Coach Carr's Pick of Interesting Integers in Local Cosmic History and Futurology

(includes some *inside info* on math quizzes and exams)

A thousand thousand is a million. A thousand million is a billion. A thousand billion is a trillion.
A thousand trillion is a quadrillion. A thousand quadrillion is a quintillion. Timeline is on the back.

The technology built into your phone comes from science that says things about the world … like The Universe could be infinite and likely contains quintillions of galaxies at the very least (quintillions count up to a thousand times 10^{18}). Also things like- the Universe appears mostly similar to itself everywhere we look, and big-picture views indicate that generally, it's all rushing apart

Essentially, it was human curiosity and skepticism over a thousand millennia (1,000,000 years) that produced the knowledge listed on this page. Science knows that no amount of experimentation can ever prove a theory correct, and that a single experiment or observation at any time may prove a theory incorrect. Your doubts are welcome and questions are encouraged. This page's homework assignment will have you label and explain the blanks on the timeline. Then in class we will ask- How do the cardinal numbers on this side of the page relate to the ordinal numbers on the other side? What can be revealed by the examination of significant integers in the world? To what extent is the study of mathematics relevant to Earthlings this century?

There are about 10,000 galaxies in Earth's cosmic neighborhood: Nearby we can see around ten thousand galaxies in what we call the "Local Supercluster". Farther out we can see other groups (sets of many galaxies), clusters (big sets of groups), and superclusters (big sets of clusters). Of course, we can also see stars in the Milky Way galaxy, and other planets that orbit the Sun. Jupiter was first seen through a telescope 415 years ago.

Galaxies average 100,000,000,000 stars (10^{11} or "one hundred billion") and have changing shapes. In orbits of stars are an average of maybe 2 planets. Average galaxies may likely contain **more** iPMOs (isolated planetary-mass object – iPMO, also called free-floating planets *FFP*, or rogue planets) than stars. These interstellar objects have the mass of a planet but are not gravitationally bound to any star or brown dwarf. The Milky Way could contain more than 1,000,000,000,000 (10^{12} or "one trillion") rogue planets. The Sun is moving around the Milky Way's center at 230 km/s (13,800 km/h)

The integer **26** is the atomic number of iron, which is the element formed by stellar fusion in the precipitation of supernovas. The integer 1 gets used as the speed of light by cosmologists. A quintillion times one hundred billion is 100,000,000,000,000,000,000,000,000,000, which is the estimated number of planets that could be found orbiting stars in the universe: 10^{29} or "one hundred octillion". The number of iPMOs in the entire Universe could exceed 10^{30} or "one nonillion".

The ***observable*** universe claims only a miniscule fraction of all matter in spacetime. We have learned that the vast majority of the Universe is *causally disconnected* / unobservable. 46.5 billion light years is the maximum radius (R) of what any being in the Universe can currently observe from any position. In this radius, 2 trillion galaxies (approx. 10^{80} protons) are likely observable.

The span of the whole Universe might very well be 250R (that's 250 times the radius of the observable universe). These estimates put the entire diameter of the total Universe at approximately 23,000,000,000,000 (twenty-three trillion) light years. The "Local Group" spans roughly 10,000,000 light years and its biggest members, the Milky Way and the Andromeda galaxies, are moving toward each other at a velocity of **123** km/s

Science has recently shown us that just like black holes, everything in the Universe is subject to Hawking radiation and eventually evaporates. White dwarf stars, neutron stars, everything decays. Physicists and mathematicians have calculated that the universe itself could evaporate away in approximately 10^{78} years.

HOMININ-FOCUSED TIMELINE **INTEGERS**

Positive integers are approximate years from now and negative integers refer to approximate years ago.

10^{78} Redshift anywhere becomes unobservable due to evaporation
This is a quadrillion (10^{15}) vigintillion (10^{63}) years from now.
2,000,000,000,000 Redshift makes the last visible galaxy outside the Local Supercluster become unobservable from Milkomeda*
5,000,000,000 Tardigrades disappear along with the Sun
4,500,000,000 Milkomeda galaxy forms (galactic collision in the Local Group)
1,000,000,000 Sun brightens 10% (every billion years) Earth's oceans boil
0 Nowadays: The Holocene extinction is happening
-12,000 _____ _____
-20,000 Diverse egalitarian cultures reach four corners of the globe
-23,000 Agriculture by humans: evidence of cultivation
-103,000 Agriculture by humans: evidence of harvest
-170,000 Fashion becomes a thing among people
-300,000 Anatomically Modern Humans appear
-1,000,000 People have dinner parties / Tribes domesticate fire
-3,200,000 Lucy lives her bipedal life
-6,300,000 Hominini appear on Earth
-50,000,000 Ants on Earth engage in agriculture
-600,000,000 Tardigrades appear on Earth
-2,500,000,000 Andromeda galaxy forms (galactic collision in the Local Group)
-4,543,000,000 Planet Earth forms
-4,603,000,000 The Sun forms and gets brighter
-13,610,000,000 Milky Way galaxy forms
-? 13,800,000,000 ? Spacetime as we know it starts expanding

Quadratics Quizzes and Exams: What to Expect – Explain how a plane must slice a cone to produce a parabola. Definitions will almost always be on a test. If you believe that a mathematical definition does not exist for a term in question, then you may write DNE. Be ready to define a circle and a parabola. Define relation, Cartesian product, and function. Define bijection and cardinality. Define a polynomial of degree n. State Euclid's theorem. State Euclid's lemma. State the Fundamental Theorem of Arithmetic. Prove that the diagonal of a unit square does not have a rational length. True-False (T/F) sections on any test tally negative three points (-3) for a wrong answer, zero (0) for blank, and two points (2) for a correct answer. Expect statements about subsets and cardinality along with algebraic expressions in T/F. Given a synthetic directrix and focus, construct the parabola's vertex using a compass and straight edge. Then map your constructed vertex to a Cartesian plane and derive the general-form equation for a parabola. From the general form clearly derive the standard form using the most powerful word in math. Then use the parabola's standard equation to derive the quadratic formula. State decimal approximations of e (to 9-place accuracy) and π (to 5-places) and standard gravity (to 3 places)