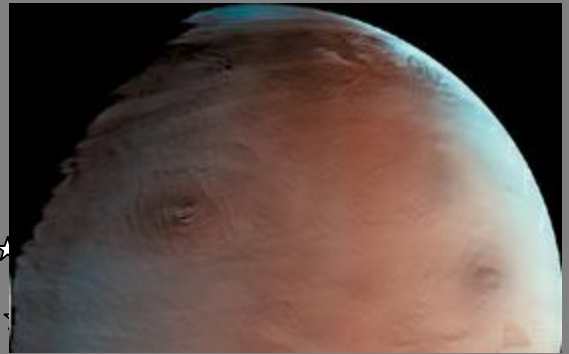


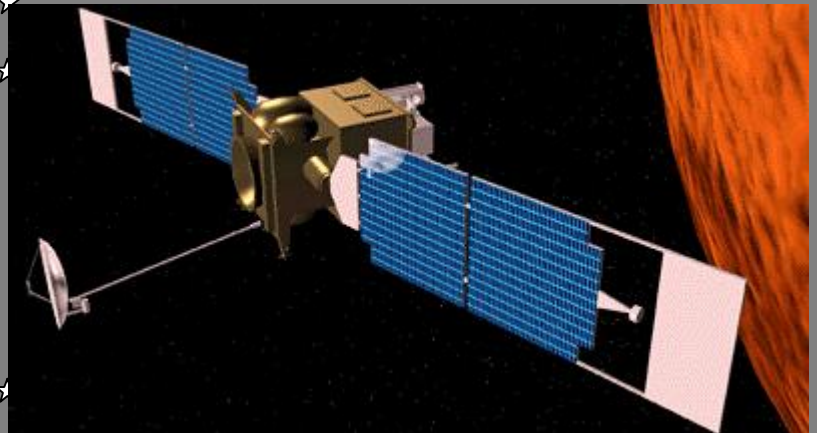
# Mars and Beyond!



Mars taken by Mars Orbital Camera



Family Portrait of Jupiter's Great Red Spot and the Galilean Satellites



Mars Global Surveyor

By Nancy Wilkinson

**Mars and Beyond**  
**Lesson 4**  
**Large Numbers**

**Objectives:**

- 1) Students will discover very large numbers and how they relate to the universe.
- 2) Students will apply the use of scientific notation to express numbers in real-life situations.
- 3) Students will analyze how exponents are related to the size of numbers and how they are related to the use of exponents and place value.

**Materials Needed:**

- 1) Worksheet Lesson 4
- 2) Construction paper signs with place value: thousands, millions, billions, trillions, quadrillions, quintillions, sextillions, septillions, octillions, nonillions, decillions, undecillion, duodecillion, tredecillion, quattuordillion, quindecillion, sexdecillion, septendecillion, octodecillion, novemdecillion, vigintillion.

**Opening Activity:**

Ask students how far away they think Pluto is.

**Activity:**

- 1) Place the cards in order in the front of the room. Read each word as you put the card up. The order of the cards is written above.
- 2) Ask the students what they think these words are. *(They should mention something about place value.)*
- 3) Show the students what each words represents in numerical form. Write down some numbers on the chalkboard and have the students tell you what the number is.

thousand =	1,000
million =	1,000,000
billion =	1,000,000,000
trillion =	1,000,000,000,000
quadrillion =	1,000,000,000,000,000
quintillion =	1,000,000,000,000,000,000
sextillion =	1,000,000,000,000,000,000,000
septillion =	1,000,000,000,000,000,000,000,000
octillion =	1,000,000,000,000,000,000,000,000,000
nonillions =	1,000,000,000,000,000,000,000,000,000,000
decillions =	1,000,000,000,000,000,000,000,000,000,000,000
undecillion =	1,000,000,000,000,000,000,000,000,000,000,000,000
duodecillion =	1,000,000,000,000,000,000,000,000,000,000,000,000,000
tredecillion =	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000
quattuordillion =	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000



**Mars and Beyond  
Worksheet Lesson 4  
Large Numbers**

Name \_\_\_\_\_ Period \_\_\_\_\_

A light year is the distance that light travels in one year. If you turned on a very powerful light and waited one year, the end of the beam will have traveled one light year.

\_\_\_\_\_ 1) Stars are measured in how many light years they are from the earth. The nearest star is Proxima Centauri. It is 4.3 light years away. What does this mean?

Light travels at a speed of 186,000 miles per second. We know that 2 miles equals 3.3 kilometers. How many kilometers is 186,000 miles? To figure this, we set up a proportion.

$$\frac{2 \text{ miles}}{3.3 \text{ kilometers}} = \frac{186000 \text{ miles}}{X \text{ kilometers}}$$

We now have two equivalent fractions. Remember, in equivalent fractions, whatever you did to the numerator (the top number), you must do to the denominator (the bottom number).

\_\_\_\_\_ 2) Therefore, how much did we multiply 2 by to get 186,000?  
 $186,000 \div 2?$

\_\_\_\_\_ 3) Since we multiplied the numerator by this amount, we must multiply the denominator by this amount.

4) To make sure that your proportion is correct, you can cross multiply. To do this, multiply 2 by the number of kilometers in a light year. Second, multiply 3.3 by 186,000. You should get the same answer for both problems. Show your work below.

\_\_\_\_\_ 5) You've now figured how many kilometers light travels in one second. How many kilometers is a light year? (Remember, there are 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day and 365 days in a year.)

6) Do you know how to read this number? Write down what this number says.

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\_\_\_\_\_ 7) The earth is 12,756 kilometers in diameter. The solar system is about a million times wider than the earth. Write down the width of the solar system.

\_\_\_\_\_ 8) The Milky Way Galaxy is about 100 million times wider than the solar system. Write down the width of the Milky Way Galaxy.

\_\_\_\_\_ 9) The distance to the farthest visible object in the universe is about 100,000 times farther away than the width of our galaxy. Write the distance to the farthest object.

10) You wrote down some very large numbers. The number in question 9 is the largest number you wrote. Can you write down in words what the name of that number is?

11) You learned how to write numbers in exponential form. Copy and fill out the chart below. The first one is done for you.

Name	What it Looks Like	Exponential Form $10^e$
1 thousand	1 with 3 zeros	$10^3$
1 million	1 with 6 zeros	
1 billion	1 with 9 zeros	
1 trillion	1 with 12 zeros	
1 quadrillion	1 with 15 zeros	
1 quintillion	1 with 18 zeros	
1 sextillion	1 with 21 zeros	
1 septillion	1 with 24 zeros	
1 octillion	1 with 27 zeros	
1 nonillion	1 with 30 zeros	
1 decillion	1 with 33 zeros	
1 undecillion	1 with 36 zeros	
1 duodecillion	1 with 39 zeros	
1 tredecillion	1 with 42 zeros	
1 quattuordillion	1 with 45 zeros	
1 quindecillion,	1 with 48 zeros	
1 sexdecillion,	1 with 51 zeros	
1 septendecillion,	1 with 54 zeros	
1 octodecillion	1 with 57 zeros	
1 novemdecillion	1 with 60 zeros	
1 vigintillion	1 with 63 zeros	

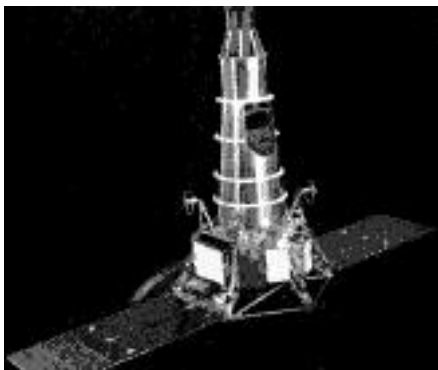
12) Create a poster for the classroom that shows the large numbers.

**Mars and Beyond**  
**Worksheet Lesson 4 – Answers**  
**Large Numbers**

- 1) Stars are measured in how many light years they are from the earth. The nearest star is Proxima Centauri. It is 4.3 light years away. What does this mean? -  
*It means that the light had to travel for 4.3 years before it reached the Earth.*
- 2) Therefore, how much did we multiply 2 by to get 186,000?  $186,000 \div 2$ ?  
*= 93,000*
- 3) Since we multiplied the numerator by this amount, we must multiply the denominator by this amount.  
 *$3.3 \bullet 93,000 = 306,900$*
- 4) To make sure that your proportion is correct, you can cross multiply. To do this, multiply 2 by the number of kilometers in a light year. Second, multiply 3.3 by 186,000. You should get the same answer for both problems. Show your work below.  
 *$2 \bullet 306,900 = 3.3 \bullet 186,000$   
 $613,800 = 613,800$*
- 5) You've now figured how many kilometers light travels in one second. How many kilometers is a light year? (Remember, there are 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day and 365 days in a year.)  
 *$306,900 \bullet 60 \bullet 60 \bullet 24 \bullet 365 = 9,678,398,400,000$*
- 6) Do you know how to read this number? Write down what this number says.  
*Nine trillion, six hundred seventy eight billion, four hundred thousand*
- 7) The earth is 12,756 kilometers in diameter. The solar system is about a million times wider than the earth. Write down the width of the solar system.  
*12,756,000,000 kilometers*
- 8) The Milky Way Galaxy is about 100 million times wider than the solar system. Write down the width of the Milky Way Galaxy.  
*1,275,600,000,000,000,000 kilometers*
- 9) The distance to the farthest visible object in the universe is about 100,000 times farther away than the width of our galaxy. Write the distance to the farthest object.  
*127,560,000,000,000,000,000 kilometers*
- 10) You wrote down some very large numbers. The number in question 9 is the largest number you wrote. Can you write down in words what the name of that number is?  
*One hundred twenty seven sextillion, five hundred sixty quintillion*

11) You learned how to write numbers in exponential form. Copy and fill out the chart below.  
The first one is done for you.

Name	What it Looks Like	Exponential Form $10^e$
1 thousand	1 with 3 zeros	$10^3$
1 million	1 with 6 zeros	$10^6$
1 billion	1 with 9 zeros	$10^9$
1 trillion	1 with 12 zeros	$10^{12}$
1 quadrillion	1 with 15 zeros	$10^{15}$
1 quintillion	1 with 18 zeros	$10^{18}$
1 sextillion	1 with 21 zeros	$10^{21}$
1 septillion	1 with 24 zeros	$10^{24}$
1 octillion	1 with 27 zeros	$10^{27}$
1 nonillion	1 with 30 zeros	$10^{30}$
1 decillion	1 with 33 zeros	$10^{33}$
1 undecillion	1 with 36 zeros	$10^{36}$
1 duodecillion	1 with 39 zeros	$10^{39}$
1 tredecillion	1 with 42 zeros	$10^{42}$
1 quattuordillion	1 with 45 zeros	$10^{45}$
1 quindecillion,	1 with 48 zeros	$10^{48}$
1 sexdecillion,	1 with 51 zeros	$10^{51}$
1 septendecillion,	1 with 54 zeros	$10^{54}$
1 octodecillion	1 with 57 zeros	$10^{57}$
1 novemdecillion	1 with 60 zeros	$10^{60}$
1 vigintillion	1 with 63 zeros	$10^{63}$



Ranger 8 – 2/17/1965 - Lunar Impact



Lunar Orbiter 4 – 5/8/1967 - Lunar Orbiter