Integers

SUMMARY:

This lesson will be the first of six lessons guiding students in constructing the abstract concepts necessary to understand adding positive and negative integers. It is designed for adult learners (or middle school or older) who are not fluent with using numbers. A real life lesson will be included in this series of lessons-Budgeting.

LEARNING GOALS:

- Apply procedures for comparing and ordering integers to complete interactive exercises
- Recognize that Integers get smaller in value as you move to the left, and larger as you move to the right on a thermometer.
- Order a set of integers from least to greatest. Order a set of integers from greatest to least.
- Define the set of integers, positive numbers, negative numbers, and signs.

Unit 1

Design Proposal

Designers for Learning - Adult Learning Zone

Part 1: Lesson Description

Lesson Title

Integers: Introduction to the concept, with activities comparing temperatures and money.

Links to Other Documents & Materials (student text, student practice)

https://www.youtube.com/watch?v=XZERD7zi_hQ   - video of this lesson being taught by the teacher.

Updated (4/26/16) Student Text/Workbook as Word Doc:

Download: Chapter one transitions integers_1.docx

as Open Document Format (draft)

Download: Chapter One Transitions Math April2016.odt

Google Doc link: Chapter One Transitions Math Google Doc

Key with Teacher's Notes and Comments:

Download: Chapter One Transitions Integers Key.docx

Google Docs Link: Chapter One Transitions Math (Integers) Answer Key - Google Doc

Abstract

 For many adult students, positive and negative integers are an example of when math "keeps changing the rules." This lesson will be the first of six lessons guiding students in constructing the abstract concepts necessary to understand adding positive and negative integers.

    This lesson will introduce the concept of negative numbers as below zero on a thermometer, with practice labeling thermometers and using the different terms (e.g., less than, negative, positive) in different contexts.   Many students don't get sufficient practice connecting the language to the concepts, so that as soon as the illustrations are removed they revert to memorizing patterns with limited understanding.

    This lesson extends the concept to money owed, with practice comparing amounts.   At the very end, amounts are added together.

    The next lesson will move to a horizontal number line and provide more practice with the concepts and language.

Learner Audience / Primary Users

This lesson is part of a structured sequence of multisensory, conceptual lessons building basic math concepts for students who struggle with number sense and arithmetic, especially figuring out what to do with practical problems.   It is taken from Parkland College's "Transitions" course for students whose placement test scores

do not qualify them for Pre-algebra.   In 4 semesters, fewer that 5% of students have questioned whether the placement was valid.   They recognize the need for more than a quick review of math.

Educational Use

- Curriculum / Instruction
- Professional Development College & Career Readiness Standards (CCRS) Alignment

- Level: Adult Education
- Grade Level:
- Subject: Mathematics
- Domain or Strand:

- Number Sense
- Primarily Math Practices 1, 2
- Level D   (because it includes negative numbers --   It is not assumed that students are competent with the first three levels.)
- Standard Description: Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. (6.NS.6) • Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite. (6.NS.6a)
- Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. (6.NS.6c) Understand ordering and absolute value of rational numbers. (6.NS.7)
- Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right. (6.NS.7a)
- Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write –3º C > –7º C to express the fact that –3º C is warmer than –7º C. (6.NS.7b)

Language

English

Material Type

- Instructional material
- Student Text
- Student practice
- Lecture Notes
- Video

Learning Goals

The purpose of this lesson is for learners to be able to:

- Define the set of integers, positive numbers, negative numbers, and signs.
- Order a set of integers from least to greatest.
- Order a set of integers from greatest to least.
- Recognize that Integers get smaller in value as you move to the left, and larger as you move to the right on a thermometer.
- Apply procedures for comparing and ordering integers to complete interactive exercises

Keywords

- Designers for Learning
- Adult Education

- Integers
- Math
- Math Anxiety
- Multisensory
- Learning Disabilities
- Developmental Math
- CCRS
- RI.6.2

Time Required for Lesson

20-30 minutes

Prior Knowledge

Learners should have counting skills. This course is designed for students with minimal "prior knowledge" or math skills.

Required Resources

Text and paper and pencil. If I can get to them, there will be support videos that can be viewed online or downloaded for viewing with a device that can show MP4 videos (computer, tablet, telephone).

- Lesson Author: Susan Jones using text by Kathy Wahl

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Part 2: Lesson

Learning Objectives

By the end of this lesson, the ESL, ABE or GED learner should be able to:

- Define the set of integers, positive numbers, negative numbers, and signs.
- Compare two integers, using the proper inequality symbol.
- Order a set of integers from least to greatest.
- Order a set of integers from greatest to least.
- Recognize that Integers get smaller in value as you move to the left or down, and larger as you move to the right or up on a thermometer.
- Discuss and apply knowledge of integers to temperature and money.

Lesson Topics

Key topics covered in this lesson include:

- Comparing integers
- Measuring and comparing cold temperatures
- Positive and negative number applications to money

Context Summary

This lesson is the initial entry into math for students whose math background is below what's expected for adults. They may have been in special education settings in K-12. In our setting, they will have taken the Accuplacer math placement test and scored below the required score to place into "Pre-Algebra." However, they need more than "test preparation' and review.

These students are usually degree- or certificate- seeking students who have significant gaps in their arithmetic and algebra skills.

Relevance to Practice

Understanding negative numbers is relevant because of their use in topics such as budgeting and science, as well as in required courses and placement tests. We have moved this chapter to the beginning of the course because we feel it will have the affective advantage of being an abstract, non-elementary math topic, while allowing the teacher to discern the students' number sense with single-digit operations. Many students with this placement are still adding by "counting up" or even counting from zero, and we can address this here without the student having to do primary-level math. For example, students label number lines with positive and negative numbers "counting by fives," or twos, or tens.

Key Terms and Concepts

Note: many of these terms will be "familiar" to learners, but we will be using and applying them in less familiar ways.

Addition

Integer

Negative

Opposite

Parentheses

Positive

Subtraction

Instructional Strategies and Activities

https://www.youtube.com/watch?v=XZERD7zi_hQ   video of lesson being taught.

Warm-Up (a minute)

This should be adapted to the learners. This is the first chapter in our Transitions Math course, assuming no background knowledge and that students may bring misconceptions ("two negatives make a positive"). However, if this lesson were taught further along in a course, then a quick review of a mastered skill would be appropriate.

In this case warmup is: ,

- explanation that while learners might already know some things about "signed numbers," and "positive" and "negative," that we don't want to just be learning rules; we want to make sure we understand what these words, symbols and numbers mean.

- Ask learners: What is a positive number and what is a negative number?

Introduction (1 minute)

Begin with talking about positive and negative as words, and their meaning, and then that in math they are opposites… and that we're going to use temperature to help understand positive and negative numbers.

Note that we might say "minus," but that can be confusing because that sounds like we're going to subtract, when really we are describing that number.

Presentation / Modeling / Demonstration

Time: 6 minutes

Present thermometer w/ positive and negative numbers, & explain that negative 12 means 12 degrees colder than, or 12 degrees less than, or 12 degrees below zero.

Student activity: Find "-12" on thermometer from page 1 in student text (image below)

°F
120°--
100°--
80°--
60°--
40°--
20°--
0°--
-20°--
-40°--
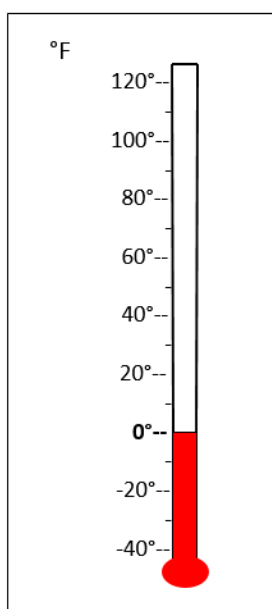
Thermometer (F) w/ numbers marked every 20 degrees from -40 to +120 (Vertical)

(Learners may need guidance in interpretation of the thermometer, since it's only marked with every 20 degrees.   Call attention to the fact that the spaces between the numbers are the same throughout. Throughout these lessons, students will be practicing number sense as well as learning about negative and positive integers))
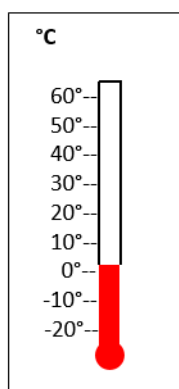
Guided Practice

Time: 15 minutes

Complete pages 2-3 in student text, as follows:

Example 1   Students may need guidance figuring out where the un-marked numbers will go.   Reviewing the "halfway" point is helpful[a].

Which is colder, 15° C or 34° C? _____   Locate both temperatures on this thermometer, and mark them with arrows.
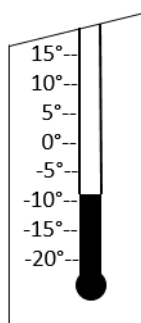
°C

60°--
50°--
40°--
30°--
20°--
10°--
0°--
-10°--
-20°--

15° C is colder than 34° C, and 15 is _____ _____ 34.

34° C is warmer than 15° C, and 34 is _____ _____ 15.
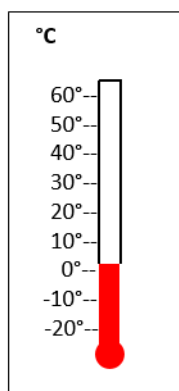
Example 2

Which is colder, -6° F or -14° F? _____   Locate both temperatures on this thermometer, and mark them with arrows.

15°--
10°--
5°--
0°--
-5°--
-10°--
-15°--
-20°--

-14° F is _____ than -6° F, and -14 is _____ _____ -6.

-6° F is _____ than -14° F, and -6 is _____ _____ -14.

°C

```
60°--
50°--
40°--
30°--
20°--
10°--
 0°--
-10°--
-20°--
```

3

Example 3

Put these temperatures in order from smallest to largest (or coldest to warmest):

    38°, 70°, -10°, 15°, -6°, 45°, 0°

Which of those temperatures are positive?_____

Which of those temperatures are negative? _____

Is 0 a positive or negative number?_____

Example 4

Make marks and label the thermometer below with appropriate numbers for a (Fahrenheit) thermometer. Make marks every 10 degrees. Try to go as low as -30° and as high as 120°.

°F

Negative integers and Money:

Ask students: has anyone ever heard of an "I.O.U."? & make sure they understand what it means.   Then work through the examples on pages 4 and 5, below, discussing the thinking as you go.

Note that the idea of adding is being introduced, but students are not "doing addition problems."   We want students to grasp the concepts of negative and positive, instead of looking for a quick way to get an answer.

Material from Text, pages 4 and 5:

4

Now let's think about money ☺, or the lack thereof ☹.

Example 5

In this example we are only considering the amount of money people have in their wallet. Samuel looks in his wallet and finds two tens and three ones; he has _____. April looks in her wallet and finds no money, but she does find a little scrap of paper that reminds her she owes her sister $12. How much money does April "have"? _____

Example 6

Figure out who has more money in each of the following cases:

1. Jaden has three five dollar bills and seven one dollar bills. Jaden has _____.

Omar has a twenty dollar bill. Omar has _____.

_____ has more money.

2. Kevin has only a note saying he owes his friend $40. Kevin has _____.

Erin has only a note saying she owes her father $50. Erin has _____.

_____ has more money.

3. Brazylle has a five dollar bill and a note reminding her she owes her mom $5. Brazylle has _____.

Truu has a ten dollar bill and a note reminding him that he owes his sister $15. Truu has _____.

_____ has more money.

The addition problems illustrated in (c) are: 5 + -5 =

                                        and   10 + -15 =

5

Example 7

Jacob has in his wallet a twenty dollar bill, three five dollar bills, four one dollar bills, a note saying he owes his friend $10, and a note saying he owes his mom $7. How much money does Jacob "have"?
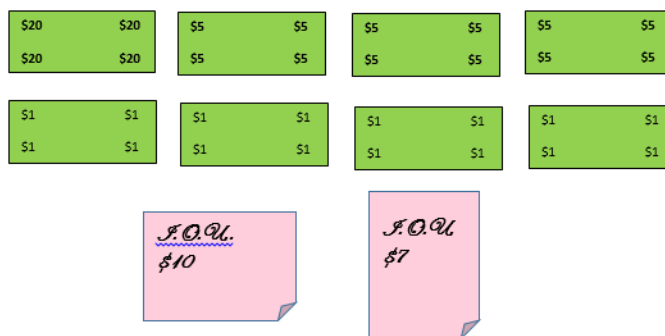
Use these pictures to help you figure it out:

Image of 20$ bill, three $5 bills, 4 1$ bills and an IOU for $10 and an IOU for $7

Example 8

Put these numbers in order from smallest to largest:

17, -5, 3, -3, 0, 12, -14

Evaluation

Time: 5-10 minutes (will vary)

Complete evaluation exercise at
https://docs.google.com/document/d/1O2dmTqSpLMUiwRZfkZHlRq2TUDg29J9kovskELBTWkc/edit?usp=sharing

Application

The examples and activities in this lesson are already "real life" activities with temperatures and money.

Part 3: Supplementary Resources & References

Supplementary Resources

http://www.mathsisfun.com/number-line.html   explanation of positive and negative on number line.

http://www.mathsisfun.com/positive-negative-integers.html   -- summary of adding

http://www.scholastic.com/teachers/top-teaching/2012/09/positive-approach-teaching-negative-numbers
 ideas for teachers for explaining negative numbers

References/Attribution Statements

[Brainzy Games by Education.com] (2014, July 16), *Number Gators (Greater Than, Less Than Symbols Song)* [Video File] Retrieved from https://www.youtube.com/watch?v=M6Efzu2sla

Transitions, Chapter One contributed by Kathy Wahl and Sue Jones of Parkland College to this project.

(Design Guide effective March 2, 2016)

[a] Notes to self: In the most awesome version of this, perhaps there would be "branch" activities to build skills in finding unmarked places on number lines.

Number Sense Foundations

Original by Kathy Wahl, Parkland College; edited for general use by Susan Jones

NOTE: This is being revised to include more visual examples.   Since it is an OER with a "CC-BY" license, you can also revise it. https://creativecommons.org/licenses/

Chapter 1   Adding and Subtracting Signed Numbers

Section 1.1   Introduction

Positive and Negative Temperatures

What is a positive number? What is a negative number? We can think about familiar things to understand these ideas. You know that if the temperature is -12° F it is very, very cold. Most thermometers give us digital temperatures now, but you have all seen an "old fashioned" thermometer:
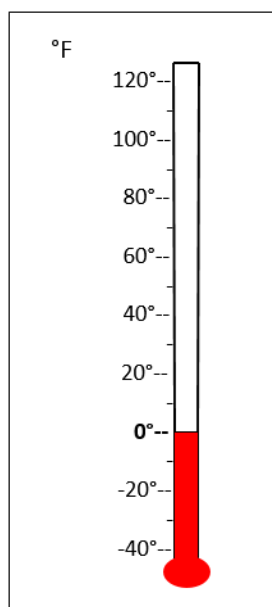
You know that -12° F is below 0° F. You know that -12° F is a colder temperature than 0° F. It follows that -12 is a smaller number than 0. Locate -12° F on this thermometer, and mark it with an arrow.
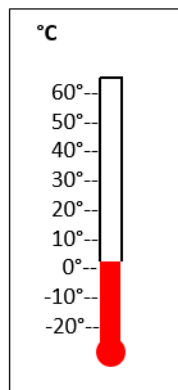
A **positive number** is a number that is _____ _____ _____.

A **negative number** is a number that is _____ _____ _____.

2

Example 1

Which is colder, 15° C or 34° C? _____   Locate both temperatures on this thermometer, and mark them with arrows.
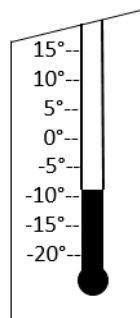
```
°C
60°--
50°--
40°--
30°--
20°--
10°--
 0°--
-10°--
-20°--
```

15° C is colder than 34° C, and 15 is _____ _____ 34.

34° C is warmer than 15° C, and 34 is _____ _____ 15.

Example 2

Which is colder, -6° F or -14° F? _____   Locate both temperatures on this thermometer, and mark them with arrows.

```
15°--
10°--
 5°--
 0°--
-5°--
-10°--
-15°--
-20°--
```

-14° F is _____ than -6° F, and -14 is _____ _____ -6.

-6° F is _____ than -14° F, and -6 is _____ _____ -14.

Example 3

Put these temperatures in order from smallest to largest (or coldest to warmest):

    38°, 70°, -10°, 15°, -6°, 45°, 0°

Which of those temperatures are positive?_____

Which of those temperatures are negative? _____

Is 0 a positive or negative number?_____

Example 4

Make marks and label the thermometer below with appropriate numbers for a (Fahrenheit) thermometer. Make marks every 10 degrees. Try to go as low as -30° and as high as 120°.

°F

Positive and Negative amounts of money

Now let's think about money ☺, or the lack thereof ☹.

Example 5

In this example we are only considering the amount of money people have in their wallet. Samuel looks in his wallet and finds two tens and three ones; he has _____. April looks in her wallet and finds no money, but she does find a little scrap of paper that reminds her she owes her sister $12. How much money does April "have"? _____

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_____ has more money.

3. Brazylle has a five dollar bill and a note reminding her she owes her mom $5. Brazylle has _____.

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_____ has more money.

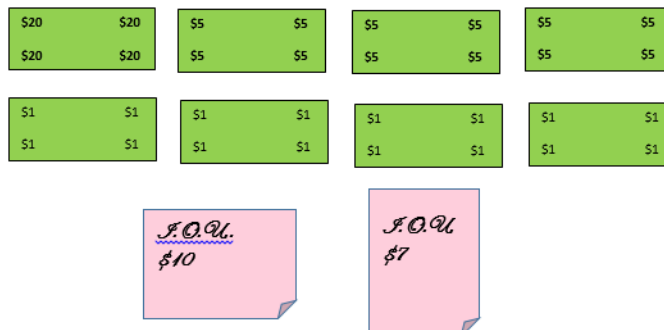The addition problems illustrated in (c) are: 5 + -5 =

                    and   10 + -15 =

5

Example 7

Jacob has in his wallet a twenty dollar bill, three five dollar bills, four one dollar bills, a note saying he owes his friend $10, and a note saying he owes his mom $7. How much money does Jacob "have"?

Use these pictures to help you figure it out:

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