Lesson Plan

Warehouse Grade 7 Adding Integers

CCSSM: Grade 7

DOMAIN: The Number System

Cluster: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Standard: 7.NS.1: Apply and extend previous understandings of addition and subtraction to add and subtract **rational numbers**, and represent addition and subtraction on a horizontal or **vertical number line** diagram.

1a. Describe situations in which opposite quantities combine to make 0.

1b. Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are **additive inverses**).

CCSSM: Grade 6

DOMAIN: The Number System

Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

Standard: 6.NS.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Standard: 6.NS.6 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.

a. 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.

Clarification: The clarification is an explanation of the indicator and objective and how these math concepts appear in the puzzle.

Materials and/or Set Up*: Adding Integers with Chips Sample, Assessment, Blank Number Line, Interactive Resource 1, Interactive Resource 2, Masking tape, Number Line Examples Interactive, Finding Sums of Integers, Finding Sums Part 2, Number signs, Scissors, Sea Level Illustration, The Accounting Game, Thermometer Interactive*

Relevant Vocabulary: difference, integer, negative, number line, positive, sum

Note to Teacher – Students should have attempted level 1 of the Warehouse puzzle before this lesson is implemented. Prior to implementing this lesson, the teacher should set up a masking tape number line on the floor with eleven equally spaced tick marks. The teacher should place the number zero (from the ***Number Signs***) in the center of the masking tape

number line.

During the implementation of this lesson, it is recommended that the ***Interactive Resources*** be projected to encourage a rich and active discussion of math strategies and concepts.

Activities:

1. After students have played level 2 of the Warehouse puzzle, have them share their experiences and strategies.
2. Pose the following questions: What is a negative number? *(a number less than zero)* When, in our real lives, do we encounter negative numbers? *(answers will vary but may include temperature, sea level, a checking account balance)*
3. Turn the students' attention to the number line that has been taped onto the floor. Distribute the ***Number Signs*** to 10 students and ask them to place them in the proper place on the number line. Distribute the blank ***Number Line*** and have students fill in the appropriate numbers. Have students make observations about the number line. (*Some observations may include that positive and negative integers are mirrored around the zero and that the numbers are equally spaced.)*
4. Display the ***Thermometer***. Present the following scenario:

    - Imagine that the temperature in the morning is -2˚ F and then over the course of the day, the temperature goes up 7 degrees. Ask students: What is the new temperature? *(Have students* use the ***Thermometer*** to start at -2˚ and add 7. *The new temperature is 5˚* F.)
    - With students, write a math sentence to describe the increase in temperature? *(-2 + 7 = 5)* Ask a student to turn the thermometer horizontally and ask: What does the thermometer now look like? *(a number line!)* Explain to students that number lines can be used to add integers just as the thermometer was.

5. Choose a student to use the floor number line to solve the problem -3 + 2. (Have the student begin by standing on the number -3.) Students can follow along using their blank ***Number Line***.
6. Have the student explain their movement on the floor number line. *(When they are adding 2, they will go to the right 2 steps because adding 2 is an increase which means they move in the positive direction.)* Have students note that after taking 2 steps the student has ended up on -1.
7. Have another student use the floor number line to solve the problem 4 + -6. Have the volunteer explain their movement on the floor number line *(Student should begin on the 4, and go to the left 6 because they are moving in a negative direction.)*
8. Write -1 + -4 on the board and have students "act out" the answer. *(Direct students to notice that they start on -1 and move to the left 4 units, so -1 + -4 = -5.)*
9. Have volunteers act out additional examples by choosing numbers that can be done using the number line.
10. Display the ***Number Line Examples.*** Discuss the examples with the class to ensure that students understand how to use the number line to find the sums.
11. Using ***Finding Sums of Integers***, have students work in teams to solve the addition

problems. Have teams compare answers.

12. Facilitate a discussion about how finding the sum of two integers when both have the same sign is different from finding the sum of two integers when one is positive and one is negative. Ask the students to explain how to determine the sum (*Find the difference between the absolute values - note that students will not use the absolute value concept in their description*) and how to determine the sign of the sum (*Sign matches integer with greater absolute value.*)
13. Using ***Interactive Resource 1***, ask students to relate their puzzle play experience to discuss how the gates and resonators work. *(If two resonators are placed on the left side of the gate, the force exerted by the gate is the sum of the two resonators and moves the creature to the right. This corresponds to adding two positive integers. If two resonators are placed on the right side of the gate, the force exerted by the gate is the sum of the two resonators and moves the creature to the left, corresponding to adding two negative integers. If two resonators are placed on opposite sides of the gate, the force exerted by the gate is the difference between the two resonators, with a positive difference moving the creature to the right and a negative difference moving the creature to the left, corresponding to finding the sum of one positive and one negative integer)*
14. As students view ***Interactive Resource 1***, have them make a list of the distances that the creature must be sent from gate 1 to gate 2, gate 2 to gate 3 and so on. Be sure to discuss with students that distances to the right should be labeled positive distances and distances to the left should be labeled as negative. *(Gate 1 to Gate 2: +1; Gate 2 to Gate 3: -3; Gate 3 to Gate 4: +2; Gate 4 to Gate 5: + 8; Gate 5 to final receptor: +)*

12. Direct students' attention to the first and second gates. Ask students: How many units away is the second gate from the first? *(1 spot to the right, or +1)* What are the possible resonator placements that will move the creature over to the right 1 unit? *(4 + -3, 4 on the left and 3 on the right, 3 + -2, 3 on the left and 2 on the right, or 2 + -1, 2 on the left and 1 on the right).*
13. Have students work together to identify possible resonator combinations for each of the other gates. *(Gate 2 to Gate 3: 1 + -4 or -1 + -2; Gate 3 to Gate 4: 1+ 1; 4 + -2; 3+ -1; Gate 4 to Gate 5: 4 + 4; Gate 5 to exit: 4+ -3; 3 + -2; 2+ -1)*
14. Have students take a look at the whole screen and their list of possible resonator combinations. Ask students: Does it make sense to work on this gate first? *(No, because there are a lot of possible options and it would just be a guess as to which combination to use).* How can we decide which of the combinations to use? *(Look at the distances of all of the gates from each other and get a sense of which resonator numbers need to be more plentiful and also determine whether there are any gates with only one possible solution.)* What problems could arise if we pick the wrong combination of charges? *(For example, if you select 2 + 2 when it should be 1 + 3 to represent a positive 4 charge, you may diminish your supply of #2 resonators and not have the necessary resonators to complete the rest of the plan).*
15. Work with students to strategize possible combinations of resonators.

    - Say: *Going from gate 1 to 2, there are 3 possible combinations of resonators.*

Ask: Are there any gates which have fewer than 3 combination options? *(Yes, going from gate 4 to 5 requires a resonator force to push the creature 8 units to the right. The only way to get there is by using 4 + 4, or two 4 resonators on the left side of the gate)*

- Say: By solving this gate with only one solution, there are no more #4 resonators left. Next, it would be good to take a look at the 2nd gate and what it will need in order to move the creature to the third gate, 3 spots to the left. Originally, there were two options for this, 1 + -4 or -1 + -2. Now that the #4 resonators are all used up, the only possible option is -1 + -2 which means placing both the 1 and 2 on the right side of the gate.

16. Have the students work with a partner to figure out the placement of the remaining resonators on the gates. Display ***Interactive Resource 1 Answers*** for students to compare their placements with the Resource.
17. Using ***Interactive Resource 2,*** have students determine the placement of all 10 resonators on the gates. Encourage students to make a list of possible resonator combinations for each gate before assigning resonators.

Differentiation Suggestions:

- For students having difficulty using the number line to add integers, provide them bi-colored chips to represent positive and negative integers. Distribute about 20 bi-colored chips and discuss the ***Adding Integers with Chips Sample***. Provide the students with several more examples. Then have them complete the ***Finding Sums of Integers*** using the chips.
- After using the number line to aid in adding integers, have students write general rules for adding and subtracting integers too large or too small to fit on the sample number line, for example, -14 + 35.
- Ask the students who are interested in football to describe how a football field is similar to and different from a number line. Have students create integer addition and subtraction problems incorporating football.
- Students who have mastered these concepts should be asked to find sums of more than two integers using ***Finding Sums Part 2***. They may work with a partner to determine rules for finding these sums.

Assessment

- Distribute ***Assessment*** resource sheet.

Answers:

1. 2

2. Part A: 5˚ Part B: ¯1˚

Follow Up:

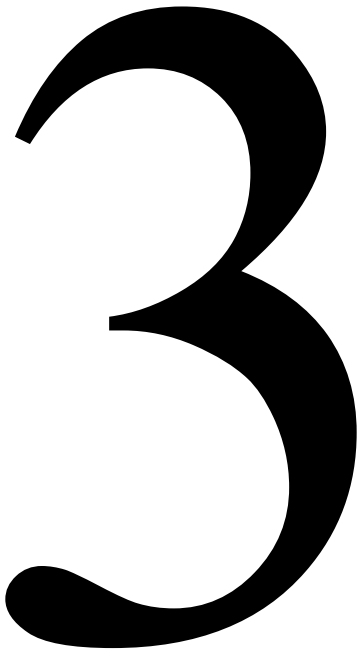
- Have students return to the puzzle to apply what they learned in the lesson. Ask: Did the lesson help you to clarify the math in the puzzle? How so? What other strategies could you have used to help you solve the puzzle? Additionally, check teacher stats in the game to determine students' level of understanding.
- Distribute ***Sea Level Problem*.** Have students create their own word problem using this illustration. Then, have the students exchange their problem with a partner to solve.

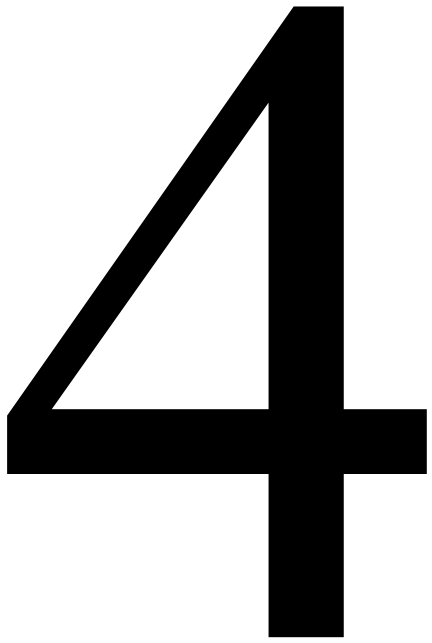
Real World Connection:

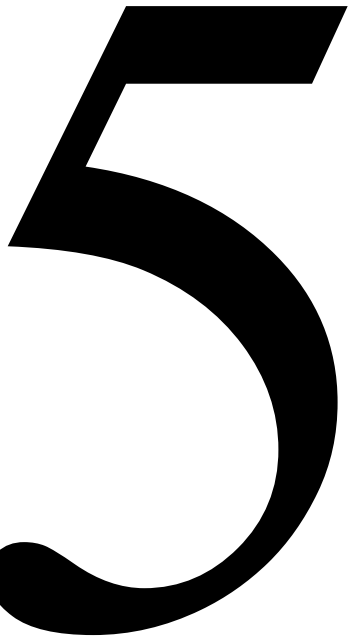
- Have students play ***The Accounting Game.*** Distribute ***The Accounting Game*** and a pair of scissors. During this game, the students will keep a running total of their account balance. (*At the end of the game, the account balance will be $0.*)

1

2







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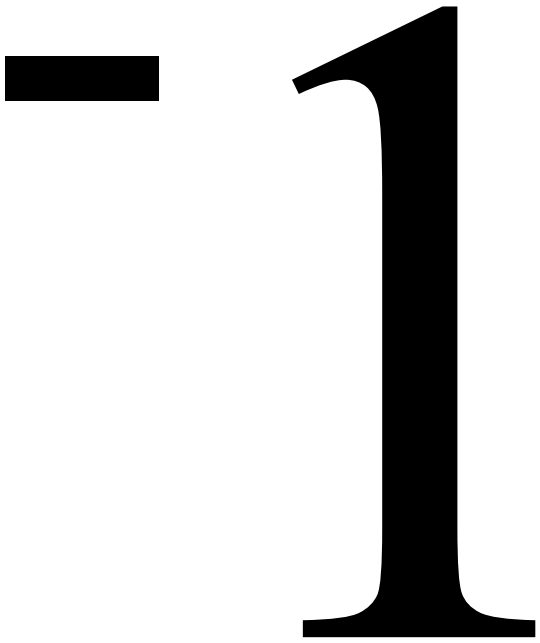
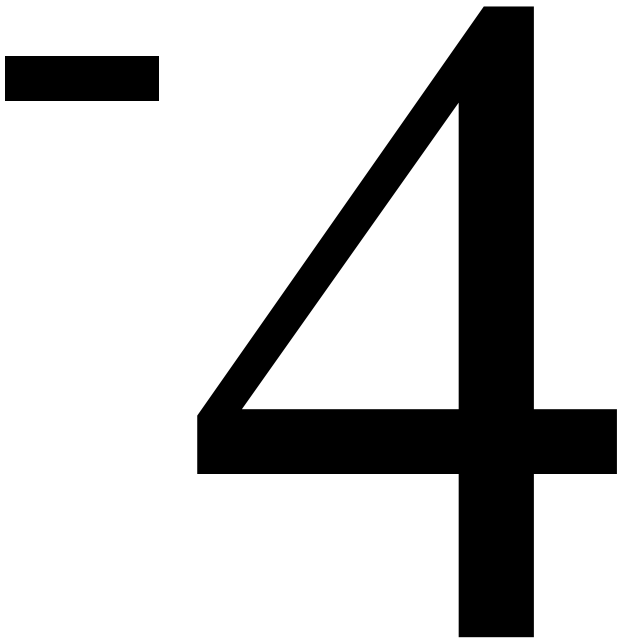
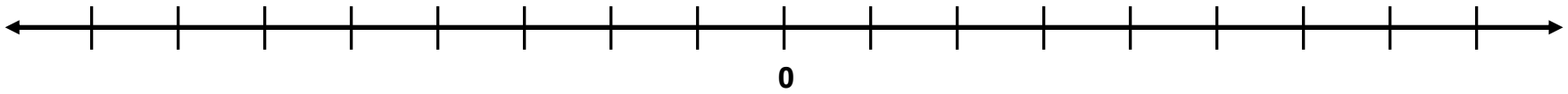
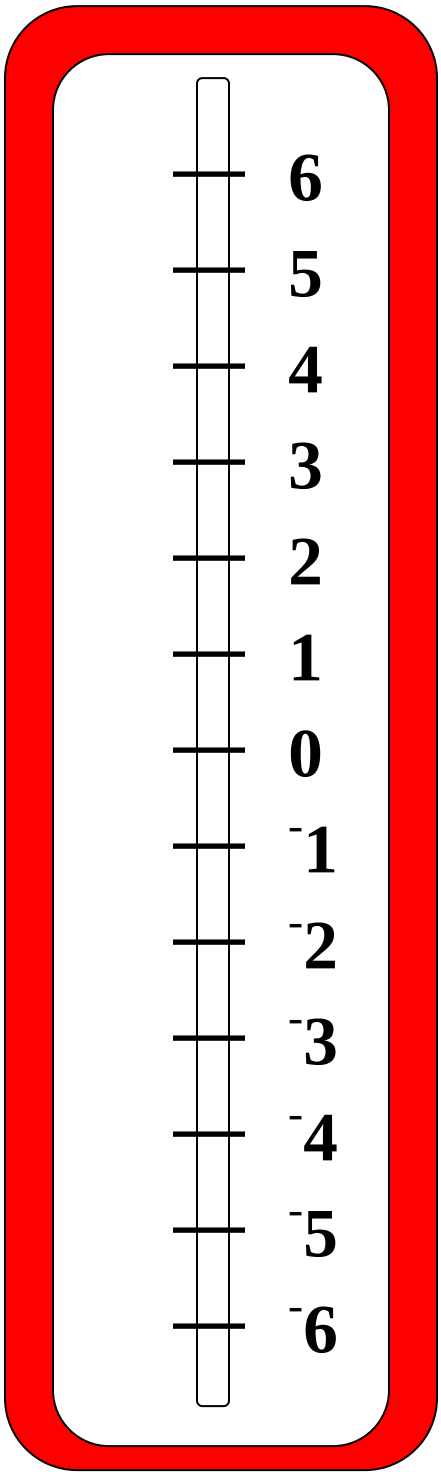




Number Line



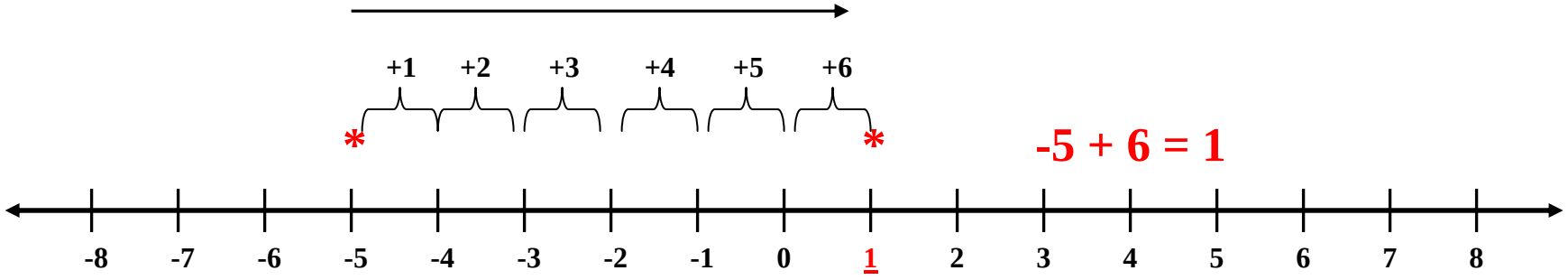
Thermometer



Number Line Examples

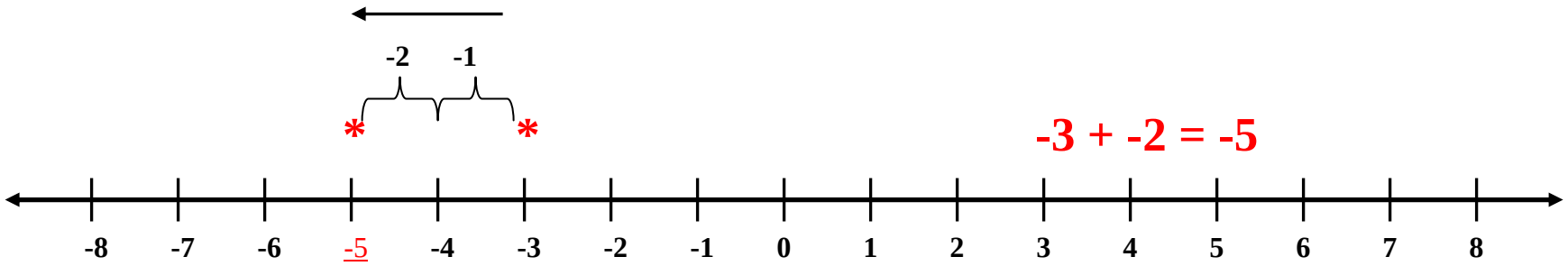
Example 1: -5 + 6 = ?

Start at the first number: -5
Then, go to the right 6 spots because you are adding six.

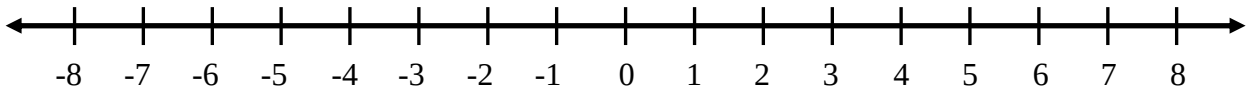


Example 1: -3 + -2 = ?

Start at the first number: -3
Then, go to the left 2 spots because you are moving in the negative direction two units.



Finding Sums of Integers

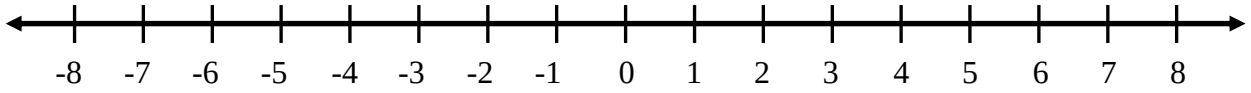


1. -7 + 6 =
2. 5 + -8 =
3. -4 + -4 =
4. -2 + 9 =
5. 1 + 5 =
6. -1 + -6 =
7. -4 + 11 =
8. 8 + -10 =
9. 7 + -4 =
10. -8 + 15 =

Challenge:

1. -5 + -9 =
2. 12 + -15 =
3. -10 + -4 =
4. 6 + 9 =
5. -14 + 20 =

Finding Sums of Integers Answers



1. -7 + 6 = *-1*
2. 5 + -8 = *-3*
3. -4 + -4 = *-8*
4. -2 + 9 = *7*
5. 1 + 5 = *6*
6. -1 + -6 = *-7*
7. -4 + 11 = *7*
8. 8 + -10 = *-2*
9. 7 + -4 = *3*
10. -8 + 15 = *7*

Challenge:

1. -5 + -9 = *-14*
2. 12 + -15 = *-3*
3. -10 + -4 = *-14*
4. 6 + 9 = *15*
5. -14 + 20 = *6*

Interactive Resource 1

Interactive Resource 1 - Answers

Interactive Resource 2

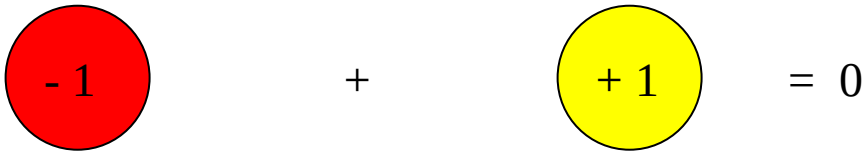
Interactive Resource 2-Answers

Lesson Plan
Warehouse Grade 7 Adding Integers
Adding Integers with Bi-Color Chips
Sample

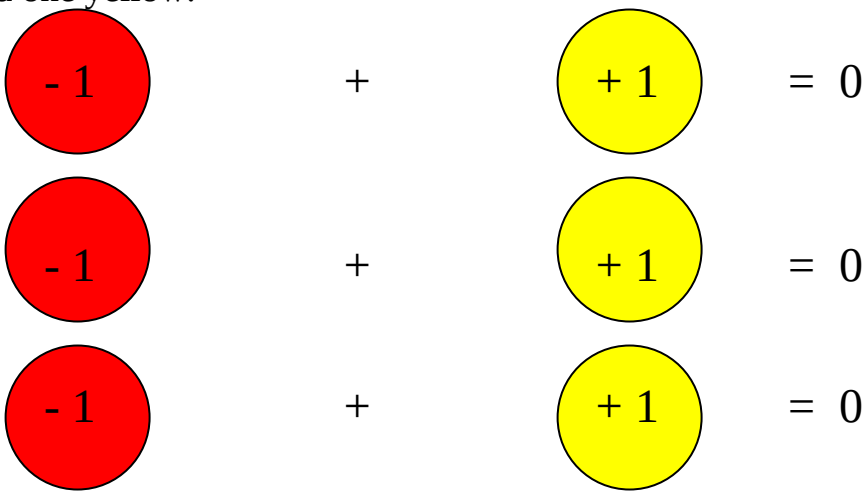
Example: -5 + 3 = ?

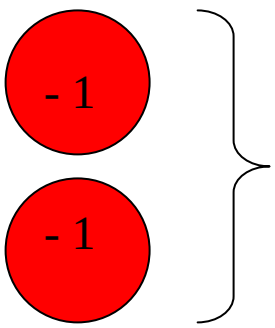
Assign one side of the chip to equal positive one (+1) and the other side to equal negative one (-1)

When you combine one red chip (+1) and one yellow chip (-1) you end up with zero.



Use the chips to represent the problem, then group the chips in pairs of one red chip and one yellow.





Two red chips are left over so -5 + 3 = - 2

Finding Sums Part 2

1. -3 + -5 + -2 =

2. 4 + -8 + -3 =

3. -2 + 6 + -1 =

4. 12 + -8 + -2 =

5. -9 + -1 + -3 + -6 =

6. -8 + -2 + 6 + 4 =

7. 5 + -7 + 2 + -8 =

8. -2 + 3 + 9 + -5 =

9. -12 + 16 + -2 + 12 + -9 =

10. 14 + -11 – 7 + -4 + -3 =

Finding Sums Part 2 Answers

1. -3 + -5 + -2 = *-10*

2. 4 + -8 + -3 = *-7*

3. -2 + 6 + -1 = *3*

4. 12 + -8 + -2 = *2*

5. -9 + -1 + -3 + -6 = *-19*

6. -8 + -2 + 6 + 4 = *0*

7. 5 + -7 + 1 + -9 = *-10*

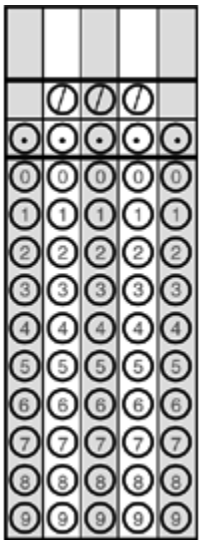
8. -2 + 3 + 9 + -5 = *5*

9. -12 + 16 + -2 + 12 + -3 = *11*

10. 14 + -11 + 7 + -4 + -3 = *3*

Assessment

1. -6 + 8 = ?

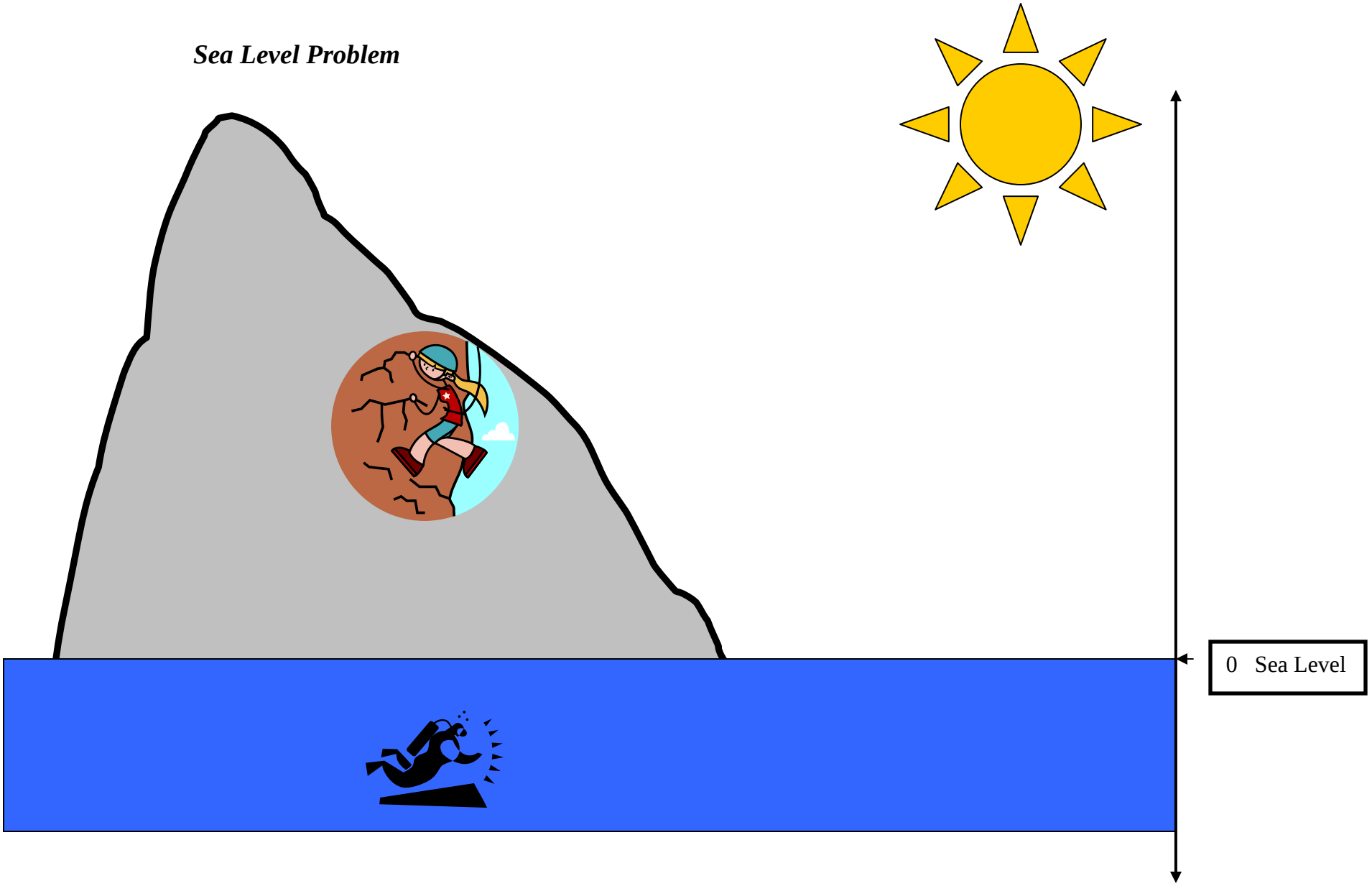


2. When Sam woke up, the temperature was -3˚ F. By lunchtime, the temperature had increased by 8˚. By the time Sam arrived home from school at 3:00 PM, the temperature had increased by 1˚. By the time Sam went to bed at 10:00 PM, the temperature had fallen 7˚.

    a. What was the temperature at lunchtime?

    b. What was the temperature at 10:00 PM when Sam went to bed?

Sea Level Problem



The Accounting Game

Scenario: At the beginning of this game, you have a bank account balance of **$15.**

Directions:

1. Cut out the action cards below. Mix them up and place them face down in front of you.
2. Draw one card at a time and keep a running balance.
3. **Please note**: Your bank will allow you to withdraw more money than is in your account. If you do take more money out of your account than you have in it, it will result in a negative balance.

You deposit $8 into your bank account.	**You take $6 out of your account to buy a snack.**
You take $7 out of your account to buy books.	**You take out $10 from your account to go to the movies.**
You find $1 on the sidewalk and deposit it into your account.	**You take $3 out of your account to pay a library fine.**
You deposit the $10 your neighbor gave you for helping her with yard work.	**You take $8 out of your account to pay for the class field trip.**