Goals:

* What are the central topics for this section?
	+ The commutative property of addition (subtraction too?)
	+ The associative property of addition
	+ The additive identity
* The addition algorithm
	+ What is “carrying?”
	+ Other ways to add (regrouping)
* The subtraction algorithm
	+ What is “borrowing?”
	+ Other ways to subtract (regrouping, counting back change)

# What are the central topics for this section?

Def: The Commutative Property for addition:

Is there a commutative property for subtraction? For Multiplication? For division?

Def: The associative property of addition:

Is multiplication associative?

Def: The additive identity (is there a number you can add that adds nothing to the original number?):

Def: The additive Inverse (the number you add to a number to bring it back to zero):

Example: Determine which property of addition is depicted by the given identity:

1. 53+0=53
2. 68+73=73+68
3. (90+96)+4=90+(96+4)
4. (14+6)+9=9+(14+6)

# The addition algorithm

Example: Sketch a number line diagram depicting the sum 3+2.

How do we add? What is “carrying” and why is it really all about placevalue?

246 240 246+17=(240+6)+(10+7)=(240+10)+(6+7)

+17 vs 10 Addition by regrouping is pretty easy

 6

+ 7

This is how the vast majority of people who can do mental math add in their heads, they do not typically use the algorithm to add in their heads. Practice: Try doing all of your homework in your head using regrouping! (you can check your work using the algorithm)

# The Subtraction algorithm

What is “borrowing” mean, and does the term “decomposing a ten into ten ones” say it clearer?

74

- 7

Or

 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_| Back up7|

 Number line walk 0 67 🡨 74

Example: Sketch a number line diagram depicting the difference 9-5.

# Alternate methods of subtracting

## Subtraction using regrouping

Subtraction using regrouping is pretty nice too! $74-7=74- 4 – 3=70-3=67$

 Because subtracting 7 is the same as subtracting 4 then subtracting another 3.

This can be done for any number, your job is to find creative ways of thinking about the problem that work for you to help you find the answer.

 Are there other ways to regroup, heck yeah, tons, it just depends on the problem.

 92 or 92-32-4 or 92-40+4 or (90-30)+(2-6)

-36

Example:

Simplify the given expression using regrouping:

1. 46-9
2. 127-99
3. 255-156
4. 14-5+6
5. 13-4+11

## Subtraction by counting back change

What is counting back change, and how does it work?

Lets say you go to the store and buy an item that costs $17.54

You only have a $20 dollar bill.

We typically think of the change like this, $20.00 which requires a lot of decomposing (borrowing)

 -$17.54

Visually, it is your $20 minus the cost ($17.54) = change



* =

But the way it more realistically happens is like this.

You find an item that is owned by the store and you bring it to the counter. You hand it back to the sales clerk and they tell you the price.

 You only have a $20 dollar bill but luckily the clerk has money owned by the store in the register.

 So you work out a swap, your $20 for their item plus some extra cash to make the deal fair.

 17.54**(cost of item)** + 2.46(change)





= +

So counting back change is just adding up to make the $20.





 + ? =

 $17.54

Counting back the change goes like this:

The item is $17.54

So the clerk starts with the items price and adds up to the value of the money you gave them.

1. $17.54 +6 cents makes 17.60
2. Then they hand you 40 more cents and that makes $18
3. Last they hand you $2 which adds back up to your twenty

So they have handed you $2.46 which is your change, but they did it by adding, not subtracting (which is generally easer)

#### So you can either think of your change (or any difference for that matter) as the result of a subtraction problem OR as the result of an addition problem; both ways are perfectly valid!

Examples:

Find 10.00-5.35 by counting back change.

Find the difference: 76-38 by counting up

Find the difference: 1000-535

Use the homework to practice subtraction using one or more alternate methods. Practice doing it in your head and only writing down the original problem and any side work needed to support these other methods (try not to use the algorithm)