




# Ancient Maya Arithmetic **ANSWERS**

Lesson 1 of 4, work individually or in pairs

The Maya number system used fewer symbols than our system does. In it, a shell  means 0, a dot  $\bullet$  means 1, and a dash  $—$  means 5. It is the arrangement of the numbers that is important. For example, 3 dashes and a dot by themselves

means 16: . Numbers were written from bottom to top, and the symbols were only used for numbers up through 19.

 0	$\bullet$ 1	$\bullet\bullet$ 2	$\bullet\bullet\bullet$ 3	$\bullet\bullet\bullet\bullet$ 4
$—$ 5	$\dot{—}$ 6	$\ddot{—}$ 7	$\ddot{\ddot{—}}$ 8	$\ddot{\ddot{\ddot{—}}}$ 9
$==$ 10	$\dot{==}$ 11	$\ddot{==}$ 12	$\ddot{\ddot{==}}$ 13	$\ddot{\ddot{\ddot{==}}}$ 14
$===$ 15	$\dot{===}$ 16	$\ddot{===}$ 17	$\ddot{\ddot{===}}$ 18	$\ddot{\ddot{\ddot{===}}}$ 19

Once you reach 20, then you write a symbol showing how many twenties there are. For example, 23 = one twenty and 3, so is written top to bottom as

$\bullet\bullet\bullet$

The top dot represents that there is one twenty, and the lower 3 dots represent that there are 3 ones.

Materials Needed: Pencil  
Math Journal or Notebook

The number written


$\bullet\bullet\bullet$   
 $\ddot{\ddot{—}}$



is  $(3 \times 20) + (8 \times 1) = 60 + 8 = 68$ .

The number written



$\ddot{\ddot{\ddot{—}}}$   
 $\dot{—}$

is  $9 \times 20 + 11 = 180 + 11 = 191$ .


We can tell the difference between 9 twenty's and just 9 by using the symbol  for 0.

$\ddot{\ddot{\ddot{—}}}$  is 9 and  is  $9 \times 20$  because the  shows that there are 0 numbers less than twenty.

1. What numbers do these Maya symbols represent?

- a.  $\ddot{\ddot{—}}$  8    b.   $8 \times 20 = 160$     c.   $4 \times 20 + 17 = 97$

2. Write the following numbers in Maya notation:

- a. 25  $\dot{—}$     b. 67  $\ddot{\ddot{\ddot{—}}}$     c. 140 

Standards: Number systems, place value

# Ancient Maya Arithmetic **ANSWERS**

Lesson 2 of 4, work individually or in pairs

Review ancient Maya numbers that you learned on Lesson 1.

The numbers above 399 need to be written with a third row of numbers: The top number is for the number of 400s, the next row is for the number of 20s, and the bottom row is for the digits less than 20. So 419 would be  $(1 \times 400) + (0 \times 20) + 19$ , written as



1. Why do Maya numbers need another row of symbols after 399?

*They need another row of symbols because the largest they can make without it is  $19 \times 20 + 19 = 399$ .*

Materials Needed: Pencil  
Math Journal or Notebook

2. What numbers do these symbols represent?



a.

a.  $400 + 0 + 5 = 405$



b.

b.  $(7 \times 400) + (1 \times 20) + 11 = 2831$



c.

c.  $(19 \times 400) + (19 \times 20) + 19 = 7,999$

3. Write the numbers in Maya symbols

a.  $6800 = 17 \times 400$



b.  $6893 = 17 \times 400 + 4 \times 20 + 13$



c.  $1024 = 2 \times 400 + 11 \times 20 + 4$



d.  $879 = 2 \times 400 + 3 \times 20 + 19$



3. In three rows, you can get 400's, 20's, and 1's. At what number would you need another row? What would the next row represent? What about the row after that?

*You need another row after 7,999 (see 2c). It would represent the number of 8,000s in the number. The row after that would represent  $20 \times 8,000 = 16,000$ .*

Standards: Number systems, place value


# Ancient Maya Arithmetic **ANSWERS**

Lesson 3 of 4, work individually or in pairs

Addition in Maya addition is usually a matter of

combining symbols: 

Sometimes, however, you'll have to regroup. You

may want to write , but you're never allowed to have a single symbol that represents more than 19. So, you'll have to write




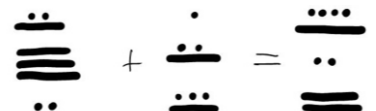
1. Perform the additions shown.

a. 

b. 

*Materials Needed: Pencil  
Math Journal or Notebook*

c. 

d. 

2. Rewrite all of the additions in problem 1 in the standard number system. Compare your answers!

a.  $1,200 + 23 = 1,223$

b.  $826 + 628 = 1,444$

c.  $1,081 + 2,433 = 3,514$

d.  $3,201 + 548 = 3,650$

*Standards: Number systems, place value*

## Ancient Maya Arithmetic **ANSWERS**

Lesson 4 of 4, work individually or in pairs

*Materials Needed: Pencil  
Math Journal or Notebook*

Compare the Maya number system and our number system.

1. **Compare** Look back at your work on problems 1 and 2 on Lesson 3. How is the regrouping in ancient Maya addition similar to carrying in our method of addition?

*The regrouping of Maya symbols is like us carrying a ten from the ones column when we add.*

2. What differences are there between the ancient Maya number system and our number system? How are they similar?

*Answers will vary. Possible answers include: They both group numbers; the Maya had fewer symbols; you can count as high as you want in either system; there is carrying in addition.*

3. How is having the number zero useful?

*Answers will vary.*

4. Did you find it easier to add in Maya numbers or your familiar numbers? Imagine that you grew up in the Maya society. Now which system do you think would be easier?

5. **Independent Research** Research the history of the number 0 and learn why it is important.

6. **Compare** If you have also done the unit on ancient Egyptian mathematics, compare that number system with the Maya number system.  
*Answers will vary. Possible answers include a discussion of the different kinds of symbols and the different ways of using those symbols.*

*Standards: Number systems, place value, research*