



Question #1: Fine Arts

10 points

In a painting this artist made of himself with his wife Isabella Brant, he wears orange hose and rests his left hand on his sword while he and his wife hold right hands. This painter placed a very old woman on the left of a painting in which a Biblical character sleeps on his wife's lap while his hair is cut. This painter of *Honeysuckle Bower* and *Samson and Delilah* has several works in Cathedral of Our Lady in Antwerp, including a **trptych** ["TRIP-tick"] depicting the raising of the Cross. Name this early-17th-century Flemish painter of *The Descent from the Cross* and several works showing fleshy nudes.

Peter Paul Rubens

Question #2: Literature

10 points

A woman in this play insults a man by saying "Courtesy itself must convert to disdain, if you come in her presence." The man in this play replies "But it is certain I am loved of all ladies, only you excepted." The woman states "I had rather hear my dog bark at a crow than a man swear he loves me." This play ends with that man saying, "Strike up, pipers" to celebrate their wedding. This play starts near Leonato's house in **Messina** [meh-SEE-nuh]. The marriage takes place after poems that those people wrote to each are shown by Claudio and Hero, who also get married at the end of this play. Name this William Shakespeare play about Benedick and Beatrice.

Much Ado About Nothing



Question #3: Science

10 points

Traditionally, this virus caused most children in the world to experience inflammation of the small intestine, or **enteritis** [**“enter-EYE”-tiss**], at some point. The name of this virus is based on the fact that it looks like a wheel. An early version of the vaccine against this virus was changed because the vaccine caused bowel obstructions through **intussusception** [**in-tuss-uh-SEP-shun**]. For the past decade, the new version of that vaccine has been recommended as an oral vaccine for infants at ages two, four, and six months. Name this genus of double-stranded RNA viruses that causes severe diarrhea in children.

rotavirus

Question #4: Social Studies

10 points

In 1966, this man led a march from **Delano** [**duh-LAY-noh**] to Sacramento, California in support of an action that was started by Filipino-Americans. Just before starting to run for president, Robert Kennedy flew to California to be present at the end of one of this man’s hunger strikes. This person often worked closely with Dolores Huerta, with whom he co-founded the National Farm Workers Association, which became the United Farm Workers. This person encouraged Americans to boycott grapes, and he popularized the phrase **“Sí se puede”** [**see say pway-day**] decades before President Obama used it. Name this Latino American labor leader.

Cesar Chavez



Question #5: Science

10 points

Joseph von Fraunhofer labelled seven prominent examples of these things using the letters ‘A’ through ‘G’. These things are widened because of thermal Doppler broadening. The most important examples of these things for hydrogen are in series named for Brackett, Paschen, Balmer, and Lyman. The study of these things led to an initial value for the Rydberg constant. These things are split by an electric field in the Stark effect and by a magnetic field in the **Zeeman** [ZAY-mun] effect. Name these things that are used to identify the presence of elements when viewed through a diffraction grating and that are often emission lines.

spectral lines or emission spectrums or emission spectra [or absorption lines; accept emission lines before “emission”]

Question #6: Literature

10 points

A sonnet by this writer states “Yet many a man is making friends with death, even as I speak, for lack of love alone.” That sonnet is “Love is not all”. This poet wrote a play in which the shepherds **Thyrsis** [THUR-siss] and **Corydon** [KOR-ih-dahn] kill each other; that work is *Aria da capo*. Another sonnet by this writer ends “I find this frenzy insufficient reason for conversation when we meet again.” In that poem, this 20th-century woman claims that life is designed to “leave me once again undone, possessed”. Another poem by this writer ends “And he whose soul is flat—the sky will cave in on him by and by.” Name this writer of “I, being born a woman and distressed” and “**Renascence**” [ren-AY-senss].

Edna St. Vincent Millay
[accept Nancy Boyd]



Question #7: Mathematics

10 points per part

The power set is the set of all of these things made from a given original set.		
1	Give this term for a set made from none, some, or all members of another set.	subsets
2	This adjective describes subsets that are not the entire original set. This adjective also means factors of a number other than the number itself.	proper [accept proper subsets or proper factors or proper divisors]
3	If a set has a cardinality of 5, how many proper subsets does it have?	31 proper subsets

Question #8: Mathematics

10 points per part

This quadric [“QUAD”-rik] surface can have one or two sheets.		
1	Name this surface generated by rotating a two-branched conic section around an axis.	hyperboloid(s) [“hi”-PUR-buh-loydz] (of revolution) [accept circular hyperboloids ; do not accept or prompt on answers containing “hyperbola” or “hyperbolic”]
2	Unlike hyperbolic paraboloids [puh-RAB-uh-loydz], hyperboloids do not have these points which are stationary points but not local extrema on a solid.	saddle points
3	Find the shortest distance from the origin to the hyperboloid generated by the equation “ x squared over 25, plus y squared over 16, minus z squared over 9, equals 1”.	4 units



Question #9: Social Studies

10 points per part

Shortly before becoming commander of the American Expeditionary Forces, John Pershing went on an unsuccessful mission to capture this person.		
1	Name this Mexican revolutionary who commanded the Division of the North.	(Francisco) “Pancho” Villa [VEE-yah] [or José Doroteo Arango Arámula]
2	Pancho Villa was allied with this revolutionary who controlled Morelos [moh-RAY-lohss] in the south of Mexico.	Emiliano Zapata (Salazar)
3	General Pershing tried to capture Pancho Villa after Villa attacked this town in New Mexico.	Columbus , New Mexico

Question #10: Social Studies

10 points per part

This person organized the diamond company De Beers Consolidated Mines.		
1	Name this Englishman who became the prime minister of the Cape Colony and whose will set up a scholarship to the University of Oxford.	Cecil (John) Rhodes
2	Rhodes was forced to resign as prime minister after this failed attack on Transvaal. At the time, Transvaal was officially called the South African Republic.	Jameson Raid
3	Rhodes hoped that these people, who were British residents in the Transvaal denied citizenship, would revolt, but they did not. The name for these people means “foreigners”.	uitlanders [“ate”-lahn-durz]



Question #11: Literature

10 points per part

This sky goddess was the mother of several major Egyptian deities.		
1	Name this wife of Geb.	<u>Nut</u> [or <u>Nunut</u> or <u>Nent</u> or <u>Nuit</u>]
2	In addition to being the mother of Osiris [oh-“SIGH”-riss] and Isis, Nut was the mother of this god of storms and his wife Nephthys [NEFF-thiss]. This god murdered Osiris.	<u>Seth</u> [accept <u>Setekh</u> or <u>Sutekh</u> or <u>Sety</u>]
3	This father of Nut kept her separated from Geb so that life could exist between them.	<u>Shu</u>

Question #12: Literature

10 points per part

In some civilizations, this god represented the morning star, while his brother represented the evening star.		
1	Name this Aztec god whose name means “feathered serpent”.	<u>Quetzalcoatl</u> [KET-sul-koh-AH-tull]
2	Quetzalcoatl helped create the human race when he traveled to this location, the Aztec underworld.	<u>Mictlan</u> [MEEKT-lahn]
3	The Pyramid of Quetzalcoatl was built in this city, the capital of the Toltec Empire.	<u>Tula</u> [or <u>Tollan</u> -Xicocotitlan]



Question #13: Science

10 points per part

This method uses Cas9 nuclease [kass “nine” NOO-klee-“ace”].		
1	Name this method of gene editing. It was discovered by Jennifer Doudna [DOUD-nuh] and Emmanuelle Charpentier [shahr-pen-tay] in the past decade.	CRISPR [“crisper”] [or clustered regularly interspaced short palindromic repeats]
2	CRISPR was used in China in 2018 to make two baby girls who are missing the CCR5 gene and are therefore immune from this disease.	HIV/ AIDS or acquired immune deficiency syndrome [do not prompt on “HIV”]
3	Feng Zhang developed a CRISPR technique using this endonuclease [EN-doh-NOO-klee-“ace”] instead of Cas9.	CPfl

Question #14: Science

10 points per part

Andrew Benson, James Bassham, and this person traced the path of carbon during photosynthesis.		
1	Identify this person whose namesake cycle is the light-independent reaction of photosynthesis.	Melvin Calvin [accept the Calvin cycle]
2	Melvin Calvin also studied these rings of pyrrole [PIR-ohl] molecules that can hold a metal, as they do in hemoglobin.	porphyrins [POR-fih-rinz]
3	This enzyme is used in the Calvin cycle and the pentose [PEN-tohss] phosphate pathway. This enzyme removes two carbons from F6P and from S7P to create pentose.	transketolase [“trans-KEY-toe-lace”]



Question #15: Miscellaneous

10 points

<p>A musical about this character contains the song “Rise Above”. The Sinister Syndicate that has opposed this character includes Boomerang and Hardshell; this character has also been opposed by the Sinister Six. Many of the criticisms of this character are amplified by J. Jonah Jameson Jr., who is the editor-in-chief of the <i>Daily Bugle</i>. This character is raised by Aunt May and Uncle Ben after his parents die, and his real name is Peter Parker. Name this Stan Lee superhero who stops Doctor Octopus and Green Goblin and who gained superpowers after being bitten by an arachnid.</p>	<p>Spider-Man [accept Peter Parker or Peter Parker before “Peter”]</p>
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Question #16: Social Studies

10 points

<p>This country was divided into seven provinces in 2015, several of which have taken time to pick a name; the first name chosen was Karnali, whose capital is Birendranagar [bir-en-DRAH-nuh-gar]. Soldiers from this country use a curved knife called a <i>kukri</i> and are called Gurkhas; many of them are from the city of Pokhara [POH-kuh-rah]. Sagarmatha [sah-gahr-MAH-thuh] National Park is in the eastern part of this country. Lumbini [loom-BEE-nee], the birthplace of Buddha, is in this country. The Indian state of Sikkim [seek-KEEM] separates this country from Bhutan. Name this country between India and Tibet in the Himalayan mountains, whose capital is Kathmandu [“cat-man-do”].</p>	<p>(Federal Democratic Republic of) Nepal [or (Sanghiya Lokatantrik Ganatantra) Nepal]</p>
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Question #17: Mathematics

10 points

Helly's theorem implies that if each polygon in a set has this property, and every subset of three polygons overlaps, then the entire set overlaps. For a set of points, the gift-wrapping algorithm finds the "hull" with this property. A set of points has this property if given every two points in the set, a segment connecting the points only goes through points in the set. Polygons with this property have their diagonals entirely within the shape. Name this property of polygons whose interior angles are all less than 180 degrees.

convexity [accept
convexness]

Question #18: Literature

10 points

In this novel, the Postmaster goes into a long and mistaken description of Captain **Kopeikin** [koh-PAY-kin], who lost an arm and a leg during a battle. One character in this novel gets mad at the skewbald horse because it makes a show of pulling while the two other horses do all the work. That character in this novel, who gets drunk and gets lost before eventually finding Madame **Korobotchka** [kor-oh-BOHCH-kuh], is **Selifan** [SEH-lee-fan]. In the first part of this novel, the protagonist makes a deal with **Manilov** [MAN-ih-lawff]. This novel is about a character's scheme to get a huge loan after buying up the rights to former serfs. Name this Russian novel about **Chichikov** [CHICH-ee-kof], written by Nikolai Gogol.

Dead Souls [or
Myortvye dooshi]



Question #19: Social Studies

10 points

In the late 19th and early 20th century, this country was led by the Generation of '80, which included **Julio Roca** [HOO-lee-oh ROH-kah], the leader of the Conquest of the Desert. This country's Infamous Decade, during which there was a depression and electoral fraud, ended when Ramón Castillo's attempt to make **Robustiano Patrón Costas** [roh-boo-stee-AH-noh pah-TROHN KOHSS-tahss] the president led to the Revolution of '43. A giant rally in this country in 1951 encouraged a woman to run for vice president; she did not run and soon died of cervical cancer. That woman had been this country's first lady. Name this South American country that was the home of Eva Perón, who was nicknamed Evita.

Argentina [or the
Argentine Republic or
República Argentina]

Question #20: Science

10 points

This process has been better at handling larger particles since the 1980s thanks to the introduction of the pulsed-field version of it. The capillary type of this process can be used to study saliva and microsattellites. This process sometimes uses **agarose** [AG-uh-rohss], including when it is used as a follow-up to the **polymerase** [puh-LIM-ur-"ace"] chain reaction. This process can be used to study the interaction of proteins with DNA by creating a mobility shift assay. Name this movement of charged particles in a fluid under the influence of an electric field, which is used to separate molecules based on size and often uses gel.

(gel) electrophoresis or
cataphoresis or
electroosmosis or
anaphoresis



Question #21: Fine Arts

10 points per part

Benny Goodman was known as the “king of” this type of music that was associated with big bands.		
1	Name this jazz style dominant during the 1930s and '40s.	<u>swing</u>
2	This bandleader composed “It Don’t Mean a Thing If It Ain’t Got That Swing”, and Irving Mills wrote the lyrics.	(Edward Kennedy) “Duke” <u>Ellington</u>
3	These brothers and bandleaders created a lot of swing music during their collaboration that lasted until 1935, when Tommy left Jimmy.	<u>Dorsey</u> brothers or the <u>Dorseys</u> [or Thomas Francis “Tommy” <u>Dorsey</u> Jr. and James Dorsey]

Question #22: Fine Arts

10 points per part

This singer popularized the Jimmy Cox song “Nobody Knows You When You’re Down and Out”.		
1	Identify this singer who was nicknamed “the Empress of the Blues” and who died in a 1937 car accident.	Bessie <u>Smith</u>
2	Early in her career, Smith often worked with this singer whose nickname was “the Mother of the Blues”.	(Gertrude) “Ma” <u>Rainey</u> [or Gertrude <u>Pridgett</u>]
3	Smith performed in the movie <i>St. Louis Blues</i> , which has a title track written by this composer. This composer also wrote “Memphis Blues”.	W(illiam) C(hristopher) <u>Handy</u>



Question #23: Science

10 points per part

Albert Einstein explained this phenomenon in his paper “On a Heuristic Viewpoint Concerning the Production and Transformation of Light”.		
1	Name this phenomenon in which electromagnetic radiation causes metal to emit electrons.	photoelectric effect
2	This American scientist used the photoelectric effect to show that X-rays are photons. The increase of the wavelengths of scattered X-rays and gamma rays is named for this person.	Arthur Compton [accept the Compton effect]
3	This phenomenon similar to the photoelectric effect is the creation of an electromotive force by electromagnetic radiation.	photovoltaic effect

Question #24: Science

10 points per part

The Higgs particle is this type of particle.		
1	Name this type of particle with integer spin, as opposed to fermions [FAIR-mee-ahnz].	bosons [BOH-zahnz]
2	This collective name is given to the vector bosons that are force carriers. The Higgs boson is a scalar boson, not one of these particles.	gauge bosons
3	The Peccei [peh-CHAY]-Quinn mechanism predicts the existence of this boson, which could be changed into a photon by an electric field. It is possible that dark matter is made of this particle.	axion



Question #25: Social Studies

10 points per part

The ninth month of the Islamic calendar is generally considered the holiest month.		
1	Name this month during which Muslims fast from dawn until sunset.	<u>Ramadan</u>
2	This is the name of the meal after sunset that breaks the fast each day.	<u><i>iftar</i></u> [or <u><i>fatoor</i></u>]
3	This first month of the Islamic calendar is also considered holy. It includes the Day of Ashurah.	<u>Muharram</u>

Question #26: Social Studies

10 points per part

The last of these concepts is the method for attaining the end of suffering, which is the Eightfold Path.		
1	Name these fundamental concepts in Buddhist thought that address suffering. There are four of them.	Four <u>Noble Truths</u> [or <u>catvari aryasatyani</u> ; prompt on <u>truths</u>]
2	This Sanskrit word, meaning “suffering”, is often given as the first Noble Truth.	<u>dukkha</u> [DOO-kuh]
3	The Four Noble Truths are described in this collection of <u>Theravada</u> [teh-ruh-VAH-duh] Buddhist texts named for the language they were written in. These texts are also called “Tipitaka”, which means “triple basket”.	<u>Pali canon</u>



Question #27: Literature

10 points per part

This author wrote a short story about a clown who wishes to impart joy to his audiences in “The Smile at the Foot of the Ladder”.		
1	Name this author whose novels <i>Tropic of Cancer</i> and <i>Tropic of Capricorn</i> were for a time classified as obscene and banned from the U.S.	Henry (Valentine) <u>Miller</u>
2	Henry Miller had an affair with this diarist; part of her diary was published under the title <i>Henry and June</i> .	Anaïs <u>Nin</u>
3	Henry Miller wrote the introduction for this author’s novella <i>The Subterraneans</i> and praised his novel <i>The Dharma Bums</i> . This author wrote <i>On the Road</i> .	Jack <u>Kerouac</u> [or Jean-Louis (Lebris de) <u>K��rouac</u>]

Question #28: Literature

10 points per part

Wash Williams, the subject of the story “Respectability”, is a telegraph operator in this town, where Kate Swift is a teacher.		
1	Name this town that George Willard leaves in the story “Departure”.	<u>Winesburg</u> , Ohio
2	This author wrote the short story cycle <i>Winesburg, Ohio</i> .	Sherwood <u>Anderson</u>
3	<i>Winesburg, Ohio</i> starts with “The Book of the Grotesque”, in which a writer is helped by—and shares cigars with—a member of this profession.	<u>carpenter</u> or <u>carpentry</u>



Question #29: Social Studies

10 points

In 1953, this federal agency sued Ralston Purina over the way it paid employees. In 2009, Bank of America paid a 33-million-dollar fine to this agency for not disclosing bonus payments to Merrill Lynch executives. The Sarbanes-Oxley Act doubled this agency's budget and gave it oversight over the newly created Public Company Accounting Oversight Board. The Wheeler-Rayburn Act required holding companies to register with this federal agency and was passed in 1935, the year after this agency was created. This agency's first chairman was Joseph Kennedy Sr. Name this federal agency created during the Great Depression that regulates stocks and bonds.

SEC or Securities and Exchange Commission

Question #30: Mathematics

10 points

The first step in the Holm-Bonferroni Method is to rank values of this quantity from smallest to largest. Fisher's method uses the natural log of this quantity to find **chi [ky]** squared. This quantity traditionally was often found using a table that listed degrees of freedom and chi-squared values. This quantity is often compared to a predetermined quantity called the alpha level or significance level. Give this term for the quantity between 0 and 1 that is smaller when there is strong evidence against the null hypothesis, typically causing the null hypothesis to be rejected when this value is less than 0.05.

p-value [accept **probability** value or **asymptotic significance**]



Question #31: Literature

10 points

In one play by this writer, **Schuppanzigh** [SHUP-ahn-zig] is a German refugee who works for the London Electricity Board, and Brindsley Miller is a sculptor trying to impress rich people. That play, which this writer set during a blackout so that the audience can see the characters but they cannot see each other, is *Black Comedy*. In another play by this writer, a mother says “What the eye does not see, the heart does not grieve over.” In this writer’s play, that mother—Dora—reads from the Bible to her son, who is under the care of Martin Dysart, a psychiatrist. The son, Alan Strang, has blinded six horses. Name this playwright of *Equus* [EK-wuss].

Peter (Levin) Shaffer

Question #32: Science

10 points

Like MSH, the beta form of this chemical is formed by breaking down beta-lipotropin, and its precursor is POMC. When these chemicals produced in the body are bound to receptors, they inhibit substance P and **GABA** [GAB-uh], leading to a release of **dopamine** [“DOPE-uh-mean”]. These chemicals play the same role as **enkephalins** [en-KEFF-uh-linz]; they are both classified as neuro-hormones. These naturally-produced chemicals reduce pain and increase euphoria, much like opioids. Name these chemicals whose release is often mentioned in claims of pseudo-scientific healers and which is credited for “runner’s high”.

endorphins [or
dynorphins]



Extra Question #1: Social Studies

10 points

After **Philippe Briez** [fee-leep bree-ay] criticized this group, one of its members stated “He who seeks to debase, to divide, to paralyze the Convention is an enemy of the fatherland.” At its peak powers, the size of this group grew from nine to twelve members. **Louis Antoine de Saint-Just** [loo-ee an-twahn deh sahn-zhoos] was reading to this group when he was interrupted by the Thermidorian Reaction, which caused this group to lose power. This group was at first informally called the Danton Committee. Name this group created by the National Convention that had dictator-like power and was for a time dominated by Maximilien Robespierre before he was executed and this group lost power to the Directory.

Committee of Public Safety [or Committee for Public Safety or Comité De Salut Public]

Extra Question #2: Mathematics

10 points

The logarithmic example of this type of shape is carved on the bottom of Jacob **Bernoulli's** [bair-NOO-lee'z] tombstone and is also known as the “equiangular” type. A pattern named for Stanislaw Ulam is similar to this type of shape and shows unexplained patterns with prime numbers. Many equations in polar coordinates that *don't* use trig functions can generate this kind of shape. A version of this type of shape named for **Theodorus** [thee-oh-DOR-uss] is based on right triangles butted up against each other. A nautilus shell exemplifies this type of shape. Name this shape generated by moving outward while rotating around a fixed center point.

spirals



Extra Question #3: Fine Arts

10 points

This composer requires the tenor to hit eight high C's in the aria "Ah! mes amis, quel jour de fête!" [ah mess ah-mee, kel zhoor deh fet]. That aria is in this composer's opera *La fille du régiment* [lah feel doo reh-zhee-mawn]. In another opera by this composer, the title character sings about seeing a ghost in "Regnava [rain-YAH-vah] nel silenzio". After that character marries Arturo despite loving Edgardo di Ravenswood, she has a "mad scene" that this composer wrote. In another opera by this composer, Nemorino sings "Una furtiva lagrima" after getting Adina to fall in love with him by drinking a potion. Name this composer of *L'elisir d'amore* [leh-lee-ser dah-mor] and *Lucia di Lammermoor* [loo-CHEE-ah dee lah-mer-moor].

(Domenico) Gaetano
Donizetti

Extra Question #4: Science

10 points

The use of this substance increases the risk of **angiosarcoma** [AN-jee-oh-sar-KOH-muh] of the liver. The most common use of DEHP, or **phthalate** [f'-THAL-"ate"], is to soften this substance. This substance is often chlorinated to improve ductility, and though it is not a metal, it is often used to make pipes. Bottles made from this substance can be recycled to make traffic cones. A shortened version of this substance's name is often used to refer to phonograph records because they are made of this substance. Name this plastic used in raincoats and shower curtains that is almost as common as polyethylene.

PVC or **polyvinyl**
chloride [prompt on
plastics or **vinyls**]



Extra Question #5: Literature

10 points

Near the beginning of this novel, a man laughs so hard that he falls off his donkey, which is followed by prosperous times. This novel then tells about an attempt to end a plague by having a Divine Teacher lead a prayer service. This novel then describes a stone slab being moved to reveal a pit that is 100,000 feet deep. The movement of that slab releases 36 stars of Heavenly spirits and 72 stars of Earthly Fiends, which is a total of 108 demons. Name this novel set during the Song dynasty at **Liangshan [lee-AHNG-shahn]**, and which is often grouped with *Romance of the Three Kingdoms*, *Journey to the West*, and *Dream of the Red Chamber*.

Water Margin [or
Shuihu Zhuan or
Outlaws of the Marsh
or *Tale of the Marshes*
or *All Men Are*
Brothers or *Men of the*
Marshes or *The*
Marshes of Mount
Liang]



Extra Question #6: Literature

10 points per part

The ninth and final section of this poem begins “Autumn already!”.		
1	Name this poem in which the writer discusses his ancestors the Gauls in the “Bad Blood” section. It also has two sections titled “Delirium”.	A <i>Season in Hell</i> [or <i>Une Saison en Enfer</i>]
2	This French author wrote <i>A Season in Hell</i> . He collected many of his prose poems in <i>Illuminations</i> .	(Jean Nicolas) Arthur Rimbaud [art-yur ram-boh]
3	<i>A Season in Hell</i> was based in part on Arthur Rimbaud’s stormy relationship with this other poet, who wrote <i>Poèmes saturniens</i> [poh-em sah-toorn-yen].	Paul(-Marie) Verlaine

Extra Question #7: Literature

10 points per part

This woman marries George Tesman, who has a rivalry with Eilert Lovborg.		
1	Name this title character of a play. She burns Lovborg’s manuscript.	Hedda Gabler (Tesman) [accept any]
2	<i>Hedda Gabler</i> was written by this Norwegian playwright who also wrote <i>Peer Gynt</i> .	Henrik (Johan) Ibsen
3	In this play by Ibsen, an orphanage funded by Helen Alving burns down.	Ghosts [or Gengangere]



Extra Question #8: Mathematics

10 points per part

The shape of the graph of this function is a catenary.		
1	Name this function that can be given by the formula " $\frac{1}{2}$ times the quantity e to the x plus e to the minus x ".	<u>hyperbolic cosine</u> or <u>cosh</u> [do not accept or prompt on "cos" or "cosine"]
2	For a given interval, the area under a hyperbolic cosine graph is equal to this other property of the graph. In general, this quantity is calculated by taking the integral of the square root of the quantity "derivative squared plus 1".	arc <u>length</u>
3	Find the only rational number that is equal to the hyperbolic cosine of a rational number.	<u>1</u>

Extra Question #9: Mathematics

10 points per part

This rule is used for finding limits of indeterminate forms such as "0 raised to the 0 power" or "0 divided by 0".		
1	Name this "rule" that uses derivatives to evaluate such limits.	<u>L'Hôpital's</u> [<u>loh-pee-tahl'z</u>] rule
2	When the indeterminate form involves an exponent, L'Hopital's rule is used after applying this function to the form.	natural <u>logarithm</u> or <u>ln</u> [or <u>logarithm</u> base e]
3	Find the limit, as x approaches 0, of the quantity " 3 to the x minus 2 to the x , end quantity, all over x ".	the natural <u>logarithm</u> of <u>3</u> minus the natural <u>logarithm</u> of <u>2</u> [or <u>ln 3</u> minus <u>ln 2</u> ; or the natural <u>logarithm</u> of <u>3/2</u> ; or <u>ln 3/2</u>]