

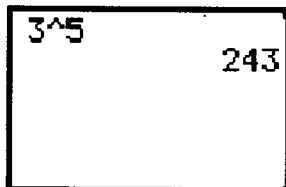
Simply HUGE

Exponents
Patterning
Order of Operations
Approximations
Measurement

How to Find a Number Raised to the Power of Another Number

The carat key \wedge is used to take a number to a power. To find 3^5 :

Press 3
 \wedge key
 5
 EXE



Standards: Problem Solving, Communication, Reasoning, Connections, Number Theory, Estimation, Patterns, Algebra, and Measurement.

Materials: fx-7400G, and Real Big activity

Calculator Use: RUN Menu and \wedge key.

The "Real Big" activity indicates that 4^{4^4} is a rather large number and also, that the sequence $2^{2^2}, 3^{3^3}, 4^{4^4}, \dots, 9^{9^9}$ grows rapidly. One question that is frequently asked is "How big is 9^{9^9} ?"

Consider 10. 10^{10} would mean 1 followed by 10 zeros. 10,000,000,000 would be the exponent of 10 in $10^{10^{10}}$, meaning the answer would be 1 followed by 10 *billion* zeros. That is a fairly large number.

Using a similar approach:

A. $9^9 = \underline{\hspace{2cm}}$

This means 9 is used as a factor that many times.

Using that information, 9^{9^9} is about 165 million digits long.

Suppose a word processor or typewriter uses a font that produces 12 digits in an inch. How long would the 365 million digit number be if it were typed? **B.**

Suppose a word processor or typewriter uses a font that gives 10 digits in an inch. How long would the 165 million digit number be if it were typed? **C.**

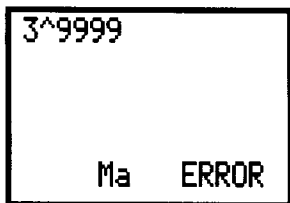
Using your "normal" writing style, write a 10 digit number. In inches, how long is your 10 digit number? **D.**

What would the length of 9^{9^9} be if you wrote it? **E.**

Would you be interested in writing that number if you were paid a penny a digit? Explain your reasoning. **F.**

What is Ma ERROR?

If you get an **Ma ERROR** when using exponents, the solution is too large for the calculator to compute? For example, try 3^{9999} .



Press AC/on to clear the Ma ERROR

Simply HUGE

$$2^{(2^2)}$$

16

$$3^{(3^3)}$$

7.62559748+12



represents a high level question

$$4^{(4^4)}$$

Ma ERROR

Time yourself for a minute as you write digits at a "normal" pace. How many digits can you write? **G.** _____

Time yourself for a minute as you write digits as fast as you can (remember they must be legible). How many digits can you write? **H.** _____

Calculate how long it would take you to write 9^{9^9} your normal pace? **I.** _____

Calculate how long it would take you to write 9^{9^9} at your fast pace? **J.** _____
Remember that you have to allow for your hand getting tired.

Could you actually do this working an 8 hour day, 365 days a year? Explain your reasoning **K.**



Figure out approximately how much you would make per year writing this number for a penny a digit. Remember, you were offered a penny a digit and we will assume you will work 8 hours a day, 365 days a year **L.**

Do you still want the job? **M.** _____

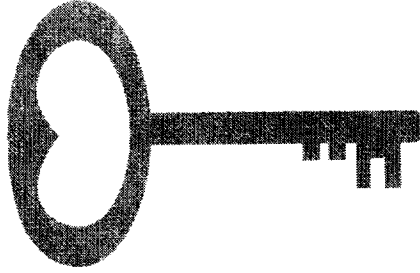


How many digits long is $2^{2^{2^2}}$? **N.** _____



How many digits long is $9^{9^{9^9}}$? **O.** _____

Solution Key



Simply HUGE

- A.** 387420489 **B.** 480.0610269 miles **C.** 576.0732323 miles
- D. - J.** Answers will vary
- K.** If an individual could write 60 digits per minute, it would take 34.72222222 years working 8 hours a day, 365 days a year, to write $9^{(9^9)}$. The answers will vary depending on your answer for G.
- L.** \$105,120 **M.** Answers will vary **N.** 65536
- O.** Simply HUGE. You are approaching a googol which is a 10^{100} .