



I'm Thinking of a # - Remainders

Math Concepts: Division - single digit
Materials: None
Players: 2

Set up: The Puzzler thinks of a number in some range that is comfortable for everyone to work with, say to 100. The Puzzler then announces to the Guesser: "I'm thinking of a number from 1 to 100."

Play: The Guesser asks questions of the form: "What is the remainder when you divide your number by 4?" The numbers that can be divided by are usually the numbers from 2 to 9.

Goal: Find the Puzzler's number using the fewest number of questions.

- DISCUSSION AND TIPS -

Discuss which numbers give new information. If you have asked for the remainder when you divide by 4, there is no point in asking for the remainder when you divide by 2.

There is a lot to discuss in how to combine information from two questions. For example, if you know that 2 is the remainder when you divide by 9, and 5 is the remainder when you divide by 8, then you know the remainder must be 29 when the number is divided by 72. This is a result of something called the Chinese Remainder Theorem, which says that the remainder when dividing by two relatively prime numbers (8 and 9 in this example) is completely determined by the two remainders by the numbers individually. In this example, knowing that the remainder is 29 when divided by 72, means that the number is either 29, 101, 173, and so on - if the range is 1 to 100, then the number must be 29.

- VARIATIONS -

Use larger or smaller ranges of numbers for the Puzzler to use. When using single digit divisors, you cannot use a range above $5 * 7 * 8 * 9 = 2520$ (which is pretty large). Use smaller number ranges and smaller dividing numbers for students just learning division.

Allow numbers larger than 9 for the Guesser to ask about.

