

## Notes for the Teacher

Students play a game to hone their mental math skills. Given a collection of numbers, students pair the numbers together so that each pair sums to a given target value, like 40. The game can be customized in several ways to adjust its difficulty: the target value can be made smaller or larger, and the game can be played with or without a time limit.

### **Objectives:**

- Students will develop and refine their mental math strategies for addition.
- Through repeated play of the Paired Sums Game, students will develop fluency in solving the mental math challenges.

**Common Core Mathematical Practices:** (1) Make sense of problems and persevere in solving them; (2) Reason abstractly and quantitatively; (3) Construct viable arguments and critique the reasoning of others; (5) Use appropriate tools strategically; (7) Look for and make use of structure.

**Common Core State Standards:** K.OA1, 3, 4, 1.OA6, 1.NBT2, 4; 2.OA2, 2.NBT5, 7, 9; 3.NBT2

**Grade Range:** Grades K–4

### **Introduce:**

Project the sketch, **Paired Sums Game--Mental Math Strategies.gsp** and go to the “Untimed 20” page. The sketch displays 20 numbers in the middle and 10 circles around the outside. Explain that the goal of the game is to drag two numbers into each circle so that the sum of the numbers in each circle is equal to 20.

Start by asking students to name two numbers in the list whose sum is 20. Students might pick 13 and 7. Ask a student to drag these numbers into one of the circles. Then, ask another volunteer to drag a second pair of numbers whose sum is 20 into another circle. Continue in this manner until there are two numbers in each circle. If students make a mistake and place two numbers whose sum is not 20 into a circle, do not ask them to fix it.

Press *Check Answer*. Those circles that contain numbers that sum to 20 will turn green. Circles whose numbers don’t sum to 20 will be red. Students receive 10 points for each correct pair of numbers, with a total possible score of 100 points.

Press *New Puzzle*. A new set of 20 numbers will appear. For any collection of numbers, it will always be possible to match them in pairs so that there are ten pairs with the

desired sum. It is possible, however, that because the set of numbers is generated randomly, there may be duplicate pairs of numbers.

When students are comfortable with the rules of the game, go to page “Timed 20.” This game is played the same way as the untimed game, but now there is a time element. Press *New Puzzle* to begin the game. After a brief countdown, the list of 20 numbers will appear, and students, as before, should drag them in pairs into the circles so that their sums are 20.

As students play, a timer counts down. When it reaches zero, time is up and the score is reported (If students finish dragging the numbers into the circles before the time expires, they can press *Check Answer*.)

The purpose of adding a timed element to the game is **not** to suggest that speed is prized above all else in mathematics. Indeed, it is the thought process by which students pair the numbers together that is of primary importance here. However, becoming fluent in mental math does have value, as it frees students to focus on more involved tasks that take as a given students’ ability to add. As such, developing a lean and agile approach to mental math can be beneficial to students’ mathematical growth. Students can edit the *seconds* parameter on the timed pages to allow themselves more time (as needed) or less time (for a tougher challenge).

Subsequent pages of the sketch, “Untimed 30” and “Timed 30,” present more challenging games where the sum of the numbers in each circle must equal 30.

Finally, the two “Make Your Own” pages of the sketch allow you or your students to adjust the difficulty of the game by setting *any* target sum whatsoever. To do so, enter a new value for *sum*, such as 40, 50, 80, or 100. Students will benefit from using this page to play the game with sums such as 15, 25, or even 37.

### ***Explore:***

Assign students to partners and send them in pairs to the computers. Many students will be eager to play the timed version of the Paired Sums Game, but other students who are still in the early stages of developing their mental math skills will benefit from starting with the untimed game.

As they play the game, some students may benefit from manipulatives such as ten rods, ten frames, or number charts (99 charts or 100 charts). Over time, however, the goal of the activity is to develop students’ facility with mental math to the degree where they can form the sums entirely in their mind.

As you circulate through the classroom, ask students to describe the strategies they are using to pair the numbers in their lists together. Are they being methodical by starting

with the number in the top-left corner and looking for its partner, or are they targeting certain numbers in their list first because they are easier to work with? The “Discuss” section below describes a variety of strategies students might employ.

Encourage students to explore the Make Your Own pages of the sketch if they are finding the game too simple.

***Discuss:***

Call students together and display the Paired Sums Game sketch. Ask students to describe and demonstrate the strategies they used to pair the numbers together to form the required sums. Possible strategies include:

- *Our sum was 100. We started by looking for numbers that ended in 0. Those were easy to pair together. So, for instance, we could pair 30 with 70 and 90 with 10.*
- *We focused on landmark numbers. If our sum was 40 and one number in our list was 28, then we started by adding 2 to 28 to reach 30. From 30, we added another 10 to reach 40. That meant that  $28 + 2 + 10 = 40$ , or  $28 + 12 = 40$ .*
- *We looked for numbers in our list that were either very small or very close to the target sum. For example, if our sum was 50 and one number in our list was 3, then it was easy for us to know that  $3 + 47 = 50$ .*
- *Our sum was 80. If one of the numbers in our list was in the 40s, then we knew that its pair was in the 30s. That helped us to narrow down our choices.*
- *We decided to make the game hard by forming sums of 99. Our strategy, though, was to make 100 and then subtract 1. Here’s an example: If one number in our list was 25, then we knew that  $25 + 75 = 100$ . We wanted a sum of 99, though, so we subtracted 1 from 75 to get 74.*

When time allows on subsequent days, encourage students to continue playing the Paired Sums game when they have a few free minutes. When played over a course of days or weeks, the game can help students improve their mental math skills to the point where they can form sums fluently without having to concentrate as intently on the process.

***Credits:***

This activity is based on an idea from Paul Goldenberg.

***Related Activities:***

- *99 Chart—Mental Math Strategies*

- *Number Navigation—Adding on an Open Number Line*

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