

## 2018 Reinstein Set – Packet 6

### Tossups

1. The size of these entities determines the sum of their rank and their nullity. One of these mathematical things is unitary if its inverse equals its conjugate-transpose. If multiplying one of these entities times a vector is the same as multiplying a number times the vector, then the number is one of its **eigenvalues** [“EYE-gun-values”]. These things can be used to solve systems of equations by putting them in reduced row echelon form. These entities are also used in Cramer’s rule, in which you take quotients of determinants after removing columns from them. Name these rectangular arrays of numbers.

Answer: **matrices** or **matrix**

2. One animal in this class can entrench itself between rocks by inflating its lungs; that animal is the chuckwalla. These animals’ skin is formed from pleated sheets of alpha- and beta-keratin. The first known animal of this class was the *Hylonomus* [“hi”-LAH-nuh-muss], which lived in the **Carboniferous** [kar-buh-NIF-uh-russ] period, and the **Mesozoic** [meh-so-ZOH-ik] era is called the “Age of” these animals. Most of the surviving animals in this class are in the order **Squamata** [skwah-MAH-tuh]. These animals were the first **amniotes** [AM-nee-“oats”], meaning that they laid eggs on land before birds. Name these vertebrates with dry and scaly skin, among which are dinosaurs and snakes.

Answer: **reptiles** or **Reptilia**

3. The turning point of this battle was when the ships *Queen Charlotte* and *Detroit* got entangled. This battle was the first surrender by a complete British squadron, made by Robert Heriot Barclay. The winning commander in this battle received the surrender aboard the *Lawrence* after fighting on the *Niagara*. One of the commanders in this battle used James Lawrence’s dying words from a few months earlier: “Don’t give up the ship.” The report sent after this battle stated “We have met the enemy and they are ours.” Name this September 1813 victory by Oliver Hazard Perry.

Answer: Battle of **Lake Erie** [or Battle of **Put-in-Bay**]

4. Slightly less than 10% of the objects in cosmic rays are these particles. The emission of these particles is used in ionization smoke detectors. The first artificial nuclear transmutation used these particles to turn nitrogen into oxygen, releasing a proton. Hans **Geiger** [“GUY”-gur] and Ernest Marsden used these particles to discover atomic nuclei in an experiment overseen by Ernest Rutherford in which these particles collided with gold foil. Name these particles that are equivalent to helium nuclei since they comprise two protons and two neutrons.

Answer: **alpha** particles or **alpha** radiation [accept **helium nuclei** or **helium nucleus** before it is mentioned; do not accept or prompt on “helium”]

5. The main character of this play tells his daughter “Here cease more questions: Thou art inclined to sleep.” This play continues when that character’s servant enters and states “All hail, great master!” and reports that Ferdinand said “Hell is empty and all the devils are here.” Before the events of this play, that servant had been trapped in a tree by the witch **Sycorax** [“SICK-or-axe”], who is the mother of **Caliban** [KAL-ih-ban]. In this play, Ferdinand, who is the Prince of Naples, falls in love with Miranda, who is Prospero’s daughter. Identify this William Shakespeare play in which Ariel causes the title storm.

Answer: *The **Tempest***

6. Lester Young primarily played clarinet and this instrument; he and pianist Bud Powell inspired the character Dale Turner in the movie *Round Midnight*, who was portrayed by Dexter Gordon, another performer on this instrument. The trumpeter Miles Davis had two people playing this instrument in his sextet, including “Cannonball” Adderley. The other Davis sextet member who played this instrument recorded *Giant Steps* and *A Love Supreme*, and was named John Coltrane. Name this reed instrument that is usually made of brass.

Answer: **saxophone**(s) [accept more specific answers]

7. In this city there is a pair of waterfalls where the **Rideau** [rid-oh] River ends. Until 1855, this city was named for the engineer who oversaw construction of the Rideau Canal, Colonel John By. In 2001 this city absorbed its surrounding Carleton County. The Peace Tower clocktower is at the front of Centre Block on this city’s Parliament Hill. A famous residence in this city has the address 24 Sussex Drive. This city, whose namesake river meets the St. Lawrence River in Montreal, is the second most populous in Ontario. Name this capital city of Canada.

Answer: **Ottawa**, Ontario

8. This person wrote “For fruits are all of them female, in them lies the seed” to open his poetry collection *Birds, Beasts and Flowers*. A novel by this author begins with two sisters discussing whether marriage is an experience or the end of experience. Those sisters, Gudrun and Ursula Brangwen, were also in this author’s earlier novel *The Rainbow*. Another novel by this author is about Constance and her love affair with the gamekeeper Oliver Mellors. Name this British author of *Women in Love* and *Lady Chatterley’s Lover*.

Answer: D(avid) H(erbert) **Lawrence**

9. During this war, Henry Hopkins Sibley attempted to establish a supply line, but his troops retreated after the Battle of Glorieta Pass. This war featured three Battles of Winchester, including the defeat of Jubal [JOO-“ball”] Early by Philip Sheridan. After this war, Henry Wirz was executed for war crimes because of conditions at Andersonville Prison. During this war’s Peninsula Campaign, there was criticism of the cautiousness of opposing generals Joseph Johnston and George McClellan. Name this war whose sides were led by Generals Robert E. Lee and Ulysses Grant.

Answer: (U.S. or American) **Civil War**

10. This compound is used to differentiate between **carboxylic** [“car-box-ILL”-ik] acids and alcohols based on whether bubbles are formed. Older fire extinguishers combined this compound with sulfuric acid to create carbon dioxide. This compound and ammonium chloride are produced during one step of the Solvay process. This compound is commonly used with acids, such as vinegar or lemon juice, as a leavening agent. Because it absorbs odors, many people leave open boxes of this compound in their refrigerator. Name this compound whose chemical formula is  $\text{NaHCO}_3$ .

Answer: **sodium bicarbonate** or **sodium hydrogen carbonate** or **bicarbonate of soda** [prompt on **baking soda** or **bread soda** or **cooking soda**]

11. One character in this novel asks for credit to buy sugar with her coffee, which the clerk pays for himself; earlier, that character had threatened an officer with a skillet. This novel’s protagonist hides in a cave after retaliating for the murder of Jim. To save 40 dollars, the central family in this novel does not report Granpa’s death in Ivy and Sairy Wilson’s tent. Rose of Sharon has a stillborn child in this novel, and the central family picks peaches and cotton after arriving in California. Name this novel by John Steinbeck about Tom Joad’s family’s migration during the Dust Bowl.

Answer: *The **Grapes of Wrath***

12. In Hindu mythology, one of these places named Chakravana is the location where **Vishvakarma** [VISH-vuh-“karma”] made Vishnu’s weapon, which was called the **Sudarshana Chakra** [soo-dar-SHAH-nah CHAHK-rah]. One of these places was used to churn the ocean of milk and was called Mandara. In Norse mythology, these places were made from **Ymir’s** [EE-mir’z] bones. **Hesiod** [HESS-ee-ud] claimed that he spoke with the muses at one of these places called **Helicon** [HEL-ih-kahn], though some sources place the muses at another one, **Parnassus** [par-NASS-us]. Name these locations, one of which is where the twelve most powerful Greek gods lived and is called Olympus.

Answer: **mountains** [accept mountain **ranges** after “Ymir’s”]

13. Ruins near this river were discovered by James Lewis, who used the pen name “Charles Masson”. One of the early settlements just west of this river was at Mehrgarh [“MARE”-gar]. An ancient city next to this river has a Great Bath on one of its mounds, and it contained a bronze statuette now called *Dancing Girl*. That city is Mohenjo-daro, and the ancient cities near this river made up the Harappan civilization. Name this river that mostly goes through Pakistan, though its name was used to make the name of a different country.

Answer: **Indus** River

14. 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”.

Answer: Ed(ward Christopher) **Sheeran**

15. This adjective describes main-sequence stars of luminosity class V [5]. The maximum mass of a star described by this adjective is the Chandrasekhar [shahn-druh-SAY-kahr] limit. An object that orbits the sun and is generally round will earn this adjective if it fails to clear its orbit of other objects. This adjective and “brown” describe a celestial object unable to create helium. This adjective and “white” refer to stars made of electron-degenerate matter. Name this adjective that comes after “yellow” in a description of the Sun and before “planet” in a description of Pluto.

Answer: **dwarf**

16. 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].

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

17. This country gave more power to an elected House of Representatives in the Constitutional Reform of 1848 overseen by J. R. Thorbecke. In 1840, William I abdicated this country's throne after losing control of Belgium. The ruler of this country also ruled Luxembourg until this country was headed by a queen in 1890, which broke Luxembourg's laws. In 1945, the International Court of Justice was established in this country at The Hague [hayg]. Name this country that was taken over by the Nazis in the Rotterdam Blitz.

Answer: The **Netherlands** or **Nederland** [prompt on **Holland**]

18. One painting by this artist shows a man on one knee having his eyes anointed by Jesus. This painter of *Christ Healing the Blind* depicted Jesus wearing red between a man in armor and a man in green with a rope in *The Disrobing of Christ*. Another painting by this artist is based on a legend of Saints Stephen and Augustine burying a person who gave a lot of money to a church. Name this painter of *The Burial of the Count of Orgaz* who lived in Italy and Toledo [toh-LAY-doh], Spain after leaving his birthplace, Crete.

Answer: **El Greco** [el GREH-koh] [or Doménikos **Theotokópoulos**]

19. Albert Einstein's equivalence principle tied together the strength of a gravitational field with this quantity for a reference frame, which is why in his thought experiment about elevators, people cannot tell if this quantity is nonzero. The discovery that this quantity is positive for distant supernovas gave support to the idea of dark energy. In circular motion, the magnitude of this quantity equals speed squared divided by radius. According to Newton's second law, if mass is constant then this quantity equals net force divided by mass. Name this quantity, the rate of change of velocity, that can be measured in meters per second squared.

Answer: **acceleration** [accept centripetal **acceleration**]

20. This president's criticism of currency stabilization during his first year in office prevented any agreements at the London Economic Conference despite the efforts of Secretary of State Cordell Hull. Long before President Nixon took the final step, this president took the United States off the gold standard. The Banking Act establishing the Federal Deposit Insurance Corporation and the National Industry Recovery Act were signed at the end of this president's Hundred Days to help the U.S. get out of the Great Depression. Name this president whose domestic policy was the New Deal.

Answer: **Franklin Delano Roosevelt** [prompt on **Roosevelt**; accept **FDR**]

21. All but three known **Sierpiński** [ser-PIN-skee] numbers of the first kind are this type of number. By definition, Sierpiński numbers of the second kind generate this type of number. **Euclid** [YOOK-lid] said that these numbers are “measured” by another number. The first nineteen superabundant numbers are also the first nineteen numbers that are “highly” this type of number, meaning they have more factors than any smaller number. Name these numbers that have factors other than one and themselves, which means that they are not prime.

Answer: **composite** numbers or **composites** [accept **plane** numbers]

## 2018 Reinstein Set – Packet 6

### Bonuses

1. Statues depicting this mythological creature are often located in front of Masonic temples.

A. Name this creature with the head of a human, the body of a lion, and sometimes the wings of an eagle. A sculpture showing a giant one is in Egypt.

Answer: **sphinx(es)** [or **phix**]

B. The mythological sphinx guarded this Greek city.

Answer: **Thebes** [theebz]

C. This creature with the same body structure as the sphinx, but a more dangerous tail, was popular in Persian mythology. Because of a mistake by **Pliny [PLIN-ee]** the Elder, many people thought this creature was real.

Answer: **manticore(s)** [or **manticora**]

2. A law passed in 2009 to deter this type of crime was the first federal law to give explicit civil rights protections to transgender people.

A. Give this term for a crime motivated by bias against certain types of people.

Answer: **hate** crimes

B. The 2009 law was named for James Byrd Jr., who was murdered by white supremacists, and this gay University of Wyoming student who was brutally murdered in 1998.

Answer: Matt(hew Wayne) **Shepard**

C. The Matthew Shepard Act requires this law enforcement agency to keep statistics on hate crimes. When the bill was passed, this agency was headed by Robert Mueller.

Answer: **Federal Bureau of Investigation**

3. Tay-Sachs [“sacks”] disease and **cystic fibrosis [SIS-tik fy-BROH-siss]** are caused by this type of **allele [uh-LEEL]**.

A. Name this type of **autosomal [aw-toh-SOH-mul] alleles [uh-LEELS]** that contrasts dominant alleles.

Answer: **recessive** allele(s) [accept **recessiveness**]

B. This diagram is commonly used to show that the offspring of two heterozygous individuals has a 1/4 probability of having the recessive trait. This diagram is named after the author of *Mendelism*.

Answer: **Punnett square**

C. These genes control the production of proteins, often repressor proteins, that impact structural genes.

Answer: **regulator** gene or **regulatory** gene or **homeotic** gene

4. António Guterres [aw-TAWN-yoo goo-TER-ish] took this position at the beginning of 2017.

A. Give this title for the chief administrative officer of the United Nations.

Answer: **Secretary-General** (of the United Nations) [do not accept or prompt on “Secretary” or “General”]

B. This Norwegian politician was the first Secretary-General. He was disliked by the Soviet Union because of the Korean War and resigned in 1952.

Answer: Trygve **Lie** [TRIG-vuh LEE]

C. Kurt Waldheim [VAHLT-hym] served as the President of this country after being Secretary-General. Waldheim was accused of working with the Nazis, who annexed this country in the Anschluss [AHN-shlooss].

Answer: (Republic of) **Austria** [or (Republik) **Österreich**]

5. This novel was influenced by Gary Snyder having introduced its author to Buddhism.

A. Name this novel in which the narrator, Ray Smith, learns philosophy from Japhy Ryder. As in its author’s later novel *Desolation Angels*, the narrator spends part of his time as a lookout on Desolation Peak.

Answer: *The **Dharma Bums***

B. *The Dharma Bums* was this author’s follow-up to his first novel, *On the Road*.

Answer: Jack **Kerouac** [or Jean-Louis Lebris de **Kerouac**]

C. The Dharma Bums includes a fictionalized scene of the first reading of this poem, whose first line is “I saw the best minds of my generation destroyed by madness.”

Answer: **“Howl”**

6. One example of this relationship between functions is the relationship between “ $x$  cubed” and “the cube root of  $x$ ”.

A. Name this relationship between two functions that “undo” each other.

Answer: **inverse** functions or **inverses**

B. A function has an inverse if it has this property, meaning it is both one-to-one and onto.

Answer: **bijection** or **bijjective** or **bijection** [prompt on **one-to-one correspondence**]

C. If  $f$  of 6 equals 10, and the derivative of  $f$  of  $x$  is 3 when  $x$  equals 6, find the derivative of the *inverse* of  $f$  of  $x$  when  $x$  equals 10.

Answer: **1/3** [accept **0.3 repeating**]



7. Most lists name six of these objects, though some also include the gear drive and/or the hydraulic press.

A. Give this two-word phrase for a group of mechanical devices, such as pulleys, that redirect forces.

Answer: **simple machines**

B. This two-word phrase refers to the ratio of output force to input force for a simple machine.

Answer: (actual) **mechanical advantage**

C. This simple machine is sometimes used to separate objects. This machine transfers force applied to one side into forces from two other sides.

Answer: **wedge**

8. This character's murder was proclaimed with the headline "Well-known city engineer shot dead. Assailants thought to be natives."

A. Name this man who was shot when three young men broke into his home. This author of "The Truth About Native Crime" had an entire bookshelf in his study dedicated to Abraham Lincoln.

Answer: **Arthur** (Trevelyan) Jarvis [prompt on **Jarvis**]

B. Arthur Jarvis was shot by a man whose first name was Absalom; what was his last name? Absalom's father, Stephen, traveled to Johannesburg but was unable to save his son from execution.

Answer: **Kumalo**

C. Arthur Jarvis and Stephen Kumalo appear in this novel by the South African author Alan Paton.

Answer: **Cry, the Beloved Country**

9. The Society of Independent Artists set up an exhibit in 1917 that allowed any artist to display any work of art, but this work was hidden during the show against those guidelines.

A. Give this name that was applied to a urinal signed "R. Mutt".

Answer: **Fountain**

B. This French-American artist submitted *Fountain*.

Answer: (Henri-Robert-)Marcel **Duchamp**

C. *Prelude to a Broken Arm*, another readymade by Duchamp, was originally one of these objects.

Answer: snow **shovel**

10. Consider the graph in three dimensions of the equation  $2x$  plus  $3y$  plus  $6z$  equals 14.

A. What is the shape of the graph?

Answer: a **plane** or **planar**

B. What is the plane's  $x$ -intercept?

Answer:  $x = 7$  or  $(7, 0, 0)$

C. What is the smallest distance between the plane and the origin?

Answer: **2** units

11. This poem states "It is the hour of departure."

A. Identify this poem that begins "The memory of you emerges from the night around me" and repeats "In you everything sank."

Answer: "The **Song of Despair**" or "A **Song of Despair**" [or "**canción desesperada**"]

B. This Chilean poet wrote *Twenty Love Poems and a Song of Despair*.

Answer: Pablo **Neruda** [nay-ROO-dah] [or Neftali Ricardo **Reyes** Basoalto]

C. The last of the 20 love poems gives "The night is shattered / and the blue stars shiver in the distance" as an example of one of these compositions. That poem's title claims that "Tonight I Can Write [these compositions]".

Answer: the **saddest lines** [or los **versos más tristes**; prompt on **lines** or **versos**]

12. This composer referred to 13 of his pieces, including *Les préludes* [ley pray-lood], as symphonic poems.

A. Name this composer of the *Hungarian Rhapsodies*.

Answer: Franz (Ritter von) **Liszt** ["list"] [or **Liszt** Ferenc]

B. This collection of 12 solo piano pieces by Liszt includes *Preludio* and *Mazeppa*.

Answer: **Transcendental Études** [ay-toodz] [or **Études d'exécution transcendante**]

C. Liszt led five other composers to write the *Hexameron* ["hex"-AM-ur-ahn], which is a set of variations based on a theme from this composer's opera *I puritani*.

Answer: **Vincenzo (Salvatore Carmelo Francesco) Bellini** [veen-CHEN-zoh bay-LEE-nee]

13. The elevation of this quantity is a **colligative** [kuh-LIG-uh-tiv] property.

A. Name this temperature at which a liquid turns into a vapor.

Answer: **boiling point**

B. Formulas for boiling-point elevation often use this measure of concentration, equal to amount of solute divided by the mass of the solvent.

Answer: **molality** [do not accept or prompt on “molarity”]

C. Boiling-point elevation can be explained using this law stating that effective partial pressures are proportional to the mole fraction of a component. This law is combined with Dalton’s law of partial pressures to find total vapor pressure.

Answer: **Raoult’s law**

14. Near the beginning of this play, Professor Henry Higgins bets Colonel Pickering that he can transform Eliza Doolittle into a proper lady.

A. Name this play that inspired the musical *My Fair Lady*.

Answer: **Pygmalion** [“pig-MALE”-yun]

B. This author wrote *Pygmalion* and *Arms and the Man*.

Answer: George Bernard **Shaw**

C. In *Arms and the Man*, Raina Petkoff lives in this country, which is fighting Serbia. Raina falls in love with a Swiss mercenary fighting for the Serbs.

Answer: **Bulgaria**

15. 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.

A. Name this group whose language dialects include Dakota, Nankota, and Lakota.

Answer: **Sioux** [soo]

B. Custer’s Last Stand occurred at this battle in the Great Sioux War of 1876.

Answer: Battle of the **Little Bighorn** [or **Greasy Grass**]

C. 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. The war included the Fetterman Fight.

Answer: **Red Cloud** or **Mahpiya Luta** [or **Red Cloud’s War**]

16. These molecules have a chain of carbon rings that includes three rings with six carbons each and one ring with five carbons.

A. Name these compounds. The **anabolic** [an-uh-BAH-lik] type includes testosterone and is sometimes used illegally as a performance-enhancing drug.

Answer: **steroids**

B. Some steroids are named for **ecdysis** [ek-“DIE”-siss] in invertebrates, which is also known as this process.

Answer: **molt**ing [prompt on **slough**ing or **shed**ding]

C. **Cholic** [KOH-lik] acid is in the class of steroid acids named for this substance that they work with in the body.

Answer: **bile** acids

17. One character in this novel states “My mother is a fish.”

A. Name this novel in which Anse Bundren leads his children to Jefferson to bury his wife, Addie. This novel is partially narrated by Addie’s children, including Cash, who built her coffin.

Answer: ***As I Lay Dying***

B. This author set *As I Lay Dying* in Mississippi. His novel *The Sound and the Fury* is set there too.

Answer: William (Cuthbert) **Faulkner** [or William (Cuthbert) **Falkner**]

C. In this Faulkner novel, Boon Hogganbeck steals a car to take Lucius Priest and Ned McCaslin to Memphis to find Miss Corrie, a prostitute.

Answer: *The **Reivers***

18. Special relativity predicts a curvature of electric field lines that explains the existence of this force.

A. The alignment of electron spins causes what force that compasses depend on?

Answer: (electro)**magnet**ism or (electro)**magnet**ic force

B. These materials are repelled by magnetic fields and tend to have all of their electrons paired up.

Answer: **diamagnet**ic or **diamagnet**ism

C. This quantity, equal to relative permeability minus 1, is negative for diamagnetic materials.

Answer: magnetic **suscept**ibility

**19.** This country is mostly the same area that was once called British East Africa, and its current name is taken from a mountain.

A. Name this country where in the 1950s, the **Kikuyu** [kih-KOO-yoo] people instigated the Mau Mau Uprising.

Answer: (Republic of) **Kenya** [or (Jamhuri ya) **Kenya**]

B. What is Kenya's official language other than English? This language is also official in several other East African nations.

Answer: **Swahili** or **Kiswahili**

C. This person served as vice president under Jomo Kenyatta and succeeded Kenyatta as president, ruling for 24 years. He was criticized for using the **Nyayo** [en-YAI-oh] House torture chambers.

Answer: Daniel (Toroitich) arap **Moi**

**20.** An internal angle and external angle at the vertex of a polygon have this relationship.

A. Name this relationship between angles whose measures add up to  $180^\circ$ .

Answer: **supplementary** angles or **supplements**

B. A single angle measuring  $180^\circ$  is known by this term.

Answer: **straight** angle [accept straight **line** or line **segment**]

C. If an angle measures  $10^\circ$  and 10 minutes, find the measure of its supplement in degrees and minutes.

Answer:  $169^\circ$  and **50** minutes

**21.** Answer the following about science you can observe at the beach:

A. This term refers to particles, common on beaches, that are smaller than pebbles but larger than silt.

Answer: **sand**

B. The sand you stick your toes in may have reached the beach by creep or by this other process, where water "bounces" larger particles along the sea floor.

Answer: **saltation** [or **saltating** or **saltate**]

C. A beach in Hawaii has green sand due to the presence of this rock, a solution of **forsterite** [FOR-stuh-"rite"] and **fayalite** [FAY-uh-"lite"] that comprises the gemstones **peridot** ["PAIR-uh-dot"].

Answer: **olivine** [AH-lih-"vine"]