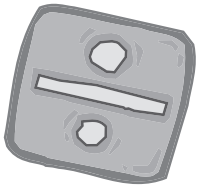
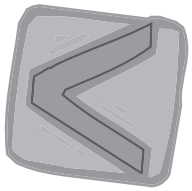


$-5 < 3$



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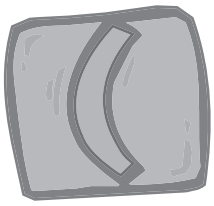

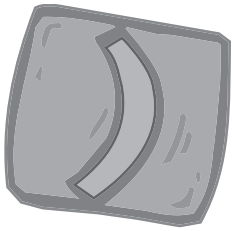

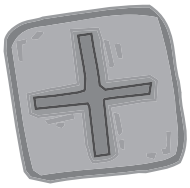

Student Notebook & Workbook

$(-3)^2(-5)$

$\frac{-48}{-8}$

C. Leung

Note to Students

The purpose of this publication is to provide an outline for teachers and students to use during direct classroom instruction. As a student you are aiming for the following:

1) Recognize the difference between integer and non-integer numbers.
2) Identify ways in which integers are used in real-life situations.
3) Develop an understanding of the integer operations.
4) Be able to quickly and accurately carry out the four basic operations (+, –, ×, ÷) without a calculator.
5) Be able to understand and use BEDMAS (order of operations) to simplify expressions involving integers.

The integer operations form the basis for much of high school mathematics. It is especially important that you are able to carry out the basic operations quickly and accurately without a calculator – without this ability you will find junior high algebra extremely difficult.

Through a workbook format, you the student, can follow lessons more easily with less copying and more time-on-task. Stay focused and be an active participant during the lessons. There are many opportunities to learn and practice during the lessons. Actually do the work during the lessons – do not wait for your teacher to do the work and then just copy it down. You won't learn much by just copying! Make sure you ask questions when you don't understand something.

Some students will learn concepts right away while others of you may need more time or practice. If after marking a section of homework, you find that you have many errors, your teacher has more practice sheets – ask for them! Get extra help! Your part is to put in the required effort, attention, participation, and practice. Responsibility for your learning belongs to you.

Good luck!

Leung, Calvin

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Integer Number Concepts & Operations

Student Notebook & Workbook

Calvin Leung

Contents:

TOPIC: SUBTRACTING INTEGERS

Review from last class.

Simplify the following:

a) $(-8)+(-15)$

b) $22+(-14)$

c) $(-37)+(24)$

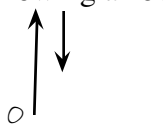
d) $-12+17+(-11)$

e) $(-53)+(-20)+13$

f) $(+12)+(-30)+(-7)$

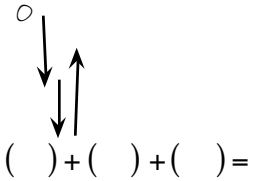
Given the following arrow diagrams, what are the signs on the numbers being added, and on the answer?

a)



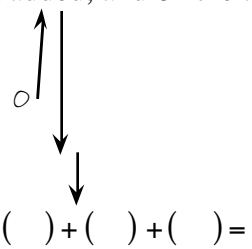
( ) + ( ) =

b)



( ) + ( ) + ( ) =

c)



( ) + ( ) + ( ) =

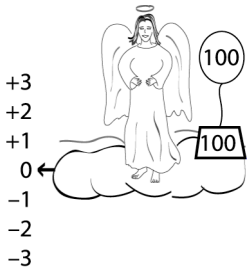
What does it mean to subtract something?

In your own words, write an explanation for the word "subtraction."

List as many words or phrases as you can, that mean "subtract or subtraction."

Understanding subtraction of integers

Imagine Integer Angel floating at zero. If we gave her 100 balloons and 100 weights, what would happen to her? Explain why.



So, there is Integer Angel with her 100 balloons and 100 weights. Now, let's say you want her to go ***up 4*** spaces but you do not have any balloons to give her. How can you still make her move up 4 spaces?

Again, there is Integer Angel at zero with 100 balloons and 100 weights. If you want to make her drop ***down 28*** steps but do not have any weights to give her, how can you still get the end result of 28 down?

TAKING AWAY BALLOONS makes Integer Angel move _____

TAKING AWAY WEIGHTS makes Integer Angel move _____

Now we have a model for understanding why the subtraction of integers gives certain results.
Write UP or DOWN (or draw an arrow) and by how much, next to each of the following to indicate the direction Integer Angel will move in each situation.

a) add 11 weights _____

b) take away 3 balloons _____

c) take away 7 weights _____

d) add 7 balloons _____

e) take away 8 weights _____

f) take away 11 balloons _____

Question f) had the same answer as _____. This means that

TAKING AWAY _____ IS THE SAME AS ADDING _____.

Question c) had the same answer as _____. This means that

TAKING AWAY _____ IS THE SAME AS ADDING _____.

Write precise word expressions for each of the following:

a) -5 _____

b) $0 - 7$ _____

c) $(+4) - (-3)$ _____

d) $(-2) - 5$ _____

Look at the following math expressions, arrow drawings, and equivalent "thinking statements":

$(-5) + (+12)$ 5 weights, add, 12 balloons +7, 0	The (-5) means that 5 weights are given to Integer Angel, so she moves down 5. $+(+12)$ means that 12 balloons are given to her so she goes up 12 and finishes at positive 7.
$5 - 12$ 5 balloons, take away, 12 balloons 0, −7	The 5 means that 5 balloons are given to Integer Angel, so she moves up 5. -12 means that we take away 12 balloons so she goes down 12 and finishes at negative 7.
$(-7) - (-20)$ 7 weights, take away, 20 weights +13, 0	The (-7) means that 7 weights are given to Integer Angel, so she moves down 7. $-(-20)$ means that we take away 20 weights so she goes up 20 and finishes at positive 13.
$(+12) - (-6)$ 12 balloons, take away, 6 weights +18, 0	The $(+12)$ means that 12 balloons are given to Integer Angel, so she moves up 12. $-(-6)$ means that we take away 6 weights so she goes up 6 and finishes at positive 18.
$-11 - (+15)$ 11 weights, take away, 15 balloons 0, −26	The -11 means that 11 weights are given to Integer Angel, so she moves down 11. $-(+15)$ means that we take away 15 balloons so she goes down 15 and finishes at negative 26.

Another way to "subtract" integers.

Now that we understand the results of the operation of subtraction for integers, let's see if we can think of another, possibly easier way, to get the same results. This is based on the idea that most people have a much easier time with addition than they do with subtraction. Remember what we found earlier?

Taking away balloons is the same as _____.

Taking away weights is the same as _____.

See what we wrote just above? An easier way to do subtraction is to "ADD THE OPPOSITE." Look at the following examples to see the original expression and then what we change it to make it easier:

Original expression	Equivalent expression	
a) $43-(-6)$	$43+(+6)$	taking away weights → adding balloons = 49
b) $15-(+6)$	$15+(-6)$	taking away balloons → adding weights = 9
c) $-23-8$	$-23+-8$	
d) $-14-(-5)$	$-14+(+5)$	
e) $15-34+(-3)-(-9)$	$15+-34+(-3)+(+9)$	

When we change a *subtraction* sign to addition, the sign on the second integer changes its opposite. Concentrate on one subtraction sign and the number immediately to its left and right. Try changing these and then evaluating for practice:

a) $19-(+30)$ b) $17-31$ c) $-12-(-34)$ d) $5-(-14)-6$

Some of you may prefer to perform the subtraction without changing to "add the opposite." For example some of you might think according to Method 1. Others prefer to follow "add the opposite" in Method 2.

Method 1

$-5-(-14)$

five weights means down 5

take away 14 weights means up 14

answer = +9

Method 2

$-5+(+14)$

five weights means down 5

add 14 balloons means up 14

answer = +9

Notice that both methods get the same answer so it does not matter which method you choose. Just use the way that works better for you. Practice changing and evaluating:

a) $8+(-19)-4$ b) $-7-(-3)+(-14)-8$ c) $12-(+5)-(-9)+(-3)$

Lesson Summary:

_____

_____

_____

_____

_____

_____

_____

_____

PRACTICE QUESTIONS: (No calculators for any of these questions!)

1. Write a precise balloons and weights statement that means:

a) $-(-15)$ _____

b) $-(+7)$ _____

c) $+(-8)$ _____

d) -20 _____

2. Draw an up or down arrow for each separate question:

a) -14 c) $-(-12)$ e) $+(-5)$ g) $+20$

b) (-29) d) $-(+9)$ f) $-(14)$ h) $+(-32)$

3. Subtract the following.

a) $-15-8$ g) $-12-(-19)$

b) $17-26$ h) $-8-5-2$

c) $24-18$ i) $12-20-(+4)$

d) $-7-7$ j) $-4-(-12)-5$

e) $-28-(-20)$ k) $6-(+8)-(-7)$

f) $8-(-6)$ l) $-17-6-(-4)$

4. For each word statement write a number expression and then evaluate.

a) Take away five balloons, add ten weights, then take away six balloons.

_____

b) Add three balloons, take away eleven weights.

_____

c) Take away thirteen weights, then take away seven weights.

_____

d) Give Angel twenty-five balloons, then give twenty-five weights.

_____

e) Give Angel nineteen balloons, then take away nineteen weights.

_____

f) Give Angel sixty-two weights, then take away seventeen balloons.

_____

g) Give Angel thirty weights, then take away eighteen weights.

_____

5. Simplify (notice that there is now a mix of addition and subtraction questions):

a) $6+(-14)-8$

b) $15-(-7)+(-4)$

c) $-9-11+7$

d) $20-(+15)-9$

e) $-12-(-7)+(-9)$

f) $-9+(-14)-(-7)$

g) $(-12)+(-5)-15$

h) $(+23)+7-(21)$

i) $(-8)+(-19)-(-12)$

j) $-17-8-(-21)$

k) $50+(-35)-(-7)$

l) $-14-(-8)-(+9)$