

RACE FOR A WHOLE

NUMBER • PROBABILITY/STATISTICS

- Decimals
- Place value
- Addition
- Game strategies

Getting Ready

What You'll Need

Base Ten Blocks, 2 sets per group

Number cubes marked 0.1 to 0.6, 2 per group

Number cubes marked 0.01 to 0.06, 2 per group

Overhead Base Ten Blocks (optional)

Overview

In this game for two to four players, children roll number cubes to indicate numbers of tenths and hundredths. They collect Base Ten longs and units to represent the tenths and hundredths, respectively, in an effort to be the first to accumulate blocks with a total value of 1. In this activity, children have the opportunity to:

- ◆ compare the relative values of wholes, tenths, and hundredths
- ◆ model decimal notation
- ◆ add decimal amounts
- ◆ develop strategic thinking skills



The Activity

Be sure children understand that the four number cubes used for this game differ from others they have used. Unlike 1–6 number cubes, the two cubes that represent tenths are marked 0.1–0.6. The two that represent hundredths are marked 0.01–0.06.

Introducing

- ◆ Go over the game rules for *Race for a Whole*.
- ◆ Establish the values of the two tenths number cubes and the two hundredths number cubes. Emphasize that a player may choose to roll any one to four of these cubes on a turn.
- ◆ Invite several children to each roll any combination of the cubes, announcing the value of the roll and recording its decimal value.
- ◆ Elicit how to model each roll using longs to represent tenths and units to represent hundredths.
- ◆ Invite two volunteers to play part of a demonstration game with you while the rest of the class keeps score.
- ◆ Play until someone covers his or her flat “halfway” with blocks with a value of at least 0.5. Point out that in a regular game, this would entitle the player to an extra turn.

On Their Own

Play Race for a Whole!

Here are the rules.

1. This is a game for 2 to 4 players. It is played with 4 number cubes—2 tenths cubes and 2 hundredths cubes. The object is to be the first to collect enough Base 10 longs and units so that the sum of their values equals 1 whole.
2. In this game: a flat = 1 (a whole); a long = 0.1 (a tenth); a unit = 0.01 (a hundredth)
3. Players each take a flat to use as a gameboard.
4. On each turn, a player:
 - ◆ rolls 1, 2, 3, or 4 number cubes and takes longs and units to match the roll.
 - ◆ records the decimal value of the roll.

Then the player:

- ◆ places the longs and units on his or her flat.
 - ◆ adds the value of the roll to the previous score.
5. When a player gets halfway (with a score of at least 0.5), he or she circles that score and then gets an extra turn.
 6. Anyone who rolls a number that would take his or her score above 1 loses a turn.
 7. Players take turns rolling, putting blocks on their gameboards, and updating their scores. Whoever is first to completely cover a gameboard wins.
- Play 2 more games of *Race for a Whole*. Be ready to talk about your games.

The Bigger Picture

Thinking and Sharing

Invite children to talk about their games and describe some of the thinking they did.

Use prompts like these to promote class discussion:

- ◆ What is the *greatest* (or least) value you can roll on the two tenths number cubes? on the two hundredths number cubes? on all four number cubes?
- ◆ What decimal are you most likely (and least likely) to roll on each number cube?
- ◆ When you rolled just the two tenths cubes, (or hundredths cubes), which decimal did you roll most often?
- ◆ How did you decide which cubes to roll at the beginning of the game? at the middle? at the end?
- ◆ What was your score when you got an extra turn?
- ◆ Did you lose any turns? Explain.

Writing

Have children tell whether or not they would change one of the rules of this game and why.

Extending the Activity

1. Have children play *Race for a Whole* again, this time starting by covering their flat with 5 longs and 50 units. As they roll the number cubes, they should remove blocks, subtracting tenths and hundredths, to completely clear off their gameboard.

Teacher Talk

Where's the Mathematics?

The outcome of a game of *Race for a Whole* is partially determined by the choices children make about which number cubes and how many of them to roll on a turn. Children at these grade levels may think “the more the better,” and decide to roll all four cubes at first.

In the course of play, however, children are likely to realize that rolling all four number cubes can result in total values of from 0.22 to 1.32. Many of these possible outcomes could put a player's score over 1 even on a first turn. As children play, they may notice that rolling even three number cubes (2 tenths cubes and 1 hundredth cube) could push their scores over 1. Rolling three cubes could result in total values of from 0.21 to 1.26. Many of these possible outcomes would also take a score beyond 1 on a first turn.

After focusing on which number cubes will force their scores above 1, children may realize that rolling certain cubes will keep them “safe” from going above 1 well into the game. The “safe” rolls are:

- ◆ 1 hundredths cube, on which 0.01 to 0.06 could be rolled
- ◆ 2 hundredths cubes, on which 0.02 to 0.12 could be rolled
- ◆ 1 tenth cube and 1 hundredth cube, on which 0.11 to 0.66 could be rolled

As children play, they will become aware of risks. Deciding to take or avoid risks will become part of a game plan. Since players are competing to cover their own gameboards, keeping watch on their opponents' gameboards becomes important in making strategic decisions. Risking the penalty of missing a turn may be acceptable to a player whose opponents' gameboards are not very full.

Children who have considered the probable outcomes of rolling two number cubes (or dice) are likely to realize that certain outcomes that apply to

2. Establish that a thousands cube can have the value of 1. Then, have children play *Race for a Whole* with the understanding that:

a cube = 1 (a whole)

a flat = 0.1 (a tenth)

a long = 0.01 (a hundredth)

a unit = 0.001 (a thousandth)

Children will need three number cubes for this game—one marked 0.1 to 0.6, a second marked 0.01 to 0.06, and a third marked 0.001 to 0.006.

rolling whole numbers also apply to rolling decimals. Children may have noticed, for example, that a sum of 7 is the most likely outcome of rolling whole numbers because there are more possible combinations of rolls that total 7 than any other number (1 + 6, 2 + 5, 3 + 4, 4 + 3, 5 + 2, 6 + 1). Similarly, 0.7 is the most likely outcome for the roll of 2 tenths number cubes, and 0.07 is the most likely for a roll of 2 hundredths cubes.

Giving players an extra turn when they reach or first exceed the halfway point not only helps enliven the play but also acts as a “signpost,” highlighting that the decimal quantities 0.5 and 0.50 are each equivalent to $\frac{1}{2}$. An extra turn also demonstrates that quantities such as 0.48 and 0.51 are close to half. Helping children to examine the half and near-half numbers that they have circled on their score sheets strengthens their understanding of how to express these fractional amounts as decimals.

Some children may confuse hundredths and tenths as they add to keep score. Be sure to emphasize that as children record their rolls in vertical form they should line up the decimal points in order to help them add correctly. Checking the blocks that they have collected on their gameboards against their written totals will help them to self-correct as necessary.

Play is likely to become increasingly thought provoking as players approach their goal. In deciding which number cubes to roll, those who reached for all four cubes earlier in the game will tend to think more along these lines:

“I only need 0.05 to get to 1. I’d better roll just one of the hundredths cubes on my next turn.”

OR

“I’ve missed my turn twice by rolling three cubes. I’d better roll just one or two next time.”