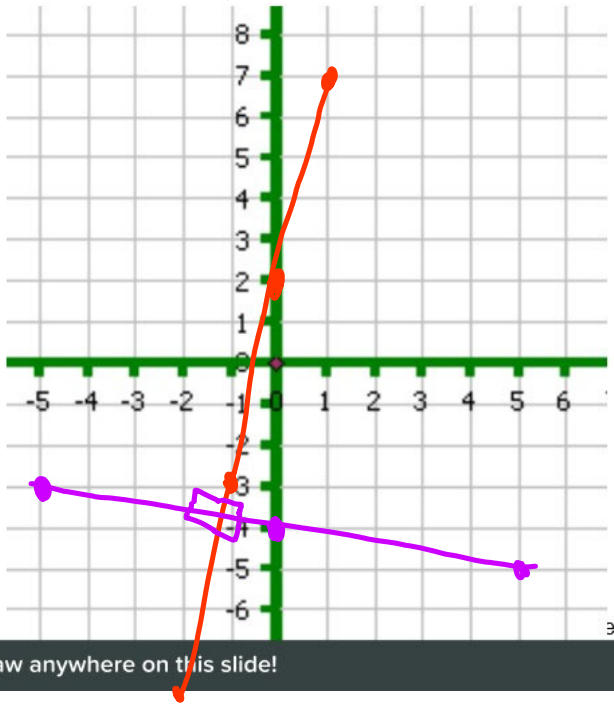
Example 5 – Parallel and Perpendicular Lines cont'd

Graph the lines $y = 5x + 2$ and $y = -\frac{1}{5}x - 4$



perpendicular
slopes
negative
reciprocals
$\frac{5}{1}$ & $-\frac{1}{5}$

eserved.

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Example 2 – Graphing a Nonlinear Equation

Sketch the graph of $x^2 + y = 4$.

Sketch the graph of $x^2 + y = 4$.

Solution:

Begin by solving the equation for y, so that y is isolated on the left.

$y =$

Next, create a table of values, as shown below.

x	−3	−2	−1	0	1	2	3
$y = -x^2 + 4$	−5	0	3	4	3	0	−5
Solution point	(−3, −5)	(−2, 0)	(−1, 3)	(0, 4)	(1, 3)	(2, 0)	(3, −5)

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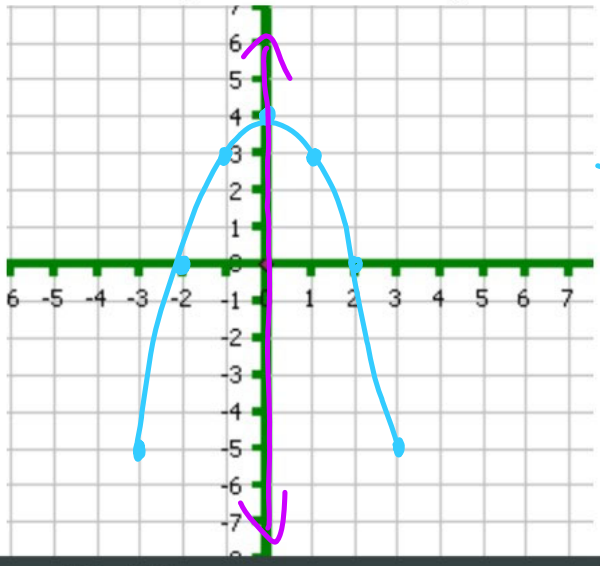
Example 2 – Graphing a Nonlinear Equation cont'd

Now, plot the solution points. Finally, connect the points with a smooth curve. *Also factor to prove

The x-intercepts. Draw your line of symmetry & plot.



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Example 3 – Graphing an Absolute Value Equation

Sketch the graph of $y = |x - 1|$.

Solution:

$y = |-2-1| = |-3| = 3$

$|-1-1| = |-2| = 2$

$|2-1| = |1| = 1$

$|0-1| = |-1| = 1$

$|+1-1| = |0| = 0$

$|4-1| = |3| = 3$

$|3-1| = |2| = 2$

x	−2	−1	0	1	2	3	4
$y = \|x - 1\|$	3	2	1	0	1	2	3
Solution point	(−2, 3)	(−1, 2)	(0, 1)	(1, 0)	(2, 1)	(3, 2)	(4, 3)

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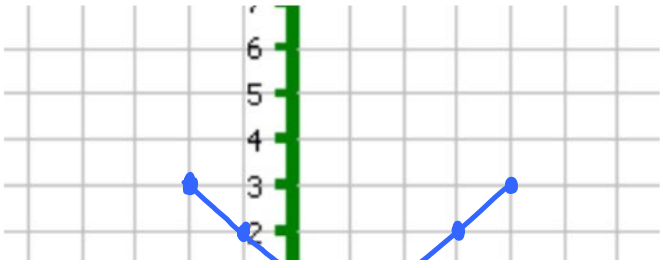
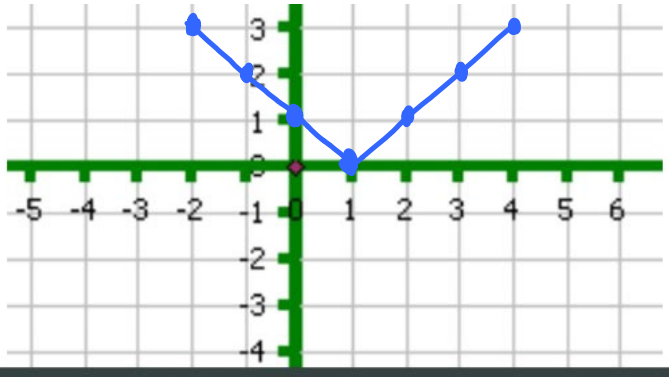
Example 3 – Graphing an Absolute Value Equation cont'd

Now, plot the solution points. It appears that the points lie in a "V-shaped" pattern, with the point (1,0) lying at the bottom of the "V." Following this pattern, connect the points to form the graph.



$y = |x - 1|$



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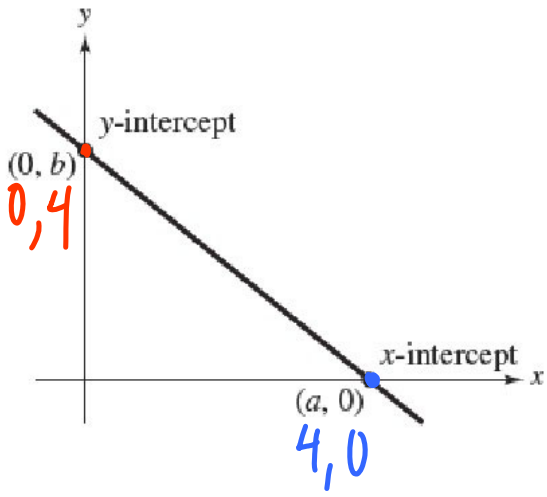
Intercepts: Aids to Sketching Graphs

The point $(a,0)$ is called an ***x*-intercept** of the graph of an equation when it is a solution point of the equation. To find the x-intercept(s), let $y = 0$ and solve the equation for x.

The point $(0,b)$ is called a ***y*-intercept** of the graph of an equation when it is a solution point of the equation. To find the y-intercept(s), let $x = 0$ and solve the equation for y.



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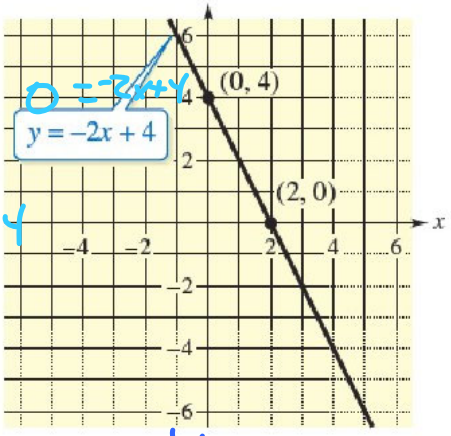
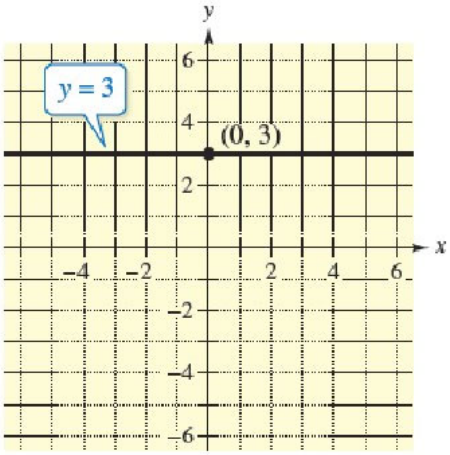
Example 4 – Identifying the Intercepts of Graphs

$4 = 4$

a.



b.



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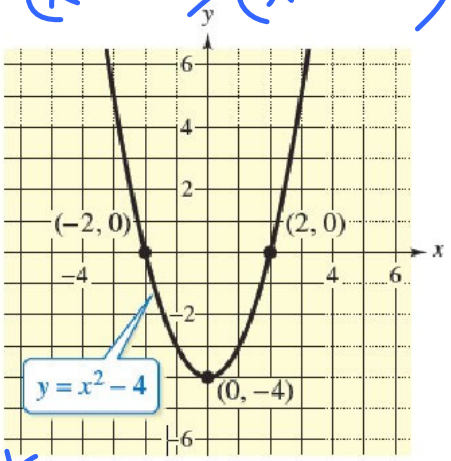
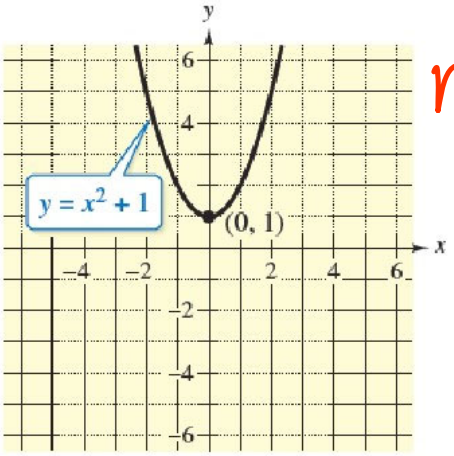
Example 4 – Identifying the Intercepts of Graphs cont'd

c.



d.



Example 5 – Finding the Intercepts of a Graph 1

Find the intercepts and sketch the graph of $y = 2x - 5$.

Solution:

To find any x-intercepts, let $y = 0$ and solve the resulting equation for x.

$y = 2x - 5$ Write original equation.

$0 = 2x - 5$

$-2x \quad -2x$

$\frac{-2x}{-2} = \frac{-5}{-2}$ $x = 2.5$

To find any y-intercepts, let $x = 0$ and solve the resulting equation for y.

$y = mx + b$

$y = 2x - 5$ Write original equation.

$y = 2(0) - 5$

$y = -5$

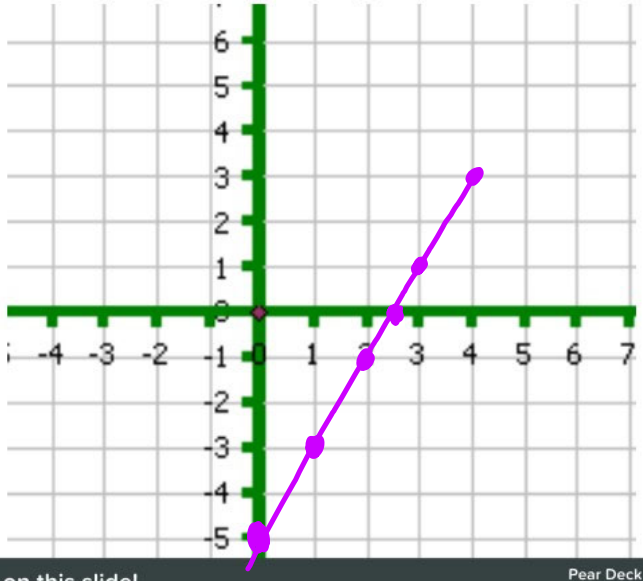
$y = -5$

Students, draw anywhere on this slide!

Example 5 – Finding the Intercepts of a Graph 2

So, the graph has one *x*-intercept, which occurs at the point $\left(\frac{5}{2}, 0\right)$, and one *y*-intercept, which occurs at the point (0, −5).

Also use your y-intercept & slope to graph.



$y = 2x - 5$

$y = \frac{2}{1}x - 5$

$y = mx + b$

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