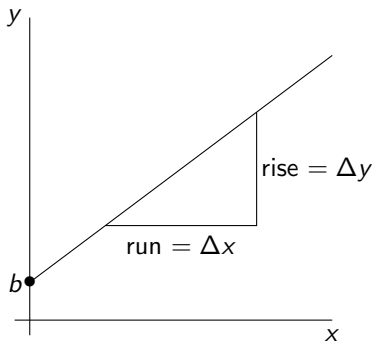# Linear Functions

Hitchman

Linfield Academic Academy 2023
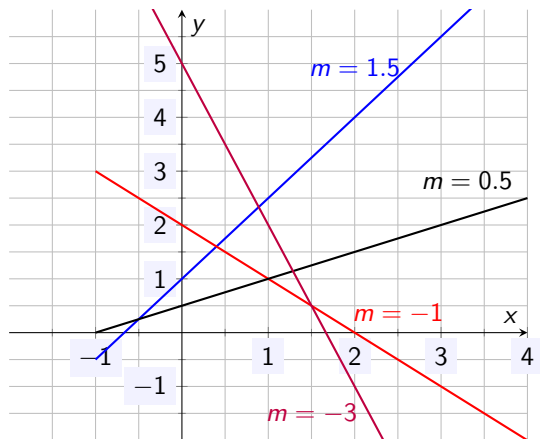
July 17, 2023

Lines - Quick Review

- ▶ A non-vertical line is determined by two features:
  - ▶ a single point on the line (often we consider the y-intercept)
  - ▶ the slope of the line, which is a measure of its direction
- ▶ The *slope-intercept equation* of a line has the form $y = mx + b$
  - ▶ $b = y$-intercept
  - ▶ $m = \text{slope} = \text{rise/run} = \frac{\Delta y}{\Delta x}$
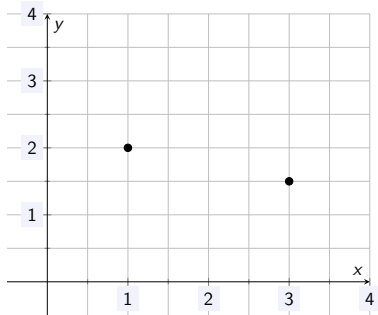
Some Lines

Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).

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First, we plot the points:
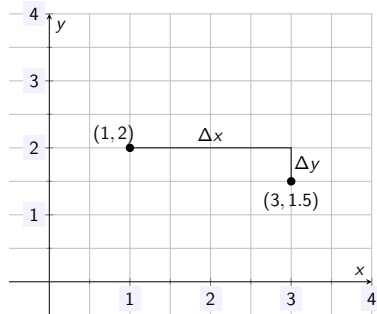
Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
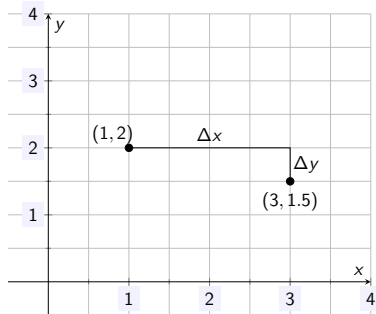First, we plot the points:

Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
Next we compute the slope:

Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
Next we compute the slope:

$$\Delta y = 1.5 - 2 = -0.5$$

$$\Delta x = 3 - 1 = 2$$

$$m = \frac{-0.5}{2} = -0.25$$

Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
Next we find the y-intercept:
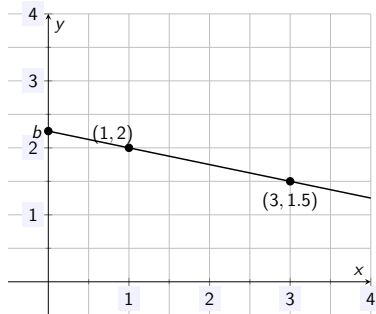
Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
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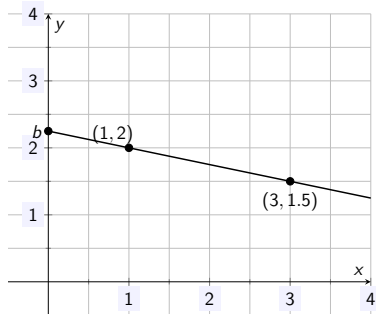
$y = mx + b$

$y = -0.25x + b$ (plug in for m)

$2 = -0.25(1) + b$ (plug in a point)

$2 + 0.25 = b$ (solve for b)

$b = 2.25$

Lines - Quick Review

Example: Find the equation of the line through (1,2) and (3,1.5).
Final equation
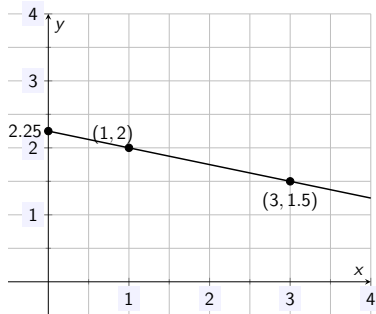
$$y = -0.25x + 2.25$$

Linear or not?

x	y
1	4
3	8
4	10
6	14
9	20

Linear or not?

x	y
1	4
3	8
4	10
6	14
9	20

Yep! The slope between any two pairs of points is the same! *y* increases by 2 for each increase of *x* by 1!

Linear or not?

x	y
1	4
2	3.8
3	3.6
4	3.4
5	3.2

Linear or not?

x	y
1	4
2	3.8
3	3.6
4	3.4
5	3.2

Yep! The slope between any two pairs of points is the same! y decreases by 0.2 for each increase of x by 1!

Linear or not?

x	y	diffs
1	4	
		-0.2
2	3.8	
		-0.2
3	3.6	
		-0.2
4	3.4	
		-0.2
5	3.2	

In other words, differences in successive outputs (based on inputs that are the same distance apart) are constant!

Linear or not?

x	y
1	4
2	6
3	10
4	16
5	24

Linear or not?

x	y
1	4
2	6
3	10
4	16
5	24

No! y tends to increase by larger and larger amounts as x increases by an additional unit.

Linear or not?

x	y	diffs
1	4	
		2
2	6	
		4
3	10	
		6
4	16	
		8
5	24	

The differences in successive outputs (based on inputs that are the same distance apart) are not constant!

Linear or not?

x	y	diffs	2nd diffs
1	4		
		2	
2	6		2
		4	
3	10		2
		6	
4	16		2
		8	
5	24		2

But the **second** differences are constant. This suggests a quadratic fit!