1. Bernard Bolzano pointed out the lack of proof of a fact about curves that are continuous, do not intersect themselves, and have a property known by this term; that fact became the Jordan [zhor-dahn] curve theorem. To be a subspace, a subset of a vector space must have a property known by this term under addition and scalar multiplication. In topology, any intersection of sets with a property known by this term must have the same property, but a weaker condition applies to unions. A group is a set with an associative operation that has an identity, inverses, and a property known by this term. The integers have this a property known by this term under multiplication but not division, since any product of integers is an integer but some quotients of integers aren't integers. Give this term that also describes intervals that contain their endpoints and are denoted by square brackets.

   Answer: <u>closed</u> (accept word forms like <u>closure</u> or <u>closedness</u>)

2. In 1879, the Supreme Court combined three cases addressing this legal concept in relationship to alcoholic drinks. In 1995 and 2006, Congress passed laws preventing the "dilution" of these legal claims, a response to *Moseley v. V Secret Catalogue*. In 1946, the Lanham Act created Principal and Supplementary Registers for these legal claims, and a later law strengthened the Lanham Act by prohibiting the counterfeiting of these things. Those registers of these claims are maintained by a federal office that also oversees patents. Name this legal concept, sometimes confused with copyright, in which a symbol represents a company or product.
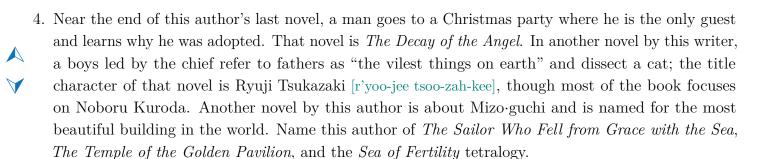
   Answer: <u>trademark</u>s [or <u>service mark</u>s; do not accept "copyright(s)" or "patent(s)"]

3. This Yale University history professor often adventured with chemistry professor Harry Ward Foote, and he was assisted by Melchor Arteaga [mel-chor ar-tay-AH-gah]. It is believed that this archaeologist was beaten by a few decades to his famous find by Augusto Berns, who was more interested in money than study. This person believed that he found a sanctuary inhabited mostly by women, but it is now believed that he found a royal retreat. This person also believed that he found the city of Vilca·bamba. Name this professor and eventual U.S. Senator who, beginning in 1911, organized expeditions to Peru, eventually writing *The Lost City of the Incas* after discovering Machu Picchu.

   Answer: Hiram <u>Bingham</u> III

4. Near the end of this author's last novel, a man goes to a Christmas party where he is the only guest and learns why he was adopted. That novel is *The Decay of the Angel*. In another novel by this writer, a boys led by the chief refer to fathers as "the vilest things on earth" and dissect a cat; the title character of that novel is Ryuji Tsukazaki [r'yoo-jee tsoo-zah-kee], though most of the book focuses on Noboru Kuroda. Another novel by this author is about Mizo·guchi and is named for the most beautiful building in the world. Name this author of *The Sailor Who Fell from Grace with the Sea*, *The Temple of the Golden Pavilion*, and the *Sea of Fertility* tetralogy.

Answer: <u>Mishima</u> Yukio [or <u>Hiraoka</u> Kimitake; accept names in either order; prompt if the wrong name is given]

5. This mathematician developed a system that he had to rework into an "untyped" form to avoid the Kleene ["CLAY"-nuh]-Rosser paradox. This American's paper "An Unsolvable Problem of Elementary Number Theory" was the first to prove that the *Ent·schei·dungs·problem* [ent-SHY-doonks-"problem"] was undecidable. He introduced a formal system on which functional programming languages are based, the lambda calculus. Name this logician and computer scientist who helped devise the idea that the intuitive notion of an algorithm is equivalent to the formal definition of computability, which is called his and Alan Turing's "thesis".

Answer: Alonzo <u>Church</u>

Check the score.

6. Franz Liszt ["least"] composed a piece in this form based on a song by Manuel García and nicknamed "El Contra·band·ista [KOHN-trah-bahn-DEES-tah]". Ludwig van Beethoven wrote a composition of this type for piano that is "almost a caprice" and is commonly called "Rage Over a Lost Penny". In this musical form, which often occurs within a movement, there is a recurring theme that plays at the end after alternating with other themes. This form is often used in final movements and combined with sonata form, such as in Mozart's serenade *Eine kleine Nachtmusik* ["EYE"-nuh KLY-nuh NAHKT-moo-zeek]. Name this form whose name is taken from French poetry, in which its name ends with the letters 'e-a-u' instead of 'o'.

Answer: <u>rondo</u>(s) [or <u>rondeaux</u>]

7. When told to leave, this person said "Your people will be my people and your God my God." After working in a field, this person asked the field's owner "Why have I found such favor in your eyes that you notice me, a foreigner?". This person is then instructed to uncover that man's feet and lie down, and he gives her six measures of barley. This person later had a son named Obed [OH-bed] after marrying that owner, Boaz. Through Obed and Obed's son Jesse, this person became the great-grandmother of David. This Moabite [MOH-uh-"bite"] was the sister-in-law of Orpah and the daughter-in-law of Naomi. Identify this namesake of a book in the Hebrew Bible.

Answer: <u>Ruth</u> [may be pronounced ["root"]]

8. Due to a mistake by the historian Cornelius Nepos, this battle occurred at Narag·gara but is known by a different name. This battle built upon the Roman victory at the Battle of Cirta. The winning side in this battle was able to gain a cavalry advantage by allying with Masinissa [mass-in-ISS-uh], the first king of Numidia. The *hastati* [hah-STAH-tee] infantry in this battle were arranged in columns so that charging elephants would pass between them rather than trample them. Name this battle in what is now Tunisia, which ended the Second Punic War with Hannibal's defeat at the hands of Scipio Africanus.

Answer: Battle of <u>Zama</u>

9. This city is the primary setting of a novel in which Julian has become a heroin-addicted prostitute who gets tracked down by his friend Clay. This city is the setting of Bret Easton Ellis's *Less Than Zero*, and is the home of the first major transgender literary character, Gore Vidal's Myra Breckinridge. The burning of this city is the subject of a fictional painting undertaken by Tod Hackett, who befriends an accountant who moves from Iowa to this city. That accountant, Homer Simpson, appears in Nathanael West's *The Day of the Locust*. Name this city that is also the setting for Raymond Chandler's novels featuring the detective Philip Marlowe, including *The Big Sleep*.

Answer: <u>Los Angeles</u>, California [or <u>L.A.</u>; accept <u>Hollywood</u>]

10. One of these material properties for a fluid is equal to density times the speed of sound squared according to the Newton-Laplace formula, a correction to Newton's formula, which used pressure. That property of this type can be defined as density times the derivative of pressure with respect to density. Several of these values, one of which is the Poisson [pwah-saw] ratio, are related by the Lamé [lah-may] parameters. One of these properties can be multiplied by length divided by area to make it equivalent to the spring constant, though it is often used in different situations. Give this term for the class of material properties that describe resistance to elastic deformation, some of which are called "shear", "bulk" and "Young's."

Answer: elastic <u>moduli</u> or <u>moduli</u> of elasticity [or elastic <u>modulus</u> or <u>modulus</u> of elasticity; accept bulk <u>modulus</u> or Young's <u>modulus</u> or shear <u>modulus</u>]

Check the score.

11. One character in this opera sings "the power of death alone can change the affections of our hearts" in the aria "Come scoglio" [koh-may SKOHL-yoh], or "Like A Rock". In this opera, that aria—which has great swings in tone—is sung by Fiordiligi [fyor-dee-LEE-jee], the sister of Dorabella. In this opera, Despina [dess-PEE-nah] makes fun of those sisters and all men by singing "In uomini, in soldati, sperare fedeltà?" [een woh-MEE-nee, een sohl-DAH-tee, spair-AR-ay fed-el-TAH] before being bribed by Don Alfonso, who has made bets that involve Ferrando and Guglielmo [gool-YEL-moh] disguising themselves as Albanians. Name this opera by Mozart whose title, referring to women, means "Thus Do They All."

Answer: *Così fan tutte* [koh-zee fahn TOOT-tay](*, ossia La scuola degli amanti*) [or *Così fan tutte, or the School for Lovers*]

12. This city annually celebrates the folk hero Catherine Ségurane [seg-oo-rahn], who helped repel an Ottoman siege in 1543. This city contains the archaeological site Terra Amata, which shows evidence of human fire nearly 400,000 years ago. A salad made of tomatoes, olives, hard-boiled eggs, and anchovies is named for this city. This city is home to the Promenade of the English, a walkway along the Mediterranean coast that was the site of a terrorist attack in 2016 on Bastille Day. This city is served by the airport Côte d'Azur [koht dah-zoor], the third-busiest in France. This is the second-most populous city in Provence-Alpes-Cote d'Azur [pruh-vahnss ahlp koht dah-zoor], behind Marseille [mar-say]. Identify this largest city on the French Riviera.

Answer: <u>Nice</u>, France [prompt on salad <u>Niçoise</u> [nees-wahz]]

13. Samuel Johnson supposedly said that if you were to read this author for the story, you would hang yourself. One character created by this author pays the servant Joseph Leman to spy for him and supports a poor girl whom he nicknames Rosebud. That character dies after being in a duel with Colonel Morden. In another novel by this author, the title character is seduced by a man after working as a maidservant for his mother. That son is Mr. B, and Henry Fielding wrote a famous satire of that novel. Name this 18th-century Englishman who wrote about Robert Lovelace in *Clarissa* and who also wrote the epistolary novel *Pamela; or, Virtue Rewarded.*

Answer: Samuel <u>Richardson</u>

14. The 1723 Treaty of St. Petersburg weakened an attempt to continue this dynasty, giving lands to Peter the Great. That attempt ended when Tahmasp II and his son Abbas III were killed at Sab·zevar by Nader, who established the Af·sharid dynasty. Tahmasp I made Qazvin the capital of this dynasty, but the capital was then changed to Isfahan by Abbas I. This dynasty's original capital was Tabriz under the leadership of Ismail I. This dynasty expanded its empire westward to gain control of Baghdad. Name this dynasty that made the Twelver school of Shi'a Islam its official religion in Persia.

Answer: <u>Safavid</u> dynasty [or <u>Safavids</u>; prompt on <u>Shahs</u> or <u>Persian</u>]

15. The study of the growth of these structures by Manfred Girbardt led him to label an apical ["APE"-ih-kul] body as the Spitzen·körper. Some of these structures in oomycetes ["OH-oh-MY-seats"] bear sporangia [spor-AN-jee-uh] and are known as spor·angio·phores [spor-AN-jee-oh-forz]. In oomycetes, these structures lack cross walls, making them non·sep·tate, which is atypical though the same thing happens in the mold *Mucor*. Structures *similar* to these structures are formed after budding when daughter cells do not separate, are easily disrupted, and are common in yeast. Name these branching filament·ous structures that form the my·ce·lium in fungi.

Answer: <u>hyphae</u> ["HI-fee"]

Check the score.

16. This organization's current leader, Irina Bokova [ee-REE-nah BOH-koh-vah], is about to be replaced by Audrey Azoulay [ah-zoo-lay]. In 2011, the United States withdrew funding from this organization when it allowed Palestinians to become full members. In 1984, the United States withdrew from this organization because it was viewed as pro-Soviet Union, and we rejoined in 2002. Bashar al-Assad is inexplicably a member of this organization's human rights committee. This organization classified Hebron [HEB-run] and the Tomb of the Patriarchs as part of the Palestinian Territory, leading to complaints from Nikki Haley. The United States and Israel withdrew support from this agency in 2017. Name this agency that designates World Heritage sites.

Answer: UNESCO [yoo-NESS-koh] or United Nations Educational, Scientific and Cultural Organization

17. On the right side of this painting there is a thin rectangular rock formation; on the left side there is a taller triangular mountain. That rectangular formation is Zirkelstein, and this painting is set in the Elbe Sandstone Mountains. Another formation slopes downward from both sides of this painting, reaching the only person in it about chest high. This painting is displayed at the Kunsthalle [KOONST-hah-luh] in Hamburg along with its artist's *Seashore by Moonlight* and *The Sea of Ice*. Created in 1818, this Romantic painting shows a person holding a walking stick and standing on a rock formation. Name this painting depicting the artist from behind, painted by Caspar David Friedrich.

Answer: *Wanderer Above the Sea of Fog* [or *Der Wanderer über dem Nebelmeer* or *Wanderer above the Mist* or *Mountaineer in a Misty Landscape*]

18. A poem by this writer shares its name with an Archibald MacLeish poem that ends "A poem should not mean / But be." A hymn by this writer begins "O Phoebus [FEE-buss], and Diana ruler of the woodlands, / Radiant glory of the sky, O ye who are to be worshiped" and was performed for Augustus' revival of the Secular Games. This author wrote "Life grants nothing to us mortals without hard work" in his *Satires*, and "He who has begun has half done" in his *Epistles*. Name this writer of *Ars Poetica* who said that "cruel time is fleeing", so therefore we should "Seize the day", or "Carpe diem."

Answer: Horace [or Quintus Horatius Flaccus]

19. Though this compound is now made from methyl an·thran·il·ate, it was discovered when Constantin Fahlberg reacted sulfo·benzoic acid with phosphorus chloride and ammonia, and some of it spilled onto his hand. This molecule, also known as benzoic sulfimide, has a carbon ring attached to a ring with a carbonyl [KAR-buh-nil], an amine, and a sulf·on·amide. The use of this compound has been controversial because it causes bladder cancer in rats, but it is now considered safe for humans. Some people complain about its bitter aftertaste but use it anyways because it has no calories. Name this first modern artificial sweetener.

Answer: (sodium) saccharin [accept benzoic sulfimide before "sulfobenzoic"]

20. In 1923, Leo Deckers took over the public buildings in this city and announced the formation of the Rhenish Republic. A treaty signed in this city in 1668 forced Louis XIV [14] to return several territories he gained in the War of Devolution, and another treaty signed in this city ended the War of the Austrian Succession. This city is not in Italy but contains the ancient Palatine Chapel. In the early 19th century this city was part of France, but it is now close to Belgium and the Netherlands, and controlled by Germany. Name this city where Charlemagne lived and died, and which hosted the coronations of several Holy Roman Emperors.

Answer: <u>Aachen</u> [AHKH-'n] or <u>Aix-la-Chapelle</u> ["ex" lah shah-pel]

This is the end of the packet.