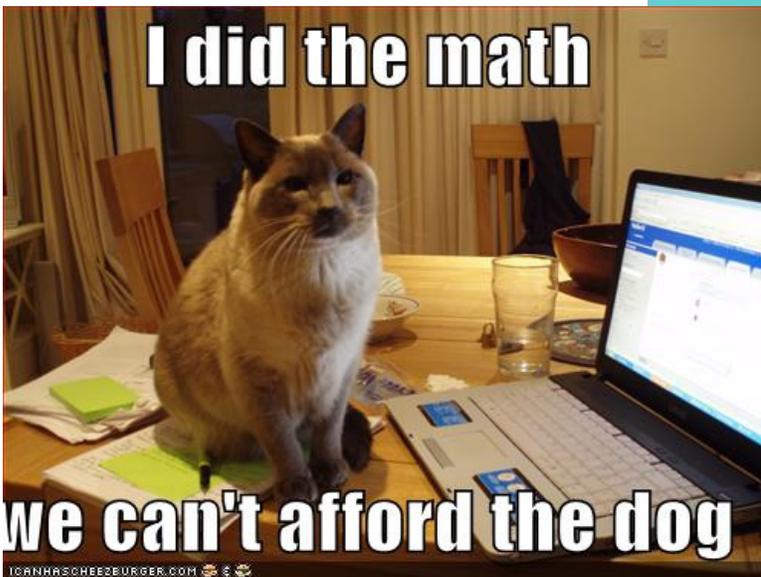
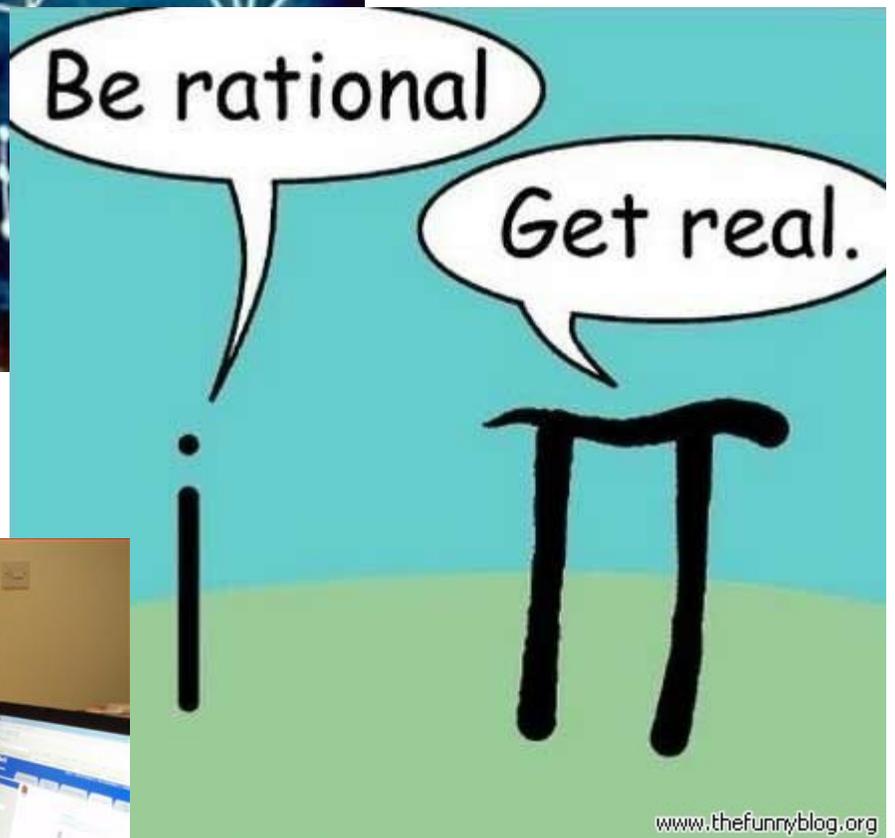


Mathematics



This is the bonus where we test to see how well you paid attention in high school. Don't worry, we won't make you solve any actual math problems!

History of Mathematics

1. Let's start at the beginning. Which ancient civilization was the first known to work with written mathematics?
2. How many different numerals did this civilization use in its number system?
3. Which ancient Greek cult coined the term "mathematics"?
4. What principle did Archimedes discover in his bathtub, causing him to jump and shout "Eureka"?
5. According to Zeno, why can Achilles never beat the tortoise in a race?
6. What societal need prompted the development of negative numbers in ancient India?
7. Tycho Brahe lost the front of his nose in a duel against his cousin. What were they arguing over at the time?
8. Which mathematician did Isaac Newton accuse of plagiarizing his work on calculus, even though he had not yet published it?
9. Ada Lovelace wrote what is arguably the first computer program for Charles Babbage's difference engine. What did the program do?
10. Where was Curt Herzstark when he completed his invention of the mechanical calculator?

Mathematics in Popular Culture

11. What mistake regarding Fermat's Last Theorem was made in an episode of Star Trek: The Next Generation and later rectified in an episode of Star Trek: Deep Space Nine?
12. Everybody knows that Pi Day is on March 14, and we all celebrate by eating pi and sharing our favorite pi trivia. But the real math nerds are looking forward to Pi Approximation Day. What date do they have marked on their calendar?
13. Explain very briefly why a real pineapple could never look like Spongebob's house. Hint: it has to do with the number of spirals on the pineapple
14. A computer program that could solve a Sudoku puzzle very quickly might lead to a breakthrough in solving which famous math problem?
15. In the movie *A Beautiful Mind*, what are John Nash's friends doing when they inspire his groundbreaking work in game theory?
16. Dungeons and Dragons players typically use six types of dice. Geometrically speaking, how is the ten-sided die different from the others?
17. According to *The Restaurant at the End of the Universe*, forty-two is the answer to the question, "What do you get if you multiply six by nine?" What assumption do you have to make for this answer to actually be correct?
18. Why is the square imprisoned at the end of the novel *Flatland*?
19. What is so funny about Bender's serial number, 2716057, and Flexo's serial number, 3370318?
20. In the Simpsons episode *Treehouse of Horror VI*, the equation $1782^{12} + 1841^{12} = 1922^{12}$ appears floating in the 3D realm. This equation is not true, but why might you think it is?



Numeral Systems

The number systems of various cultures are shown below. Name the civilization that devised each set.

21. 0 1 2 3 4 5 6 7 8 9
 - = ≡ ≡ ≡ ≡ ≡ ≡ ≡ ≡ ≡

22.

1	10	100	1000	10000	100000	10 ⁶

23.

0	1	2	3	4
5	6	7	8	9

24.

10	11	12	13	14
15	16	17	18	19

25. *ἕξ ἑπτά οὐκ ἔστιν ἀριθμὸς ἀριθμῶν*
ἑπτά τοῦ ἑξαβίου

26. \ V W W ^ < V W > > > > > = F V W x
 Y Y Y Y Y Y Y Y Y Y <

27. 零 一 二 三 四 五 六 七 八 九 十

28. I II III IV V VI VII VIII IX X

29.

1	2	3	4	5	6	7	8	9	0

30.

Identify the Theorem

The following equations and statements represent famous math theorems. Connect each theorem with its name:

- | | |
|--|--------------------------------------|
| 31. $a^2 + b^2 = c^2$ | A. Binomial Theorem |
| 32. $a^2 + b^2 - 2ab\cos(\gamma) = c^2$ | B. Euler's Theorem |
| 33. $a^n + b^n \neq c^n$ if $n > 2$ | C. Fermat's Last Theorem |
| 34. $(x + a)^n = \sum_{k=0}^n \binom{n}{k} x^k a^{n-k}$ | D. Fundamental Theorem of Algebra |
| 35. Any integer greater than one can be written as a unique product of primes. | E. Fundamental Theorem of Arithmetic |
| 36. If A, B and C are points on a circle where the line AC is a diameter of the circle, then the angle ABC is a right angle. | F. Fundamental Theorem of Calculus |
| 37. $e^{ix} = \cos(x) + i \sin(x)$ | G. Law of Cosines |
| 38. $\frac{d}{dx} \int f(x) dx = f(x)$ | H. Poincaré conjecture |
| 39. A polynomial of degree n has at most n real roots. | I. Pythagoras' Theorem |
| 40. Every simply connected, closed 3-manifold is homeomorphic to the 3-sphere. | J. Thales' Theorem |

Number Hierarchy

We can classify numbers into many different groups, based on their properties. Form a number hierarchy for these groups of numbers. In other words, sort these groups so that if a given number is in a group, it's also in each group below it.

Algebraic Numbers: Numbers that can be expressed as the root of a polynomial with integer coefficients

Complex Numbers: Numbers of the form $a+bi$

Integers: Numbers that are divisible by one

Natural Numbers: The numbers you use to count things

Octonions: They have some uses in quantum physics

Quaternions: These were used before vectors were invented

Rational Numbers: Numbers that can be expressed as the division of two roots

Real Numbers: All numbers with a decimal representation