

Student Guide

Explore Big Numbers with Base-Ten Hoppers (SG pp. 129–135)

Questions 1–13

- 1.\* Hopper can move by 10,000; 100,000, 1,000,000 and 10,000,000
- 2.\* Hoppers can move right (+) or left (–)
3. 10,000,000; 9,000,000 and 8,000,000
4. –10,000,000; –10,000,000
5. A. 16,000,000  
B. 50,100,000  
C.\*34,100,000 (Possible responses: I counted up and added the hops. I counted back and subtracted the hops.)

### Explore Big Numbers with Base-Ten Hoppers

After the fifth grade students finished reading and writing big numbers, the teacher invited Professor Peabody to class. Professor Peabody studies mathhoppers, which are very special creatures that live on number lines. He brought a base-ten hopper along so the students could study how it moves on the number lines.

**Discuss**

Study the base-ten hopper's moves on the two number lines below.

1. What distances can the base-ten hopper move in one hop?
2. In what directions can the base-ten hopper move?

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### Explore

3. Professor Peabody saw a base-ten hopper make the moves shown below. He did not finish his drawing. What should he write under the number line?
4. Professor Peabody started to record the moves of a base-ten hopper on the number line below. What should he write for the question marks?
5. Observe the base-ten hopper's moves below.
  - A. Where did the hopper start?
  - B. Where did the hopper land when it finished hopping?
  - C. How far is it from where the hopper started to where it landed? How do you know?

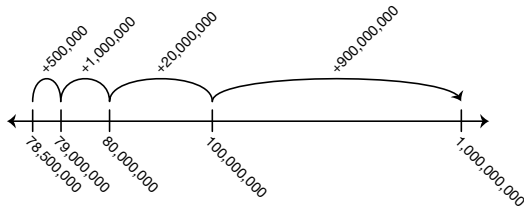
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\*Answers and/or discussion are included in the lesson.

6. A.\* Possible response:



B. (Possible response:

$$78,500,000 + 500,000 + 1,000,000 + 20,000,000 + 900,000,000 = 1,000,000,000$$

C.\*  $78,500,000 + \boxed{921,500,000} = 1,000,000,000$

$1,000,000,000 + \boxed{921,500,000} = 78,500,000$

7. Answers will vary. Possible responses:

A. Yes. I agree because the hopper can move in multiples of 100,000; 1,000,000; and 10,000,000.

B.\* Yes and no. The hopper moved 40,000,000 by hopping 10,000,000 four times not 40,000,000 at once; 2,000,000 by 2 hops of 1,000,000 and 300,000 by hopping 100,000 three times. So this number sentence represents the distance travelled by the hopper but not the exact hops of the hopper.

C.\* Yes. I agree because the hopper made 4 hops of 10,000,000, 2 hops of 1,000,000 and 3 hops of 100,000.

6. Work with a partner.

A. Show how a base-ten hopper can start at 78,500,000 and land on 1,000,000,000.

B. Write a number sentence to describe the moves of your base-ten hopper.

C. Use what you know about the relationship between addition and subtraction to complete these number sentences.

$$78,500,000 + \square = 1,000,000,000$$

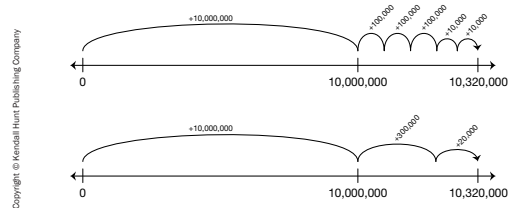
$$1,000,000,000 - \square = 78,500,000$$



**Find Equal Number Sentences with Big Numbers**

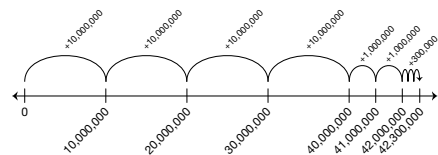
Professor Peabody looked for shorter ways to represent the moves of the base-ten hopper. He decided it would be more efficient to show the hops using multiples of ten million, one million, and a hundred thousand.

The number lines and number sentences below show two ways to represent how the base-ten hopper could move from 0 to 10,320,000.



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7. Study the number line and the number sentences below. Do you agree that each number sentence represents how the hopper moved? Why or why not?



A.  $42,300,000 = 10,000,000 + 10,000,000 + 10,000,000 + 10,000,000 + 1,000,000 + 1,000,000 + 100,000 + 100,000 + 100,000$

B.  $42,300,000 = 40,000,000 + 2,000,000 + 300,000$

C.  $42,300,000 = 4 \times 10,000,000 + 2 \times 1,000,000 + 3 \times 100,000$

The number sentence below is a true statement since the amount on one side of the equal sign has the same value as the amount on the other side.

$$10,000,000 + 100,000 + 100,000 + 100,000 + 20,000 = 10,000,000 + 300,000 + 20,000$$

The number sentence can also be called an **equation** because the answers on both sides are equal.



The number sentence is true because it is the same on both sides except for the 300,000 on one side and the three 100,000s on the other. 300,000 equals 100,000 + 100,000 + 100,000, so it's true.

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\*Answers and/or discussion are included in the lesson.

8. Tell whether the number sentences are true or false. Be ready to explain your thinking. Use number lines or other strategies.
- A.  $10,000,000 + 30,000 + 2,000 = 10,000,000 + 3 \times 10,000$
  - B.  $32,074,000,000 = 30,000,000,000 + 2,000,000,000 + 70,000,000 + 4,000,000$
  - C.  $8,000,000 + 900,000 + 40,000 + 6,000 = 9,000,000 - 100,000 + 40,000 + 6,000$
  - D.  $1,235,000 = 1 \times 2,000,000 + 2 \times 100,000 + 3 \times 10,000 + 5,000 \times 1$
  - E.  $5,045,000 = 500,000 + 400,000 + 500,000$

Professor Peabody wrote the following equation on the board. He asked Romesh to help him find the number that will make the number sentence true.

$$3,072,000 = 3,000,000 + n + 2000$$



I think  $n$  must be 70,000. If you write 3,072,000 in expanded form, it's  $3,000,000 + 70,000 + 2,000$  and the 70,000 is missing.

9. Replace the letter with a number to make each sentence true.
- A.  $8,920,000 = 8,000,000 + n + 20,000$
  - B.  $96,500,000 = 9 \times 10,000,000 + h + 500,000$
  - C.  $40,000,000 + 3,000,000 + 10,000 + 7,000 = 43,000,000 + g$
  - D.  $300,000,000 + 1,000,000 + 4 \times 100,000 = 3 \times 100,000,000 + 1,000,000 + h$
  - E.  $5,783,000 = 5,000,000 + 700,000 + r + 3,000$

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- 8. A. False
- B. True
- C. True
- D. False
- E. False
- 9. A. 900,000
- B. 6,000,000
- C. 17,000
- D. 400,000
- E. 80,000
- 10. A. 300,000,000
- B. 5,000,000
- C. 600,000,000
- 11. A. True. Possible response: I drew a number line starting at 0 and showed the hopper taking 12 hops of 100,000,000 and one hop of 5,000,000 to land on 1,205,000,000.
- B. False. Possible response: I compared the numbers on both sides of the equation.  $400,000 = 100,000 \times 4$  and  $7,000 = 7,000$  but  $20,000$  does not equal  $2,000$ .
- C. True. Possible response: I checked the equation by partitioning 67,420,000 into parts  $60,000,000 + 7,000,000 + 400,000 + 20,000$  and then compared this to the other side. I could see that  $6 \times 10,000,000 = 60,000,000$  and  $2 \times 10,000 = 20,000$ , and  $7,000,000$  and  $400,000$  were the same as the partitioned number.

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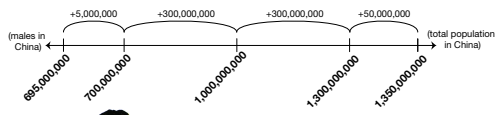
Study World Population Numbers

The fifth-grade students are learning about populations in their Social Studies class. They use a table to compare female and male populations in the world.

2013 International Populations Rounded to the Nearest Million

Country	Total Population	Female	Male
China	1,350,000,000		695,000,000
Colombia	46,000,000	23,000,000	
Japan		65,000,000	62,000,000
Mexico	116,000,000		57,000,000
Pakistan		94,000,000	100,000,000
United States	317,000,000	161,000,000	
World	7,095,000,000	3,524,000,000	3,571,000,000

Nila decided to find the population of females in China. She looked at the table and used a number line and base-ten hopper:



I added the hops to find the total number of females in China.  $5,000,000 + 300,000,000 + 300,000,000 + 50,000,000 = 655,000,000$  females in China.

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✓ **Check-In: Questions 10-13**

10. Replace the letter with a number to make each number sentence true.  
 A.  $1,350,000,000 = 1,000,000,000 + n + 50,000,000$   
 B.  $600,000,000 + 50,000,000 + d = 655,000,000$   
 C.  $695,000,000 = n + 90,000,000 + 5,000,000$

11. Tell whether the number sentences below are true or false. Explain your thinking. You may use number lines or other strategies.  
 A.  $12 \times 100,000,000 + 5,000,000 = 1,205,000,000$   
 B.  $400,000 + 20,000 + 7,000 = 100,000 \times 4 + 2,000 + 7,000$   
 C.  $67,420,000 = 6 \times 10,000,000 + 7,000,000 + 400,000 + 2 \times 10,000$

12. Use the population table. Draw a number line or use an equation to show how to find the answers to the following questions.  
 A. What is the male population of Colombia?  
 B. What is the female population of Mexico?  
 C. What is the total population of Pakistan?

13. Put the total populations of each country on the *World Population Number Line 1* page in your *Student Activity Book*.

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12. A. The male population of Colombia is 23,000,000. Possible response: I could see that the female population of 23,000,000 was half of the total population of 46,000,000.
- B. The female population of Mexico is 59,000,000. Possible response: I drew a number line starting at 57,000,000 (male population) and used the hopper to hop up to 116,000,000 (total population). The hopper hopped + 50,000,000 then + 9,000,000 to land on 116,000,000. I added the hops to find the female population  $50,000,000 + 9,000,000 = 59,000,000$ .
- C. The total population of Pakistan is 194,000,000. Possible response: I wrote a number sentence adding the male and female populations together to find the total population:  $100,000,000 + 94,000,000 = 194,000,000$ .

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13. Using the *World Population Number Line 1* in the *Student Activity Book*:

