

Everyone can participate in these puzzles, compare notes, and share solutions. *Enjoy!*

## Adventures with Numbers and Words

Math is a universal language. Everyone around the world agrees that  $1 + 2 = 3$ . You can communicate with just about anyone when you use mathematical symbols. This month's Family Math Activity explores the linguistics of math and the words behind the numbers. You will discover some puzzling facts and some surprising patterns. Why is the tenth month of the year called October, when oct- is a prefix for eight? Which vowel does not appear in the name of any number between 1 and 999? Get ready for an adventure with numerical words!

### Names of Numbers

In how many different languages can you or someone in your family count from 1 to 10? Write down as many number names as you can. Do you see similarities in the number names?

### Number Names for All Seasons

This table shows the number names in Latin.

	1	2	3	4	5	6	7	8	9	10
Latin	<i>unus</i>	<i>duo</i>	<i>tres</i>	<i>quattuor</i>	<i>quinque</i>	<i>sex</i>	<i>septem</i>	<i>octo</i>	<i>novem</i>	<i>decem</i>

Do you see any similarities between Latin and English, or any of the other languages you know? Do the Latin names for 7, 8, 9, and 10 look familiar? They are in the names of the last four months of the year. What is unusual about meaning of the Latin words and the months they represent? How did this happen? Research the history of the Roman, Julian, and Gregorian calendars.

### Which Letters are in Number Names?

- Do you think the whole alphabet is used for the English names of numbers? Make a prediction before completing this activity. Consider the vowels and consonants separately.

Explore the number names in groups:

- 1, 2, 3, 4, 5, 6, 7, 8, 9
- 10, 20, 30, 40, 50, 60, 70, 80, 90
- 100; 1,000; 1,000,000; 1,000,000,000; . . .

# Using Letters for Numbers

## Roman Numerals

The idea of using letters to represent numerical quantities is not new. The Roman numeral system shows numbers differently. What letters are used? What numbers do the letters represent? How are the letters combined?

Write the numbers 1–10 in Roman numerals. What patterns do you notice in how numbers are formed from the letters?

## Computer Speak

There is a very modern field in which letters are needed to represent numbers. The need to communicate with computers was made possible by the language of math.

At the basic level, computers “speak” binary. The binary system is a counting system based on two symbols—the digits 0 and 1. Computer scientists came up with this as a way to connect human logic and machine activity. They used the fact that electricity running through a computer circuit is either on or off, so there are only two choices: 0 means the circuit is off, and 1 means electricity is running through the circuit.

At a more complex level, instructions for computers are written with hexadecimal numbers, which are based on the number 16. Since our numeral system only has digits 0–9, computer scientists needed “single digits” for 11, 12, 13, 14, and 15. Using symbols people already knew, their choice was to use A for 10, B for 11, C for 12, D for 13, E for 14, and F for 15.

Count from 1–20 in the binary and hexadecimal systems.

## Adventures with Numbers and Words Answers

### Names of Numbers

In how many different languages can you or someone in your family count from 1 to 10? Write down as many number names as you can. Do you see similarities in the number names?

Answer:

Number	English	French	Spanish	German	Latin
1	one	<i>un</i>	<i>uno</i>	<i>eins</i>	<i>unus</i>
2	two	<i>deux</i>	<i>dos</i>	<i>zwei</i>	<i>duo</i>
3	three	<i>trois</i>	<i>tres</i>	<i>drei</i>	<i>tres</i>
4	four	<i>quatre</i>	<i>cuatro</i>	<i>vier</i>	<i>quattuor</i>
5	five	<i>cinq</i>	<i>cinco</i>	<i>fünf</i>	<i>quinque</i>
6	six	<i>six</i>	<i>seis</i>	<i>sechs</i>	<i>sex</i>
7	seven	<i>sept</i>	<i>siete</i>	<i>sieben</i>	<i>septem</i>
8	eight	<i>huit</i>	<i>ocho</i>	<i>acht</i>	<i>octo</i>
9	nine	<i>neuf</i>	<i>nueve</i>	<i>neun</i>	<i>novem</i>
10	ten	<i>dix</i>	<i>diez</i>	<i>zehn</i>	<i>decem</i>

### Number Names for All Seasons

Do the Latin names for 7, 8, 9, and 10 look familiar? They are in the names of the last four months of the year. What is unusual about meaning of the Latin words and the months they represent? How did this happen? Research the history of the Roman, Julian, and Gregorian calendars.

*Possible response: The Latin names for 7, 8, 9, and 10 are used in the calendar for the ninth, tenth, eleventh, and twelfth months (September, October, November, and December). The names do not match their numerical meaning.*

*The month names came from the early Roman calendar, one of the oldest known calendars. The Roman calendar originally started with March and only had 10 months, so October really was the eighth month and December really was the tenth. However, the Roman calendar did not match well with the seasons or cycles of the moon, so the number of days per month and the number of months per year were adjusted. January and February were added at the beginning of the year, and the existing month names were shifted down in order. October became the tenth month, and December became the twelfth.*

## Which Letters are in Number Names?

Do you think the whole alphabet is used for the English names of numbers? Make a prediction before completing this activity.

*Possible response:*

- All vowels appear in English number names, but A does not appear until one thousand.
- J and K are the only letters that do not appear in any English number names.

## Using Letters for Numbers

### Roman Numerals

The idea of using letters to represent numerical quantities is not new. The Roman numeral system shows numbers differently than we do. What letters are used? What numbers do the letters represent? How are the letters combined?

Write the numbers 1 to 10 in Roman numerals. What patterns do you notice in how numbers are formed from the letters?

*Answers:* Roman numerals use the letters I (1), V (5), X (10), L (50), C (100), D (500), and M (1,000).

<b>Number</b>	1	2	3	4	5	6	7	8	9	10
<b>Roman Numerals</b>	I	II	III	IV	V	VI	VII	VIII	IX	X

<b>Number</b>	11	12	13	14	15	16	17	18	19	20
<b>Roman Numerals</b>	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX

The letters for 1, 10, and 100 can be repeated, but the letters for 5, 50, and 500 cannot. Most combinations of the letters indicate addition of the numbers represented by the letters. When the letter for a smaller number is put before another letter, this indicates subtraction. The Roman numerals do not show place value.

Examples

- $IV = 5 - 1 + 4$
- $VI = 5 + 1 = 6$
- $VIII = 5 + 1 + 1 + 1 = 8$
- $IX = 10 - 1 = 9$

## Computer Speak

Count from 1–20 in the binary and hexadecimal systems.

Answers:

Number	Binary	Hexadecimal
1	1	1
2	10	2
3	11	3
4	100	4
5	101	5
6	110	6
7	111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	10000	10
17	10001	11
18	10010	12
19	10011	13
20	10100	14