Answer Key and Explanations

Reading and Writing—Module 1

1. C: In this passage, the sentence is in the present perfect tense, indicating that these innovations and discoveries have already occurred and continue to be relevant. The phrase "have expanded" in choice C correctly indicates a past action with ongoing implications. These innovations and discoveries, initiated in the past, have contributed to expanding our knowledge of the universe, and this expansion is ongoing.

2. D: *Exemplifies* is the correct choice because it means to serve as a typical or model example of something, which aligns perfectly with the passage's description of the collaboration between the Navajo Nation and the University of Arizona as a shining model demonstrating the principles of community-based participatory research. In contrast, Choice A (*circumvents*) implies avoidance or bypassing, directly contradicting the portrayal of the successful partnership in the passage. Choice B (*eclipses*) suggests complete overshadowing, which does not capture the collaborative essence intended by *exemplifies*. Choice C (*fabricates*) denotes a false creation, a concept that contradicts the genuine nature of the collaboration portrayed in the passage.

3. A: This quotation effectively illustrates the claim made in the passage about the role and significance of the humanities. It conveys the central idea that the humanities are not just academic subjects but are deeply connected to the essence of humanity itself. It emphasizes that the humanities are integral to our understanding of the human experience and our identity as human beings.

4. C: In this passage, the order of the steps in the scientific method serves primarily to emphasize the importance of making observations. The passage outlines the steps of the scientific method sequentially and highlights that it starts with making observations. This structure emphasizes the foundational role of observation in the scientific process. While the scientific method does involve forming hypotheses, conducting experiments, and analyzing data, the passage's primary focus is on the initial step of making observations and how it contributes to scientific progress.

5. C: In the provided passage, Sarah's statement, "Believe me, Alex, your excuses won't cut it this time," is marked by her narrowed eyes and disdainful tone. This expression suggests a strong sense of skepticism and criticism. She is clearly not supportive of Alex's explanations and is questioning their validity. Therefore, choice C, which characterizes Sarah's statement as conveying skepticism and criticism, best aligns with the purpose of her statement in the context of the passage.

6. D: The passage discusses how leafcutter ants have evolved specialized adaptations for efficiently farming their fungus gardens. In this context, the presence of a specialized enzyme that enhances the growth of the cultivated fungus directly supports the idea that they have evolved specific mechanisms to optimize their farming process.

7. C: Choice C effectively highlights the uniqueness of Romantic literature by emphasizing its distinctive focus on imagination and nature. This choice directly addresses the student's goal of emphasizing each period's uniqueness.

8. C: The passage mentions that despite his busy schedule as a baker, Mr. Johnson always found time to donate fresh loaves of bread to the local shelter. This act of generosity indicates that he is known for his charitable actions and kindness toward those in need.

9. D: The passage primarily serves as a reflection on the author's personal belief in the power and significance of literature. It discusses the author's perspective on literature as a means of conveying ideas and emotions. While it mentions various aspects of literature, the central focus is on the author's viewpoint and belief.

10. B: The passage primarily emphasizes the values and cultural contexts reflected in artistic movements throughout history. It discusses how movements like the Renaissance and Romanticism celebrated and represented certain values and cultural aspects of their respective times. The passage does not specifically focus on the influence of scientific exploration, the celebration of emotion and individualism in Romanticism, or the appreciation of classical aesthetics in the Renaissance, although these topics are mentioned as part of the broader context.

11. C: The passage suggests that the impact of climate change on coral reefs has been challenging to understand due to intricate relationships. However, Dr. Olivia Chang's recent findings offer hope for preservation, indicating a more definitive, or *conclusive*, explanation. The other options do not fit as well: *an intricate* implies complexity; *an elusive* suggests difficulty in understanding; and *a clear* does not capture the idea of a definitive explanation.

12. C: This choice logically completes the text by emphasizing the underlying motivation for space exploration: scientific curiosity. While there are various objectives in space exploration, the primary driver is our innate curiosity to learn more about the cosmos. This choice aligns with the main theme of the passage.

13. C: The sentence starts in the present tense with "Even today, his words resonate," but then it suddenly switches to the past tense with "reminded us." This inconsistency in verb tense disrupts the flow and meaning of the sentence. To correct this error, the past tense *reminded* should be changed to the present participle *reminding* to maintain consistent verb tense throughout the sentence.

14. A: Choice A effectively compares the roles of Daisy Buchanan and Jordan Baker by highlighting their contrasting characteristics and the roles they play in the novel. It accurately describes Daisy as reflecting the disillusionment and emptiness of the wealthy elite, which aligns with her portrayal in the novel, and it correctly characterizes Jordan as a more independent and self-reliant woman, which is also consistent with her character.

15. D: Plants treated with Type D fertilizer achieved an average height of 47.5 cm, which is 20 cm higher than the average of the plants without fertilizer.

16. C: *Conversely*, is the most appropriate transition in this context. It helps to establish a contrast or counterpoint to the previous statement. The passage discusses the properties of acids (donating) and bases (accepting).

17. C: In the sentence, we are describing attire that belongs to the little girl, an individual child. To indicate possession in this context, we need to use a possessive form of *child*. The correct possessive form for a singular noun like *child* is *child's*.

18. B: Choice B, *perspective*, is the most appropriate selection, as it accurately conveys how Jane Austen's novels provide readers with a distinctive and insightful lens through which to view the society and manners of her time. Choice A, *endorsement*, doesn't align with the context of the sentence, as it suggests approval or support rather than the insightful perspective on society and manners that Austen's novels offer. Likewise, Choice C, *commentary*, pertains to providing opinions or explanations but doesn't quite capture the essence of offering a unique viewpoint or deep insight

into the subject at hand, which is the primary focus of the sentence. Lastly, Choice D, *refusal*, is entirely unrelated to the context of the sentence and lacks relevance.

19. B: *Because of* is the most suitable choice in this context because it indicates a causal relationship. It explains why Leonardo da Vinci is considered a quintessential Renaissance polymath: he had mastered numerous fields. This transition helps connect the introductory statement about the Renaissance to da Vinci's significance.

20. C: Choice C effectively utilizes relevant information from the notes to explain the role of enzymes. It begins by highlighting that enzymes are specialized proteins, setting the stage for understanding their essential function in living organisms. By stating that enzymes "speed up chemical reactions in living organisms," it directly addresses their catalytic role, clarifying that they act as biological catalysts. The option then goes on to provide specific examples of how enzymes contribute to various crucial biological processes, such as digestion, cellular respiration, DNA replication, and protein synthesis. This detailed information demonstrates that enzymes play a central role in these fundamental processes, emphasizing their significance in biological systems.

21. D: This choice effectively uses a non-restrictive participial phrase, "challenging the known laws of physics," set off by commas to provide additional information about the concept of black holes without making it essential to understanding the sentence. The use of commas correctly indicates that this information is supplemental but not necessary for the core meaning of the sentence, enhancing clarity and readability.

22. B: The word *which* is a relative pronoun that correctly connects the two clauses. It refers to *oxygen* and helps to provide additional information about it.

23. C: In this sentence, the blank refers to the ideas of multiple thinkers: Socrates, Confucius, and Simone de Beauvoir. Therefore, a plural pronoun is needed to agree with the plural noun *ideas*. *Their* is a plural possessive pronoun that correctly indicates that the ideas belong to the thinkers mentioned.

24. C: This choice provides a logical and fitting completion to the sentence in the passage. The previous descriptions in the passage convey a serene and awe-inspiring atmosphere in the forest. The phrase "they felt an overwhelming sense of wonder" aligns with the tranquil and captivating nature of the forest setting, making it the most suitable choice to complete the sentence.

25. B: In Passage 2, it's mentioned that Maya Angelou emphasized the importance of literature as a tool for empowerment and social change, with a specific focus on breaking down racial barriers and promoting an understanding among people of different backgrounds. Given this perspective, it's likely that Angelou would be critical of Twain's portrayal of race in *The Adventures of Huckleberry Finn*, which has sparked debates about racial stereotypes in literature.

Reading and Writing—Module 2

1. A: The passage highlights the significant impact of the Hubble Space Telescope in the field of astronomy. It mentions that Hubble has revolutionized our understanding of the universe, capturing images of distant galaxies, stars, and nebulae. The central idea revolves around the transformative role of Hubble's observations in the field of astronomy.

2. A: In this sentence, the use of a comma after *heart* is appropriate because it creates a pause that helps to clarify the structure of the sentence. The comma sets off the phrase "reminding all

individuals to hold dear their inner values" as an appositive, providing additional information about *heart*.

3. A: This answer effectively and correctly provides an explanation of Rosa Parks' significance in the Civil Rights Movement by highlighting her act of civil disobedience and her refusal to give up her bus seat as a symbol of the movement. It directly addresses the student's goal of explaining and providing an example of Rosa Parks' significance based on the information from the notes.

4. A: In the sentence, *fortunately* is used as a transition word to indicate a fortunate or positive outcome of the situation. It logically connects the action of Alice running after the rabbit to the result of her being just in time to see it go down the rabbit-hole. The other options, such as *therefore*, *unexpectedly*, and *nevertheless*, do not provide a suitable transition in this context and would not convey the intended meaning.

5. B: The transitional phrase *In conclusion* is the most appropriate choice here because it indicates a final statement summarizing the passage.

6. B: Choice B combines information about the greenhouse effect and the ozone layer to provide a comprehensive explanation of how the atmosphere regulates Earth's temperature.

Choice A provides relevant information about the atmosphere's composition and the greenhouse effect but doesn't mention the ozone layer's role in UV radiation absorption, making it less comprehensive. Choice C mentions the atmosphere's composition and photosynthesis but doesn't directly explain the role in regulating temperature, making it less effective. Choice D provides information about the ozone layer and the atmosphere's composition but doesn't directly explain the greenhouse effect and its role in temperature regulation, making it less comprehensive.

7. A: The passage discusses the importance of photosynthesis, particularly in terms of providing oxygen and capturing solar energy. Given this context, the most logical completion for the text is to emphasize that photosynthesis is essential for sustaining life on Earth.

8. B: Choice B aligns best with the passage's emphasis on Shakespeare's beautiful representation of human life, making it the most logical and precise word. Choice A contradicts the passage by suggesting it *avoids* depth. Choice C, while similar to *captures*, implies direct copying, not creative representation. Choice D, *diminishes*, contradicts the passage's praise for enhancing human life's depth.

9. C: The passage highlights that Scout serves as the primary narrator. She immerses readers in Maycomb, a town marked by complex societal dynamics and prejudices. This emphasis on Scout as the narrator, along with the reference to her being a young girl, suggests that her role is primarily to provide a contrast between the innocence of childhood and the often biased and prejudiced viewpoints of adults.

10. C: A plural possessive form is used to indicate that something belongs to or is associated with a plural noun. In this passage, the word *artists'* is the only word that represents a plural possessive form. The phrase "The artists' loose brushstrokes and vivid palettes" indicates that the artists used their painting style and color selection to create their desired impression.

11. A: *Complex* is the most fitting word to complete the sentence. The sentence describes critics debating the nature of the protagonist in a novel, with some seeing the character as a symbol of hope and others as a representation of despair. This suggests that there is a diversity of opinions

regarding the character's attributes. The other choices, *one-dimensional*, *unambiguous*, and *predictable*, do not align with the sentence's context.

12. C: In this sentence, the verb should be in the past tense to match the past tense context of the sentence. "Tom's voice" and "he was reading them" both indicate actions that occurred in the past. Therefore, the past tense form of the verb, *trembled*, is appropriate.

13. C: The main purpose of the passage is to paint a vivid picture of the forest's serene and tranquil atmosphere, with the old oak tree serving as a symbol of wisdom and solace. The passage doesn't primarily focus on describing the traveler's journey, emphasizing the strength of the tree, or suggesting an interaction with a talking tree. Instead, it aims to convey the calming and peaceful ambiance of the forest, making choice C the most suitable description of its purpose.

14. A: "Scientific inquiry and innovation" best fits this description, as the Renaissance was a time of great scientific advancement and exploration, with figures like those mentioned above making significant contributions to the understanding of the natural world.

15. A: In this passage, the sentence is discussing a necessity in the present tense, which requires the use of *requires* in choice A. Choices B and C use *requiring*, which is in the present participle form and doesn't fit the context. Choice D is grammatically incorrect as it adds *it* before *requires*, which is unnecessary in this sentence structure.

16. D: In Passage 2, Dr. Johnson acknowledges the impact of human activities on climate change but emphasizes the role of natural factors like volcanic eruptions and solar variations in shaping the Earth's climate as well. This suggests that Dr. Johnson's perspective aligns with the idea that both human activities and natural factors are significant contributors to climate change.

17. C: In the passage, it's mentioned that chameleons have the remarkable ability to change the color of their skin. The word *synchronization* is the most appropriate word in this context because it implies that chameleons synchronize, or match, their skin color with the environment, making them virtually invisible to predators or prey. The other choices, *prediction*, *moderation*, and *hibernation*, do not convey the same sense of matching or alignment with the surroundings and are not logical in this context.

18. A: The passage provides information about the surface temperatures of planets. To complete the example using data from the table, the planets' surface temperatures need to be noted and compared to each other. Choice A correctly states that Neptune has a lower surface temperature than Venus and Mars.

19. C: The main role of literature, as described in the passage, is to reflect societal issues and human experiences. The passage discusses how literature serves as a mirror to society, shedding light on issues such as racial injustice and totalitarianism. It emphasizes that literary works like *To Kill a Mockingbird* and *1984* provide valuable insights into the human condition by addressing and reflecting upon these societal issues and human experiences. While literature can certainly entertain and provide glimpses into historical events, the primary focus in this passage is on its role as a reflection of broader societal and human concerns.

20. A: Both passages highlight aspects of Romanticism. John Keats, in Passage 1, praises Romanticism for its emphasis on emotion, individualism, and a deeper connection with nature, which aligns with many of the themes in Mary Shelley's *Frankenstein* described in Passage 2. Shelley's novel, often considered a product of the Romantic era, explores themes of individuality and the power of nature. Given these shared themes, it's likely that Shelley would agree with Keats

and expand on the importance of emotion in literature, as it resonates with the emotional depth and exploration in *Frankenstein*.

21. A: To ensure grammatical agreement and clarity, the pronoun *them* is the most suitable choice. *Them* refers to the plural noun *finest ingredients*, maintaining consistency in both subject and pronoun.

22. B: This finding, if true, most directly supports the student's claim that literature has a profound impact on society and individuals. It provides empirical evidence that reading literature with diverse characters and experiences can lead to increased empathy and tolerance in individuals, demonstrating how literature can shape attitudes and behaviors. This aligns with the student's argument that literature can evoke empathy and influence perceptions.

23. B: In the sentence, "They represent the deep connection between Japanese culture and the philosophy of Zen Buddhism," the verb tense should match the context of the passage. The passage primarily uses present tense verbs to describe the traditional Japanese tea ceremony and its characteristics. *Represent* maintains the present tense and is in agreement with the surrounding context.

24. C: Choice C is the most appropriate transition in this context because it effectively connects the preceding information about the role of electromagnetic waves to the consequence, which is the development of various devices and technologies. It logically shows the cause-and-effect relationship between the study of electromagnetism and the resulting technological advancements.

25. B: Choice B correctly uses the coordinating conjunction *and* to connect the independent and dependent clauses in the sentence. This maintains proper sentence structure and conveys the intended meaning effectively, indicating that these discoveries are important for advancing our knowledge of neuroscience and developing treatments for neurological disorders.

Mathematics—Module 1

1. A: To find when the apple reaches the ground, set the function $f(x)$ equal to 0 and solve for x.

$$0 = -x^2 - 2x + 7$$

This quadratic can't be easily factored, so use the quadratic formula to solve.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(-1)(7)}}{2(-1)}$$

$$x = \frac{2 \pm \sqrt{4 + 28}}{-2}$$

$$x = \frac{2 \pm \sqrt{32}}{-2}$$

$$x = \frac{2 \pm 4\sqrt{2}}{-2}$$

$$x = -1 \pm 2\sqrt{2}$$

$$x \approx 1.8, -3.8$$

In this scenario, time can only be a positive value, so it took about 1.8 seconds for the apple to reach the ground.

2. C: First, solve for x in the first equation.

$$2x + 6 = -2$$

Subtract 6 from each side.

$$2x = -8$$

Then, divide each side by 2.

$$x = -4$$

Now we can plug this value of x into the second expression.

$$10(-4) + 11 = -40 + 11 = -29$$

3. C: A method commonly taught to multiply binomials is the FOIL method, an acronym for *first, outer, inner, last*: multiply the first terms of each factor, then the outer terms, then the inner terms, and finally, the last terms.

$$(x + 2)(x - 3)$$

$$(x)(x) + (x)(-3) + (2)(x) + (2)(-3)$$

From here, simplify and combine like terms.

$$x^2 - 3x + 2x - 6$$

$$x^2 - x - 6$$

4. A: We first find the mean, or average, of the lab grades by adding them and dividing by the number of grades.

$$\frac{84 + 86 + 98 + 90 + 97 + 85 + 90}{7} = \frac{630}{7} = 90$$

Then we find the median by arranging the grades in increasing order and finding the middle value: 84, 85, 86, 90, 90, 97, 98. The middle number is 90. So, the difference of the mean and median is $90 - 90 = 0$.

5. 2: We can find the points of intersection by setting the two equations equal to each other.

$$2x^2 + 3x = -x$$

Add x to each side and combine like terms.

$$2x^2 + 4x = 0$$

Factor the left side.

$$(2x)(x+2)=0$$

Setting the first term equal to 0 yields $2x=0$. Thus, $x=0$. This corresponds with the point we were given, (0,0). Now we set the second term equal to 0: $x+2=0$. We subtract 2 from each side to yield $x=-2$. This is a. To find b, we plug in -2 for x to either of the two equations and solve for y. Using the second equation: $y=-(-2)$, or $y=2$. So, our point is $(-2,2)$ and $b=2$.

6. 10: Since the population is multiplied by 3 for 5 days, we can write $x(3^5)=2{,}430$, where x is the original population. Calculate 3^5 and simplify the equation.

$$243x=2{,}430$$

Divide each side by 243.

$$x=10$$

So, the original population was 10.

7. D: For Days 1, 2, and 3 (choices A, B, and C) on the chart, the number of seedlings is 0. Day 4 is the first time we see the line move away from 0, showing that 2 seedlings sprouted that day.

8. C: We first need to find the volume of water that Kasie is putting in each glass. The volume of a cylinder is $V=\pi r^2 h$. Since we know the radius is 1.25 and the height is 5 (ignore the actual height of the glass since it is not filled to the brim), we can write the following equation.

$$V=(3.14)(1.25)^2(5)$$

$$V\approx 24.53\ \text{in}^3$$

Now we need to find the number of cubic inches in 3 quarts.

$$\left(\frac{3\ \text{qt}}{1}\right)\left(\frac{1\ \text{gal}}{4\ \text{qt}}\right)\left(\frac{231\ \text{in}^3}{1\ \text{gal}}\right)=173.25\ \text{in}^3$$

Finally, we divide 173.25 by 24.53 to find that Kasie could fill 7.06 glasses. In other words, she could completely fill 7 glasses.

9. C: The situation may be modeled by this system of equations:

$$\begin{cases}4y+3c=9.55\\2y+2c=5.90\end{cases}$$

Multiplying the bottom equation by -2 gives:

$$\begin{cases}4y+3c=9.55\\-4y-4c=-11.80\end{cases}$$

Adding the two equations gives $-c=-2.25$, or $c=2.25$. Thus, one box of crackers costs \$2.25.

10. C: If 85% of the sample group prefer the new brand of juice, we can infer that most shoppers will likely prefer it. We cannot say that 85% of all shoppers will prefer it (choice A), because that would require testing all shoppers, but we can make a generalization that most shoppers seem to

prefer the new brand. Choice B is incorrect because 15% is the number of the surveyed shoppers who did not prefer the new brand. Choice D is incorrect because it implies the opposite of the correct answer.

11. D: We solve for x and y by using elimination. We can multiply the second equation by 2 and then add the two equations to eliminate the y-terms.

$$\begin{array}{r} 5x - 6y = 12 \\ \underline{+(-4x + 6y = -10)} \\ x = 2 \end{array}$$

If $x = 2$, we can solve for y by plugging the x-value back into one of the equations. For example, use the second equation.

$$-2(2) + 3y = -5$$

Simplify and add 4 to each side.

$$3y = -1$$

Divide each side by 3.

$$y = -\frac{1}{3}$$

So, the solution is $\left(2, -\frac{1}{3}\right)$. Now we can use these values to find $x^2 - 3y$.

$$(2)^2 - 3\left(-\frac{1}{3}\right) = 4 + 1 = 5$$

12. D: Bacterial growth is exponential. Let x be the number of times the population doubles, a be the number of bacteria in the colony originally transferred into the broth, and y be the number of bacteria in the broth after x doubling times. After 1 hour, the population would have doubled three times:

$$\begin{aligned} a(2)^x &= y \\ a(2^3) &= 8 \times 10^6 \\ 8a &= 8 \times 10^6 \\ a &= 10^6 \end{aligned}$$

So, the number of bacteria originally transferred into the petri dish was 10^6. The equation for determining the number of bacteria is $y = (2^x) \times 10^6$. Since the bacteria double every twenty minutes, they go through three doubling times every hour. So, when the bacteria are allowed to grow for eight hours, they will have gone through $8 \times 3 = 24$ doubling times. When $x = 24$, $y = (2^{24}) \times 10^6 = 16{,}777{,}216 \times 10^6$, which is approximately 1.7×10^{13}.

13. B: We first solve for x in the first equation.

$$3x - 4 = -1$$

Add 4 to each side.

$$3x = 3$$

Then, divide each side by 3.

$$x = 1$$

Be careful not to mistakenly select answer choice D rather than finishing the problem. The final step is to plug this value of x into the second expression.

$$12(1) + 3 = 12 + 3 = 15$$

14. C: Because the radicals are the same, we can add the coefficients in front of the radicals and keep the radical the same.

$$4\sqrt{6} + 8\sqrt{6} = (4 + 8)\sqrt{6} = 12\sqrt{6}$$

Since the radicand, 6, has no perfect square factor, we cannot simplify this expression further.

15. 6: If the two triangles are similar, corresponding sides are also similar. Set up a ratio.

$$\frac{AB}{4} = \frac{9}{6}$$

Then, cross-multiply.

$$6AB = 9(4)$$
$$6AB = 36$$

Divide both sides by 6.

$$AB = 6$$

16. D: The equation of a circle is $(x - h)^2 + (y - k)^2 = r^2$, where r is the radius. We need to put the equation in this form to solve for r. First, we separate the x- and y-terms and then we complete the square.

$$(x^2 - 4x) + (y^2 + 2y) = 4$$

$$(x^2 - 4x + 4) - 4 + (y^2 + 2y + 1) - 1 = 4$$

$$(x - 2)^2 + (y + 1)^2 - 5 = 4$$

$$(x - 2)^2 + (y + 1)^2 = 9$$

$$(x - 2)^2 + (y + 1)^2 = 3^2$$

Thus, we can see that the radius is 3 (be careful not to mistakenly choose answer choice B). Since the diameter is twice the radius, we multiply 3 by 2 to obtain 6.

17. A: We begin by solving the inequality for a.

$$4x + 3 \leq 1$$

First, subtract 3 from each side.

$$4a \leq -2$$

Then, divide each side by 4 and reduce.

$$a \leq -\frac{1}{2}$$

So, $-\frac{1}{2}$ is the greatest possible value for a. We plug this value into $6a - 2$

$$6\left(-\frac{1}{2}\right) - 2 = -3 - 2 = -5$$

18. C: We need to find the point at which i is equal to p, so we set the two equations equal to each other.

$$5.5x = 15{,}200 + 0.75x$$

Subtract $0.75x$ from each side.

$$4.75x = 15{,}200$$

Divide each side by 4.75.

$$x = 3{,}200$$

Therefore, the "break even" number of products is 3,200.

19. B: The point marked on the scatterplot for the final day shows that Julio practiced for 3 hours, while the line of best fit crosses the 2-hour mark on the same day. The difference between 3 hours and 2 hours is 1 hour.

20. B: Dividing both sides of the equation by $\frac{1}{3}\pi h$ gives $r^2 = \frac{V}{\frac{1}{3}\pi h} = \frac{3V}{\pi h}$. We can then solve for r by taking the square root of both sides, which gives us $r = \sqrt{\frac{3V}{\pi h}}$.

21. C: If Jan has 6 pairs of socks for each pair of shoes, we can write that socks $= 6$(shoes). We can then substitute 12 for the shoes and s for the socks: $s = 6(12)$. We look through the answer choices to see which matches this. Answer choice A can be rewritten as $s = \frac{6}{12}$. Answer choice B can be rewritten as $s = \frac{12}{6}$. Answer choice C can be rewritten as $s = 6(12)$. Answer choice D can be rewritten as $s = 12 - 6$. So only answer choice C matches.

22. C: To solve, we raise each side to the –2 power. This yields $(x^{-\frac{1}{2}})^{-2} = m^{-2}$. We can simplify to $x = \frac{1}{m^2}$. Answer choice A is incorrect because it raises m to the power of 2, not –2. Answer choice B is incorrect because it adds in a constant (1) and does not raise m to the power of –2. Answer choice D is incorrect because it raises m to the power of –1, not –2.

Mathematics—Module 2

1. 0.25: If the two triangles are similar, corresponding sides are also similar. We can set up a ratio: $\frac{AB}{EF} = \frac{4}{8} = \frac{1}{2}$, or 0.5. If the ratio of each side of ΔABC to each side of ΔEFG is $\frac{1}{2}$, the ratio of the areas is $\left(\frac{1}{2}\right)^2 = \frac{1}{4}$, or 0.25. Alternatively, we could find the actual area of each right triangle. We can find side BC by multiplying side FG by $\frac{1}{2}$: $12 \times \frac{1}{2} = 6$. So the area of ΔABC is $\frac{1}{2} \times 4 \times 6 = 12$. The area of ΔEFG is $\frac{1}{2} \times 8 \times 12 = 48$. Thus, the ratio of the areas is $\frac{\Delta ABC}{\Delta EFG} = \frac{12}{48} = \frac{1}{4}$, or 0.25.

2. D: We look for a value at which $f(x) = 0$ to determine a factor, because the graph of the equation crosses the x-axis at this point. The table shows that $f(x) = 0$ when $x = 2$, so the point is (2,0). This means that if we were to factor the original equation, one of the factors would be $(x - 2)$, as $y = x - 2$ goes through the point (2,0).

3. A: The solution(s) to a system of equations is the point or points at which the graphs of the two equations cross. If a system has no solution, this means that the graphs never cross. In other words, the two graphs are parallel. In the system here, we know the lines will be parallel if the slopes are identical. We can look at the first equation to find the slope by moving the x-value to the right and solving for y.

$$y = -\frac{1}{3}x - \frac{7}{3}$$

Thus, the slope of the second equation needs to also be $-\frac{1}{3}$. We again move the x-value to the right and solve for y.

$$y = \frac{-a}{-2}x + \frac{6}{-2}$$

$$y = \frac{a}{2} - 3$$

Therefore, the slope here is $\frac{a}{2}$. We can set the slopes equal to each other to solve for a.

$$\frac{a}{2} = -\frac{1}{3}$$

Then we cross-multiply.

$$3a = -2$$

Finally, we divide both sides by 3.

$$a = -\frac{2}{3}$$

4. C: We need to simplify the equation so we can factor it. First, we subtract 3 from each side.

$$5x^2 - 30x - 35 = 0$$

Then we can divide each term by 5.

$$x^2 - 6x - 7 = 0$$

Finally, we can factor.

$$(x + 1)(x - 7) = 0$$

Setting each factored term equal to 0 yields $x + 1 = 0$ and $x - 7 = 0$, or $x = -1$ and $x = 7$. The sum of -1 and 7 is 6.

5. 0.8: The cosine of an angle can be calculated as the adjacent Dside (3) divided by the hypotenuse (5). If angle M measures $a°$, then angle N measures $(90 - a)°$, so we are looking for the cosine of angle N. We begin by solving for the remaining side of the triangle. If the hypotenuse of a right triangle is 5 and one leg is 3, the other leg can be found with the Pythagorean theorem:

$$3^2 + NP^2 = 5^2$$
$$9 + NP^2 = 25$$
$$NP^2 = 16$$
$$NP = 4$$

So, we can find the cosine of angle N by taking the adjacent side (4) and dividing by the hypotenuse (5). So the answer is $\frac{4}{5}$ or 0.8.

6. D: If 52% of the sample group prefer Brand A, this is very close to half, and it is not logical to claim that either brand has a majority (answer choices B and C) when only 25 people were polled and results are fairly inconclusive (we can calculate that 13 liked Brand A and 12 liked Brand B). We cannot presume that 52% or more of all shoppers will prefer it (answer choice A), because there can be margin of error in either direction.

7. 1 or 2: We can choose any value between 1.2 and 1.5 to use as our diameter. The formula for volume of a sphere is $V = \frac{4}{3}\pi r^3$, so the first step is to find the radius, dividing the diameter by 2. If we choose the smallest value, our diameter is $1.2 \div 2 = 0.6$. We then can calculate volume.

$$V = \frac{4}{3}(3.14)(0.6)^3$$
$$V \approx 0.90$$

Rounding to the nearest cubic inch gives us 1 in^3.

If we choose the largest value, our diameter is $1.5 \div 2 = 0.75$. We then can calculate volume.

$$V = \frac{4}{3}(3.14)(0.75)^3$$
$$V \approx 2.4$$

Rounding to the nearest cubic inch gives us 2 in^3. Since any possible answer will be between these two values, either 1 or 2 is a correct answer.

8. C: We first need to find the volume of the container. Since we will need to know the volume in cubic inches to convert to gallons, we convert each measurement from feet to inches by multiplying

each by 12. Thus, the length is $8 \times 12 = 96$ inches, the width is $4 \times 12 = 48$ inches, and the height is $3 \times 12 = 36$ inches. The volume of a rectangular prism is $V = lwh$, so we can calculate the container's volume.

$$V = 96 \times 48 \times 36 = 165{,}888 \text{ in}^3$$

Now we need to find the number of gallons needed to fill this container.

$$\left(\frac{165{,}888 \text{ in}^3}{1}\right)\left(\frac{1 \text{ gal}}{231 \text{ in}^3}\right) = 718.13 \text{ gallons}$$

Since the problem is asking for the number of gallon jugs to completely fill the container, we need to round up. Buying 718 jugs will almost completely fill the container, but a little water will be needed from jug 719.

Choice A is incorrect because it only multiplies the volume in feet by 12 to convert to inches, rather than multiplying each dimension. Choice B is incorrect because it rounds down instead of up. Choice D is incorrect because it is the volume in cubic inches rather than gallons.

9. A: Note that $(2x^2 + 3x + 2) - (x^2 + 2x - 3) = (2x^2 + 3x + 2) + (-1)(x^2 + 2x - 3)$. Distribute the –1 to remove the parentheses: $2x^2 + 3x + 2 - x^2 - 2x + 3$. Next, combine like terms.

$$(2x^2 - x^2) + (3x - 2x) + (2 + 3) = x^2 + x + 5$$

10. D: We can see from the table that 9 people ordered a small serving of lemon yogurt and that a total of 57 orders were placed. So, the probability is 9 out of 57, or $\frac{9}{57}$. We can divide both the numerator and denominator by 3 to reduce the fraction to $\frac{3}{19}$. Choice A is the probability of choosing a small serving given that lemon yogurt was selected (not the overall probability). Choice B is the probability of choosing lemon given that a small serving was selected ($\frac{9}{21}$ reduces to $\frac{3}{7}$). Choice C is the probability of choosing a small serving ($\frac{21}{57}$ reduces to $\frac{7}{19}$).

11. B: We can solve the system of equations by using substitution. We can plug in $-x$ for y in the top equation.

$$3x + (-x) = -2$$

This simplifies to $2x = -2$, and dividing each side by 2 yields $x = -1$. Then we can solve for y with the bottom equation.

$$y = -(-1) = 1$$

Finally, we can calculate $x + y = -1 + 1 = 0$. Choice A is incorrect because it is the value of x. Choice C is incorrect because it is the value of y. Choice D is incorrect because it is the value of $(y - x)$.

12. D: For Rylie to make \$75 in profit, she needs to earn \$75 + \$12 = \$87 to compensate for her overhead costs. We can calculate the amount she will earn by weeding the garden: $0.05(1{,}000) =$ \$50. We subtract this from \$87 to find that she needs to earn an additional \$37 from mowing and edging the lawn. Letting the size of the lawn be x, we can write out our equation.

$$0.003x + 0.002x = 37$$

Simplify by combining like terms on the left side.

$$0.005x = 37$$

Next, divide each side by 0.005.

$$x = 7{,}400$$

So, the lawn needs to be at least 7,400 square feet.

13. D: Start by calculating the cost of each person's mowing and edging.

Elise's cost: $0.0025(7{,}500) + 0.0015(7{,}500) = 18.75 + 11.25 = \$30$

Max's cost: $0.002(7{,}500) + 0.0015(7{,}500) = 15 + 11.25 = \$26.25$

Now we can set up an inequality, letting x be the size of the flower bed. For Elise's services to be a better deal, they must cost less than Max's.

$$30 + 0.055x < 26.25 + 0.065x$$

Solve for x by subtracting $0.055x$ from both sides.

$$30 < 26.25 + 0.01x$$

Now, subtract 26.25 from each side.

$$3.75 < 0.01x$$

We rewrite this as $0.01x > 3.75$ and divide each side by 0.01 to obtain $x > 375$. It is important to remember to reverse the inequality sign when we move the x to the left so we don't end up with $x < 375$ (answer choice B).

14. 4: Since the total is an even number of hundreds (16) and the \$100 prize is the only prize that is an odd number of hundreds, we can conclude that there must be an even number of \$100 prizes awarded. Since we are looking for the greatest number, we should begin at the top and check each number to see if it is possible.

If there are six \$100 prizes awarded, this leaves only one other prize to make up the difference.

$$\$1{,}600 - 6(\$100) = \$1{,}600 - \$600 = \$1{,}000$$

Since there is not a \$1,000 prize, there cannot be six \$100 prizes.

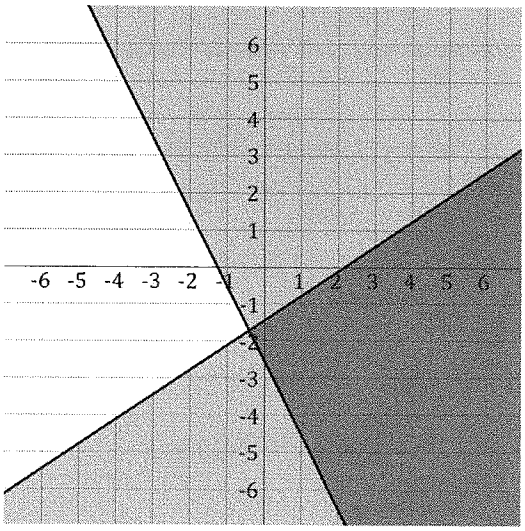
If there are four \$100 prizes awarded, this leaves three other prizes to make up the difference.

$$\$1{,}600 - 4(\$100) = \$1{,}600 - \$400 = \$1{,}200$$

Note that \$1,200 divided by 3 is \$400, so a combination of four \$100 prizes and three \$400 prizes satisfies all the parameters.

15. D: We can graph the two lines on a coordinate plane by plotting the y-intercept and then finding another point based on the slope. For the first equation, the y-intercept is $-\frac{3}{2}$, so we plot the point $\left(0, -\frac{3}{2}\right)$. Then we use the slope $\left(\frac{2}{3}\right)$ to plot another point by moving up 2 and 3 to the right, to $\left(3, \frac{1}{2}\right)$.

Now we can draw a line passing through the two points. It is a solid line because the solution is less than or equal to the equation. Next, we graph the second line. The y-intercept is $-\frac{5}{2}$, so we plot the point $\left(0, -\frac{5}{2}\right)$. Then we use the slope (–2) to plot another point by moving down 2 and over 1, to $\left(1, -\frac{9}{2}\right)$. Now we can draw a line passing through the two points. It is also a solid line because the solution is greater than or equal to the equation. We shade the area that is both below the graph of the first line and above the graph of the second line. When we do this, we can see that the overlap of the shaded area in Quadrants I, III, and IV.



16. C: Solve for a by rearranging the equation to isolate a.

$$d = vt + \frac{1}{2}at^2$$

Subtract vt from both sides.

$$d - vt = \frac{1}{2}at^2$$

Then, multiply each side by $\frac{2}{t^2}$.

$$a = \frac{2d - 2vt}{t^2}$$

Finally, break it into two fractions and simplify.

$$\frac{2d}{t^2} - \frac{2v}{t}$$

Choice A is incorrect because it is missing one t in the denominator. Choice B is incorrect because it multiples the d and vt terms instead of subtracting them. Choice D is incorrect because it leaves off the denominator of t^2 in the second term.

17. A: We look for a value at which $f(x) = 0$ to determine a factor, because the graph of the equation crosses the x-axis at this point. The table shows that $f(x) = 0$ when $x = -3$, so the point

is $(-3,0)$. This means that if we were to factor the original equation, one of the factors would be $(x + 3)$, as $y = x + 3$ goes through the point $(-3,0)$.

18. B: Use the FOIL method (first, outside, inside, and last) to expand the polynomial multiplication.

$$12x^2 - 18x + 20x - 30$$

Then, combine like terms to simplify the expression.

$$12x^2 + 2x - 30$$

19. C: We can solve the system of equations by using substitution. Plug in $3y$ for x in the top equation, and solve for y.

$$4(3y) - y = 11$$

$$12y - y = 11$$

$$11y = 11$$

$$y = 1$$

Then, solve for x by substituting 1 in for y in the bottom equation.

$$x = 3y = 3(1) = 3$$

Finally, we can calculate the final expression.

$$x - y = 3 - 1 = 2$$

20. C: Solve for L by rearranging the equation to isolate it. First, divide 2π from both sides.

$$\frac{T}{2\pi} = \sqrt{\frac{L}{g}}$$

Then, square each side to eliminate the radical.

$$\left(\frac{T}{2\pi}\right)^2 = \left(\sqrt{\frac{L}{g}}\right)^2$$

$$\frac{T^2}{4\pi^2} = \frac{L}{g}$$

Finally, multiply both sides by g.

$$\frac{T^2 g}{4\pi^2} = L$$

Choice A is incorrect because it subtracts 2π instead of dividing it. Choice B is incorrect because it takes the square root when it should have squared the fraction. Choice D is incorrect because it is the reciprocal of the correct answer.

21. 6: Solve for x in the equation by first subtracting 12 from each side.

$$x^2 - 4x - 12 = 0$$

Then, factor the left side.

$$(x + 2)(x - 6) = 0$$

Solving yields $x = -2$ or $x = 6$, and since the problem specifies that $x > 0$, this means that $x = 6$.

22. A: First, solve for the constant by using the ordered pair (2,0).

$$0 = \frac{3}{2}(2) + b$$

Multiply on the right side.

$$0 = 3 + b$$

Then, solve for b by subtracting 3 from each side.

$$-3 = b$$

Now the equation can be rewritten with the value of b plugged in.

$$f(x) = \frac{3}{2}x - 3$$

Finally, plug in -1 for x and solve.

$$f(-1) = \frac{3}{2}(-1) - 3 = -\frac{3}{2} - \frac{6}{2} = -\frac{9}{2}$$

Answer choice B is incorrect because it is the value of b rather than the function required. Choice C is incorrect because it uses 1 for x rather than -1. Choice D is incorrect because it adds 3 rather than subtracting.