



Question #1: Mathematics

10 points

This set of numbers is countable, dense, and without a least or greatest element. A diagram similar to one used to demonstrate the Cantor pairing function is used to show that this set of numbers is countable. A **Dedekind** [deh-duh-kint] cut partitions this set of numbers into two sets, a technique used to construct the real numbers. A theorem that finds roots within this set of numbers uses the leading and constant coefficients of a polynomial. Name this type of number that can be expressed as a repeating decimal, terminating decimal, or a fraction with integers in the numerator and denominator.

rational numbers or the **rationals** [prompt on **Q**]

Question #2: Social Studies

10 points

Some of the impacts of this agreement were addressed by the formation of the Commission for Environmental Cooperation. This agreement extended an agreement that the United States had negotiated earlier with Brian Mulroney because this deal was also negotiated with Carlos **Salinas** [suh-LEE-nus] de Gortari. The phrase “giant sucking sound” was used by Ross **Perot** [puh-roh] to build opposition to this agreement. Name this agreement supported by Presidents George H. W. Bush and Bill Clinton that made it easier for the United States to import and export goods with Canada and Mexico.

NAFTA or the **North American Free Trade Agreement**



Question #3: Literature

10 points

In one novel by this author, Iowa Bob says “You’ve got to get obsessed and stay obsessed.” Bob is the father of Win Berry in this author’s *The Hotel New Hampshire*. Another novel by this author is titled for a list posted by a light switch that includes “Please don’t smoke in bed or use candles.” This author set much of that novel at St. Cloud’s Orphanage, which is where Candy gives birth to Angel. In the same place, this author portrayed Dr. Wilbur Larch training Homer Wells to become an obstetrician. Name this author who addressed the issue of abortion in his novel *The Cider House Rules*.

John (Winslow) **Irving** [or John Wallace **Blunt** Jr.]

Question #4: Science

10 points

Samples from these things have been gathered by the *Hayabusa* missions. The D-types of these objects are difficult to find, but a few dozen of them have been located. The vast majority of objects that have had non-zero **Torino** [**tor-EE-noh**] scale ratings are these objects, but as of the writing of this question there are no objects with current non-zero ratings. Examples of these objects that were on that scale are **Apophis** [**uh-PAH-fiss**] and 2022 AE1. Most of these objects are located between 2 and 4 astronomical units from the Sun. Some of the largest examples of these objects are **Hygiea** [**“hi”-JEE-uh**], Pallas, and Vesta. Name these rocky objects that are mostly located in a belt between Mars and Jupiter.

asteroids [accept **minor planets** or **planetoids**; do not accept “dwarf planet(s)”; do not prompt on “planet(s)”]



Question #5: Miscellaneous

10 points

Some fans were disappointed because this movie did not include an Elena Fisher character. Possibly inspired by an Indiana Jones quote, one of the characters in this movie asks Chloe “Why does it always have to be nuns?”. One of the characters in this movie is in Barcelona when he says “I’m literally in a Papa John’s right now.” The villains in this movie are played by Tati Gabrielle [TAH-tee GAH-bree-el] and Antonio Banderas. This movie is about an attempt by Nathan Drake and Sully to find Ferdinand Magellan’s treasure. Name this 2022 movie starring Tom Holland and Mark Wahlberg that is based on a Naughty Dog video game franchise.

Uncharted

Question #6: Social Studies

10 points

After the new year, Shintos use a large one of these things called a Dondo-Yaki [DOHN-doh YAH-kee] to bring good luck. According to the Koran, one of the angels claims that he is better than man because man was made from clay but the angel was made from this thing. In Leviticus, this thing kills Aaron’s sons Nadav [nuh-DAHV] and Avihu [ah-VEE-hoo]. In Luke 12:49, Jesus says that he is bringing this thing to Earth. During a Vedic Agnihotra [ahg-nee-HOH-truh] ceremony, three of these things exist to the east, west, and south. Name this thing that, according to the King James Bible, is combined with brimstone when punishing Sodom and Gomorrah.

fires [accept bonfires or flames]



Question #7: Science

10 points per part

Most mammalian species have this temporary organ.		
1	Name this organ that is connected to a fetus and is expelled in an afterbirth.	placenta
2	The luteal [LOO-tee-ul]–placental shift changes the production of several hormones, particularly this so-called “hormone of pregnancy”. This hormone often works in tandem with estrogen.	progesterone [proh-JESS-tur-ohn] [accept progestogen]
3	In this pregnancy complication, the placenta covers some or all of the opening of the uterus. This problem can lead to placenta accreta [uh-KREE-tuh].	placenta previa

Question #8: Science

10 points per part

This process is sometimes called budding, but budding also is a method of asexual reproduction.		
1	Name this joining together of plant parts so that the bottom part of the new plant is the rootstock.	grafting [accept inosculation]
2	Successful grafting means joining together this tissue between the xylem [ZY-lem] and phloem [FLOH-em].	(vascular) cambium
3	Grafting is done to decrease the amount of the bacterial, fusarium [fyoo-ZAR-ee-um], or verticillium [vur-tuh-SIL-lee-um] type of this disease.	wilts [accept wilting]



Question #9: Literature

10 points per part

Identify these characters from Irish mythology and folklore:		
1	These creatures make shoes and have hidden gold. More recent stories place these creatures at the ends of rainbows.	<u>leprechauns</u>
2	These wailing female fairies can be heard when a family member is about to die.	<u>banshees</u>
3	When a person falls asleep, this fairy turns into a newt, crawls into the person's mouth, and lives off of some of the food the person ate.	<u>Joint-eater</u> [accept <u>Just-halver</u> or <u>Alp-luachra</u>]

Question #10: Literature

10 points per part

The English term for these characters is translated from the Roman word “ parcae ” [PAR-ky] and the Greek word “ moirai ” [MOY-“rye”].		
1	Name these three women who affect the thread of life.	<u>Fates</u>
2	Which of the Fates is usually mentioned first? She spins the thread and determines when people are born.	<u>Clotho</u> [accept <u>Nona</u>]
3	Clotho revived this god after his father, Tantalus, cooked him into a stew.	<u>Pelops</u> [<u>PEE-lahpss</u>]



Question #11: Fine Arts

10 points per part

This sculptor is generally credited for creating both a plaster model and a bust of King Akhenaten [AH-keh-NAH-ten].		
1	Name this famous sculptor who worked in the 14th century BCE in what is now the town of Amarna.	Thutmose [TOOT-mohss] [accept Djhutmose or Thutmosis or Thutmes]
2	The best-known work by Thutmose probably is the colored bust of this Egyptian queen. The bust is now displayed in Berlin.	(Neferneferuaten) Nefertiti [neh-fer-TEE-tee]
3	Thutmose succeeded this sculptor, whose portrait with his wife Taheret [TAH-huh-ret] might be the oldest self-portrait.	Bek [accept Bak]

Question #12: Fine Arts

10 points per part

Many painters have depicted Jacob wrestling with an angel based on the description in Genesis.		
1	The wrestling scene takes place in the upper-right part of this painter's <i>Vision After the Sermon</i> .	(Eugène Henri) Paul Gauguin [goh-gan]
2	This artist painted <i>Jacob Wrestling With The Angel</i> several years after he painted <i>The Night Watch</i> and <i>The Anatomy Lesson of Dr. Nicolaes Tulp</i> .	Rembrandt (Harmenszoon van Rijn) [accept either underlined name; do not prompt on "van" or "Rijn"]
3	This painter created his <i>Jacob and the Angel</i> before becoming a leader of the Symbolist movement with works such as <i>Jupiter and Semele</i> [SEH-muh-lee].	Gustave Moreau



Question #13: Social Studies

10 points per part

Nury Martinez stepped down as the president of this city’s City Council after an audio recording was leaked on which some politicians, including her, made racist statements.		
1	Name this major city whose Santa Monica Mountains were, until recently, the home of the mountain lion P-22.	Los Angeles , California [accept L.A.]
2	This governor of California said that Gil Cedillo and Kevin de León should resign from the city council after the recording was leaked.	Gavin (Christopher) Newsom
3	After criticizing the people in the recording, this person was elected the first female mayor of Los Angeles.	Karen (Ruth) Bass

Question #14: Social Studies

10 points per part

Dina Boluarte [bohl-WAR-tay] became the first female president of this country on December 7, 2022.		
1	Name this country where Boluarte took charge after President Pedro Castillo [kah-STEE-yoh] was impeached for trying to dissolve Congress.	(Republic of) Peru [or (República del) Perú]
2	Pedro Castillo was arrested when he attempted to enter the embassy of this country, whose current president is Andrés Manuel López Obrador.	Mexico [or United Mexican States or Estados Unidos Mexicanos]
3	In the 2021 election, Castillo defeated a woman from this family. Her father was the president of Peru from 1990 to 2000.	Fujimori family or the Fujimoris [accept Alberto (Kenya) Fujimori (Inomoto) or Keiko (Sofía) Fujimori (Higuchi)]



Question #15: Science

10 points

Richard Feynman [“FINE”-mun] stated that nobody has ever defined the difference between this effect and diffraction satisfactorily. The colorful patterns that form on soap bubbles are caused by the thin-film type of this effect. This effect is a direct result of the superposition principle. The fringes in Young’s double-slit experiment are named for this phenomenon. This phenomenon can be constructive or destructive, both of which can be seen in a common experiment in which there are two point sources in a wave pool. Name this effect in which waves combine.

(wave) **interference**
[accept waves **interfering**]

Question #16: Literature

10 points

A character in this novel says “Take nothing on its looks; take everything on evidence.” In the same chapter in this novel, that character says that Mr. Provis and John Wemmick have exchanged letters. The character who says those things in this novel is a lawyer who saved Molly from the gallows, named Mr. Jaggers, who helps the woman who raises both Estella and the protagonist of this novel. That woman, who has stopped all of her clocks, is Miss Havisham. Name this novel by Charles Dickens about Joe Gargery’s brother-in-law, Pip.

Great Expectations



Question #17: Social Studies

10 points

This person was named after the tyrant of **Sicyon** [SISS-ee-ahn], who was his maternal grandfather. **Cleomenes** [klee-AH-muh-neeZ] I of Sparta helped **Isagoras** [“eye”-SAG-uh-russ] take control from this leader, but this leader had enough popular support to allow him to gain back power after returning from exile. This ruler replaced the four-tribe system that was based on family with a 10-tribe system based on location. According to Aristotle, this ruler instituted the Athenian policy of ostracism. This leader, who extended the democratic reforms of **Solon** [SOH-lun], was the great uncle of Pericles. Name this “father of Athenian democracy”.

Cleisthenes

Question #18: Fine Arts

10 points

During a premiere performance of one of this composer’s works in London, the audience laughed during the bassoon part of *Symphonies of Wind Instruments*. This student of Nikolai Rimsky-Korsakov used the octatonic scale in several pieces, including *Symphony of Psalms*. This composer’s fame is based to some extent on ballets he wrote for Sergei **Diaghilev** [dee-AH-guh-leff], including one in which a girl dances herself to death. Another ballet by this composer depicts three puppets whose jealousies lead them to murder. Name this Russian composer of *Petrushka* and *The Rite of Spring*.

Igor (Fyodorovich)
Stravinsky



Question #19: Science

10 points

The graph named for this person uses the reciprocal of absolute temperature on the x -axis and the log of the rate constant on the y -axis. That graph is supposed to show a line according to the equation named for this person, which usually expresses the rate constant in terms of a function that has activation energy in the exponent. In 1896, this scientist published calculations showing that increases in carbon dioxide could warm the atmosphere. This person defined acids and bases based on whether they increase the concentration of hydrogen or hydroxide ions. Name this Swedish chemist who won the 1903 Nobel Prize for his **electrolytic** [eh-LEK-troh-LIT-ik] theory of dissociation.

Svante (August)
Arrhenius [SVAHN-teh
uh-REE-nee-uss]

Question #20: Literature

10 points

The narrator of this novel claims that he has trouble paying attention to a magistrate because “the office was so stiflingly hot and big flies were buzzing round and settling on my cheeks.” The magistrate in this novel had taken a silver crucifix from a file cabinet and asked the narrator “Do you know who this is?”. Just before that, the magistrate had asked this novel’s narrator “Why did you pause between the first and second shot?”. Earlier, this novel’s protagonist began a relationship with Marie just after his mother’s funeral. The narrator of this novel kills a man he refers to as “the Arab”. Name this existentialist novel about **Meursault** [mair-sohl] written by **Albert Camus** [al-bair ka-moo].

*The **Stranger*** [or *The **Outsider*** or *L’**Étranger***]



Question #21: Science

10 points per part

Identify these curvy lines on maps:		
1	These lines on topographic maps connect points that are at the same altitude.	contour lines or contours
2	These lines on weather maps connect points that are at the same pressure.	isobars [ICE-oh-bars]
3	This is the general term for an isoline [ICE-oh-line] on a map. Contour lines and isobars are both examples of this type of line.	isopleths

Question #22: Science

10 points per part

Name these soil contaminants:		
1	This metal element is in soil because it was once used in pesticides, gasoline, and water pipes. Ingestion of this element can cause learning and behavior problems.	lead [accept Pb]
2	Many insecticides combined lead with this metalloid that sometimes contaminates groundwater. The Marsh test determines the presence of this element.	arsenic [accept As]
3	Many leftover pesticides from the middle of the 20th century combined this element with carbon and hydrogen. Examples include Aldrin and DDT.	chlorine [accept Cl]



Question #23: Social Studies

10 points per part

This family ruled Florence and Tuscany and included four popes and two queens of France.		
1	Name this extremely wealthy family that was at the height of its influence from the 15th through 18th centuries.	(de') Medici [MED-ih-chee] family or (de') Medicis
2	The rise of the family was attributed to this Medici who lived from 1389 to 1464 and his younger brother Lorenzo. This person had a political comeback after being imprisoned and exiled by the Albizzi [al-BEET-zee] family.	Cosimo de' Medici
3	Marie de' Medici was the wife of this French king who was assassinated in 1610 by Francois Ravailac [fran-swah ra-vah-yahk].	Henry IV [accept Good King Henry or Henry the Great ; prompt on Henry]

Question #24: Social Studies

10 points per part

Around 1870, Iran experienced a famine that killed millions of people.		
1	Give the name for Iran that was commonly used by foreigners before 1935.	Persia [accept Persis or Persian]
2	This empire founded by Cyrus the Great is sometimes called the first Persian Empire.	Achaemenid [uh-KEE-muh-nid] Empire [accept Achaemenian or Hakhamanishiya]
3	Starting with Ismail I in 1501, this dynasty ruled Persia for over 200 years.	Safavids



Question #25: Mathematics

10 points per part

Splines are defined in this manner, with each portion being a polynomial.		
1	Name this way of defining a function using different cases for different parts of the domain.	piecewise (-defined) functions [prompt on hybrid functions]
2	This “rule” breaks a function down into a piecewise function in which each piece is quadratic, then uses those pieces to estimate the integral.	Simpson ’s (1/3) rule
3	Find the integral, from negative one to one, of the quadratic function that goes through the point “negative one comma one”, the point “zero comma zero”, and the point “one comma one”.	<u>2/3</u>

Question #26: Mathematics

10 points per part

The lowercase form of this Greek letter is often used to represent standard deviation.		
1	Name this Greek letter whose capital form indicates repeated summation.	<u>sigma</u>
2	Give the name of the series whose terms are 1 over k , with k going from one to infinity.	<u>harmonic</u> series
3	Find the sum, from k equals zero to k equals 5 , of the expression “ 5 combination k ”.	<u>32</u>



Question #27: Literature

10 points per part

This poem states “A world of made is not a world of born.”		
1	Name this poem that ends “There’s a hell of a good universe next door; let’s go.”	“ <u>pity this busy monster, manunkind</u> ”
2	“pity this busy monster, manunkind” was written by this poet who sometimes avoided capitalization.	E(dward) E(stlin) <u>Cummings</u>
3	Which E. E. Cummings poem contains the line “he sang his didn’t he danced his did”?	“ <u>anyone lived in a pretty how town</u> ”

Question #28: Literature

10 points per part

The kinsmen of the title character of this poem “Bore her away from me, to shut her up in a sepulchre [SEH-pul-kur] in this kingdom by the sea.”		
1	Name this poem that begins “It was many and many a year ago, in a kingdom by the sea.”	“ <u>Annabel Lee</u> ”
2	This poet wrote “Annabel Lee” and “The Raven”.	Edgar Allan <u>Poe</u>
3	Poe also wrote this poem that asks whether the title thing “is all that we see or seem.”	“A <u>Dream Within a Dream</u> ”



Question #29: Social Studies

10 points

After being fired from this state's supreme court for opposing Reconstruction, Richard Coke became its governor and one of its U.S. senators. The Iran-Contra investigation ordered by President Ronald Reagan was headed by this state's former senator John Tower. The 1988 running mate of Michael Dukakis [doo-KAH-kis] was this state's Senator Lloyd Bentsen. The Senate Majority Leader for most of the late 1950s, who was the subject of a set of biographies by Robert Caro [KAY-roh] and who left the Senate to become vice president, was this state's Lyndon B. Johnson. Name this state represented in the Senate more recently by John Cornyn and Ted Cruz.

Texas

Question #30: Science

10 points

Animals in this class have a layer of uncalcified dentine [DEN-tin] in their teeth, so their teeth are considered pedicellate [peh-duh-SELL-it]. Some animals in this class have parotoid [puh-RAH-toyd] glands near their neck that can secrete bufotoxins [byoo-foh-"toxins"] to deter predators. Most of these animals will die within a few hours if they are placed in saltwater but require a freshwater environment for breeding. This class of animals are born with gills, though they either develop lungs or the ability to breathe air through their skin. Name this class of vertebrates that includes salamanders and frogs.

amphibians [accept
Amphibia]



Question #31: Literature

10 points

In one novel by this author, a man says of his son, “If he is not the word of God, God never spoke.” In much of that novel, this author depicts the man and his son traveling with a supermarket cart and trying to avoid cannibals. In another novel by this author, the sheriff of Terrell County is a World War II veteran who tries to protect Carla Jean. That sheriff is Ed Tom Bell, and in a novel by this author, Bell protects Carla Jean after her husband Anton **Chigurh** [chih-GUR] finds the aftermath of a drug deal gone bad in the Texas desert. Name this author of *The Road* and *No Country for Old Men*.

(Charles) Cormac
McCarthy (Jr.)

Question #32: Mathematics

10 points

One statement of this type uses the ratio 1 divided by k squared, where k is the number of standard deviations from the mean. That statement is named for **Pafnuty Chebyshev** [pahff-NOO-tee CHEB-ee-shawff]. Another statement of this type is about the square of an inner product and can be demonstrated in **Euclidean** [yook-LID-ee-un] space by the fact that the cosine function is between -1 and 1 . That statement of this type is named for **Augustin-Louis Cauchy** [oh-goo-stan loo-ee koh-shee] and Hermann Schwarz. One of these statements for triangles compares the length of one side to the sum of the lengths of the other two sides. Name these statements that compare values using a relation like “greater than” or “less than”.

inequality/ies



Extra Question #1: Social Studies

10 points

When this military leader heard that his enemy was retreating, he stated “Now, God be praised, I will die in peace.” This leader was credited for the decision to make an amphibious landing at **L’Anse-au-Foulon** [lahns oh foo-lawn]. Earlier, as a **brigadier** [bri-guh-“DEAR”], this person, along with Charles Lawrence and Edward Whitmore, supported Jeffery Amherst in his victory over the French at **Louisborg** [loo-ee-burg]. This leader is best known for a military victory over the Marquis de Montcalm in a 1759 battle that killed both of them. Name this British Army officer who became known as “The Hero of Quebec” due to his fatal victory at the Battle of the Plains of Abraham.

James Wolfe

Extra Question #2: Science

10 points

One measure of this concept is the Hill numbers, which in some cases is equivalent to an application of Shannon entropy to biology. Robert Whittaker used “alpha” to describe this concept on a local level and “beta” to describe comparisons of local areas. This concept can be broken down into species, genetic, and ecological variants, and sometimes others. Coral reefs and tropical rainforests are leading locations for the version of this concept based on species, but tundras and polar seas have a low degree of it. One measure of this concept is species richness, which is based on the number of species in an area. Name this concept equivalent to the variety of life.

diversity [accept
biodiversity]



Extra Question #3: Literature

10 points

One novel by this author is about the effects of the deaths of Rochelle and Paul Isaacson, who have a lot in common with the real-life Ethel and Julius Rosenberg. That novel, which this author wrote in the voice of the dead couple's son, is *The Book of Daniel*. In another novel by this author, Bo Weinberg has his feet cast in cement before getting thrown in the East River. That novel by this author is about a worker for the mobster Dutch Schultz. Another novel by this author describes Coalhouse Walker's attempts to avenge the vandalization of his Model T Ford. Name this author of *Billy Bathgate* and *Ragtime*.

E(dgar) L(awrence)

Doctorow

Extra Question #4: Mathematics

10 points

For all real numbers other than zero, the **signum** [SIG-num] of x can be expressed as x divided by this function of x . The complex modulus function is written the same way as this function because they have a similar purpose. Though the derivative of the natural log function is the reciprocal of x , the antiderivative of the reciprocal of x is the natural log of this function of x , plus a constant. This function of x is equal to the combined operations of squaring and then square-rooting x . Name this function that does not change non-negative numbers [pause] and that changes negative numbers into positive numbers.

absolute value function

[prompt on complex
modulus before it is
mentioned]



Extra Question #5: Fine Arts

10 points

One painting by this artist shows the silhouettes of two girls and a boy sitting on a rock [pause] and two boats further in the background. That painting, which was created at about the same time as this artist's *The Lonely Tree* to contrast different times during the day, is *Moonrise by the Sea*. Another painting by this artist shows a man holding a walking stick while standing on very rocky ground. Like many of this painter's subjects, that work shows a person with their back to the viewer. Name this 19th-century German Romantic landscape artist who painted *Wanderer above the Sea of Fog*.

Caspar David Friedrich



Extra Question #6: Literature

10 points per part

This character reads a letter out loud that says “Some are born great, some achieve greatness, and some have greatness thrust upon them.”		
1	Name this character who believes that Olivia loves him and who is confined to a dark room by Maria and Toby.	<u>Malvolio</u>
2	Malvolio appears, along with the twins Viola and Sebastian, in this play by William Shakespeare.	<u>Twelfth Night</u> , or <i>What You Will</i>
3	Fill in the blank to complete the first line of <i>Twelfth Night</i> : “If music be the <i>blank</i> of love, play on.”	<u>food</u>

Extra Question #7: Literature

10 points per part

Near the beginning of this play, a major character states “I confess! I confess what I did! I’m guilty! I killed you! Sir I confess! I killed you!”.		
1	Name this 1979 play in which that confession is made by Antonio Salieri.	<u>Amadeus</u> <u>[ah-mah-DAY-uss]</u>
2	<i>Amadeus</i> was written by this playwright who also wrote <i>Equus</i> [EH-kwuss].	Peter (Levin) <u>Shaffer</u>
3	<i>Equus</i> is about a boy who blinds this type of animal.	<u>horses</u>



Extra Question #8: Mathematics

10 points per part

This angle must be zero, acute, or right.		
1	Give this term for an angle that equals how much a given angle is rotated from either side of the x -axis in either direction.	reference angle(s)
2	Give the reference angle for 250 degrees.	70 degrees
3	If the tangent of an angle equals -5 , what is the tangent of its reference angle?	(positive) 5

Extra Question #9: Mathematics

10 points per part

There is a historical argument that this rule should be named after Colin Maclaurin [mak-LOR-in], but it's named after somebody else.		
1	Name this rule that describes how to solve systems of linear equations by dividing matrix determinants.	Cramer's rule
2	Find the determinant in the denominator when solving for either variable for the system " $2x$ plus $3y$ equals 5 and $3x$ plus $8y$ equals 6 " using Cramer's rule.	7
3	Solve for x in the system " $4x$ plus $3y$ equals 10 and $5x$ plus $3y$ equals 7 ". You only need to solve for x , and you can use any method.	$x = \underline{-3}$ (and $y = 22/3$) [do not prompt on " 3 "]