Scientific Notation
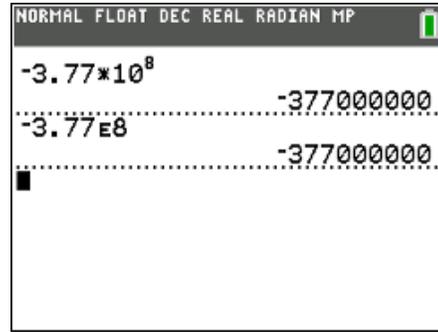**Student Activity**

Name _____

Class _____

This activity gives students an opportunity to see where large and small numbers are used and how scientific notation offers a convenient method of writing such numbers. This will be done both with and without technology.

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NORMAL FLOAT DEC REAL RADIAN MP

-3.77*10⁸
                    -377000000
-3.77E8
                    -377000000
■
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Part 1 – Writing Scientific Notation in Expanded Form

Scientific notation is a way of writing very large and very small numbers. Numbers in scientific notation include two parts, a number greater than or equal to 1 and less than 10, and a power of 10. Examples include:

$$5.6 \times 10^5 = 5,600,000 \quad \text{and} \quad 2.3 \times 10^{-8} = 0.000000023$$

Write each of the following numbers in expanded notation. Check your answer with a calculator.

1. -3.77×10^8

Write the answer. _____

2. 1.202×10^5.

Write the answer. _____

3. 4.224×10^{-6}

Write the answer. _____

4. -5.24×10^{-12}

Write the answer. _____

Part 2 – Writing Numbers in Scientific Notation

To write numbers in scientific notation, place a decimal point so there is one non-zero digit to the left. Count the number of decimal places the decimal point moved. The number of places the decimal point moves to the left is the positive exponent power of 10. The number of places the decimal point moves to the right is the negative exponent power of 10.

$$\text{For example:} \quad 156,000,000 = 1.56 \times 10^8 \quad \text{and} \quad 0.0000045 = 4.5 \times 10^{-6}$$

5. The following are salaries for the 5 top paid players of the Cincinnati Bengals. Write each salary in scientific notation.

Player	Salary	Scientific Notation
Joe Burrow	$19,515,043	
DJ Reader	$15,521,324	
Trey Hendrickson	$15,143,126	
Jonah Williams	$12,604,000	
BJ Hill	$10,354,000	

6. The 2022 median American household income was 7.4580×10^4. Compare this to the salaries above. Explain what you notice. _____

_____

_____

7. Imagine you could fold a piece of paper 0.004 inches thick 50 times. Find how many inches thick the resulting paper would be after the 50ᵗʰ fold.

_____

To solve, type 0.004 on the home screen and press e   . Then, type * 2 e   . Each time e   is pressed, the previous value is doubled.

```
NORMAL FLOAT DEC REAL RADIAN MP
0.004
                          0.004
Ans*2
                          0.008
Ans*2
                          0.016
Ans*2
                          0.032
```

8. Write this answer in expanded form. _____

9. Find the probability of flipping a coin 40 times and having it come up heads each time.

_____

To solve, type 0.5 on the home screen and press e   . Then, press * 0 . 5 e   . Each time e   is pressed, the previous value is multiplied by 0.5. The screen at the right shows the probability of heads once, two times in a row, three times in a row and four times in a row.

```
NORMAL FLOAT DEC REAL RADIAN MP
0.5
                            0.5
Ans*0.5
                           0.25
Ans*0.5
                          0.125
Ans*0.5
                         0.0625
■
```

10. Write this answer in expanded form. _____

Part 3 – Ordering Numbers in Scientific Notation

11. Place the following numbers on the number line. After placing them on the number line, switch with a partner to check answers.
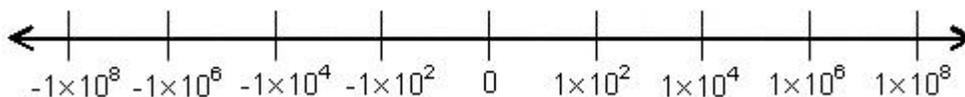
    a. 1.25×10^{-3} **c.** -4.45×10^4 **e.** 1.8×10^2

    b. 5.5×10^4 **d.** -3.11×10^6 **f.** 7.79×10^8

$$-1 \times 10^8 \quad -1 \times 10^6 \quad -1 \times 10^4 \quad -1 \times 10^2 \quad 0 \quad 1 \times 10^2 \quad 1 \times 10^4 \quad 1 \times 10^6 \quad 1 \times 10^8$$

12. Draw an appropriate number line for the following numbers. Explain your choice.

2.25×10^{-3} $\qquad$ -1.05×10^{-4} $\qquad$ 5.603×10^{-2}

_____

_____

Part 4 – Operations with Scientific Notation

Numbers that are written in scientific notation can be multiplied and divided rather simply by taking advantage of the properties of numbers and the rules of exponents that you may recall. To multiply numbers in scientific notation, first multiply the numbers that are not powers of 10 (the a in $a \times 10^n$). Then multiply the powers of ten by adding the exponents.

In order to divide numbers in scientific notation, you once again apply the properties of numbers and the rules of exponents. You begin by dividing the numbers that are not powers of 10 (the a in $a \times 10^n$). Then you divide the powers of ten by subtracting the exponents.

13. Perform the indicated operation for each problem and write in the form $a \times 10^n$, where $1 \le a < 10$, and $n \in \mathbb{Z}$:

(a) $(4 \times 10^7)(5.6 \times 10^{-10})$ $\qquad$ _____

(b) $(3.1 \times 10^8)(4.3 \times 10^{-4})(1.2 \times 10^{-5})$ $\qquad$ _____

(c) $\dfrac{2.75 \times 10^{-6}}{1.25 \times 10^7}$ $\qquad$ _____

(d) $\dfrac{(5.15 \times 10^{-9})(4.21 \times 10^5)}{3.35 \times 10^{10}}$ $\qquad$ _____

Further IB Application

The asteroid belt orbiting around the sun between Mars and Jupiter is said to be valued at over \$715 quintillion dollars (US), where one quintillion = 10^{18}. This equates to each person on the planet earth having approximately 100 billion dollars (US).

(a) Write down the value of the asteroid belt in the form $a \times 10^k$ where $1 \le a < 10$, $k \in \mathbb{Z}$.

One of the asteroids in the belt is named Diotima and is approximately spherical with a diameter of 176 km.

(b) If you were to use this information to estimate its volume, calculate its volume in km^3.

(c) The actual volume is found to be 2.95×10^6 km^3. Find the percentage error in your estimate of the volume.