Warm Up

Write the following numbers in proper Scientific Notation Form:

1. 0.000456 4.56×10^{-4}
2. 2,037,000 $2.037 \cdot 10^{6}$
3. 392.7×10^{-2} 3.927×10^{0}
4. 0.0035×10^{-2} 3.5×10^{-3}

2 strategies

$392.7 \times 10^{-2} = 3.927$

SN Form Standard Form

How do we write 3.927 in S.N. Form?

3.927×10^{0}

OR

392.7×10^{-2}

$3.927 \times 10^{-2+2}$

Lost 2 place values

we need to add 2

Expand to Standard

0.0035×10^{-2}

$= 0.000035$

$= 3.5 \times 10^{-5}$

Keep in SN

0.0035×10^{-2}

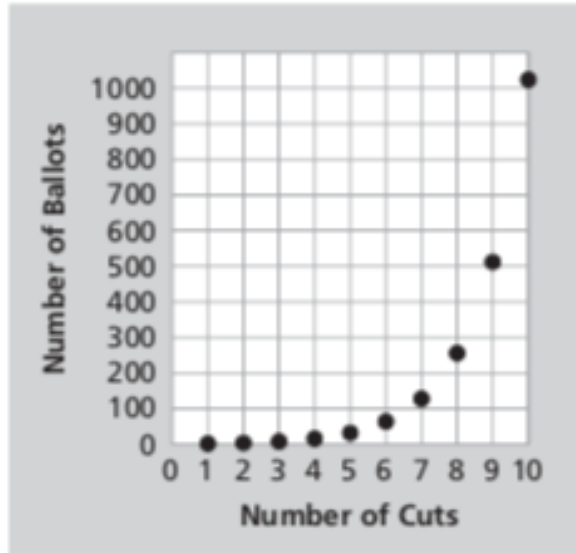
$3.5 \times 10^{-2-3}$

3.5×10^{-5}

Two methods, pick which one works best for you!

Problem 1.1 Recap

Number of Cuts	Number of Ballots
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1,024



Number of Cuts	Number of Ballots	Calculation
1	2	2
2	4	$2 \cdot 2$
3	8	$2 \cdot 2 \cdot 2$
4	16	$2 \cdot 2 \cdot 2 \cdot 2$
5	32	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
6	64	
7	128	
8	256	
9	512	
10	1,024	

×2 ×2 ×2 ×2 ×2

Multiplying by 2 every new cut

$$y = 2^x$$

Always check your equation w/ 2 data points.

Let's check (2,4) and (10,1,024)

$$y = 2^x$$
$$4 \stackrel{?}{=} 2^2$$
$$4 = 4 \checkmark$$

$$y = 2^x$$
$$1024 \stackrel{?}{=} 2^{10}$$
$$1024 = 1024 \checkmark$$

Homework Questions?

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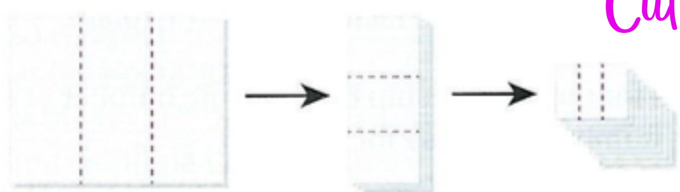
1. Cut a sheet of paper into thirds. Stack the three pieces and cut the stack into thirds. Stack all of the pieces and cut the stack into thirds again.

What is different?
Cutting into thirds!



a. Copy and complete this table to show the number of ballots after repeating this process five times.

b. Suppose you continued this process. How many ballots would you have after 10 cuts? How many would you have after n cuts?

c. How many cuts would it take to make at least one million ballots?

Cutting Ballots

Cutting Processes	Number of Ballots
1	3
2	9
3	27
4	81
5	243

$y = 3^x$

$y = 3^{10}$

$= 59{,}049$ ballots

1.2 Requesting a Reward

Representing Exponential Functions

When you found the number of ballots after 10, 20, and 40 cuts, you may have multiplied long strings of 2s. Instead of writing long product strings of the same factor, you can use **exponential form,** such as 2^5. You can write $2 \times 2 \times 2 \times 2 \times 2$ as 2^5, which is read "2 to the fifth power."

In the expression 2^5, 5 is the **exponent** and 2 is the **base.** When you evaluate 2^5, you get $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$. Since there are two ways to write 2^5, we call 32 the **standard form** and $2 \times 2 \times 2 \times 2 \times 2$ the **expanded form** of 2^5.

Exponential Form

Exponent

$$\underbrace{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}_{\text{Expanded Form}} = 2^5 = 32$$

Base

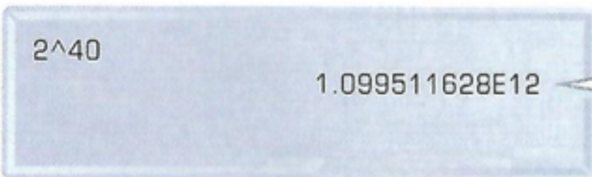
Standard form

How do we use our calculators to calculate numbers raised to powers?

$$\mathbf{3}^{8}$$

^ y^x

Stella used her calculator in Problem 1.1 to compute the number of ballots after 40 cuts. Calculators use shorthand for displaying very large numbers.



This is how the calculator displays $1.099511628 \times 10^{12}$

1.0995 x10

The number $1.099511628 \times 10^{12}$ is written in **scientific notation.**

you may also see this

This notation can be expanded as follows:

$$1.099511628 \times 10^{12} = 1.099511628 \times 1{,}000{,}000{,}000{,}000$$
$$= 1{,}099{,}511{,}628{,}000$$

The number 1,099,511,628,000 is the standard form for the number $1.099511628 \times 10^{12}$ written in scientific notation.

The calculator above has approximated 2^{40} as accurately as it can with the number of digits it can store. A number written in scientific notation must be in the form:

(a number greater than or equal to 1 but less than 10) $\times$ *(a power of 10)*

One day in the ancient kingdom of Montarek, a peasant saved the life of the king's daughter. The king was so grateful he told the peasant she could have any reward she desired. The peasant, the kingdom's chess champion, made an unusual request:

Plan 1—The Peasant's Plan

"I would like you to place 1 ruba on the first square of my chessboard, 2 rubas on the second square, 4 on the third square, 8 on the fourth square, and so on. Continue this pattern until you have covered all 64 squares. Each square should have twice as many rubas as the previous square."

The king replied, "Rubas are the least valuable coin in the kingdom. Surely you can think of a better reward." But the peasant insisted, so the king agreed to her request.

- Did the peasant make a wise choice? Explain.

Problem 1.2

A 1. Make a table showing the number of rubas the king will place on squares 1 through 10 of the chessboard.

2. Graph the points (*number of the square, number of rubas*) for squares 1 to 10.

3. Write an equation for the relationship between the number of the square n and the number of rubas r.

B 1. How does the number of rubas change from one square to the next?

2. How does the pattern of change you observed in the table show up in the graph? How does it show up in the equation?

C 1. Which square will have 2^{30} rubas? Explain.

2. What is the first square on which the king will place at least one million rubas? How many rubas will be on this square?

3. Larissa uses a calculator to compute the number of rubas on a square. When is the first time the answer is displayed in scientific notation?

D Compare the growth pattern to the growth pattern in Problem 1.1.

Homework

Finish 1.2A 1-3