

# Hot Air Balloon Unit

## Objective

Introduce addition and subtraction of integers using a concrete model.

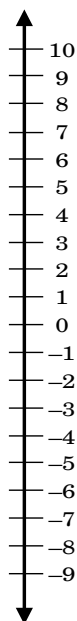
## Overview

During the Hot Air Balloon unit students use a hot air balloon and vertical number line to develop a conceptual understanding of addition and subtraction of integers. Students evaluate expressions involving addition, subtraction, positive and negative numbers using their balloon and vertical number without memorizing rules. During the unit students complete half 8 1/2 by 11 pages. The pages can be compiled into a booklet.

## Activities

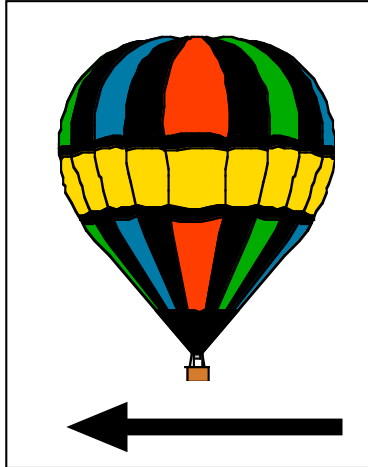
### Introducing the Model

- 1) Introduce the unit by talking about hot air balloons. Ask students what they know about hot air balloons. How do they fly? What makes them go up? How do they come down?
- 2) Have students draw a vertical number line on 1/4 inch graph paper. Students need to use the lines of the graph paper and number the vertical number line using three different colors, one for the positives, one for the negatives and a different one for the zero.



# Hot Air Balloon Unit

- 3) Give each student an index and tell them to draw a hot air balloon and an arrow.



- 4) Discuss with students what makes a balloon go up and what makes it go down. Gas makes the balloon go up and sand makes it go down.

Tell students: we are going to write bags of gas as positive numbers, for example 3 bags of gas will be expressed as +3; 10 bags of gas will be expressed as +10. Bags of sand will be negative numbers, for example 5 bags of sand will be expressed as -5; 7 bags of sand will be expressed as -7.

Hand out the page “What Happens when...” and complete it.

	What happens with the balloon when....	Mathematically
<b>Add Bags of Gas</b>	<b>Balloon Goes up</b>	<b>3 bags of gas = + 3</b> <b>10 bags of gas = + 10</b>
<b>Add Bags of Sand</b>	<b>Balloon Goes down</b>	<b>3 bags of sand = - 3</b> <b>10 bags of sand = - 10</b>

Have students put their number line on the their desk and their balloon on zero. Tell students: now you add 4 bags of gas show me what happens with your balloon. (the balloon moves up to +4). From there you will add five bags of sand show me what happens to the balloon, where does it finish. (the balloon goes down five to -1). Repeat this activity with several examples.

# Hot Air Balloon Unit

## Introducing Addition of integers

5) On the board, write the expression  $-3 + 6$ .

Tell students: the first number indicates where the balloon starts.

Ask: where will the balloon start in this example?" ( $-3$ ).

Ask: what does the "+" symbol mean? (add).

Tell students: the "+" symbol tells you that you will "add" something to the balloon.

Tell students: the number that follows the addition tells you what you are adding to the balloon: gas or sand.

Ask: what are you adding to the balloon in this example? (six bags of gas)

Ask: what will happen to the balloon if you add six bags of gas? (it will go up six)

Tell students: show me on your number line the balloon starting at  $-3$  and going up six.

Ask: where does it end? ( $+3$ )

Tell students: where the balloon stops is the answer to  $-3 + 6$

Ask: what is the answer of  $-3 + 6$ ? ( $+3$ )

Repeat with the following expressions:

$$\begin{array}{l} 4 + -7 \\ -3 + -5 \\ -2 + 9 \end{array}$$

Note: the questions are very important to help students make the connections between the model and the mathematical expressions.

# Hot Air Balloon Unit

6) Hand you the “Expression” page.

Write the expression  $7 + -9$  on the board.

Have students complete the “Expression” page as you ask them the following guiding questions:

Where does the balloon start? (7).

What does the “+” symbol mean? (add).

What are you adding in this example? (nine bags of sand)

What will happen to the balloon if you add nine bags of sand? (it will go down nine)

Where does the balloon finish? (-2 )

What is the answer of  $7 + -9$  ? (-2 )

Expression  
 $7 + -9$

The balloon starts at 7.

put on 9 bags of sand .  
put on/take off    number                    gas/sand

This makes the balloon go down 9 units.  
up/down

The balloon finishes at -2.

Represent the expression with a picture.

-2  
 Answer

7) Hand out one “Expression “ page for each problem and ask students to complete it for the following expression:

- ✓  $-2 + -5$
- ✓  $4 + -9$
- ✓  $-2 + 8$
- ✓  $-1 + -6$
- ✓  $-6 + 6$

# Hot Air Balloon Unit

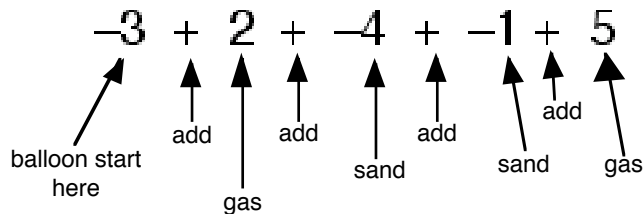
8) Hand out a blank piece of paper.

On the board write the expression “ $5 + -7 + -2 + 4$ ”.

Ask:       where does the balloon start? (5);  
              what do you do next? (add 7 bags of sand);  
              what happens to the balloon? (it goes down);  
              what do you do next? (add 2 bags of sand);  
              what happens to the balloon? (it goes down again);  
              what happens next? (add 4 bags of gas);  
              what happens to the balloon? (it goes up);  
              where does the balloon end? (0)

Have students write a sentence for each part.

Example:



The balloon starts at  $-3$ . Add 2 bags of gas. This makes the balloon go up to  $-1$ . Then add 4 bags of sand. This makes the balloon go down to  $-5$ . Then I add 1 bags of sand. This makes the balloon go down to  $-6$ . Then add 5 bags of gas. This makes the balloon go up to  $-1$ . The balloon finished at  $-1$ .

Next, students model on the number line what happens to the balloon.

Repeat this activity with three or four problems of this type.

# Hot Air Balloon Unit

## Introducing Subtraction of Integers

9) Ask students:

- what do you think happens to the balloon if you take away sand instead of adding sand? it goes up
- what do you think happens to the balloon if you take away gas instead of adding gas? it goes down

Have students show you on their number line what would happen if the balloon started at 6 and you take away 4 bags of gas. (it goes down 4) Repeat with several similar examples.

10) Hand out an “Expression” page to each student.

Write the expression  $2 - -3$  on the board.

Students complete the “Expression” page. To help make connections between the model and the mathematical expression ask the following guiding questions:

Where does the balloon start? (2)

What does the “-” symbol mean? (take away)

What are you taking away in this example? (three bags of sand)

What will happen to the balloon if you take away bags of sand? (it will go up 3)

Where does the balloon end? (5)

What is the answer of  $2 - -3$ ? (5)

# Hot Air Balloon Unit

Expression  
 $2 - -3$

The balloon starts at 2.

take off 3 bags of sand .  
put on/take off    number                    gas/sand

This makes the balloon go up 3 units.  
up/down

The balloon finishes at 5.

Represent the expression with a picture.

Answer  
 5

Complete the “Expression page” for the following expressions:

- ✓  $5 - 9$
- ✓  $8 - -6$
- ✓  $-3 - 8$
- ✓  $-7 - -7$
- ✓  $-2 - -5$
- ✓  $4 - 9$

11) Review addition and subtraction.

Hand out an “Expression “ page for each problem and ask students to complete them to evaluate the following expression:

- ✓  $-3 + -5$
- ✓  $4 - -1$
- ✓  $7 + -5$
- ✓  $0 - -4$
- ✓  $-4 + 8$
- ✓  $-2 - -6$

# Hot Air Balloon Unit

## Connecting Addition and Subtraction of Integers

12) Hand out a blank piece of paper and fold it in half.

On one half students write  $0 - 2$  and on top of the other half they write  $0 + -2$ .

Tell students to evaluate both problems using the number line and ask them to write a paragraph for each one:

For  $0 - 2$  ----> The balloon starts at zero, take away 2 bags of gas, this makes the balloon go down to  $-2$ .

For  $0 + -2$  ----> The balloon starts at 0, add 2 bags of sand, this makes the balloon go down to  $-2$ .

Next, have students compare and contrast both problems by asking:

- how are these problems the same?  
they both start at 0, they both end at  $-2$  and they both go down.
- how are these problems different? one is an addition, the other a subtraction; one has sand; the other gas.

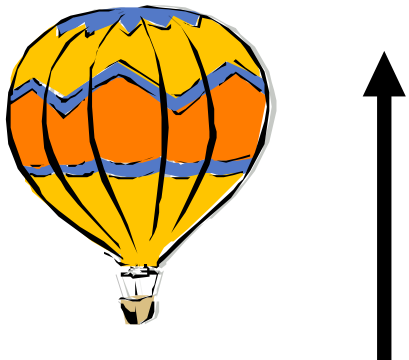
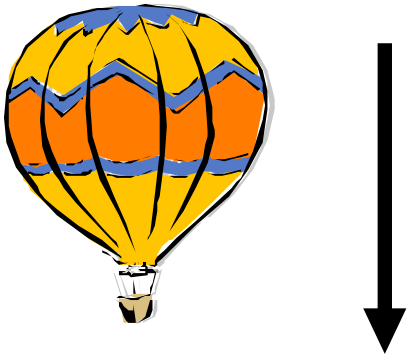
You record their answers on the board and students record them on their page.

Repeat this activity for:

$-5 - -3$	and	$-5 + 3$
$-1 - 4$	and	$-1 + -4$
$0 - 9$	and	$0 + -9$

# Hot Air Balloon Unit

- 13) On a blank piece of paper, students draw two balloons, one with an arrow going up, the other one with an arrow going down. On top of each balloon students write: what makes a balloon go up? what makes a balloon go down? Discuss with them what makes a balloon go up and what makes it go down. Students complete their page.

<p>What makes a balloon go up?</p>  <p>add gas or take away sand</p>	<p>What makes a balloon go down?</p>  <p>add sand or take away gas</p>
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- 13) Hand out a blank piece of paper. Students draw a vertical number line. Label  $-2$  as start and  $+5$  as finish.

Ask students: How can the balloon get from  $-2$  to  $+5$ . (add 7 bags of gas or take away 7 bags of sand)

Repeat with:

start: $+6$	finish: $-2$
start: $-1$	finish: $-8$
start: $+3$	finish: $+8$

Encourage students to realize that adding  $x$  bags of gas or taking away  $x$  bags of sand the balloon ends in the same place. And subtracting  $x$  bags of gas or adding  $x$  bags of sand the balloon ends in the same place.

# Hot Air Balloon Unit

## Compile the Hot Air Balloon Unit Booklet

- 14) Last, handout the Hot Air Balloon Unit cover page and a blank piece of paper. Have students put all the pages together in the form of a book, staple it and write a self-evaluation on the last page.

Ask: what did you learn during this unit? Write a paragraph and give examples.

# Hot Air Balloon Unit

	What happens with the balloon when...	Mathematically
Add Bags of Gas		
Add Bags of Sand		

	What happens with the balloon when...	Mathematically
Add Bags of Gas		
Add Bags of Sand		



## Hot Air Balloon Unit

# HOT AIR BALLOON UNIT

Name : \_\_\_\_\_

# HOT AIR BALLOON UNIT

Name : \_\_\_\_\_