# Operations with Integers

**Strand:** Computation and Estimation

**Topic:** Add, subtract, multiply, and divide integers

**Primary SOL:** 6.6 The student will
a) add, subtract, multiply, and divide integers;*

**Related SOL:** 6.6b, 6.6c

**Materials**

- Red and yellow chips (small squares of red and yellow construction paper or another manipulative can be used)
- Graphic Organizer: Addition (attached)
- Integer Addition activity sheet (attached)
- Graphic Organizer: Subtraction (attached)
- Integer Subtraction activity sheet (attached)
- Integer Multiplication and Division activity sheet (attached)
- Graphic Organizer: Multiplication and Division (attached)
- Integer Multiplication Chart activity sheet (attached)
- Red and yellow colored pencils

**Vocabulary**

*absolute value, integer, inverse, inverse operation, operations, zero pairs* (6.6, 6.3)

**Student/Teacher Actions: What should students be doing? What should teachers be doing?**

**Addition and Subtraction of Integers**

1. Give each student an Integer Addition activity sheet and some red and yellow chips. Establish that the red chips will represent negative numbers and the yellow chips will represent positive numbers. Help all students understand that one yellow chip and one red chip put together represent a value of zero.
2. Use the chips to model how to solve the first problem on the Integer Addition activity sheet. Have students use their chips and their activity sheets to complete the same steps. Next, model how to represent the chips in pictorial form. Have students draw the same representation.
3. Place students in groups of two, and ask them to finish the activity sheet.
4. When students have completed the activity, give each student a blank graphic organizer. Ask students whether they see any patterns in the problems. As they recognize the rules in the algorithm for addition of integers, list them on the board. A graphic organizer may be used to represent the algorithm.
5. Give students additional problems for practice.
6. Give each student an Integer Subtraction activity sheet and some red and yellow chips. Establish that the red chips will represent negative numbers and the yellow chips will represent positive numbers. Help all students understand that one yellow chip and one red

chip put together represent a value of zero. Zero pairs will have to be added for students to complete the problems.

7. Use the chips to model how to solve the first and second problems on the Integer Subtraction activity sheet. Have students use their chips and their activity sheets to complete the same steps. Next, model how to represent the chips in pictorial form. Have students draw the same representation.
8. Place students in groups of two, and ask them to finish the activity sheet.
9. When students have completed the activity, give each student a blank graphic organizer. Ask students whether they see any patterns in the problems. As they recognize the rules in the algorithm for subtraction of integers, list them on the board. A graphic organizer may be used to represent the algorithm.
10. Give students additional problems for practice.

**Multiplication and Division of Integers**

1. Give each student an Integer Multiplication and Division activity sheet and some red and yellow chips. Establish that the red chips will represent negative numbers and the yellow chips will represent positive numbers.
2. Use chips to model how to multiply $4 \cdot 3$. Students should be using their chips to complete the same steps. Next, model how to represent the chips in pictorial form. Have students draw the same representation in their box on the activity sheet.
3. Model how to multiply $4 \cdot -3$, using chips. Students should be using their chips to complete the same steps. Next, model how to represent the chips in pictorial form. Have students draw the same representation in their box. Lead a discussion about the product.
4. Place students in groups of two and ask them to complete Chart 1 on the Integer Multiplication and Division activity sheet. Lead a discussion on the pattern occurring in the chart.
5. Have each group complete Chart 2. The first part of the chart can be completed from chart 1. Direct students to finish the rest of the chart by continuing the pattern. When students have completed the chart, lead a discussion about the product. As students begin to formulate the algorithm for multiplication with integers, list the rules for the algorithm. A graphic organizer can be used. A sample organizer has been included.
6. Give students additional problems for practice.
7. Facilitate a discussion about related facts or "fact families." Have students use the multiplication charts to complete Chart 3. Discuss the results of the chart. Continue in the same manner to complete Chart 4.
8. When students have completed the activity, discuss the pattern. List the rules for the algorithm. A graphic organizer can be used. A sample organizer has been included.
9. Give students additional problems for practice.
10. Give students the Integer Multiplication Chart activity sheet to complete.

**Assessment**

- **Questions**
  - How do you add two integers if they have the same sign?
  - How do you add two integers if they have different signs?

    - How do you subtract integers?
    - How are the rules for multiplying and dividing integers different from the rules for adding and subtracting?
    - When multiplying or dividing integers, how do you know what the sign of your answer will be?
    - When you multiply three positive integers, what sign does the product have? Is this the same if you multiply three negative integers? Give an example to prove your answer.
- **Journal/Writing Prompts**
    - Describe how to model addition of integers using two-color counters.
    - Describe how to model addition of integers using a number line.
    - Describe how to model subtraction of integers using two-color counters.
    - Describe how to model subtraction of integers using a number line.
    - Describe how to model multiplication of integers using two-color counters.
    - Describe how to model multiplication of integers using a number line.
    - Describe how to model division of integers using two-color counters.
    - Describe how to model division of integers using a number line.
    - Explain how to determine the sign of the product if the multiplication problem contains more than two factors.
- **Other Assessments**
    - Ask students to create four multiple-integer-operations problems on an index card. One of the problems must use a concrete representation, the second a pictorial representation, the third a number line, and, lastly, an algorithm. Allow the students to engage in a "give one, get one" exchange to solve one another's problems. Then, allow the students to present at least one of their problems to the class for whole group discussion.
    - Have students create posters to explain how to multiply and divide integers. Examples should be included.

**Extensions and Connections (for all students)**

- Use dynamic software to model integer operations using two-color counters, number lines, or algebra tiles.
- Use the newspaper or an internet search to find examples of addition and subtraction of integers.
- Place students in small groups, and have them use decks of cards and play War. Black cards are positive; red cards are negative. Each student flips two cards and finds the sum. The student with the higher sum wins the round.

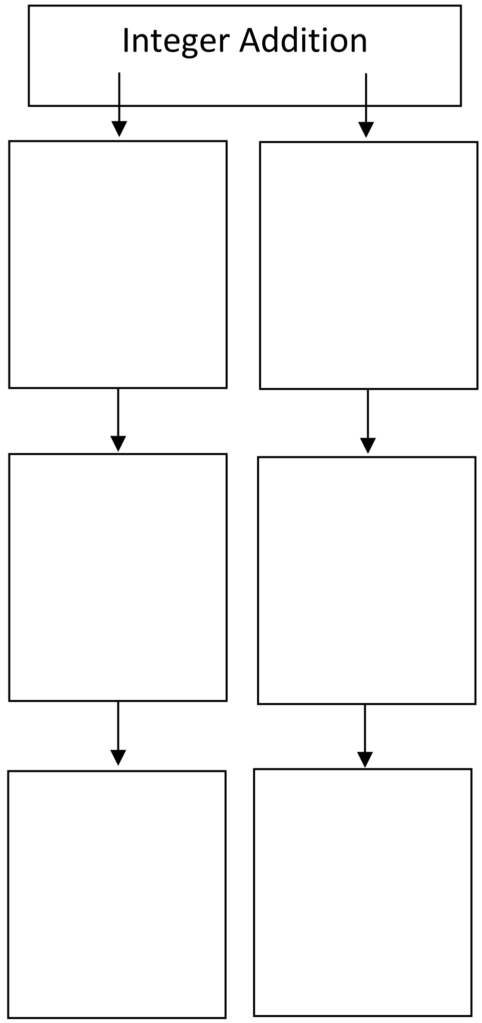
**Strategies for Differentiation**

- Use a number line to determine the sum or difference. Create a large number line on the floor with tape. Students can walk the number line to solve the problem.
- Preteach vocabulary to certain students as necessary.

- Provide scaffolding for some students in which the graphic organizers have a completed example to use as reference.
- Use a coordinate grid instead of a multiplication chart for the Integer Multiplication Chart activity.
- Draw the representations of red and yellow chips.

**Note: The following pages are intended for classroom use for students as a visual aid to learning.**

**Graphic Organizer: Addition**



## Integer Addition

**Name** ______________________________________ **Date** _______________________

Use red and yellow chips to solve each problem. In the box, draw a picture of your solution and justify your reasoning.

$-5 + 3 =$ ________________

$6 + 2 =$ _____________

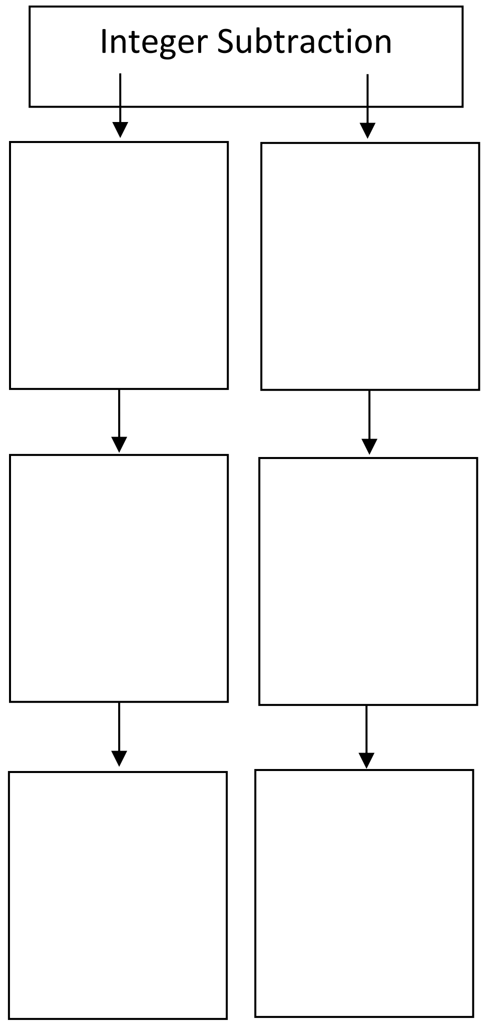
$-3 + -4 =$ _______________

$-2 + 5 =$ ___________________

$9 + -4 =$ _________________

$3 + -7 =$ ____________________

## Graphic Organizer: Subtraction



# Integer Subtraction

**Name ___________________________________ Date ______________________**

Use red and yellow chips to solve each problem. In the box, draw a picture of your solution and justify your reasoning.

8 − 2 = _____________

1 − (−5) =________________

−7 – (−3) = _______________

−4 − 3 = ___________________

– (−4) = ________________

−2 − 6 = ____________________

# Integer Multiplication and Division

**Name** ____________________________________ **Date** ______________________

Model $4 \cdot 3$

Model $4 \cdot (-3)$

Complete the charts.

**Chart 1**

| | |
|---|---|
| $4 \cdot 3 =$ | |
| $4 \cdot 2 =$ | |
| $4 \cdot 1 =$ | |
| $4 \cdot 0 =$ | |
| $4 \cdot -1 =$ | |
| $4 \cdot -2 =$ | |
| $4 \cdot -3 =$ | |

**Chart 2**

| | |
|---|---|
| $-4 \cdot 3 =$ | |
| $-4 \cdot 2 =$ | |
| $-4 \cdot 1 =$ | |
| $-4 \cdot 0 =$ | |
| $-4 \cdot -1 =$ | |
| $-4 \cdot -2 =$ | |
| $-4 \cdot -3 =$ | |

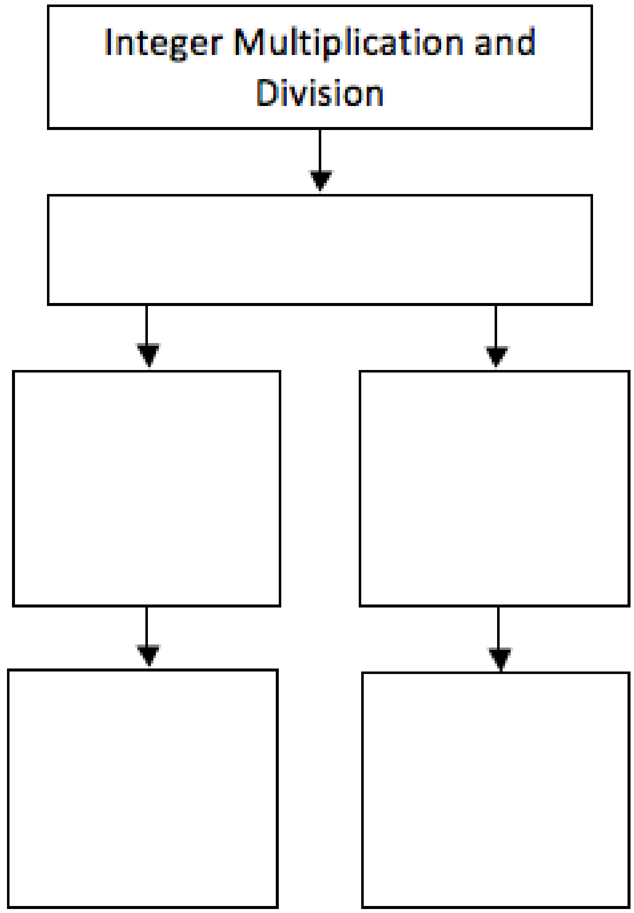
**Chart 3**

| | |
|---|---|
| $12 \div 4 =$ | |
| $8 \div 4 =$ | |
| $4 \div 4 =$ | |
| $0 \div 4 =$ | |
| $-4 \div 4 =$ | |
| $-8 \div 4 =$ | |
| $-12 \div 4 =$ | |

**Chart 4**

| | |
|---|---|
| $-12 \div 4 =$ | |
| $-8 \div 4 =$ | |
| $-4 \div 4 =$ | |
| $0 \div 4 =$ | |
| $-4 \div -4 =$ | |
| $-8 \div -4 =$ | |
| $-12 \div -4 =$ | |

## Graphic Organizer: Multiplication and Division



## Integer Multiplication Chart

**Name** ________________________________ **Date** ______________________

Complete the chart.

| | –4 | –3 | –2 | –1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|
| 4 | | | | | | | | | |
| 3 | | | | | | | | | |
| 2 | | | | | | | | | |
| 1 | | | | | | | | | |
| 0 | | | | | | | | | |
| –1 | | | | | | | | | |
| –2 | | | | | | | | | |
| –3 | | | | | | | | | |
| –4 | | | | | | | | | |

If both factors are positive, color the product **red**.

If both factors are negative, color the product **blue**.

If one factor is positive and one factor is negative, color the product **green**.

☐ Both factors are positive.

☐ Both factors are negative.

☐ One factor is positive; one factor is negative.