

Activity name: Math modeling unit and activities

- **Big Idea(s)/ Concept(s)/major math area(s): Integers and the Application of Integers**

Day 1: What is an integer?

Where are they found?

How do we represent integers?

Defining what negative means in math?

- **Grade level(s): 6**
- **Duration: 10 days**

Indiana State Standards:

6.NS.1: Understand that positive and negative numbers are used to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge). Use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.2: Understand the integer number system. 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.

Procedure overview/ teacher directions

Day 1

Day 1- Integer Elevator Activity

Lesson details, expected timing, including:

**Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

(5 minutes) Bell Ringer for students:

If you were on the ground level of a building and went up 10 floors on the elevator, down 5 floors, then up 5 floors, what floor are you on?

Students will individually work on this question to lead to a class discussion.

Part 1 Initial whole group discussion - setting the scene

(10 minutes) The entire classroom will discuss the opening questions

Students will not tell the answer until the end of the discussion.

5 minutes: Students separate into groups of 2-4 people to begin discussing the lesson.

Have your group draw a diagram to illustrate and solve for a mathematical solution for the bell ringer.

What's the same, and what's different about your board and others boards?

Explain how you arrived to your answer.

Instead of saying floors up and floors down, how else can I describe the movement of the

numbers?

Students may or may not know that the numbers can be described as negative or positive. At this time, introduce the term positive and the term integer.

What number does the ground level represent?

Are there other pairs of moves that would get me back to floor 10?

Why did you arrive back at floor 10?

What kind of change do these pairs represent?

Why did those pairs give us no change?

*Make a note that the symbol for zero was mentioned as having no change

Part 2 Student group activity/pre-activity (with/without whiteboard)

Whole group discussion of part 1 activity - conclusions to be drawn from discussions about activity - these may be only qualitative or just introducing the “big ideas” - being developed by the students, with teacher guidance.

Group Activity- Groups of 4

(8 minutes)What would happen if you start at 10, go down 5, and down 7?

How does this change your picture?

A scaffolding question: what floors are added to our building?

What role does zero play?

Positive numbers, negative numbers, and zero are called integers and 0 is neither positive nor negative.

Part 3 Student group activity (with/without whiteboard)

Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s); conclusions to be drawn from discussions.

Students will answer these questions independently

5- 10 Start at floor zero, list the moves you would make to...

- A. Move positive 4 floors and end up on floor 2
- B. Move negative 3 floors, but end on floor 4.
- C. Move negative 11 floors, but end up on basement floor 2.

Part 4 Student group follow-up activity.....etc - there might be several of these, as the topic is extended in the unit...

Students will begin a running concept map for integers.

Part 5 Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Student reflection: Tri-fold foldable style

3 things I learned about integer

2 observations about zero

1 question I would like to ask the class about integers

Day 2- Adding Integers

Lesson details, expected timing, including:

**Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

(5 minutes) Bell Ringer for students:

Looking at the thermometer on the board, how does it compare to the elevator we've been using? If the temperature is currently 4 degrees, and it drops 6 degrees, what temperature will the thermometer show?

Part 1 Initial whole group discussion - setting the scene

(20 minutes)

What can we add to our description of "negative" and "positive" numbers?

Students will begin a describing how math can be a description or a value

Part 2 Student group activity/pre-activity (with/without whiteboard)

Whole group discussion of part 1 activity - conclusions to be drawn from discussions about activity - these may be only qualitative or just introducing the "big ideas" - being developed by the students, with teacher guidance.

Group Activity- Students will be given colored chips to illustrate 0, 2, and 5. The yellow chips represent positive and the red chips represent negative.

Represent zero using the colored chips 3 different ways.

Represent two using the colored chips 3 different ways.

Represent five using the colored chips 3 different ways.

Gallery walk after students illustrate their models on their whiteboard.

Are there any changes that need to be made for the board?

Part 3 Student group activity (with/without whiteboard)

Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s); conclusions to be drawn from discussions.

Whole class discussion. Teacher uses the doc camera to work through examples with the students. Students will process out why the picture makes sense and how the model represents what the students need to know. Students will make any revisions to their board to make sure they have fully conceptualized the concept.

Students will then represent -5 using the colored chips three different ways.

How does your picture change and what does the negative symbol tell us about the integers?

Students will then connect numbers to their illustration of the colored chips.

After students have illustrated the numbers with the diagram, students will be asked to pick two problems and asked if any of the problems can be rewritten and how.

Part 5 Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Model or reason $-30 + 70$ for homework

Extend concept map ideas

Day 3- Extension of adding integers

Lesson details, expected timing, including:

**Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

Bell Ringer for students:

Video of diving coaster: Vanish!

The rollercoaster drops 115ft to the surface of the water then drops 30ft before heading back up. How far did the coaster drop altogether?

Part 1 Initial whole group discussion - setting the scene

Socratic discussion of $-30 + 70$ from day 2 homework

Need to see that we are subtracting and we know that we use signs of whatever has more

Do these ideas work with the roller coaster problem?

Do the same ideas work with the rollercoaster project at the beginning of class?

Explore what happens when signs are the same:

Examples:

$$3 + 7$$

$$-3 + -7$$

Describe any observations or patterns

Take $3+7$ and $-3+7$ and illustrate using the elevator examples from the day before

- Students will be asked to write an addition problem using what they know about integers and illustrate to the classroom. Students will first work on the problem with their peers then each group will write their questions on the board

Example

- $-3+7$
- Students will then reverse the order of the problem.
- Discussion about what patterns we noticed when adding positive numbers?
 - Are there more positives than negatives?
 - Are there more negative than positives?

Is the answer greater or lesser than any of the two integers? How about if the signs are the same for the problems?

Reflection in class: What are the methods we used for answering addition integers?

Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Reflections

Exit ticket:

Answer and explain

$$-5+4+2$$

Day 4- Integer Elevator Activity**Lesson details, expected timing, including:****Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

(5 minutes) Bell Ringer for students:

A diagram of a number line, starting at zero and ending at 50, will be given.

Starting on the 20 yard line, the team completes a pass for a gain of 8 yards. On the next play the runner loses 3 yards. What yard line is the ball on?

Write the problem and using an illustration and be ready to explain

Part 1 Initial whole group discussion - setting the scene

*Make a note that the symbol for zero was mentioned

Question to the class:

What can we add to our description of positive and negative numbers

Part 2 Student group activity/pre-activity (with/without whiteboard)

Use a model with the colored chips to illustrate:

- a. $3-2$, then explain your reasoning
- b. $3-2$, then explain your reasoning

Part 3 Student group activity (with/without whiteboard)**Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s); conclusions to be drawn from discussions.**

What addition problems can we create that use similar amounts and the same answer?

Next students will be asked the following question:

- c. $3- -2$, Can you solve using a model 2 ways?

How can we use the elevator model in this problem?

What does negative mean? To change direction or do the opposite

Students will practice these concepts using the number line or the elevator/floor exercises to create problems to enrich their understanding of negative numbers.

Part 4 Student group follow-up activity.....etc - there might be several of these, as the topic is extended in the unit...

Part 5 Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Exit ticket:

Now that you have added and subtracted integers, explain 2 differences and 2 similarities.

Students will continue adding to their diagram

Brief summary of how this unit fits into year's curriculum and storyline (e.g preceding and post activity/units) [This could go at the beginning of the description].

Day 5- Integer Elevator Activity

Lesson details, expected timing, including:

**Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

Part 1 Initial whole group discussion - setting the scene

Joe mows lawns and earned \$11. He owes his dad \$30. If Joe gives his lawn money to his dad, does Joe still owe his father or does he have money left over? Explain your answer.

Group questions: What does the problem add to our picture of positive and negative numbers

This is the opportunity for the teacher to make connections between “earned” and positive and “owed” and negative.

Was subtracting valid to find 19?

(Yesterday's activity we got 4 from $-3+7$)

Part 2 Student group activity/pre-activity (with/without whiteboard)

Part 3 Student group activity (with/without whiteboard)

Station Work:

A) Extension (word problems)

Pick 3 random numbers and create integer word problem

B) Remediation- white boards and helium balloons exercise with teacher

C) Football integer game (google search for ideas)

D) Flip cards- subtract (memory game)

E) Choose 5 integers and write as a description on a card

Example: “-2” Move two floors down

Arranging the cards as a matching game

Part 5 Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Day 6- Integer Elevator Activity

Lesson details, expected timing, including:

Pre and post activities (student preconceptions, pre-knowledge etc);

teacher introduction to activity; guidance to students; math vocabulary

pre-discussion (usually whole group)

(5 minutes) Bell Ringer for students:

Illustrate two different ways $-3+4$ and $-3-4$ and explain

Part 1 Initial whole group discussion - setting the scene

Students will describe the following problems and model the problems using the whiteboards and the colored chips.

1. $2 \cdot 3$

2. $2 \cdot -3$

3. $-2 \cdot 3$

The deployment activity would be for students to work independently on the following problem:

$-2 \cdot -3$

Part 2 Student group activity/pre-activity (with/without whiteboard)

Students will draw a number line to illustrate how to solve the problems.

$2 \cdot 3$

$2 \cdot -3$

$-2 \cdot 3$

$-2 \cdot -3$

Part 3 Student group activity (with/without whiteboard)

Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s); conclusions to be drawn from discussions.

The teacher will

Part 4 Student group follow-up activity.....etc - there might be several of these, as the topic is extended in the unit...

Reflections

What did we observe when multiplying integers?

How can we use what we have observed to solve:

a. $-5 \cdot 4$

b. $-6 \cdot -2$

c. $13 \cdot -7$

Day 7- Integer Elevator Activity

Lesson details, expected timing, including:

**Pre and post activities (student preconceptions, pre-knowledge etc);
teacher introduction to activity; guidance to students; math vocabulary
pre-discussion (usually whole group)**

Bell Ringer:

Rewrite each as division problems

a. $2 \cdot 3 = 6$

b. $-2 \cdot 3 = -6$

c. $2 \cdot -3 = -6$

d. $-2 \cdot -3 = 6$

How are the problems the same or different?

What patterns do you observe?

Part 1 Initial whole group discussion - setting the scene

Students will choose 2 division problems from the bell ringer. Illustrate each in 2 ways.

Students will explain what patterns they observed and present their models

Questions to ask:

Have we seen these patterns before?

Part 2 Student group activity/pre-activity (with/without whiteboard)

Use patterns to tell whether answers are positive or negative. Students will need to explain.

Students will have a break out session to flashcards with division problems

Ex: $-12 \div 2$, $15 \div -3$, $-8 \div -4$, etc.

Part 3 Student group activity (with/without whiteboard)

Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s); conclusions to be drawn from discussions.

Students will create a foldable to organize thoughts on something like

Part 4 Student group follow-up activity.....etc - there might be several of these, as the topic is extended in the unit...

Part 5 Final discussion (with/without whiteboard)

Generalizations, connections to other math topics, connections to real life

Exit ticket:

How would you solve $2(3 + -1) - (8 \div 4)$? Show your steps

Extension Activity:

Use meter stick and elevator idea to work with expand the concept from integers to irrational numbers.

An atom had protons and electrons (it also had neutrons but for the purpose of this problem we will ignore it)

Each proton has a charge of +1 and each electron has a charge of -1.

A calcium atom had 20 protons and 20 electrons

What is its charge overall and why? How do you know?

An oxygen atom has 8 protons and 8 electrons. What is its charge and why?

When Calcium and Oxygen get together, the Oxygen atom steals 2 electrons from the Calcium to create a calcium ion and an oxygen ion.

What is the charge of the calcium ion?

Illustrate with a model and explain.

What is the charge of the oxygen ion?

Illustrate with a model and explain.

Assessment activity:

Students will be given 4 addition, subtraction, multiplication and division integer problems for each operation used.

Students will answer all the problems but illustrate two of each.

Students will choose one of the following to write a word problem to represent the problem”

- a. $5 + -8$

b. $-12 + -2$

c. $3(-6)$

Things to think about:

Teaching students about cancelling out numbers

What does this add to our understanding of positive and negative number?

Making sure students list the equations

Make note when people labeling spaces and labeling lines

Keeping a journal to relate with other concepts

Before telling the students it's zero, ask was there any motion if I start at the ground level.

Up $\frac{4}{3}$ a ways up and $\frac{3}{2}$ of a way down

Such as fractions

Illustrate and write a mathematical solution

-Constructing

-Deploying