



**Question #1: Mathematics – Math Concepts**

10 points

<p>The “numbers” named for this person are numeric encodings of sentences in formal languages. This person simplified the work of <b>von Neumann [vawn NOY-mun]</b> and Bernays to develop an alternative to Zermelo-Fraenkel set theory. One of this person’s theorems stated that a theory including a statement of its own consistency must be inconsistent. That theorem is in this person’s <i>On Formally Undecidable Propositions in Principia [prin-CHI-pee-uh] Mathematica and Related Systems</i>. Name this mathematician whose most famous result can be phrased as “in any system strong enough to describe arithmetic, some statements are true but unprovable”.</p>	<p>Kurt <b>Gödel</b> [“girdle”]</p>
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**Question #2: Literature – British Literature**

10 points

<p>This character drank tobacco-steeped rum before reading a bible and throwing his calendar off track. He was forced into slavery in Sallee following his capture by Moors. Purchased simultaneously with Xury by a Portuguese man, he later became a plantation owner. This character made a cross and carved the date he arrived on an island where he fought cannibals and rescued Friday. Name this sailor who, in a story inspired by the adventures of Alexander Selkirk, is marooned in a novel by Daniel Defoe.</p>	<p><b>Robinson Crusoe</b> [accept either]</p>
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**Question #3: Fine Arts – Art History**

10 points

One painting by this artist shows a man holding up a dagger while he pulls a uniformed man he just stabbed head first off the back of a white horse. The Duchess of Alba, dressed in black, points to his name in the ground in one of his paintings, while another painting of the Duchess shows her in white standing next to her dog with both of them wearing a red bow. Another of his paintings is lit by a square lantern between a man holding his arms out and a firing squad. Name this artist of *The Charge of the Mamelukes* and *The Third of May 1808*.

Francisco (José de) **Goya** (y Lucientes)

**Question #4: Science – Physics**

10 points

The power spectral density of thermal noise is proportional to temperature and this quantity. Leon Chua proposed a circuit element whose value for this quantity depends on the history of charge that has passed through it. Three elements with known values for this quantity can be used to measure the unknown value of a fourth object by assembling the four into a configuration called the Wheatstone bridge. For a wire, this quantity is proportional to length and inversely proportional to area. A complex analogue of this quantity used in alternating-current circuits is called impedance. The power dissipated by a circuit component equals the square of the current through the component squared times this property of it. Name this quantity equal to electrical potential difference divided by current, and measured in ohms.

**resistance** [do not accept “resistivity”]



**Question #5: Social Studies – U.S. History**

10 points

<p>One key participant in this election was quoted by Robert Novak describing the losing candidate as being for “amnesty, abortion, and acid”. The source of that quote would later be backed “1000 percent” before withdrawing following revelations concerning electroshock therapy. Actions taken during this election led to Mark Felt becoming an anonymous source for Carl Bernstein and Bob Woodward under the name “Deep Throat”. Name this election during which George McGovern lost to Richard Nixon, who then started his second term.</p>	<p>United States presidential election of <b>1972</b> [prompt on answers mentioning '72]</p>
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**Question #6: Literature – World Literature**

10 points

<p>An actor who is supposed to be playing Jupiter takes a ladder so that he can view this character. This child of Sister <b>Gudule</b> [guh-dool] spared the life of a trespassing poet by agreeing to marry him. This character owned a goat that could spell out the name of her love interest. Threatened with a vise being applied to her feet, she falsely confesses to the murder of Captain <b>Phoebus</b> [FEE-bus], which was actually committed by Claude Frollo. Name this gypsy, the love interest of Quasimodo in Victor Hugo’s <i>The Hunchback of Notre Dame</i>.</p>	<p><b>Esmeralda</b> [accept <b>Agnes</b>]</p>
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**Question #7: Fine Arts – Classical Music & Opera**

*10 points per part*

Emerson, Lake, and Palmer performed this Modest Mussorgsky suite.		
<b>1</b>	Name this suite ending with “The Great Gate of Kiev” that was inspired by the art of Viktor Hartmann.	<b><u>Pictures at an Exhibition</u></b> [or <i>Kartiniki s Veestavskee</i> ]
<b>2</b>	A commonly performed version of <i>Pictures at an Exhibition</i> was arranged by this composer of <i>Bolero</i> .	(Joseph-)Maurice <b><u>Ravel</u></b>
<b>3</b>	Another popular arrangement of <i>Pictures at an Exhibition</i> was made by this person, who conducted the Philadelphia Orchestra from 1912 to 1940.	Leopold (Anthony) <b><u>Stokowski</u></b>

**Question #8: Fine Arts – Classical Music & Opera**

*10 points per part*

This piano quintet in A major is number 667 in the <b>Deutsch [doych]</b> catalogue.		
<b>1</b>	Name this quintet by Franz Schubert that calls for a piano and a double bass.	<b><u>Trout</u></b> quintet [or Das <b><u>Forellen</u></b> Quintett; accept Die <b><u>Forelle</u></b> ]
<b>2</b>	Give the nickname of Schubert’s symphony that is usually numbered eighth. It contains two movements and a <b>scherzo [“SCARE”-tsoh]</b> .	<b><u>Unfinished</u></b> Symphony
<b>3</b>	This nickname is used for Schubert’s final finished symphony. English speakers often label it as his ninth symphony, but it is sometimes numbered seventh or eighth.	<i>The <b><u>Great C Major</u></b></i>



**Question #9: Science – Biology**

*10 points per part*

These compounds undergo beta oxidation to produce energy.		
<b>1</b>	Name these compounds which join with <b>glycerol</b> [GLIS-ur-awl] to form <b>triglycerides</b> [“try”-GLISS-ur-“ides”].	<b>fatty acids</b> [prompt on <b>carboxylic acids</b> ]
<b>2</b>	One of the products of beta oxidation is this <b>thioester</b> [“thigh-oh-ester”], which consists of a two-carbon group bound to a certain <b>coenzyme</b> [koh-“enzyme”].	<b>acetyl-CoA</b> [uh-SEE-tul KOH-ay] or <b>acetyl coenzyme A</b>
<b>3</b>	The two carbons of the acetyl in acetyl-CoA are added to this compound at the beginning of the Krebs cycle. In C4 plants, <b>PEP carboxylase</b> [P-E-P kar-“BOX”-ih-“lace”] forms this molecule from <b>pyruvate</b> [“pie”-ROO-vayt] and carbon dioxide.	<b>oxaloacetate</b> [“OX”-uh-loh-“ASS”-ih-tayt]

**Question #10: Science – Biology**

*10 points per part*

This structure is composed of a <b>fibrillar</b> [FIB-ril-ur] center, dense fibrillar component, and a granular component.		
<b>1</b>	Name this structure within the nucleus.	<b>nucleolus</b> [nook-lee-OH-luss] [or <b>nucleoli</b> ; do not accept “nucleus” or “nuclei”]
<b>2</b>	These nucleolar accessory bodies help process RNA produced in the nucleolus. They are named for their Spanish discoverer.	<b>Cajal</b> [kah-HAHL] body/ies
<b>3</b>	The nucleolus is where these organelles are produced that are responsible for translation and stud the rough endoplasmic reticulum.	<b>ribosomes</b>



**Question #11: Mathematics – Geometry**

*10 points per part*

An exterior angle of a regular type of this polygon measures 36 degrees.		
<b>1</b>	Name these polygons that have 10 sides.	(regular) <b>decagons</b>
<b>2</b>	Find the angle measure in degrees of an <i>interior</i> angle of a regular decagon.	<b>144</b> degrees
<b>3</b>	How many diagonals does a convex decagon have?	<b>35</b> diagonals

**Question #12: Mathematics – Geometry**

*10 points per part*

This theorem, also known as the SAS inequality, addresses the situation when two triangles have a pair of congruent sides, but the angle between them is not congruent.		
<b>1</b>	Name the theorem stating that if side $PQ$ is congruent to $XY$ , side $QR$ is congruent to $YZ$ , and angle $PQR$ is greater than angle $XYZ$ , then side $PR$ is greater than $XZ$ .	<b>hinge</b> theorem [or <b>open mouth</b> theorem]
<b>2</b>	If two sides of a triangle are each 6 units long, and the angle between them is 60 degrees, then how long is the other side of the triangle?	<b>6</b> units
<b>3</b>	If two sides of a triangle are each 6 units long, and the angle between them is 90 degrees, then how long is the other side of the triangle?	<b>6 root 2</b> units [or <b>6 times the square root of 2</b> or <b>6 radical 2</b> units or equivalents]



**Question #13: Literature – British Literature**

*10 points per part*

Though he did not create this character, Anthony Burgess wrote that the inspiration for this character came from posters depicting J. M. Bennett.		
<b>1</b>	Name this English Socialist Party leader, who was also the leader and the guardian of the Revolution.	<b><u>Big Brother</u></b>
<b>2</b>	This employee of the Ministry of Truth could not distinctly remember when Big Brother rose to power. Mr. Charrington trapped him and Julia, and he betrayed his lover once a cage of rats was placed on his head.	<b><u>Winston Smith</u></b> [accept either]
<b>3</b>	Winston Smith is the protagonist of this dystopian George Orwell novel.	<b><u>Nineteen Eighty-Four</u></b>

**Question #14: Literature – British Literature**

*10 points per part*

Much to the chagrin of Jabez Wilson, it was dissolved on October 9, 1890.		
<b>1</b>	Name this fictional organization that hired Jabez to copy out of the <i>Encyclopedia Britannica</i> , which was a pretext for Vincent Spaulding and John Clay to burrow an underground tunnel to a nearby bank.	The <b><u>Red-Headed</u></b> League
<b>2</b>	The elaborate robbery of the City and Suburban Bank was foiled by this detective.	<b><u>Sherlock Holmes</u></b> [accept either]
<b>3</b>	After capturing the criminals, Holmes misquotes a line from a letter to George Sand written by this author of <i>Madame Bovary</i> .	Gustave <b><u>Flaubert</u></b> ["flow-bear"]



### Question #15: Miscellaneous – Popular Culture

10 points

This channel teamed up with the BBC for the first season of *Liquid Television*, and it aired the cartoons *Clone High* and *Daria*. Carson Daly made his big break hosting this channel's top-10 show *Total Request Live*. One of its shows, about a woman looking for her biological family, is *Finding Carter*. Two of this channel's annual award shows use golden popcorn and a moonman as trophies. This channel airs *16 and Pregnant*. Name this home of the reality series *Jersey Shore*, which started out in 1981 as a station that showed music videos.

**MTV** [accept **Music Television** or **Music TV**]

### Question #16: Science – Astronomy

10 points

Attempts to explain this object's rotational period of less than four hours have focused on a graze-and-merge collision between two objects roughly equal in size. This object is believed to be in a 7:12 ["seven to twelve"] orbital resonance with Neptune. This object's high albedo [al-BEE-doh] is attributed to a surface of water ice. Its rotational speed explains why this ellipsoidal object has not become approximately spherical. The moons of this object are Hi'iaka ["high"-ee-AH-kah] and Namaka [nah-MAH-kah]. Name this fifth object to be classified as a dwarf planet, receiving the classification just after Makemake [mah-kay-mah-kay].

**Haumea**



**Question #17: Social Studies – World History**

10 points

In *Life of Aristeides* [ar-iss-TAY-uh-deez], Plutarch [PLOO-tark] described the perversion of this process, citing an agreement between Alcibiades [al-sih-BYE-uh-deez] and Nicias [NISH-ee-uss]. It was introduced due to the actions of Hippias [“hippie-us”], and the first person affected by it was a son of Charmus [KAR-muss] named Hipparchus [hip-ARK-uss]. This process was only successful if there were at least 6,000 votes cast; those votes were cast on pieces of broken pottery. Name this ancient practice of expelling a citizen from Athens for 10 years.

**ostracism** [accept word forms; do not accept “exile” or “banishment”]

**Question #18: Literature – U.S. Literature**

10 points

In one work, this writer described an object that “has the power to kill without the power to die” and whose speaker is a “deadly foe”, as “none stir the second time.” This person wrote of a creature that appeared between the speaker and the light, with a “blue, uncertain, stumbling buzz”. This poet also described seeing schoolchildren “at recess in the ring” and a house “that seemed a Swelling of the Ground” while in a carriage that “held Immortality”. Name this writer of “Because I Could not Stop For Death”, a poet from Amherst.

Emily (Elizabeth) **Dickinson**



**Question #19: Science – Biology**

*10 points*

The gene **TSIX** [“T six”] controls the formation of these structures by opposing the action of the effector protein **XIST** [“exist”]. Bruce **Beutler’s** [BOYT-lur’z] investigation of women **heterozygous** [“hetero”-ZY-guss] for **G6PD** [G “six” P-D] deficiency supported the existence of these structures. Mary Lyon’s hypothesis explained the formation of these structures, which is sometimes called lyonization. The randomness of which objects undergo this process causes the pattern of calico cats. Women typically have one of these per cell, while men usually have none. Name these inactivated X chromosomes.

**Barr bodies** [do not prompt on “X chromosome(s)”]

**Question #20: Social Studies – U.S. History**

*10 points*

Thomas Edison improved on this man’s creation with the Quadriplex system, while Ezra Cornell improved the insulation for a key component of his creation. During the Whig nominating convention where Clay and **Freylinghuysen** [FREE-ling-hie-sun] were victorious, he bested a railroad in a race by two hours. This person’s main invention improved on a system based on five magnetic needles, invented by Cooke and Westinghouse, and was used to send to Albert Vail the message “what hath God wrought” from Baltimore, then to relay it back to this man. Name this inventor of the single-wire telegraph and the “code” it used.

Samuel (Finley Breese)  
**Morse**



**Question #21: Literature – U.S. Literature**

*10 points per part*

This act was the subject of a poem “copied out of a loose paper”, and it resulted in the loss of both pelf and store.		
<b>1</b>	Occurring at night on July 10, 1666, the speaker looked on the bright side of this event, saying “The world no longer let me love. My hope and treasure lie above.”	<b><u>burning</u></b> of the <b><u>house</u></b> of Anne Bradstreet [accept equivalents or “ <b><u>Verses upon the Burning of our House, July 10th, 1666</u></b> ”]
<b>2</b>	Anne Bradstreet’s house burned down in this state, the setting of <i>The Scarlet Letter</i> and <i>The Crucible</i> .	<b><u>Massachusetts</u></b>
<b>3</b>	In a <b>quaternion</b> [kwuh-TER-nee-un], Bradstreet described the first of these stages as “son of Phlegm, grandchild to water”. In Shakespeare’s <i>Twelfth Night</i> , <b>Jacques</b> [JAY-kweez] describes seven of them.	<b><u>Ages of Man</u></b> [accept “ <b><u>Four Ages of Man</u></b> ”]; prompt on <b><u>Ages</u></b> ]

**Question #22: Literature – U.S. Literature**

*10 points per part*

He grew to love being in a hospital setting while stationed at Lowery Field, Colorado.		
<b>1</b>	Name this character who used the pseudonym Washington Irving while censoring letters. One of his superiors used the same name and occasionally reversed it.	(Captain) (John) <b><u>Yossarian</u></b>
<b>2</b>	Yossarian attempts to weasel his way out of flying combat missions in this novel by Joseph Heller.	<b><u>Catch-22</u></b>
<b>3</b>	Noting its brevity, Major Major Major Major switched from using the name “Washington Irving” to the name of this British poet, occasionally reversing his name as well.	John <b><u>Milton</u></b>



**Question #23: Mathematics – Trigonometry**

*10 points per part*

If $x$ equals the sin of $y$ , then for a particular set of inputs, $y$ equals this function of $x$ .		
<b>1</b>	Name this function on $x$ whose derivative equals one divided by the square root of the quantity one minus $x$ squared.	<b>arcsine</b> (of $x$ ) [prompt on answers containing <b>inverse sine</b> but do not prompt on <b>sine</b> ]
<b>2</b>	Give the largest number in the domain of the arcsine function.	<b>one</b>
<b>3</b>	Evaluate the arcsine of negative one-half. Give your answer in radians between negative pi divided by 2, and positive pi divided by 2.	<b>negative pi over 6</b> [or <b>negative one-sixth</b> (times) <b>pi</b> ; accept <b>divided by</b> in place of “over”; do not prompt on partial answers]

**Question #24: Mathematics – Trigonometry**

*10 points per part*

This angle is used to describe the sight line of an observer who is looking upward, but not straight up.		
<b>1</b>	Give the name for the angle between the horizontal and the upward line of sight.	angle of <b>elevation</b> [accept angle of <b>altitude</b> ]
<b>2</b>	If the sine of the angle of elevation to the Sun is three fifths, find the length of the shadow cast by a person who is 120 centimeters tall. Give the height in centimeters.	<b>160</b> centimeters
<b>3</b>	If the angle of elevation to the Sun is 30 degrees, what is the ratio of the length of a shadow cast to the height of the object casting the shadow?	<b>root 3</b> [or the <b>square root of 3</b> or <b>radical 3</b> ; do not accept “3”]



**Question #25: Social Studies – World History**

*10 points per part*

<p><b>Bhimrao Ambedkar</b> [BIM-rao ahm-BED-kar] put forth 22 vows with which hundreds of thousands of these people converted to Buddhism, and he strongly advocated for reserved legislative seats for them.</p>		
<p><b>1</b></p>	<p>Name these people whose rights were supported by Namdeo Dhasal, who helped found a Panther organization to agitate for their rights.</p>	<p><b>Dalits</b> people [or <b>Untouchables</b> or <b>Scheduled</b> or <b>Harijan</b> or <b>Panchamas</b> or or <b>Asprushya</b>]</p>
<p><b>2</b></p>	<p>In 1997, Kocheril Narayanan became the first Dalit elected to this office.</p>	<p><b>President</b> of <b>India</b></p>
<p><b>3</b></p>	<p>This pacifist leader coined the term “Harijan”, or “Children of God”, for Dalits. During a prayer, this person was assassinated by Nathuram Godse.</p>	<p><b>Mohandas</b> (Karamchand) <b>Gandhi</b> [accept <b>Mahatma Gandhi</b>; prompt on <b>Gandhi</b>]</p>

**Question #26: Social Studies – World History**

*10 points per part*

<p>This nation gained territory from Bolivia in the <b>Chaco</b> [CHAH-koh] War.</p>		
<p><b>1</b></p>	<p>Name this country led by Alfredo Stroessner for much of the 20th century. Francisco Solano López led this country in a war in which it failed to capture <b>Mato Grosso</b> [MAH-toh GROH-soh].</p>	<p>(Republic of) <b>Paraguay</b> [or República del <b>Paraguay</b>]</p>
<p><b>2</b></p>	<p>In this conflict, Paraguay was soundly defeated by Brazil, Uruguay, and another country. It came to an end following Francisco Solano López’s death at <b>Cerro Cora</b> [SAIR-oh KOH-rah].</p>	<p>War of the <b>Triple Alliance</b> [prompt on <b>Paraguayan War</b>]</p>
<p><b>3</b></p>	<p>When Francisco Solano López was in a dispute with Brazil, this country’s president <b>Bartolomé Mitre</b> [bar-TOH-loh-MAY MEE-tray] joined with Brazil and Uruguay to form the Triple Alliance.</p>	<p><b>Argentina</b></p>



**Question #27: Science – Physics**

*10 points per part*

This field of mathematics incorporates the principle of least action used in <b>Lagrangian</b> [luh-GRAN-jee-un] mechanics.		
<b>1</b>	Name this field in which functionals are optimized by solving their associated <b>Euler-Lagrange</b> [OY-lur luh-GRAHNJ] equation.	<b>calculus of variations</b> [or <b>variational calculus</b> ; do not prompt on partial answers]
<b>2</b>	This operator represents total energy, and lends its name to a formulation of mechanics.	<b>Hamiltonian</b> operator
<b>3</b>	The equations of motion in Hamiltonian mechanics can be found by considering the Hamiltonian as a function of three quantities, including this product of mass and velocity.	linear <b>momentum</b> [prompt on <b>p</b> ; do not accept “angular momentum”]

**Question #28: Science – Physics**

*10 points per part*

One of the laws named for this man states that an object in motion will continue moving if no forces act upon it.		
<b>1</b>	Identify this namesake of three laws of motion.	Isaac <b>Newton</b>
<b>2</b>	In Newton’s cannonball thought experiment, an object will leave the orbit of the earth if it exceeds this speed, which for a spherically symmetric body is equal to the square root of the quantity 2 times the universal gravitational constant times mass over radius.	<b>escape</b> speed [accept <b>escape</b> velocity]
<b>3</b>	Newton’s rings are an interference pattern that appear when light is reflected between surfaces with these two shapes.	<b>flat</b> [or <b>planar</b> or <b>plane</b> ] and <b>spherical</b> [or <b>sphere</b> ; prompt on <b>round</b> ] [either order]



**Question #29: Social Studies – U.S. History**

*10 points*

This act's perpetrator asserted that its target was "dumb", but being dumb "wasn't against the law". Immediately before this event, Joseph Martin read a letter in which one party wrote "there is no substitute for victory." This event resulted in the promotion of Matthew Ridgway. Shortly afterwards, the target of this event gave the "Old Soldiers Never Die" speech to a joint session of Congress. Name this controversial action towards an Army General by a sitting President during the Korean War.

Harry Truman **firing** Douglas **MacArthur** [accept similar answers mentioning **MacArthur** and the notion of firing or dismissal or relief of duties]

**Question #30: Literature – World Literature**

*10 points*

The person who describes this location states "My solitude is cheered by that elegant hope." The contents of this location can be broken down into 25 characters. One group of its employees, the "Purifiers", seeks out a crimson area, while others seek out the perfect index. This place consists of hexagonal rooms whose contents are 410 pages long and can be used to write any literary work. Name this fictional book depository created by **Jorge Luis Borges [HOR-gay loo-EESS BOR-hayss]** whose name references a Biblical tower.

the **Library of Babel** [or La **biblioteca de Babel**; prompt on "Universe" or "Library"]



### Question #31: Science – Chemistry

10 points

The presence of one of these ligands results in a weak stretch in the 1600-to-2000-inverse-centimeter range in an IR spectrum. **DIBAL** [“DIE-ball”] is a reagent that donates this group. Along with **alkyl** [AL-kul] shifts, this ion commonly shifts in **carbocation** [KAR-boh-“CAT-ion”] rearrangements. **LAH** [L-A-H] and a compound consisting of sodium bound to boron bound to this **anion** [“AN-ion”] are reducing agents that work by donating this ion. Name this **monatomic** [MAHN-“atomic”] anion whose formula is  $H^-$  [“H minus”].

**hydride** ion [accept  $H^-$  before the end; prompt on **hydrogen** ion; do NOT accept “H<sup>+</sup>”]

### Question #32: Mathematics – Math Concepts

10 points

The inequality named for this person states that the quantity one plus  $x$ , end quantity, raised to the  $n$  power, is greater than or equal to one plus  $n$  times  $x$ . This person’s “golden theorem” is an early version of the law of large numbers. His book *Acta Eruditorum* described **lemniscates** [LEM-nih-“skates”]. The processes and trials named for this person, like the algebra named for George Boole, can have two possible outcomes. Name this mathematician whose nephew Daniel used the conservation of energy to develop a law describing the flow of a fluid.

Jakob **Bernoulli**



### Extra Question #1: Social Studies – World History

10 points

<p>This island country is where Olaf Frederick Nelson led the “Mau” movement in response to efforts to undermine the power of local chiefs, called <i>matai</i>. Despite allegations of negligence during the influenza epidemic, the League of Nations granted New Zealand a mandate over this nation. A typhoon struck this area in 1889, averting an armed conflict between the United States, UK, and Germany. This country is now headed by <b>Tufuga Efi</b> [too-FOO-gah eh-FEE]. Name this Pacific Island nation whose capital is Apia.</p>	<p>Western <b>Samoa</b> [do not accept <b>American Samoa</b>]</p>
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### Extra Question #2: Fine Arts – Art History

10 points

<p>One artist in this movement painted another artist in this movement smoking a pipe that is easy to see in front of the subject’s white shirt but difficult to see in front of his red and yellow face. That painting by Maurice de Vlaminck shows the painter of <i>Landscape near Cassis</i> and <i>Fishing Boats</i>, <b>Collioure</b> [“coal”-yoor]. Another artist in this movement painted <i>Le bonheur de vivre</i> [lay “bone”-ur day vee-vruh]. Members of this movement built on the strong colors used by post-Impressionists such as Vincent van Gogh. Name this French movement that included Andre Derain and <b>Henri Matisse</b> [awn-ree mah-tees], whose name means “wild beasts”.</p>	<p><b>Fauvism</b> or <b>Fauvist</b> movement [or <b>les Fauves</b> [lay fohv]]</p>
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### Extra Question #3: Mathematics – Math Concepts

10 points

The numbers named for this person equal the number of Boolean functions for a given number of variables. The fact that any set of real numbers has a least upper bound is the type of completeness named for this mathematician. This person and Georg [GAY-ork] Cantor are the namesakes of the axiom that real numbers correspond to points on a line. Another process named for this person defines the real numbers by creating two subsets of the rational numbers, one of which has an upper bound. Name this German number theorist who formally constructed the set of real numbers using namesake “cuts”.

(Julius Wilhelm) **Richard Dedekind** [REEK-hart DAY-day-keent]

### Extra Question #4: Literature – World Literature

10 points

This person wrote a series of dialogues that took place “in the presence of The Lady Truth”; St. Augustine criticizes his own faith in this author’s *Secretum*. This writer used Latin hexameter in an epic poem about the Second Punic War, *Africa*. One of his collections has sections called “In Life” and “In Death”, divided by the passing of a woman whom this author met in Avignon [a-veen-yawn]. The rhyme scheme ABBA ABBA CDE CDE [A-A-B-A (pause) A-B-B-A (pause) C-D-E (pause) C-D-E] characterizes this poet’s namesake type of sonnet, also called the Italian sonnet. Name this author who wrote about his love Laura in *Il Canzoniere* [eel kahn-zoh-nee-AIR-ay].

**Petrarch** [or Francesco **Petrarca**]



**Extra Question #5: Science – Biology**

*10 points*

The product of zeta potential and relative permittivity is proportional to a form of mobility used when performing this technique in a capillary. When performing this technique, a reference ladder may be used, and will result in logarithmic spacing. **Isoelectric** [“EYE-so-electric”] focusing is done with a 2D version of this technique, which includes **SDS-PAGE** [S-D-S-“page”]. The results of this technique may be transferred to a membrane and hybridized in a Southern blot. **Ethidium bromide** [eh-THID-ee-um BROH-myde] and **UV** [U-V] light are commonly used to view the results of this technique, which are a series of bands that migrate out from wells. Name this technique in which particles are separated by size by applying an electric field.

gel **electrophoresis**



### Extra Question #6: Social Studies – World History

*10 points per part*

He was the actual ruler during the presidencies of Carlos Mendieta and José Barnet.		
<b>1</b>	Name this person who gained power in a 1952 coup, cancelling an election he probably would have lost. He fled his country early in 1959 after losing the Battle of Santa Clara.	(Rubén) Fulgencio <b>Batista</b> (Zaldívar)
<b>2</b>	Another candidate in the 1952 elections was this young lawyer. In 1953, he failed to spark an uprising with an attack on the Moncada military barracks.	<b>Fidel</b> (Alejandro) <b>Castro</b> (Ruz) [prompt on <b>Castro</b> ]
<b>3</b>	Fidel and this man, his brother, began planning the successful 26th of July movement while in prison for the Moncada attack.	<b>Raúl</b> (Modesto) Castro (Ruz)

### Extra Question #7: Social Studies – World History

*10 points per part*

After his mother died, this person instituted a year-long ban on milk consumption, and pregnant women were killed alongside their husbands.		
<b>1</b>	Name this African leader credited with introducing the buffalo horn formation. He also had his soldiers carry color-coded shields to indicate their position within the formation.	<b>Shaka</b> Zulu [or <b>Shaka kaSenzangakhona</b> ; prompt on <b>Zulu</b> ]
<b>2</b>	Shaka was born and died in what is now this country.	(Republic of) <b>South Africa</b> [prompt on “RSA”]
<b>3</b>	This person of Zulu heritage became the president of South Africa in 2009 and maintained power with the 2014 election.	Jacob (Gedleyihlekisa) <b>Zuma</b>



### Extra Question #8: Science – Physics

*10 points per part*

This quantity's conjugate variable is temperature.		
<b>1</b>	Name this quantity symbolized $S$ , which represents the disorder of a system.	<b>entropy</b>
<b>2</b>	Entropy, like volume and particle number, is this sort of variable whose size scales with the system's.	<b>extensive</b> quantity/ies or <b>extensive</b> variables
<b>3</b>	By taking the mixed partial derivatives of the thermodynamic potentials and considering the symmetry of second derivatives, these equations—which relate the partials of temperature, volume, pressure, and entropy—can be obtained.	<b>Maxwell</b> (’s) relations [do not accept “Maxwell’s equations”]

### Extra Question #9: Science – Physics

*10 points per part*

LC circuits display behavior analogous to these mechanical systems.		
<b>1</b>	Name these systems that demonstrate undamped sinusoidal motion, such as a mass on a spring without friction.	simple harmonic <b>oscillators</b> [or <b>SHOs</b> ; accept <b>simple harmonic motion</b> or <b>SHM</b> ; do not accept or reveal answers mentioning “damped”]
<b>2</b>	Resistance or friction causes a harmonic oscillator to demonstrate this behavior, in which its amplitude decays.	<b>damping</b> [accept <b>dampening</b> ]
<b>3</b>	The size of this value, equal to the resonant frequency over the bandwidth, can characterize how damped an oscillator is.	<b>Q</b> factor or <b>quality factor</b>