Place Value

h	t	o	h	t	o	h	t	o	h	t	o	h	t	o
2	0	9	3	5	6	0	7	5	8	5	5	4	0	2

trillions period	billions period	millions period	thousands period	ones period

The letters "h t o" stand for hundreds, tens, ones.

Read this number as:

"Two hundred nine trillion, three hundred fifty-six billion, seventy-five million, eight hundred fifty-five thousand, four hundred and two."

To write this number in its *expanded form*, take each digit's value, and write them all as a sum:

200,000,000,000,000 + 9,000,000,000,000 + 300,000,000,000 + 50,000,000,000 + 6,000,000,000 + 70,000,000 + 5,000,000 + 800,000 + 50,000 + 5,000 + 400 + 2

This is easier to write using exponents:

2×10^{14} + 9×10^{12} + 3×10^{11} + 5×10^{10} + 6×10^{9}

+ 7×10^{7} + 5×10^{6} + 8×10^{5} + 5×10^{4} + 5×10^{3} + 4×10^{2} + 2×10^{0}

Remember that in powers of 10, the exponent tells you how many zeros are in the number.
For example, $10^{11} = 100,000,000,000$ has eleven zeros.
Notice especially: $10^0 = 1$ (the number 1 has no zeros!).

The number system we use is based on *place value*. This means that a digit's *value* depends on its position or *place* within the number.

Our number system is called a *decimal*, or *base-ten*, system (from the Latin word decima, *a tenth part*). The value of each position or place is <u>one-tenth</u> of the value of the previous place.

h	t	o	h	t	o	h	t	o	h	t	o	h	t	o
0	0	0	6	3	0	9	5	7	8	1	2	4	9	8

trillions period	billions period	millions period	thousands period	ones period

The digit "6" is in the hundred billions place.
Its value is $6 \times$ a hundred billion, or 600 billion.

The digit "5" is in the ten millions place.
Its value is $5 \times$ ten million, or 50 million.

1. Write the numbers in the place value chart. Answer the questions.

a. 89 million, 2 thousand, 4 hundred

What is the value of the digit "9"?

_____

trillions period	billions period	millions period	thousands period	ones period

b. 142 billion, 2 million, 139 thousand

What is the value of the digit "3"?

_____

trillions period	billions period	millions period	thousands period	ones period

c. 5 trillion, 47 million, 260

What is the value of the digit "4"?

_____

trillions period	billions period	millions period	thousands period	ones period

Place Value 5 (Blue Series)

2. What is the place and the value of the digit 8 in the following numbers?

a. 56,809	**b.** 287,403,222	**c.** 18,503,200,000,000	**d.** 8,493,591,000
the hundreds place	_____	_____	_____
value __800__	value _____	value _____	value _____

3. Write as numbers.

   a. 2 billion, 180 million, 27 thousand

   b. 60 trillion, 453 thousand

   c. 4 trillion, 50 billion, 54 million, 9

4. Write the numbers and their names corresponding to the powers of ten. Notice especially that $10^0 = 1$.

10^0	1	one
10^1	10	ten
10^2		
10^3	1,000	one thousand
10^4		
10^5		
10^6		
10^7		ten million
10^8		
10^9		
10^{10}		
10^{11}		
10^{12}		

5. Write as a single number.

a. $8 \times 10^4 + 5 \times 10^2 + 7 \times 10^0$	**b.** $7 \times 10^6 + 5 \times 10^4 + 6 \times 10^3 + 6 \times 10^1$
c. $7 \times 10^9 + 1 \times 10^8 + 7 \times 10^7$	**d.** $6 \times 10^8 + 4 \times 10^6 + 5 \times 10^5 + 1 \times 10^4 + 2 \times 10^3$
e. $2 \times 10^9 + 3 \times 10^8 + 5 \times 10^6 + 8 \times 10^5 + 7 \times 10^4$	**f.** $6 \times 10^4 + 2 \times 10^7 + 1 \times 10^5 + 2 \times 10^0$