



Question #1: Mathematics

10 points

<p>One method for performing this type of transformation combines Rodrigues' formula with Euler [OY-lur] parameters. This type of transformation is performed by an orthogonal matrix whose determinant is 1. This type of transformation is commonly used to eliminate the xy term from a conic. Two-by-two matrices [MAY-truh-sees] representing these transformations have equal numbers in the upper left and lower right corners, and the other two numbers are opposites. Like reflections and translations, these transformations are isometries ["eye"-SAH-mih-treez]. Give this term for a transformation in which something pivots about an axis.</p>	<p><u>rotation</u> or <u>rotate</u> or <u>rotating</u></p>
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Question #2: Social Studies

10 points

<p>This cabinet-level department oversees the Vocational Rehabilitation and Employment Program and the Dependents Education Assistance Program. President Reagan signed the law raising this department to the cabinet level. Though the National Park Service oversees several high-profile cemeteries, most national cemeteries are overseen by this department. This department also oversees a Health Administration that had scandalously long delays in 2014. Name this department that helps people who have served in the military.</p>	<p>United States Department of <u>Veterans Affairs</u> [accept <u>VA</u>]</p>
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Question #3: Literature

10 points

<p>One poem in this form seems to contradict itself with the line “Better by far you should forget and smile.” That poem is “Remember” by Christina Rossetti. Another poem in this form ends “They also serve who only stand and wait”, and it begins “When I consider how my light is spent”. That poem is “On His Blindness” by John Milton. A poem of this type by William Shakespeare asks “Shall I compare thee to a summer’s day?” Name this type of poem of which Shakespeare wrote 154, each of which has 14 lines.</p>	<p>(Shakespearean) <u>sonnets</u></p>
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Question #4: Fine Arts

10 points

<p>Daniel Barenboim both conducted and played piano between Itzhak Perlman and Yo-Yo Ma during a performance of this composer’s <i>Triple Concerto</i> and <i>Choral Fantasy</i>. One of this composer’s sonatas was originally published as a sonatina [soh-nah-TEE-nah], but a series of descending thirds led to it being nicknamed “Cuckoo”. Another sonata by this composer begins with an adagio sostenuto [ah-DAH-joh soh-steh-NOO-toh] with rising thirds and is nicknamed “Moonlight”. This composer used Schiller’s “Ode to Joy” in his ninth and final symphony. Name this German composer of “Für Elise”.</p>	<p>Ludwig van <u>Beethoven</u></p>
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Question #5: Science

10 points

In a **coaxial** [koh-AK-see-ul] cable, this quantity varies inversely with the log of the ratio of the cable radii. This quantity is multiplied by resistance to find a time constant that describes how quickly an object charges up. This quantity is commonly increased by increasing the relative permittivity by using an electrical insulator that can be polarized, which is called a **dielectric** ["die-electric"]. This quantity equals charge divided by electric potential difference, and is directly proportional to the area of parallel plates and inversely proportional to the distance between them. Name this quantity that describes an object's ability to hold charge and is measured in farads.

capacitance

Question #6: Social Studies

10 points

This person was supported by Jean de Metz and Bertrand de **Poulengy** [poo-lan-zhee] and provided an escort by Robert de **Baudricourt** [boh-dree-kor] at **Vaucouleurs** [vaw-koo-lur] before traveling to **Chinon** [shee-noh] and being taken to **Poitiers** [pwah-tee-ay]. This person was later captured by the Burgundians near **Compiègne** [kom-pain] and sent to **Rouen** [roo-en]. This person helped Charles **VII** [7] get to **Reims** [reemz] for a proper coronation. In 1429, this person got the English to lift a siege, giving momentum to France in the Hundred Years' War. Name this person who was burned at the stake by the English after leading the French to victory at Orléans.

Joan of Arc [or Jeanne d'Arc]



Question #7: Fine Arts

10 points per part

This painting depicts the aftermath of an event blamed on Captain Hugues Duroy de Chaumareys [oog doo-roy duh shawm-ah-ray].		
1	Name this painting set in the Atlantic Ocean near Mauritania [mor-ih-TAY-nee-uh] that shows some survivors desperately waving for a rescue ship.	<i>The Raft of the Medusa</i> [or <i>Le Radeau de la Méduse</i>]
2	This French Romanticist artist painted <i>The Raft of the Medusa</i> .	(Jean-Louis André) Théodore Géricault [tay-oh-dor zhair-ee-kohl]
3	<i>The Raft of the Medusa</i> is in the same room in the Louvre [loov] as several paintings by this artist, including <i>The Death of Sardanapalus</i> and <i>Liberty Leading the People</i> .	(Ferdinand-Victor-) Eugène Delacroix [oo-zhen del-uh-kwah]

Question #8: Fine Arts

10 points per part

This building was the tallest in the world until the completion of the World Trade Center.		
1	Name this skyscraper designed by William Lamb with a large spire designed to hold dirigibles [deer-IJ-ih-bulz].	Empire State Building
2	Like New York City’s American Radiator Building and Chrysler Building, the Empire State Building’s architecture reflects this art movement that started in Paris.	art deco [or style moderne]
3	This Russian-born French designer—and leader of the art deco movement—worked in fashion, set design, and graphics. This person depicted a woman with her dog in <i>Symphony in Black</i> .	Erté or Romain de Tirtoff



Question #9: Mathematics

10 points per part

In the context of conic sections, this term might mean two intersecting lines or a line segment, among other possibilities.		
1	Give this term for a limiting, unusual case of a shape or other definition.	<u>degenerate</u> or <u>degeneracy</u>
2	A degenerate circle is equivalent to this geometric figure, since it is essentially a circle whose radius is 0.	<u>point</u>
3	Specifically describe the degenerate graph of a parabola that occurs when either x squared or y squared is set equal to a positive number.	two <u>parallel lines</u> [accept two <u>vertical lines</u> or two <u>horizontal lines</u>]

Question #10: Mathematics

10 points per part

In statistics, this term refers to data that has been cut off at some point.		
1	Give this term that in geometry refers to solids that have had a section removed. Doing this to a pyramid results in a smaller pyramid and a frustum [FRUSS-tum] .	<u>truncated</u> or <u>truncation</u> or <u>truncating</u>
2	Seven truncated polyhedra are among these 13 semi-regular convex polyhedra.	<u>Archimedean</u> solids [or solids of <u>Archimedes</u>]
3	A truncated tetrahedron has eight faces, four of which are triangles. What type of regular polygons are the other faces?	<u>hexagons</u> [prompt on <u>6-gons</u>]



Question #11: Literature

10 points per part

Near the beginning of this play, Professor Henry Higgins bets Colonel Pickering that he can transform Eliza Doolittle into a proper lady.		
1	Name this play that inspired the musical <i>My Fair Lady</i> .	<i>Pygmalion</i> [“pig-MALE”-yun]
2	This author wrote <i>Pygmalion</i> and <i>Arms and the Man</i> .	George Bernard Shaw
3	In <i>Arms and the Man</i> , Raina Petkoff lives in this country, which is fighting Serbia. Raina falls in love with a Swiss mercenary fighting for the Serbs.	Bulgaria

Question #12: Literature

10 points per part

The title character in this novel fights Brian de Bois-Guilbert [duh bwah gil-bair] in Rebecca’s trial-by-combat for witchcraft.		
1	Name this novel in which the title character, the son of Cedric of Rotherwood, falls in love with Lady Rowena.	<i>Ivanhoe</i>
2	This Scottish author wrote <i>Ivanhoe</i> .	(Sir) Walter Scott
3	Scott also wrote this narrative poem about James Fitz-James, who is King James V of Scotland in disguise. A song in this poem became the song “Hail to the Chief”.	<i>The Lady of the Lake</i>



Question #13: Science

10 points per part

The name of this order means “first rank”, which might be because the animals in this order got to pick the name.		
1	Name this order of mammals that includes monkeys and humans.	<u>primates</u>
2	The primates least related to humans are galagos, lorisids, and these animals native to Madagascar. Give the common name for these primates that are not rhesus macaques [REE-sus muh-KAHKS].	<u>lemurs</u>
3	Primates are sometimes divided into platyrrhine [PLAT-uh-ryn] and catarrhine [KAT-uh-ryn] subdivisions based on differences in this body part.	<u>noses</u>

Question #14: Science

10 points per part

The trachea [TRAY-kee-uh] connects the pharynx [“FAIR-inks”] and larynx [LAIR-eenks] to this organ.		
1	Name this organ that transfers oxygen to blood and takes out carbon dioxide from blood.	<u>lung(s)</u>
2	As it does for many organs, this term describes sections of the lungs. The right lung has three of these sections, but the left lung only has two.	<u>lobes</u>
3	This is the inward curve at the front bottom of the surface of the left lung.	<u>cardiac notch</u>



Question #15: Literature

10 points

<p>This god destroyed Salmonia after King Salmoneus built a bridge and a chariot that dragged bronze kettles so he could imitate this god. According to Ovid, when this god was an infant he created the cornucopia by tearing the horn off of a goat. That event occurred on Mount Ida, where this god was fed by Amalthea [uh-MAL-thee-uh] while being hidden from his father, Cronus. This god then saved his siblings, whom Cronus had swallowed. Name this husband of Hera who controlled lightning and thunder and who was the chief god on Olympus.</p>	<p><u>Zeus</u> or <u>Jupiter</u></p>
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Question #16: Science

10 points

<p>One of these objects is nicknamed SALT and uses 91 hexagonal segments. Two of these devices named for W. M. Keck are on altazimuth [al-TAZ-uh-muth] mounts. One of these objects named for Subrahmanyan Chandrasekhar [soo-brah-MAHN-yahn shahn-druh-SAY-kar] detected an X-ray burst from Sagittarius A* ["a-star"]. The Very Large Array consists of 27 of these devices that are currently performing a full scan of the sky. Another one of these devices is planned for launch in 2019 and is named for James Webb. Name these devices that may use lenses or mirrors to detect electromagnetic radiation coming from space.</p>	<p><u>telescope</u></p>
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Question #17: Miscellaneous

10 points

<p>This musician wears a hoodie while sitting in a hospital, while the camera follows the path of somebody pacing back and forth, in his video for a song about a stillborn baby: “Small Bump”. In the video for “Lego House”, Rupert Grint plays an obsessed fan who looks like this performer. In a popular 2017 song whose video is set in a boxing gym, this performer sings “I’m in love with your body.” That single by this musician is on an album whose cover shows a division symbol. Name this English singer-songwriter who performs the song “Shape of You”.</p>	<p>Ed(ward Christopher) <u>Sheeran</u></p>
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Question #18: Social Studies

10 points

<p>This person’s autobiography is <i>Random Reminiscences of Men and Events</i>. Though Marshall Field donated the land, this person and his son donated the money to start the University of Chicago. This person’s grandson was the vice president under Gerald Ford. The Panic of 1910 to 1911 was blamed on the enforcement of the Sherman Antitrust Act against this person’s company. A book claiming that this person’s company was rigging railroad prices was written by Ida Tarbell. Name this very wealthy person who established the first major U.S. business trust, the Standard Oil Company.</p>	<p>John D(avison) <u>Rockefeller</u> (Sr.)</p>
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Question #19: Science

10 points

<p>This object is not attached properly in the condition accreta [uh-KREE-tuh]. The two parts of this object are the chorion frondosum [KOR-ee-ahn frahn-DOH-sum] and the decidua basalis [duh-SID-oo-uh bay-SAL-us]. This object produces human chorionic gonadotropin [goh-NAD-oh-TROH-pin] even when it is not cancerous, a hormone similar to luteinizing [LOO-tuh-ny-zing] hormone. This object exists in the life cycle of most mammals, but not monotremes or marsupials. This vascular organ attaches to the uterus and has an umbilical cord connecting it to the fetus. Name this organ that is expelled as afterbirth.</p>	<p><u>placenta</u></p>
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Question #20: Literature

10 points

<p>This author created a character who describes life as “spend[ing] and wast[ing] time as though you had a million years.” In one novel by this author, the Viceroy forces an actress to apologize for improvising insults to Doña Maria [dohn-yah mar-EE-ah]. This writer created the alcoholic choir director Simon Stimson and wrote a novel in which five people connected to Camila Perichole [kah-MEE-lah pair-ih-CHOH-lay] die in a Peruvian bridge collapse that Brother Juniper investigates. In a play by this author, Emily Webb relives her twelfth birthday in Grover’s Corners, New Hampshire. Name this author of <i>The Bridge of San Luis Rey</i> and <i>Our Town</i>.</p>	<p>Thornton (Niven) <u>Wilder</u></p>
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Question #21: Science

10 points per part

These reactions are usually, but not always, spontaneous.		
1	Name this class of chemical reactions characterized by the release of heat.	<u>exothermic</u> reactions
2	This similar class of reactions is characterized by a net release of energy.	<u>exergonic</u> [ek-sur-GAH-nik] reactions
3	Because they may have <u>endergonic</u> [EN-dur-GAH-nik] steps, some exergonic reactions are not spontaneous; they require an input of energy known by this term. This quantity is used in the Arrhenius equation.	<u>activation</u> energy

Question #22: Science

10 points per part

This element is an <u>anode</u> ["AN-ode"] in many batteries, and its compounds are used to treat depression.		
1	Name this lightest metal. Its atomic number is 3.	<u>lithium</u>
2	Lithium is often combined with this ion commercially, including in medications. This ion's chemical formula is <u>CO₃²⁻</u> ["C O three, two minus"].	<u>carbonate</u>
3	Many lithium-ion batteries also use this element. This element is at the center of a molecule of vitamin B12.	<u>cobalt</u>



Question #23: Mathematics

10 points per part

Evaluate these exponential expressions.		
1	Find the value of 64 raised to the $\frac{1}{3}$ power.	<u>4</u>
2	Find the value of 5 raised to the -2 power.	<u>1/25</u> or <u>0.04</u>
3	Find the product of 2 to the 7th power, times 5 to the 5th power.	<u>400,000</u> or <u>4×10^5</u>

Question #24: Mathematics

10 points per part

Factor these expressions.		
1	x squared minus 36	<u>$(x + 6)(x - 6)$</u> or <u>$(x - 6)(x + 6)$</u>
2	x squared minus $5x$ minus 24	<u>$(x - 8)(x + 3)$</u> or <u>$(x + 3)(x - 8)$</u>
3	$2x$ squared plus $7x$ plus 6	<u>$(2x + 3)(x + 2)$</u> or <u>$(x + 2)(2x + 3)$</u>



Question #25: Literature

10 points per part

This character tells his stories to a porter who has the same name as him.		
1	Name this character who escaped being entombed alive with his dead wife on his fourth voyage. Earlier, a roc bird helped him escape an island with enough diamonds to make him wealthy in Baghdad.	<u>Sinbad</u>
2	Scheherazade [sheh-“HAIR”-ah-ZAHD] tells “The Seven Voyages of Sinbad the Sailor” as part of this collection, which also includes “Ali Baba and the Forty Thieves” and “Aladdin’s Wonderful Lamp”.	<i>The <u>Thousand and One Nights</u> or <u>Arabian Nights</u> or <u>Alf layla wa-layla</u> [accept equivalents]</i>
3	In this Jorge Luis Borges story, Juan Dahlmann is unable to read <i>One Thousand and One Nights</i> , first because of a head injury and later because of a duel.	<i>The <u>South</u> [or <u>El Sur</u>]</i>

Question #26: Literature

10 points per part

He wrote “It never troubles the wolf how many sheep there be” in his fifth <i>Eclogue</i> [EK-“log”].		
1	Name this author of an epic about a Trojan prince courting Dido [“DIE-dough”], a Carthaginian [kar-thuh-JIN-ee-un] queen.	(Publius) <u>Virgil</u> (ius Maro)
2	Name the first section of Dante’s <i>Divine Comedy</i> , in which Virgil guides Dante through the nine circles of the underworld.	<i><u>Inferno</u> [prompt on <u>Hell</u>]</i>
3	In this novel by Anatole France, Marbodius [mar-BOH-dee-uss]—one of the title birds—writes of descending to Hell and finding Virgil quite happy there.	<i><u>Penguin Island</u></i>



Question #27: Social Studies

10 points per part

Several electoral votes in the election of 1876 were under dispute, so an Electoral Commission was created.		
1	This Democratic governor of New York lost the election when the commission gave all of the disputed votes to Rutherford Hayes.	Samuel (Jones) Tilden
2	The Compromise of 1877 ended this era following the Civil War, in which there were competing visions for government treatment of former slaves.	Reconstruction Era
3	Hayes pushed for civil service reform during his presidency. After Hayes was president, Chester Arthur signed a civil service reform act named for this Ohio Senator who had been a rival of Hayes.	George Pendleton [accept Pendleton Civil Service Reform Act]

Question #28: Social Studies

10 points per part

A war named for this group of Native American tribes took place in 1876. A reservation named for them took up much of South Dakota and a little bit of Nebraska.		
1	Name this group whose language dialects include Dakota, Nankota, and Lakota.	Sioux [soo]
2	Custer's Last Stand occurred at this battle in the Great Sioux War of 1876.	Battle of the Little Bighorn [or Greasy Grass]
3	The Great Sioux Reservation was set up after a war named for this Native American leader who later decided not to help Crazy Horse and Sitting Bull.	Red Cloud or Mahpiya Luta [or Red Cloud's War]



Question #29: Science

10 points

The point named after this person is the oxygen concentration above which organisms switch from fermentation to aerobic respiration. The effect named after this person is that an increase in oxygen helps yeast while decreasing fermentation. Both of those phenomena relate to this person's dispute with **Justus von Liebig** [YOOS-toos von LEE-bik]. The process named after this person has a "flash" version, referred to as "high-temperature short-time", and involves heating drinks to kill many of their microbes. Name this French scientist whose process is commonly used on milk.

Louis **Pasteur** [prompt on **pasteurization**]

Question #30: Literature

10 points

In one play set in this country, **Jacinta** [hah-SEEN-tah] is raped by the Commander and his forces, which leads to a village beheading the Commander. In another play set in this country, Bel-Imperia has an affair with Horatio, and the murdered **Andrea** [ahn-DRAY-ah] appears onstage with the spirit of Revenge. A third play set in this country ends with Adele hanging herself and the matriarch instructing no one to cry. This setting of a tragedy by Thomas Kyd experienced a Golden Age in theater led by Lope de Vega. Name this setting of *The House of Bernarda Alba* by **Federico García Lorca** [fed-eh-REE-koh gar-SEE-ah LOR-kah].

(Kingdom of) **Spain** [or **España**]



Question #31: Social Studies

10 points

This person was criticized when, as Commissar of Foreign Affairs, he negotiated the Treaty of Brest-Litovsk, and soon after that he became the Commissar of War. This person was opposed by a troika that included Grigory **Zinovyev** [zih-NOHV-yeff] and Lev **Kamenev** [KAH-meh-neff]. This person applied Marxism to literature in *Literature and Revolution*, and he wrote *The Revolution Betrayed* while exiled in Norway. This person was killed by **Ramón Mercader** [rah-MOHN mair-kah-“DARE”] in 1940 in Mexico with an ice pick. Name this Soviet leader who lost a power struggle against Joseph Stalin after the death of Vladimir Lenin.

Leon **Trotsky** or Lev Davidovich **Bronshstein**

Question #32: Mathematics

10 points

A space equivalent to this construct can be generated from a basis with only one vector. Pascal's theorem relates a hexagon to points on this kind of figure. On an Argand diagram, one of these constructs represents real numbers, and another one represents imaginary numbers. Euclid's second postulate describes the creation of these constructs, and the intersection of two of them is the subject of the original form of his fifth postulate. Name these constructs that can be generated by graphing degree-one polynomials, and which can be written in slope-intercept form.

lines [accept **axis** or **axes**]



Extra Question #1: Mathematics

10 points

In advanced algebra, this word refers to a commutative ring in which the zero product property is true. In topology and complex analysis, this word means a connected open set. In studying functions, this term means a set that for the tangent and secant functions is all real numbers except odd multiples of one-half pi; in the same context, the sets denoted by this term are mapped to the image. For the logarithm function, the set designated by this term is every positive number. Give this term for the set of valid inputs to a function, in which context it is contrasted with the range.

domain(s) [accept integral domain]

Extra Question #2: Fine Arts

10 points

One work by this painter shows girls on the left, one of whom has her arm outstretched, challenging a group of boys on the right. This painter of *Young Spartans Exercising* showed a man looking off to the right while a woman looks downward in front of a green drink. Another painting by this artist shows a woman in orange sitting on a double bass while one dancer adjusts another dancer's sash and other dancers practice ballet poses. Name this painter of *The Absinthe Drinker* and *The Dance Lesson*.

(Hilaire-Germain-)Edgar Degas [day-gah]



Extra Question #3: Literature

10 points

This story's narrator has a vision of seven white candles sinking and his judges vanishing before passing out. The narrator of this story measures his room in the darkness by traveling the walls until he reaches a rag he pulled from his robe, and he is ultimately saved by General Lasalle's outstretched arm when Toledo ["toe-LAY-dough"] was liberated from the Inquisition. This story's narrator rubs meat on his bandages so that rats will gnaw through them, allowing him to escape just as his robe was being sliced. Name this story in which the narrator avoids the two title modes of death, written by Edgar Allan Poe.

"The Pit and the Pendulum"

Extra Question #4: Science

10 points

One of the first uses of chemical weapons was the release of this element by the Germans at the Second Battle of Ypres [EE-pruh]. Nitric acid and an acid with this element combine to form aqua regia [REH-jee-uh], and the same acid is in gastric acid along with other molecules containing this element. This element combines with fluorine and carbon to form refrigerants that deplete the ozone layer. This element is between fluorine and bromine [BROH-meen] in the periodic table's halogens column. Name this element whose compound with sodium is table salt.

chlorine [do not accept or prompt on "chloride"]



Extra Question #5: Social Studies

10 points

James Byrnes quit this job to head the Office of Economic Stabilization, and Arthur Goldberg quit it to be Ambassador to the United Nations. Samuel Chase is the only person ever impeached while holding this job, but he was acquitted. While holding this position, Joseph Story justified giving freedom to the *Amistad* rebels. When John Marshall Harlan held this position, he argued against segregation in an unsuccessful dissent. Name this position held by people who may not be chief but who serve on the top U.S. court.

(Associate) **Justice** of the **Supreme Court** of the United States [accept any reasonable answer containing all the underlined information; accept **SCOTUS** in place of **Supreme Court**; prompt on **justice** or **judge**]



Extra Question #6: Mathematics

10 points per part

The Pythagorean theorem can be considered a special case of this theorem when the angle is a right angle.		
1	Name this “law” used to find unknown measurements of a triangle. It involves the three side lengths and a trig function applied to one of the angles.	law of <u>cosines</u>
2	What is the cosine of 60° ?	<u>1/2</u> or <u>0.5</u>
3	Suppose a triangle has two sides measuring 1 unit and 3 units, and the angle between them measures 60° . What is the length of the third side?	the square <u>root</u> of <u>7</u> [accept <u>radical 7</u>]

Extra Question #7: Mathematics

10 points per part

The positive integers, in order, are this kind of sequence with an initial term of 1 and a common difference of 1.		
1	Name this type of sequence in which each number equals the previous number plus the common difference.	<u>arithmetic</u> [“air”-ith-MET-ik] sequence
2	Find the 50th term of an arithmetic sequence whose first three terms are 9, 11, and 13.	<u>107</u>
3	Find the sum of the first 200 positive integers.	<u>20,100</u>



Extra Question #8: Social Studies

10 points per part

Answer the following about mound builders:		
1	Monks Mound is a platform mound built at this site near St. Louis, a center of the Mississippian civilization.	Cahokia [kah-HOH-kee-uh] (Mounds)
2	The Fort Ancient people are credited with building a mound in southern Ohio named for this animal due to its shape. It is unclear what the oval near this animal's mouth represents.	Great Serpent
3	The earliest mounds built in America are at Watson Brake and Poverty Point in this state. The Monte Sano site was found in this state's capital, Baton Rouge.	Louisiana

Extra Question #9: Social Studies

10 points per part

A border dispute for the territory between this island and the mainland led to the Pig War.		
1	Name this island that was given to Canada in the Oregon Treaty despite stretching below the 49th parallel. Its southeast tip contains Victoria, the capital of British Columbia.	Vancouver Island
2	This strait separates Vancouver Island from Washington state's Olympic Peninsula. It shares its name with a tectonic plate of the Pacific northwest.	Strait of Juan de Fuca [WAHN deh FOO-kah]
3	The recently-named Salish [SAY-lish] Sea encompasses the waters south and east of Vancouver Island, including the Strait of Juan de Fuca and this sound that on the coasts of Olympia and Seattle.	Puget [PYOO-jit] Sound