

# The Search for Prime Numbers

## Purpose

Students will solve problems by choosing strategies, explaining their reasoning, making calculations, and checking results.

## Materials

*For the teacher:* chalk, chalkboard

*For each student:* paper, pencil, hundreds chart

## Activity

### A. Introducing the Problem

1. Give each student a hundreds chart and tell students that they are going to find all the prime numbers up to 100.
2. Have students look first at the number 10, and ask them if 10 is prime and why. [The number 10 is composite, and so not prime, because 2 and 5 divide exactly into 10.]
3. Have students look at the number 11, and ask them if 11 is prime and why. [11 is prime, because no number divides exactly into 11 except 1 and 11. Have students divide 11 by 2, 3, 4, etc., to discover this themselves.]
4. Point out to students that it seems to be easier to show that a number is composite than to show that it is prime because you only need to find one number that divides it exactly to show that a number is composite and therefore not prime.
5. Have students look again at the number 10, which is divisible by 2, and ask students whether they can see any other numbers that must be composite. [4, 6, 8, and other multiples of 2.]
6. Have students find these numbers on their hundreds chart and cross them out.
7. Ask students what they did with 2 itself and check that 2 is prime. Have students circle 2 on their charts.

### B. Solving the Problem

1. Place students in groups of three or four, and ask each group to find other rules for identifying composite numbers. Direct students to cross out the composite numbers on their hundreds charts and circle any prime numbers.
  2. If necessary, prompt students to look at 5 (which is prime) and its multiples (which are composite) and do the same with 3 and 7.
  3. If groups also consider multiples of 4, 6, 8, 9, or 10, ask them if
- (continued)*

connecting  
across the  
curriculum



### Visual Arts

Have students use a hundreds chart to color the multiples of 2 in one color, the multiples of 3 in another color, etc., and highlight the prime numbers in a bright color. Ask students to look for patterns in the positions of the prime numbers.

EXTENDING  
THE  
ACTIVITY



Have students use the same method to find all the primes up to 200, noticing that they need only check multiples of 11 and 13 in addition to those of 2, 3, 5, and 7.

Standards Link  
5.1.6

## Activity (continued)

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that allows them to cross out any new numbers. [No, because these numbers are multiples of 2, 3, 5 or 7, which they have already crossed out.]

4. If groups consider multiples of 11, 13, 17, etc. (which are prime), ask them if that allows them to cross out any new numbers. [No, because these numbers are also multiples of 2, 3, 5 or 7, which they have already crossed out (e.g.,  $22 = 11 \times 2$ ,  $51 = 17 \times 3$ ).]

### C. Discussion


1. Discuss with the whole class the rules students used and the patterns they found. These could include:
  - Circle the number 2, because it is prime, and cross out all its multiples (4, 6, 8, etc.), which appear in columns of the hundreds chart.
  - Circle the number 3, because it is prime, and cross out its odd multiples (9, 15, 21, etc.) because the even multiples (6, 12, 18, etc.) were already crossed out.
  - Cross out all multiples of 2, 3, 5 and 7, and no more composite numbers remain to be crossed out. All the remaining numbers are prime. The reason for this is that all numbers up to 100 that are divisible by a “large” prime number must also be divisible by a “small” one (e.g.,  $95 = 19 \times 5$ ).
2. If students are concerned about how to classify the number 1, point out that all numbers are multiples of 1, which does not help us decide which are prime and which are composite. Therefore, the number 1 is different from all other numbers and is classified as neither prime nor composite.
3. Tell students that the method they have used is called “The Sieve of Eratosthenes” because you sieve out the multiples of 2, then 3, etc. until you have only prime numbers left. This method was invented by Eratosthenes, a Greek mathematician, over two thousand years ago.


## Questions for Review


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### Basic Concepts and Processes

During the activity, discuss the following questions with your students to gauge their understanding of the Standard Indicators:

 Is this number [*indicate a number on the hundreds chart*] a prime number?

 How do you know?

 What rule are you using to cross out these numbers?

 Are you finding any new numbers to cross out? Why is that?