About the Lesson

In this activity, students use a dynamic, electronic manipulative to perform integer addition and subtraction. The goals of the activity are to (1) provide students with a visual for adding and subtracting integers and (2) help students understand that subtraction can be thought of as "adding the opposite" or "adding the additive inverse." As a result, students will:

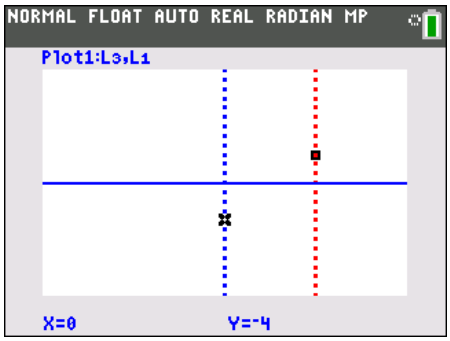
- Use technology to verify that adding the number $-x$ is equivalent to subtracting x.
- Solve one-step linear equations of the form $x + a = b$ where a and b are real numbers.

Vocabulary

- addend
- additive inverse
- integer
- subtrahend

Teacher Preparation and Notes

- It is very important that you thoroughly describe the model to students prior to them exploring the model on their own. Use a projector or a real balloon to demonstrate the model in a whole class, teacher-led setting. Some students will catch on very quickly and wean themselves from using the model. Others will prefer and/or need to stay a longer time with the model.



Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-84 Plus family with the latest TI-84 Plus operating system (2.55MP) featuring MathPrint™ functionality. Slight variations to these directions given within may be required if using other calculator models.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Compatible Devices:

- TI-84 Plus Family
- TI-84 Plus C Silver Edition

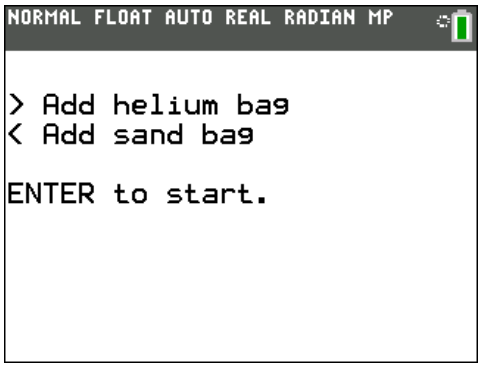
Associated Materials:

- HotAirBalloon_Student.pdf
- HotAirBalloon_Student.doc
- HotAirBalloon.8xp

Tech Tip: Before beginning the activity, the program HotAirBalloons.8xp need to be transferred to the students' calculators via handheld-to-handheld transfer or transferred from the computer to the calculator via TI-Connect.

Problem 1 – Integer addition

Help students through additional examples of using this model to add integers as needed. Be sure they understand the concepts of adding helium bags and sand bags to change the balloon's position, and be sure they understand how the helium and sand bags are related to positive and negative integers. Remind them to reset the initial position of the balloon between each calculation.



1. –4 + 7 = ___ **2.** 7 + 3 = ___ **3.** 5 + (–7) = ___ **4.** –5 + (–3) = ___

Answers: 3 10 –2 –8

5. Calculate the values of 5 + (–5), 2 + (–2), and 4 + (–4). What value do you obtain when you add a number and its opposite?

Answer: You obtain zero in every case.

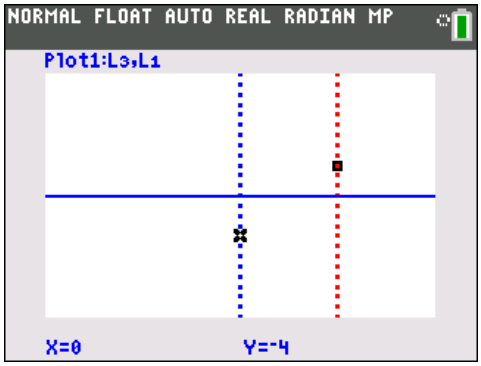
6. A balloon has 7 helium bags attached to it. How many sand bags would you need to add to make the balloon sink to the ground?

Answer: You would need to add 7 sand bags.

Problem 2 – Missing addend

Students should select option 2, Missing Addend, and press ENTER.

The model in Problem 2 displays two balloons side by side and is used to find a missing addend when the sum and the other addend are given. The balloon on the left is set at the target sum, $a + b$, and the one on the right is set at the known addend, a. The challenge is to find the value for b, the missing addend, such that the right balloon aligns with the target balloon.



7. $2 + b = -3$ **8.** $-6 + b = -1$ **9.** $5 + b = 1$ **10.** $-2 + b = 4$

Answers: $b = -5$ $b = 5$ $b = -4$ $b = 6$

Problem 3 – Integer subtraction

Students should select option 3, Integer Subtraction, and press ENTER.

Discuss the differences between this model and the one from Problem 1. In Problem 1, the number represents the number of bags *added to* the balloon, whereas in Problem 2, this number represents the number *removed from* the balloon. It is in this way that this model is for subtracting two integers.

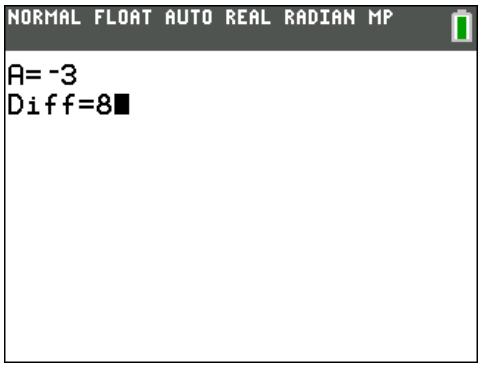
Answers:

11. $2 - 7 = -5$ **12.** $-3 - 1 = -4$ **13.** $5 - (-2) = 7$ **14.** $-4 - (-7) = 3$

Problem 4 – Missing subtrahend

Students should select option 4, Missing Subtrahend, and press ENTER.

Like the model in Problem 2, this model shows two balloons side by side; however, this model is used to find a missing subtrahend. The balloon on the left is set at the difference, and the balloon on the right is set at the minuend (known). The goal is to find the subtrahend that aligns the two balloons.



Answers:

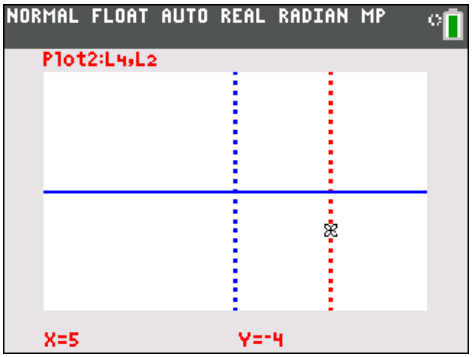
15. $6 - b = 9$ **16.** $5 - b = -3$ **17.** $-4 - b = -1$ **18.** $-2 - b = 6$

$b = -3$ $b = 8$ $b = -3$ $b = -8$

Problem 5 – Addition and subtraction exploration

Students should select option 5, Addition and Subtraction, and press ENTER.

Again, the model shows two balloons side by side. The left balloon shows subtraction and the right balloon shows addition. Guide students to use this model to explore a relationship between addition and subtraction. Namely, that subtraction is equivalent to adding the additive inverse (opposite).



Answers:

19. –2 – 4 = _–6__ **20.** –2 + (–4) = _–6__

21. 5 – (–6) = _11__ **22.** 5 + 6 = _11__

For each of the following equations, use what you've learned from Problems 2 and 4 to translate into "balloon language" and then find each missing addend or subtrahend.

23. –1 – *b* = 5
b = _–6__

24. –1 + *b* = 5
b = _6_

25. 3 – *b* = –4
b = _7_

26. 3 + *b* = –4
b = _–7__

Complete the following statements.

27. Taking off 8 sand bags is the same as putting on 8 __helium__ bags.

28. Taking off 5 helium bags is the same as putting on 5 ___sand____ bags.

29. If *a* and *b* are any two integers, then *a* – *b* = *a* + ___. That is, subtracting a number is equivalent to adding its __*–b*; opposite (or additive inverse)____.

To exit the program, arrow down to option 6 and press ENTER.