Gate
Teacher Guide

Gate is available at MathSnacks.org

Gate is a game where students take a journey to free spirits from darkness. At the start of each level, the player builds numbers to open the gate. Then, they defeat monsters by building similar numbers. *Gate* isn't just about place value: it helps students start to compose and decompose numbers with addition, subtraction and multiplication — gradually doing so in more efficient ways. It will take students a few levels to become proficient with the game mechanics for building the numbers.

There are 16 levels in this game and students will be asked to build numbers as large as 999 and as small as .01. Students are encouraged to use addition, subtraction and even multiplication to build these numbers as efficiently as possible. Please make sure to point out the number line at the bottom of the screen and the number wheel under the main character.

Talking is allowed! Encourage your students to talk to each other and share strategies. Remind students that proper hand placement on the keyboard helps. Turn the sound up on the game – that helps too!

Time Required: Two gaming sessions: 40 minutes each. Bonus activity: 30 minutes

Learning Objectives:
By playing *Gate* and engaging in at least one of the recommended bonus activities, students will be able to:
• Build numbers using addition, subtraction, multiplication and division.
• Recognize place value from hundreds to hundredths.
• Develop mental computation skills using place value and the four basic operations.

Vocabulary: Hundreds, tens, ones, tenths, hundredths, decimal, place value

Vocabulary in Spanish: Cientos, decenas, unidades, décimas, centésimas, decimal, dar un valor

Materials and Technology required:
• Access to computers and the Internet
• Bonus activity: Strips of white paper and sheets of colored construction paper

Common Core State Standards Covered

| Standard	Standard Description
4.NBT.1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
4.NBT.2	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form.
4.NF.7	Add, subtract, multiply and divide decimals to hundredths, using concrete models or drawings or strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
5.NBT	**Perform operations with multi-digit whole numbers and with decimals to hundredths.**

Preliminary Preparation

1. Please play the game so that you understand the game mechanics and how the math concepts are taught during gameplay. The games are a fun way for students to learn, and teachers also find them enjoyable.
2. Secure the proper number of computers to allow each student to play the game.
3. Make sure *Gate* is open on all computers before taking the class to the computer lab. This will maximize time playing the game.

Game Session 1 (40 minutes)

Note: There is no need to TEACH number construction before going to the computer lab. It is good for the kids to have the experience with the game first. It is also important to encourage students to talk and discuss while they are playing the game. Keep the sound at a manageable level, but do not have students mute the sound.

1. Allow students to play the game for 15–20 minutes.

2. Have students pause the game, and lead a discussion with the students about the gameplay.
    (PLEASE LIMIT DISCUSSION TO 10 MINUTES.)
    *   What do you like about this game?
    *   What are some things that make this game challenging?
    *   What strategies have you used to make the game easier?
    *   What is the best way to place your hands on the keyboard?
    *   What math do you see in this game so far?
    *   Did you notice the number line on the bottom of the screen and the scale under the character?
    *   As you continue playing, watch how the number line and the scale change as you build the numbers.

3. After the discussion, allow students to continue to play the game for an additional 20 minutes.

Encourage students to play *Gate* at home.
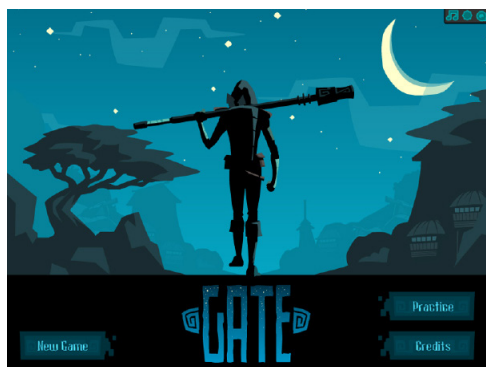
Gate can be played at MathSnacks.com

On the level select screen, type the "shift" and the "c" key on the keyboard to open up levels. This is helpful for students at home; they can pick up where they left off in class.

Bonus Activity and Discussion Questions (30 minutes)

If possible, do both bonus activities described below.

The Number Strip activity can be done as time allows. The Race activity can be done in 10-15 minutes.

Supplies

15 strips of paper that are either 10 cm or 10 in long.

1 piece of colored construction paper per group.

Number Strips: Create a physical representation of numbers from .01 to 100

1. Divide students into groups of two or three.
2. Give each group at least 15 strips of paper that are approximately 10 cm or 10 inches long.
3. Ask students to consider one of these strips as 10 units.
4. Have them cut one strip into 10 equal pieces to represent 1 unit.
5. Have them cut one of the single units into 10 equal pieces to represent a tenth (.1).
6. Have them glue or tape ten of these strips together to represent 100.
7. Have them cut a tenth into 10 equal pieces to represent a hundredth (.01).
8. Display these numbers on posters in class to show a physical representation of numbers, and then use the posters in the following activity (Number Race).

Number Race

- Write a number on the board.
  - Give students one minute to come up with as many ways as possible to build the number using any of the four operations and place value.
    (For example, 122 can be built using "one-100, two-10's, two-1's" or "twelve-10's and two-1's".)
  - Have students explain one of their methods using their place value poster as a reference.
- Continue asking students to build different numbers as long as time allows. Be sure to include decimal numbers like 12.8, 325.19, etc.
- Have students build numbers that require multiplication by 2. (For example, 122 can be built with "61 times 2", or "six-10s, one 1, times 2") This can be done wherever it is most appropriate.
- If possible, give prizes for the following:
  - The most different ways to build the number
  - The most creative way of building the number
  - The most efficient way to build the number

Gaming Session 2 (40 minutes)

1. Allow students to play *Gate* again. Allow students to use the CHEAT (shift + c on the level select screen) for the game during this second session so that they do not have to start from the beginning. Tell students to start at the level where they finished the last time they played.
2. Allow students to play for 15–20 minutes. Ask students to pause the game.
3. Ask the following questions: (PLEASE LIMIT DISCUSSION TO 10 MINUTES.)
   - How do the later levels in *Gate* get more challenging?
   - What are some strategies you have used to build numbers more efficiently?
   - How is multiplication used in the later levels? What are some strategies you can share with your classmates about using multiplication, especially with decimals?
4. Have students continue to play for as long as time allows.
5. After game play is over have students build some numbers using (x2) multiplication. Start with easy numbers like 8, then increase the difficulty of the numbers using the following list of numbers.
   a. 8 (answer: 4) (x2)
   b. 42 (answer: 21) (x2)
   c. 1.8 (answer: 0.9) (x2)
   d. 244 (answer: 122) (x2)
6. Lead a discussion about the relative size of numbers. For example, discuss the difference between hundreds and hundredths. Use the number wheel in the game (under the character) to show students how the game represents numbers of various sizes.

The Bow
(Tie it all together to bring out the main ideas)

1. Can someone describe the difference between hundreds place and hundredths place?
   (Encourage the students to refer to their posters.)
2. Use place value to build some numbers.
   Samples:
   - 8 (8 ones)
   - 129 (1 hundred, 2 tens, 9 ones or 12 tens and 9 ones, or 13 tens minus 1 one)
   - 19.89 (1 ten, 9 ones, 8 tenths, 9 hundredths)
3. Did anyone learn something about place value or building numbers that they didn't know before playing *Gate*?

Encourage students to keep playing *Gate* at home.
Encourage them to try to get through all levels of the game.