

Chapter 0 Responses

Science

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|---|--------------|------------|
| 1. Which of the following <i>physically exist</i> ? | <i>EXIST</i> | <i>NOT</i> |
| a. electrons | 15 | 2 |
| b. the temperature of the center of the Sun | 6 | 11 |
| c. the cosmological big bang | 3 | 14 |
| d. the state of the internet | 3 | 14 |

2. Is *length* an objective concept;
that is, is the length of an object independent of a particular observer?

OBJECTIVE: 8 NOT: 9

3. Can you know something about the world without changing the world?

YES: 7 NO: 10

Mathematics

4. Are mathematical ideas invented, discovered, or something else?

INVENTED: 2 DISCOVERED: 8 OTHER: 7

5. What is mathematical Truth?

Universally true, follows the rules, anything is possible, logically/deductively true, consistency of results, laws that can't be disproved, reality in numbers, true or false, validity

6. In what sense does π exist? Where might it exist?
Is π a constant? Is it eternal or might it change over time?

EXISTS yes: 9 no: 1 as a concept: 3
CONSTANT yes: 14 no: 0
ETERNAL yes: 10 no: 2

7. Are there any mathematical concepts that have only one property
(i.e., are there pure concepts independent of other concepts)?

YES: 9 (zero, void, axioms) NO: 8

8. When is the following equation True?: $7 + 8 = 3$

watch-time, mod12, based on false premise, mod10, = means >, change the definition of the symbols
NEVER: 4

9. Is every number either even or odd? How do you know?

YES: 11 *not the other, every integer, by generalization, theory of divisors,
years of learning, whole numbers, by induction*
NO: 5 *zero, infinity-1, Pi, fractions, irrationals,*

10. Prove the *Pigeonhole Principle*, that $N+1$ pigeons cannot fit into N holes without sharing.

By contradiction: assume $N+1$ pigeons can fit into N holes. There are N holes, therefore N pigeons, (one-to-one correspondence). Thus $N+1 = N$ contradiction. This is an example of something that cannot be proved by an algorithm.

11. Imagine two points as close together as possible. Is there another point in between them?
Are there an infinite number of points in between them?

YES, one and infinite: 13 NO: 4 *(finite geometry)*

12. Is the following statement True or False or something else?:
Somewhere in the decimal expansion of π , there are exactly 34 sevens in a row.

TRUE: 3 *non-repeating*
FALSE: 9 *non-terminating algorithm, non-repeating*
OTHER: 5 *can't determine*

13. What kinds of mathematics can be beautiful?

subjective choice, any kind, all, elegant and abstract, following rules, Mandelbrot set, language of science, gives explanations, analytical, fractal, integral calculus, simple clear and correct.

Computation

14. What is the shortest program which will produce a *random number*?

NONE: 7
EGS: *sampling noise, pop a number 1, pick a number, non-trivial algorithm, rand() %n*

15. Is a *bit* the simplest computational object?

YES: 15 NO: 2

16. Binary computation uses two states, 0 and 1. Is *unary* computation possible?

YES: 11 *(stroke arithmetic, change sensitive systems)* NO: 6

17. Name three mathematical concepts which cannot be computed.

Pi, infinity, i, point, circle, irrational numbers, void, chaos theory, empty, set, space, division by zero, black holes, real numbers, trisecting an angle, doubling a cube, squaring a circle, 1/3, set of natural numbers.

Attitude

18. How many of the above questions have you thought about before today?

0: 8 1-2: 4 3: 3 >3: 2

19. Look at the Chapter 0 quotes which follow. Make three lists of names: people that you agree with, people that you disagree with, and people that you do not understand well enough to have an opinion about.

	AGREE	DISAGREE	HUH?
<i>William of Occam</i>	7	2	5
<i>John Locke</i>	12	2	0
<i>G. Spencer-Brown</i>	8	8	0
<i>A. Einstein</i>	12	0	4
<i>V.I. Arnold</i>	4	5	5
<i>A. Eddington</i>	2	7	7
<i>S.G. Shankar</i>	4	3	8
<i>H. Weyl</i>	13	2	1
<i>G. Rota</i>	9	4	3
<i>I. Lakatos</i>	9	3	3
<i>R. Feynman</i>	8	3	3
<i>D. Knuth</i>	8	8	1
<i>T. Norretrandres</i>	10	1	4

20. *Essay:* Write less than one page in response to this famous question:

Why is mathematics so unreasonably effective in describing and predicting reality?

- Math concepts come from reality.*
- From years of discovery and quantification, well defined rules.*
- Objective and precise, can prove anything that is true, builds upon itself.*
- Simple, clear and correct. reasonable, applicable to real-life.*
- Build upon known principles, symbols and abstraction, what leads to wisdom?*
- The way to understand the Universe, sea of interrelated details, successful prediction, laws.*
- Makes a lot of assumptions and not precise, rules of the way reality works.*
- Humans avoid analysis and reasoning, reality comes through visionary senses.*
- An invention of human minds, doesn't apply to feelings, may not apply outside our experience.*
- Determines patterns, simplicity of concepts, describes what we perceive.*
- Math truncates information, simulates world, based on probability.*
- Explains natural mechanisms, prediction helps survival, identifies structural stabilities.*
- Ineffective, misses non-linear relations and rapid changes and irregular shapes.*
- Encompasses objective information, misses intangibles and complexities, simplified view.*
- Removes emotion, rigid rule sets, scientific beauty (simplicity, harmony, brilliance).*