

## Round 4

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### Tossups

(1) **This process can be accomplished graphically with vectors in the tip-to-tail method, in which the result of this process is the third side of a triangle. This operation can only be performed on two matrices if they are the (\*) same size.** Subtraction can be considered an application of this operation on negative numbers. Zero is the identity element of, for ten points, what mathematical operation that, when repeated, is multiplication?

ANSWER: addition (accept word forms like adding; accept summation; accept plus)

(2) **In this novel, Governor Winthrop's death is linked to the sighting of a meteor that a reverend believes represents the title object. In this novel, Roger Chillingworth tends to his wife's lover, Arthur (\*) Dimmesdale,** who dies after acknowledging his illegitimate daughter, Pearl. For ten points, name this Nathaniel Hawthorne novel in which Hester Prynne is forced to wear a red "A" on her clothes.

ANSWER: The Scarlet Letter

(3) **This empire conducted restoration projects on the Dome of the Rock and the walls of Jerusalem in the nineteenth century. Near the end of this empire, it was nicknamed a "sick man." A sixteenth-century ruler of this empire known as "the (\*) Lawgiver" was its longest-reigning sultan.** Suleiman the Magnificent ruled, for ten points, what empire that fell in the twentieth century and was based in what is now Turkey?

ANSWER: Ottoman Empire (accept Devlet-i 'Aliye-i 'Osmaniye; do not accept or prompt on "Turkey")

(4) **This man won the 1904 Nobel Prize in Physiology for using vivisection and fistulas to study the digestive system. The concept of "reflex at a distance" was expanded on by this man, with a test in which a (\*) buzzer being sounded at the same time as an assistant provided food; both the assistant and the buzzer sound triggered the salivation response.** For ten points, name this Russian scientist who studied classical conditioning by feeding dogs.

ANSWER: Ivan Pavlov (accept Ivan Petrovich Pavlov)

(5) **Zoologist Sten Bergman suggested that a very large species of this animal once lived on the Kamchatka Peninsula. Climate change has caused members of a northern species of this animal to drown while swimming between (\*) ice floes,** and thousands of its Kodiak subspecies are attracted to annual salmon runs. For ten points, name this omnivorous mammal with "grizzly" and "polar" species.

ANSWER: bears (accept Ursidae; accept distinct species of bears like "black," "brown," or "polar" bears)

(6) **This religious figure, the son of Maya, developed his theory that life is suffering after encountering illness, age, death, and religious asceticism. This man preached the (\*) Middle Way, and he described the Noble Eightfold Path after meditating under the Bodhi Tree. For ten points, name this Indian religious leader who taught his followers how to escape the cycle of reincarnation and enter Nirvana.**

ANSWER: Gautama Buddha (accept Siddhartha Gautama)

(7) **Some historians believe that this dignitary was married to Kocoum, and her marriage to a tobacco farmer caused an eight-year cooling of hostilities nicknamed this woman's "Peace." This woman adopted the name (\*) "Rebecca" and converted to Christianity before touring England with her husband, John Rolfe. For ten points, name this Native American woman who, according to legend, saved John Smith's life from her father, Powhatan.**

ANSWER: Pocahontas (accept Matoaka; accept Rebecca Rolfe before "Rebecca" is read)

(8) **This musical work uses the melody of the folk song "At the Gate," and it opens with the hymn "O Lord, Save thy People." This work uses "La Marseillaise" [lah mar-sah-YEZ] to represent the invading (\*) French army, and represents their defeat with the song "God Save the Tsar." For ten points, name this work by Pyotr Illych Tchaikovsky that celebrates Russia's victory over Napoleon in the title year, and which is often orchestrated with cannons.**

ANSWER: The 1812 Overture (accept The Year 1812 Solemn Overture)

(9) **This quantity and charge are used to predict bond type, according to Fajans' rules. The Van der Waals definition of this quantity is "half the distance of closest approach," and an unusual 4-F row reduction in this quantity results from (\*) lanthanide contraction. This quantity is largest for cesium and francium, and often decreases when metals lose electrons to form cations. For ten points, name this size measurement that is half the diameter of a neutral atom.**

ANSWER: atomic radius (accept ionic radius)

(10) **In a poem by this author, the Bellman hires a Beaver and a Baker to help with a hunting trip that ends when the Baker is carried away by a Boojum. This author of "The Hunting of the (\*) Snark" wrote a novel set in a chessboard-like land that is reached by going *Through the Looking Glass*. For ten points, name this author who wrote about the Cheshire Cat and the White Rabbit in *Alice's Adventures in Wonderland*.**

ANSWER: Lewis Carroll (accept Charles Lutwidge Dodgson)

(11) **Robert Dicke's theory of gravity assumes that this quantity is variable. The Lorentz factor includes a ratio of velocity to this quantity. A rotating mirror is used in a Fizeau-Foucault apparatus to measure this quantity, which is exceeded by (\*) electrons in water to produce Cherenkov radiation. Special relativity holds this quantity to be the same for all observers. For ten points, name this theoretically maximum velocity, equal to about three hundred million meters per second.**

ANSWER: speed of light in a vacuum (accept velocity of light; accept lightspeed; prompt on "C")

(12) **In 2019, this politician was beat by Mostik, an orange tabby cat, to be the first to cross the Kerch Strait Bridge. In 2021, this politician approved a change to his country's (\*) constitution that allows him to extend his presidency, which has bounced back and forth between this man and Dmitry Medvedev since 1999. For ten points, name this frequently-shirtless ex-KGB agent who is the president of Russia.**

ANSWER: Vladimir Putin (accept Vladimir Vladimirovich Putin)

(13) **This game's soundtrack includes "Subwoofer Lullaby" and "Stal," works by C418 ["see" four-eighteen], whose songs can be found on in-game discs. In 2021, this game added goats in an expansion that failed to update its (\*) caves or cliffs. An enemy in this game is the result of a coding error that turned what was supposed to be a pig into an elongated monster. For ten points, name this video game in which players can build structures out of digital blocks until they're blown up by creepers.**

ANSWER: Minecraft (accept Minecraft Java Edition; accept Minecraft Bedrock Edition; accept Minecraft Classic)

(14) **This city's Muddy River runs through Olmsted Park, a part of this city's Emerald Necklace. This city's Back Bay area is on the Charles River, across from its sister city, (\*) Cambridge. This city's MLB team plays near Kenmore Square in a park that holds the Green Monster, and one end of Beacon Hill forms this city's namesake Common. Fenway Park hosts the Red Sox in, for ten points, what capital city of Massachusetts?**

ANSWER: Boston

(15) **A character in this novel battles wineskins and fights Samson Carasco disguised as the Knight of Mirrors. This novel's title character rides the old horse (\*) Rocinante and tries to honor his fictional lady-love, Dulcinea, with the help of a farmer named Sancho Panza. For ten points, name this Miguel de Cervantes novel in which the title man tilts at windmills he thinks are giants while imagining he's a knight.**

ANSWER: Don Quijote (accept The Ingenious Gentleman Don Quijote of La Mancha; accept El Ingenioso hidalgo Don Quixote de la Mancha)

(16) **This civilization's gods of death include the "Obsidian Butterfly," Itzpapalotl [EETZ-pah-pah-lah-toll], and the bat Camazotz. The *Popol Vuh* was a sacred text of this civilization, and describes underworld (\*) Xibalba [shee-BAL-ba]. Priests wore the pelts of jaguars in, for ten points, what meso-american civilization, whose "long count" calendar reset in 2012?**

ANSWER: Mayan civilization (accept Mayans or Mayan Empire)

(17) **A cast of this sculpture in Meudon sits over its creator's grave. This bronze sculpture was intended to sit under *The Three Shades* at the top of the (\*) *Gates of Hell*, and was originally named *The Poet*, since it depicts Dante Alighieri contemplating the sinners he wrote about in the *Inferno*. For ten points, name this Auguste Rodin [ow-GOOST roh-DAN] sculpture in which a seated man leans forward pensively with his chin on his hand.**

ANSWER: The Thinker (accept Le penseur; accept The Poet or Le poète before "Poet" is read)

(18) **Press Secretary Ron Ziegler described the start of this event as a “third-rate burglary attempt.” During this event, Room 419 at a Howard Johnson motel was used as a lookout post, but officers arrested James McCord and four other people at (\*) DNC headquarters. A “smoking gun” tape recorded at the White House revealed the involvement of the president in, for ten points, what 1972 break-in and ensuing cover-up that led to the resignation of Richard Nixon?**

ANSWER: Watergate burglary and/or scandal (accept any description that includes the word Watergate)

(19) **A character in this novel learns French by listening to Felix De Lacey read while hiding behind his cottage. In this novel, the tragic death of William, a young boy, is wrongly blamed on the housekeeper (\*) Justine Moritz; the murder is actually the fault of a character who also kills Henry Clerval and Elizabeth Lavenza in this novel. For ten points, name this novel in which the title scientist refuses to create a female love interest for his monster, a work by Mary Shelley.**

ANSWER: Frankenstein; or, The Modern Prometheus

(20) **The inaccurate Titius-Bode Law predicted a planet at 2.8 astronomical units from the sun, inspiring the search for these objects. Ceres is both the nearest (\*) dwarf planet to Earth and the largest one of these objects, which occupy a band punctuated by Kirkwood gaps. The solar system has hundreds of thousands of, for ten points, what objects in space that inhabit a namesake “belt” between Mars and Jupiter?**

ANSWER: asteroids (accept planetoids; accept minor planets or dwarf planets before “dwarf planet” is read; do not accept or prompt on “meteor” or “meteorite;” do not accept or prompt on “planet” alone)

## Bonuses

(1) Give the following about global lightning hotspots, for ten points each.

This 102-story building in New York City is hit by lightning about twenty-five times per year and was ranked tallest in its city from 1931 to 1970, and again from 2001 to 2012.

ANSWER: Empire State Building

In this oil-rich, South American country, the world's highest concentration of lightning occurs in a nearly continuous lightning storm where the Catatumbo River meets Lake Maracaibo.

ANSWER: Venezuela (accept Bolivarian Republic of Venezuela; accept República Bolivariana de Venezuela)

According to an urban legend, an entire team of eleven footballers was killed in a single flash of lightning in this country's Kasai province in 1998. This French-speaking African country has its capital at Kinshasa.

ANSWER: Democratic Republic of the Congo (accept DRC; prompt on "Congo;" do not accept or prompt on "Republic of the Congo")

(2) According to the VSEPR [vesper] theory of molecular geometry, the compound methane has this shape. For ten points each,

Name this shape observed when a central atom is bonded to four other atoms, each of them spaced as far apart as possible.

ANSWER: tetrahedral

All of the bond angles in a tetrahedral molecule of methane measure this many degrees, rounded to one decimal place.

ANSWER: 109.5 degrees

While beryllium fluoride molecules will arrange themselves tetrahedrally as a liquid, as a gas they have a linear shape and a bond angle of this many degrees.

ANSWER: 180 degrees

(3) The main character of this novel is exiled to the island of Suma after being unfaithful to his wife, Aoi [ah-oh-ee]. For ten points each,

Name this novel by Murasaki Shikibu [moo-rah-sah-kee shee-kee-boo] set during Japan's Heian [hey-ahn] period. It is sometimes considered the world's first novel.

ANSWER: The Tale of Genji (accept Genji Monogatari)

A chapter of *The Tale of Genji*, "Vanished into the Clouds" is left entirely blank, implying this event happened to the main character. After this event, the story instead follows Kaoru [kah-oh-roo] and Niou [nee-oh].

ANSWER: Genji's death (accept word forms or equivalents like Genji dying or passing away)

Genji is the son of a man with this title. Lady Murasaki served in the household of a leader with this title who claimed to be descended from the goddess Amaterasu [ah-mah-tay-rah-soo].

ANSWER: emperor of Japan (accept tenno)

(4) Answer these questions about female Titans in Greek mythology, for ten points each.

Like later Greek gods, the Titans represented elements of the natural world. The Titaness Selene was the embodiment of this natural satellite of Earth, which dominates the night sky.

ANSWER: moon

This Titaness was the mother of the archer twins Apollo and Artemis. When the queen Niobe mocked this Titaness for only having two children, Apollo and Artemis killed all of Niobe's children.

ANSWER: Leto

This Titaness was the Greek goddess of witchcraft. She was the handmaiden of Persephone and the goddess of ghosts.

ANSWER: Hecate

(5) George Washington became the only US president to lead troops in combat while in office when he led the military in putting down this rebellion. For ten points each,

Name this 1790s insurrection in western Pennsylvania inspired by an unpopular tax.

ANSWER: Whiskey Rebellion

Washington was advised during the Whiskey Rebellion by this man, who had been Washington's aide-de-camp during the Revolution. As the first Secretary of the Treasury, this man was blamed for creating the whiskey tax.

ANSWER: Alexander Hamilton

As the Regular Army was small, the troops amassed by Washington were largely from these state-based bodies. The Second Amendment notes that these bodies must be "well regulated" for the "security of a free State."

ANSWER: militias

(6) This poet wrote "Nature's first green is gold" and described two paths that "equally lay / in leaves no step had trodden black." For ten points each,

Name this American poet of "Nothing Gold Can Stay" and "The Road Not Taken."

ANSWER: Robert Frost (accept Robert Lee Frost)

In another poem by Frost, an unnamed speaker watches this weather phenomenon while "Stopping by Woods." He eventually decides to leave, saying "I have promises to keep / and miles to go before I sleep."

ANSWER: snow (accept snowstorm or snowfall; accept Stopping by Woods on a Snowy Evening)

Frost declared, "the land was ours before we were the land's" in this poem, which he recited at John F. Kennedy's inauguration.

ANSWER: The Gift Outright

(7) In the equation computing this quantity for a box moving up a ramp, force can be replaced with mass times little  $g$  times the sine of the angle. For ten points each,

Name this quantity that is equal to the energy transferred to a moving object. This quantity is usually expressed as force times distance.

ANSWER: work

Although it does not decrease the work, a ramp does reduce the force that is needed to lift the box. This is because a ramp acts as this type of simple machine.

ANSWER: inclined plane

If the box slides back down the ramp at a constant speed, then the coefficient of friction can be found by applying this function to the ramp's angle.

ANSWER: tangent (accept tan)

(8) The loser of this battle, Harold Godwinson, had defeated Tostig and Harald Hardrada only five days earlier at Stamford Bridge. For ten points each,

Name this 1066 battle. At this battle, Harold Godwinson was defeated by William the Conqueror as they fought for succession after the death of Edward the Confessor.

ANSWER: Battle of Hastings

William the Conqueror claimed legitimate succession to the English throne, although he was born and raised in this region in what is now northwestern France.

ANSWER: Normandy

Before the battle, William the Conqueror interpreted this astronomical object as an omen of his victory. This object appears in the Bayeux Tapestry's depiction of the Battle of Hastings.

ANSWER: Halley's Comet (prompt on "comet")

(9) This museum honors musicians like Aretha Franklin, the Beatles, and Tina Turner, a 2021 inductee. For ten points each,

Name this museum dedicated to commemorating great musicians in a certain music genre. A glass pyramid makes up part of this museum in Cleveland, Ohio.

ANSWER: Rock and Roll Hall of Fame and Museum (accept RRHoF; accept Rock Hall; prompt on "Hall of Fame")

Another glass pyramid designed by the same architect is in the courtyard of this French art museum that is home to the *Mona Lisa* and the *Venus de Milo*.

ANSWER: Louvre Museum (accept Musée du Louvre)

The glass pyramids at the Rock and Roll Hall of Fame and the Louvre were both designed by this Chinese-American architect who passed away in 2019.

ANSWER: I.M. Pei (accept Ieoh Ming Pei)

(10) *The Onion*'s fictional persona of this politician, portraying him as a drug dealer and muscle car driver, was retired in March 2020, as were hopes that he would appear in more television shows. For ten points each,

Name this actor-turned-president who delivered an anti-assault monologue on a 2016 episode of *Law and Order: SVU* while he was Barack Obama's vice president.

ANSWER: Joe Biden (accept Joseph Robinette Biden, Jr)

SVU isn't Joe Biden's only television appearance. In the 2010s, he appeared on two episodes of this satirical show in which Leslie Knope, played by Amy Poehler, navigates the city-level bureaucracy of Pawnee, Indiana.

ANSWER: Parks and Recreation

While serving as a Delaware senator, Biden also appeared on a children's game show named for this fictional thief. Players showed off their knowledge of geography to help find "Where in the World" this woman was.

ANSWER: Carmen Sandiego (accept either underlined name; accept Where in the World is Carmen Sandiego?)

(11) Give the following about Kublai Khan, for ten points each.

Kublai Khan founded this dynasty of China. Revolts by the Han majority led to this dynasty being replaced by the Ming Dynasty.

ANSWER: Yuan Dynasty (accept Mongol Dynasty)

Kublai Khan received this traveler as a visitor to his court. While imprisoned, this Italian wrote a book describing the wonders of Kublai Khan's court for Western audiences.

ANSWER: Marco Polo

Kublai Khan's mainland campaigns were largely successful, but his two invasions of Japan were each thwarted by typhoons, described in Japanese by this term, meaning "divine wind."

ANSWER: kamikaze

(12) Sam-n-eric warn Ralph that this literary character has "sharpened a stick at both ends" and plans to use it to kill him. For ten points each,

Name this cruel boy from a William Golding novel, who tortures Wilfred and kills Ralph's friend while following Jack Merridew.

ANSWER: Roger

Roger joins Jack Merridew's tribe of hunters in this novel by William Golding. In this novel, a group of young boys crash-land on a deserted island and start a war amongst themselves.

ANSWER: Lord of the Flies

In *Lord of the Flies*, Roger rolls a boulder onto this asthmatic boy, killing him. This boy's glasses are used to light signal-fires, and become a trophy of power when Jack takes possession of them.

ANSWER: Piggy



(13) The formation sequence of this mineral starts with peat and proceeds through lignite, bituminous, and anthracite. For ten points each,

Name this carbon-based sedimentary rock that also serves as a major fossil fuel. It is burned in power plants that supply forty percent of the world's electricity.

ANSWER: coal

In general, coal is extracted from underground mines and open pits, or by this method in which long bands of earth are removed from the surface. This method tends to obliterate landscapes and cause severe soil erosion.

ANSWER: strip mining (accept word forms like stripping)

Like oil, coal can be transported through pipelines by using water to form this type of solid-liquid mixture. A 1972 flood of this coal mixture killed more than one hundred people in West Virginia.

ANSWER: slurry

(14) This high-pitched brass instrument has three valves, and is related to the cornet and the flugelhorn. For ten points each,

Name this jazz instrument played by Miles Davis and Wynton Marsalis.

ANSWER: trumpet (accept specific types, such as bass trumpet or piccolo trumpet)

This trumpeter, nicknamed "Satchmo," recorded two albums with Ella Fitzgerald, and is renowned for his performance of "What a Wonderful World."

ANSWER: Louis Armstrong (accept Louis Daniel Armstrong)

This jazz trumpeter was known for puffing out his cheeks while playing a signature, bent trumpet. This bebop musician wrote "A Night in Tunisia" and "Salt Peanuts."

ANSWER: Dizzy Gillespie (accept John Birks Gillespie)

(15) Abraham Maslow believed that fully self-actualized people underwent feelings of harmony called "peak experiences," which could be induced with these substances. For ten points each,

Name this class of drugs that includes psilocybin and LSD. Today, these drugs are being researched for their potential use in treating depression.

ANSWER: psychedelic drugs (accept hallucinogenic drugs; accept psychoactive drugs; accept psychotropic drugs)

In addition to depression, psychedelic drugs may also help treat this disorder that might be caused by exposure to highly shocking or hurtful events, such as abuse, assault, or war.

ANSWER: post-traumatic stress disorder (accept PTSD; prompt on "anxiety")

Another focus of psychedelic research is the treatment of the "cluster" type of this common ailment. A severe form of this ailment is called a migraine.

ANSWER: cluster headache

(16) In Judaism, Rosh Hashanah celebrates this event on the first and second days of the month of Tishrei. For ten points each,

Name this general event that occurs when the calendar begins afresh.

ANSWER: new year (accept descriptions like “the beginning of the year”)

Rosh Hashanah begins this group of Jewish holidays, which end with the Day of Atonement on the tenth day of Tishrei.

ANSWER: High Holy Days (accept Days of Awe; accept Yamim Noraim)

The “Day of Atonement” is this last of the High Holy Days. On this day, each person’s fate for the new year is sealed in the Book of Judgement.

ANSWER: Yom Kippur (accept Yom HaKippurim)

(17) Wholly aquatic amphibians tend to excrete nitrogenous waste as ammonia, and terrestrial amphibians excrete this waste product. For ten points each,

Name this chemical with formula  $\text{CH}_4\text{N}_2\text{O}$  [spell out], a waste product of protein digestion in mammals that is filtered out of the blood by the kidneys.

ANSWER: urea (accept carbamide; do not accept or prompt on “urine”)

The cycle that generates urea from amino acids occurs mainly in this organ that is also responsible for detoxifying alcohol.

ANSWER: liver

Another nitrogenous waste substance, uric acid, can form crystals that cause both kidney stones and this painful swelling of the joints, which often starts at the big toe.

ANSWER: gout (prompt on “arthritis”)

(18) In this novel, Tom flees after killing a man who murdered the preacher-turned-labor-organizer Jim Casy, and Rose-of-Sharon breastfeeds a starving man after losing her baby. For ten points each,

Name this novel about the Joad family’s disastrous journey from Oklahoma to California during the Dust Bowl.

ANSWER: The Grapes of Wrath

This American author wrote *The Grapes of Wrath* and *Of Mice and Men*.

ANSWER: John Steinbeck (accept John Ernst Steinbeck, Jr)

Both *The Grapes of Wrath* and *Of Mice and Men* explore the intense economic effects of this event that began in 1929 with the crash of the stock market.

ANSWER: Great Depression

(19) Answer the following about myths and legends surrounding Pythagoras, for ten points each.

One legend claims that Pythagoras refused to believe in this type of number because he thought they violated mathematical purity. These numbers, including examples like the square root of two, cannot be written as fractions.

ANSWER: **irrational** numbers

The most widespread myth is that Pythagoras was the discoverer of the Pythagorean Theorem, but a Babylonian clay tablet lists information about fifteen Pythagorean triples using this number system. The Babylonian use of this number system helps explain why there are 360 degrees in a circle.

ANSWER: base **sixty** (accept **sexagesimal**)

For his theorem, Pythagoras supposedly wrote the first of these mathematical arguments, but no evidence has ever been found. When writing out these arguments, geometry students often use two columns to organize their statements and reasons.

ANSWER: **proofs**

(20) Answer these questions about American women's history, for ten points each.

This constitutional amendment, first proposed in 1923, would ban sex-based discrimination. Although Virginia became the thirty-eighth state to ratify this amendment in January 2020, it has not yet been added to the constitution.

ANSWER: **Equal Rights** Amendment (accept **ERA**)

The ERA was originally drafted by Alice Paul. She also picketed outside the White House for this constitutional right, which was later granted by the nineteenth amendment.

ANSWER: women's **suffrage** (accept descriptions of "women's right to **vote**")

Alice Paul picketed the White House with this protest group, who avoided noisy protests and engaged in hunger strikes. Members of this group were beaten and tortured during the Night of Terror in 1917.

ANSWER: **Silent Sentinels** (accept **Sentinels of Liberty**)