

Place Value and Really BIG Numbers

Looking at the Heroic Qualities of Place Value

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1. Introduce Heroic Qualities: Sense of community/teamwork
2. Introduce the concept of really BIG numbers by looking at various place value periods. For example Units, Thousands, Millions, Billion, Trillions, Quadrillions etc. etc. etc.
 - a. Apartment buildings - Digits vs. Value
 - i. Hang up Units folder – discuss the Apartment Metaphor
 - ii. Each period is an apartment building and each of the places are apartments in the building.
 - iii. What is the most valuable part of your home? What would you save before anything else if there was a fire? *Hopefully they come up with - the people in it.*
 - iv. The apartments only hold value when there is a tenant (digit) in it. As the apartments are built farther to the left the value increases. If there is no tenant in the apartment the zero is holding a place for someone to move in.
 - v. An eight is just an eight until it moves into the hundreds apartment then the value of the eight it much much more.
3. Practice reading really BIG numbers using file folder periods and playing cards.
 - i. Add one more folder and continue
 - ii. Repeat – the kids get really excited to see what's next and how high they can go.
4. Going even bigger
 - a. Discuss Archimedes his work The Sand Reckoner 287BC
 - i. myriad (10,000) and vigintillion (10^{63})
 - ii. have a race to write a vigintillion (kids write the long way – 10 with 63 zeros and I write 10 to the power of 63) – I always win 😊

- b. Number names – look at the pattern of zeros – going up by threes
- c. Other patterns you can see – Sept, Oct, Nov, Dec
 - i. Can go into calendars etc – Julius Ceasar etc.

5. How big can numbers get?

- a. Fun Facts – 2009 in Zimbabwe there was a bank note for 100 trillion dollars but it was only worth 30\$. The highest bank note was produced in Hungary in 1947 Sextillion (10^{21}) due to insane inflation
- b. Million is an old French word meaning 'Big Thousand'
- c. Nicholas Chaquet, a French Mathematician has been given credit for inventing the names million, billion etc in the late 1400's.
- d. 1940's Edward Kasner write a book, Mathematics and Imagination. In it he claims his 9year old nephew Milton invented the number googol. He also came up with googolplex, which was, according the Milton a 1 followed by as many zeros as you could write before you got tired. Actually $10^{10^{100}}$ or 10^{googol}
- e. Finite/infinite or millionillion/pi – show off the receipt tape of millionillion (10^{3003}) and pi (unfinished because it will never be finished)

6. Practicing with really BIG numbers and Place Value

- a. Look at Place Value fun and the importance of lining up digits properly

7. Participants choose a Heroic Quality for Place Value.

- a. As assessment this is a great question. The student who has really understood a concept can come up with several reasonable responses and be able to explain himself clearly.

Place Value Fun

$$\begin{array}{r} 69\,724\,153\,864 \\ + \quad \quad 300\,000 \\ \hline 69\,724\,453\,864 \end{array}$$

1. Follow the directions below to reach the bottom of the number tower.
 - a) start with the number
 - b) increase the value by three hundred thousand
 - c) decrease the value by 50 000
 - d) decrease the value by three hundred
 - e) decrease the value by 3 billion
 - f) increase the value by ten
 - g) increase the value by 600 000
 - h) increase the value by thirty billion
 - i) increase the value by 80 million
 - j) increase the value by eighty
2. Which digits did not change?
_____ and _____
3. Which places were they in?
_____ and _____

4. What is the difference between the beginning number and the ending number?

5. Write the final number in word form.
