Answer Key and Explanations

Reading and Writing—Module 1

1. B: In the context of the passage, it is clear that genetics research has been highly beneficial in medicine. The passage emphasizes how genetics has led to innovative treatments and its connections with diseases. Therefore, the logical completion of the passage should suggest that ongoing genetics research is indicating promising avenues for the prevention and treatment of illnesses, aligning with the positive impact of genetics research in the medical field.

2. B: This option directly highlights her unconventional style, characterized by innovative punctuation and enigmatic themes in her vast body of work, consisting of nearly 1,800 poems. By underlining the distinctive nature of her style, it successfully distinguishes her as a unique and remarkable figure in the world of literature. This aligns with the student's goal to accentuate what makes Emily Dickinson's literary contributions stand out.

3. A: The word *evocative* is the most logical and precise choice to describe the nature of the balcony scene in *Romeo and Juliet*. While *emotional* is a valid choice, *evocative* is a more precise and fitting word for describing the balcony scene's impact and the way it captures the intensity of young love through its poetic language and imagery.

4. C: Choice C directly supports the passage's assertion that music has the potential to enhance concentration and productivity. It introduces new information about recent studies showing that background instrumental music can improve focus and productivity, which aligns with the passage's claim about the benefits of music in these contexts. This finding strengthens the argument that music positively impacts mental health and productivity.

5. B: The passage discusses how hockey captivates both the players and the fans. To maintain proper subject-verb agreement and convey the intended meaning, the plural form *players* and *fans* should be used.

6. A: The present tense *continues* is appropriate because it indicates that Asch's work is an ongoing and enduring reference. The other options, *will continue*, *continued*, and *continuing*, either introduce an unnecessary future tense or past tense, which don't align with the context.

7. B: In Passage 1, it is emphasized that folktales serve as a means of preserving cultural heritage and passing down values and traditions. In Passage 2, it is discussed that literature captures the zeitgeist of its time and reflects societal changes. Both passages highlight the role of their respective forms of storytelling (folktales and literature) in preserving cultural heritage.

8. B: In this passage, the context calls for a transitional word (*however*) to indicate a contrast or shift in the sentence's direction. A semicolon is appropriate to connect two related independent clauses, and it should be followed by *however* with a comma for proper punctuation.

9. B: To *contemplate* means to think deeply or consider something carefully. In the context of the passage, the word *contemplate* fits because it conveys the idea that literature encourages readers to think deeply and critically about complex issues. It aligns with the passage's message that literature serves as a reflection of society's values and beliefs and encourages readers to engage with these topics on a thoughtful level.

10. A: The data in the table show that the Arctic Ocean had both the greatest increase in temperature, 0.5 °C, and the highest rise in sea level, 11.5 cm. This reflects a connection between high ocean temperatures and an increase in sea level, which aligns with the researchers' claim about the influence of temperature and global warming on rising sea levels.

11. A: *Additionally* is the appropriate choice, as it smoothly introduces the idea of providing extra information about the cave's ecosystem, particularly the bats. It maintains a logical flow in the text, highlighting the connection between the geological features and the biological significance of the cave system.

12. A: The passage discusses Gabriel Garcia Márquez's impact on literature, and it's describing past actions that are still ongoing. To convey this sense of a past action with continuing relevance, the present perfect tense *has transported* is appropriate. The present perfect tense is used to show that an action started in the past and has relevance or implications in the present.

13. B: It is appropriate to use the present tense *focuses* here to maintain grammatical consistency. This verb tense indicates that the study is currently ongoing or was recently conducted, and the study is focusing on estimating the probability of ground shaking.

14. C: Using a comma and the word *is* provides the necessary clarity and proper punctuation to make it clear that the Maasai Mara is located in Kenya and can be described as "a land of rolling grasslands, acacia-studded plains, and meandering rivers." Excluding the word *is* would change the meaning of the sentence to describe all of Kenya as "a land of rolling grasslands, acacia-studded plains, and meandering rivers," which is not accurate because Kenya has other landscapes as well.

15. C: *Moreover* is the appropriate choice because it signals that additional information or a related point is about to be presented. In this case, it introduces the fact that geckos are known for their agility and proficiency as hunters and climbers, expanding on their remarkable climbing abilities discussed in the first sentence.

16. A: This choice directly highlights the development of the AC electrical system as well as his invention of the Tesla coil, thereby emphasizing Tesla's significance in the field of electrical engineering.

17. D: The main idea of the text revolves around the protagonist's emotional and psychological struggles as she battles nervous troubles. She also feels that her husband, John, does not understand the severity of her condition and dismisses her concerns. This is the central theme of the passage, making D the best choice. Choices A, B, and C touch on various aspects mentioned in the text but do not capture the core theme as effectively.

18. B: The passage emphasizes the collaborative efforts of scientists from various disciplines in understanding dark matter. Answer choice B directly supports the claim that collaboration is essential by indicating that a discovery in particle physics research, which is one of the mentioned disciplines, provides direct evidence of dark matter particles. This demonstrates the significance of various scientific fields working together.

19. D: The passage discusses how *The Little Friend* weaves a tale of mystery, revenge, and moral awakening. Choice D most logically completes the text by indicating that the book could spark conversations about the complexities of human relationships and the nature of justice, which aligns with the themes and content described in the passage.

20. C: The text emphasizes the idea that real-life events are stranger and more complex than anything one could invent, and it contrasts this unpredictability with the predictability of conventional fiction. The text encourages the reader to appreciate the richness and unpredictability of real-life events.

21. B: This is the most effective choice because it directly and clearly compares the main spans of the two bridges, the Golden Gate Bridge and the Akashi Kaikyō Bridge. It provides the relevant information from the notes, stating that the Golden Gate Bridge has a main span of approximately 4,200 feet, while the Akashi Kaikyō Bridge has a longer main span of about 6,500 feet.

22. B: The main idea of the passage is to convey the significant impact of radium on various scientific fields, including physics, chemistry, and medicine, due to Marie Curie's groundbreaking work. The passage discusses how Curie's discovery of radium challenged scientific understanding, advanced knowledge of atomic structure and subatomic particles, and ultimately influenced medical science.

23. A: The passage primarily focuses on the historical and archaeological significance of Machu Picchu, discussing its construction, purpose, architecture, abandonment, and rediscovery.

24. C: This sentence provides specific examples of Maya Angelou's work and its impact. It mentions her autobiographical masterpiece and poetry, illustrating how her writing addressed important themes. Although it mentions themes, it does not provide a comprehensive summary of the major themes of the autobiographical masterpiece. The primary purpose of the sentence is to give examples of Maya Angelou's work and its impact rather than summarizing the book's themes in detail.

25. C: The word *emphasize* aligns well with the sense of concern and urgency expressed by the scientists in the passage. It implies that they are stressing, or highlighting, the importance of taking action to protect these critical ecosystems.

Reading and Writing—Module 2

1. C: This quote serves as the opening sentence of the novella, setting the tone for the entire work. Gregor Samsa's transformation into an insect is a central element of the story, and it symbolizes the themes of identity, isolation, and the dehumanizing effects of modern society as described in the claim.

2. A: The experiments in text 2, which focus on bioremediation techniques using specific microorganisms, provide valuable insights into potential solutions for addressing environmental pollution, especially in the context of the specific pollutants mentioned in text 1.

3. C: This choice reflects the idea that even though they are different mediums, both artistic forms of expression are means by which historical narratives and cultural significance are conveyed. It highlights the shared element of historical storytelling and cultural representation between the two passages.

4. D: *For example* is the most suitable choice because the sentence describes one use of lighthouses as a symbol rather than their real-world use to guide ships.

5. C: The passage strongly suggests that iPhones are more than basic communication devices and highlights their importance by emphasizing their sleek design, cutting-edge technology, user-friendly interfaces, continuous innovation, and their role as digital assistants, entertainment

centers, and productivity tools. The passage also mentions their commitment to privacy and security, which adds to their importance and quality.

6. D: Choice D is constructed as a declarative sentence with a question mark at the end. The declarative part of the sentence states, "providing opportunities for all to experience its joys and benefits," and the question mark at the end makes it clear that it is intended as a question.

7. C: The passage discusses how the Industrial Revolution brought significant changes to society that reshaped the world in profound ways. Artists and writers responded to these changes by capturing the human experience during this period. *Upheaval* accurately reflects the tumultuous and transformative nature of the Industrial Revolution. It implies a state of disruption, change, and instability, which aligns with the context described in the passage.

8. A: This choice maintains proper subject-verb agreement and clarity. The use of *These* in "These infrasound waves" correctly refers to the plural nature of the low-frequency sound waves generated by volcanoes.

9. C: The passage presents a thought from the speaker advising against marriage until certain conditions are met. The colon in choice C is used to introduce and continue the thought in a manner where the second part expands on or explains the first part.

10. A: Choice A is the most effective choice, as it concisely provides an explanation of Picasso's involvement in the Cubist movement and a specific example of his work. It accurately captures the key information from the notes and directly addresses the student's goal.

11. B: In the passage, the sentence describes what soldiers, sailors, airmen, and marines learn to do during their rigorous training. The word *while* is sufficient to convey the intended meaning that these personnel learn to operate machinery, execute maneuvers, and adapt to challenging environments while upholding core values. The other choices introduce unnecessary phrasing and do not add clarity or improve the sentence's structure.

12. D: The word *reside* is the most logical and precise choice. It accurately conveys that episodic memories are located in the prefrontal cortex. It aligns with the description of memory storage occurring in different brain regions based on their type. The other choices do not accurately represent the process of memory storage. These words suggest processes of destruction, creation, or elimination, which are not in line with the description of memory storage in the passage.

13. A: The sentence is describing the park, which is a singular entity, so the appropriate word to use is *It*. The park is a place where various activities occur, but it is treated as a single location.

14. A: Choice A is correct because it directly correlates the low luminosity and low temperature of stars (e.g., Star B and Star E) with their smaller sizes, aligning with the researchers' claim that luminosity and temperature affect a star's size. This choice effectively references the data in the table and maintains logical consistency.

15. A: The passage describes a series of events that occurred in the past, including the causes of the Great Depression. To maintain proper tense and sentence structure, the completion should use the past tense to indicate the sequence of events. *Leading* in choice A is the past participle form of the verb *lead*, and it effectively communicates the idea that these causes initiated a chain of events that resulted in a massive economic downturn.

16. C. The passage describes Wendy's mother as a "lovely lady" with a "romantic mind" and a "sweet mocking mouth." Her "romantic mind" is likened to nested boxes from the East, suggesting complexity and depth. Additionally, it mentions a kiss on her mouth that Wendy could never get, implying a playful or teasing aspect to her personality.

17. D: The transition "On the other hand" is appropriate because it clearly signals a contrast between the famous authors and the lesser-recognized ones, highlighting a shift in perspective. It effectively conveys the intended message that there are two different sides to the literary world in terms of recognition.

18. C: This is the most effective choice, as it provides both an explanation and an example of oceanomics. It defines oceanomics as a term coined by Dr. Lisa Patel for her research that blends oceanography and genomics and presents "Coral Genomes" as a specific and notable instance of her work in this field, aligning with the student's goal.

19. C: "As a result of" is the most appropriate choice here because it indicates a cause-and-effect relationship. The discovery of the double helix structure of DNA is presented as a cause of the significant advancement in genetics research. This transition logically connects the two sentences by explaining that the groundbreaking discovery led to the subsequent advancement of genetics research.

20. B: The study's findings suggest that daily meditation has a positive impact on reducing stress and anxiety levels. The passage mentions significant reductions in stress and anxiety levels among participants who meditated for at least 20 minutes a day, and it highlights a strong correlation between meditation frequency and improved mental well-being.

21. B: The speaker in the text expresses strong emotions of love and devotion, stating that he would do anything for Miss Manette and her loved ones, even to the extent of sacrificing his life to keep a life she loves beside her. This deep emotional connection and willingness to make sacrifices are the central themes of the text, making choice B correct.

22. C: In the passage, the author discusses how empires and dynasties have left lasting legacies that persist for centuries and have shaped societies, cultures, and economies significantly. The passage suggests that these historical examples provide insights into the development of human civilization. Therefore, Choice C is the most logical choice, as it directly aligns with the passage's content. Choice D, while partially correct, does not encompass the full meaning conveyed in the passage, as it focuses more on the enduring effects rather than the insights and lessons.

23. A: The comma in "practical, as" is the correct punctuation to indicate that the clause "as it is helping us understand and care for our planet's most mysterious realms" is providing an explanation or clarification for the preceding clause. Here, the word *as* is used to mean *because*. It effectively conveys the idea that the research is both academic and practical, and the comma helps maintain the sentence's flow and readability.

24. A: The passage states that in 1900, *Starry Night* found a new home at the Galerie Bernheim-Jeune in Paris. It then goes on to state that the painting was placed at the Museum of Modern Art in New York City in 1941, so it must have been in the Galerie Bernheim-Jeune from 1900 to 1941, which includes the year 1926.

25. D: The phrase *a somber* effectively conveys the mood and atmosphere of Puritan society in *The Scarlet Letter*. It accurately describes the solemn, grave, and serious nature of the setting and society where Hester Prynne's story unfolds.

Mathematics—Module 1

1. $179,625: The ratio of new car sales to used car sales is $3 : 5$. This means that the total number of cars sold (both new and used) is $3 + 5 = 8$. The used car sales are $\frac{5}{8}$ of the total sales:

$$\frac{5}{8} \times \$287{,}400 = \$179{,}625$$

2. C: The formula for the volume of a pyramid is $V = \frac{1}{3}Bh$, where B is the area of the base and h is the height of the pyramid. The base is a square with a length of 756 feet on each side. So, the area of the base is $A = s^2 = (756 \text{ ft})^2 = 571{,}536 \text{ ft}^2$. With a base of $571{,}536 \text{ ft}^2$ and a height of 481 ft, the volume of the pyramid is $V = \frac{1}{3}(571{,}536 \text{ ft}^2)(481 \text{ ft}) \approx 9.16 \times 10^7 \text{ ft}^3$.

3. A: $(2x^2 + 3x + 2) - (x^2 + 2x - 3) = (2x^2 + 3x + 2) + (-1)(x^2 + 2x - 3)$. First, distribute the -1 to remove the parentheses: $2x^2 + 3x + 2 - x^2 - 2x + 3$. Next, combine like terms: $(2x^2 - x^2) + (3x - 2x) + (2 + 3) = x^2 + x + 5$.

4. D: To add the two fractions, first rewrite them with the least common denominator, which is in this case y^3. This is already the denominator in $\frac{x}{y^3}$, and we can rewrite $\frac{x^2}{y^2}$ as $\frac{x^2 \times y}{y^2 \times y} = \frac{x^2 y}{y^3}$. Thus, $\frac{x^2}{y^2} + \frac{x}{y^3} = \frac{x^2 y}{y^3} + \frac{x}{y^3} = \frac{x^2 y + x}{y^3}$.

5. 6: We can find the points of intersection by setting the two equations equal to each other.

$$-x^2 + 5x = 2x$$

We combine like terms by subtracting $2x$ from each side.

$$-x^2 + 3x = 0$$

We can factor the left side of the equation.

$$(-x)(x - 3) = 0$$

Setting the first term equal to 0 yields $-x = 0$. Thus, $x = 0$. This corresponds with the point we were given, $(0,0)$. Now we set the second term equal to 0: $x - 3 = 0$. We add 3 to each side to yield $x = 3$. This is a. To find b, we plug in 3 for x to either of the two equations and solve for y. Using the second equation: $y = 2(3)$, or $y = 6$. So, our point is $(3,6)$ and $b = 6$.

6. C: To find the average, we need to add up each part and divide by the number of parts. If Max reads 3 books and Lucy reads 5 books, there are 8 books in total. We can find the total number of pages by multiplying 360 by 3 and 200 by 5, and then dividing the sum by 8.

$$\frac{360 \times 3 + 200 \times 5}{8} = \frac{1{,}080 + 1{,}000}{8} = \frac{2{,}080}{8} = 260$$

Therefore, the average length of all the books that Max and Lucy read is 260 pages.

7. D: There are many ways to solve quadratic equations in the form $ax^2 + bx + c = 0$. However, some methods, such as graphing and factoring, are not useful for equations with irrational or complex roots. Solve this equation by using the quadratic formula, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Set the given

equation equal to zero, so $7x^2 + 6x + 2 = 0$. Substitute the values $a = 7$, $b = 6$, and $c = 2$ into the quadratic formula.

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

$$x = \frac{-6 \pm \sqrt{6^2 - 4(7)(2)}}{2(7)}$$
$$x = \frac{-6 \pm \sqrt{36 - 56}}{14}$$
$$x = \frac{-6 \pm \sqrt{-20}}{14}$$
$$x = \frac{-6 \pm 2i\sqrt{5}}{14}$$
$$x = \frac{-3 \pm i\sqrt{5}}{7}$$

8. C: The expression representing the charge for Ride Service A is $\$10 + \$0.25(m - 10)$, where m is the number of miles. Set this expression equal to the charge for Ride Service B, which is $\$0.40m$. Solve for m to find the number of miles the two companies charge the same amount.

$$\$10 + \$0.25(m - 10) = \$0.40m$$
$$\$10 + \$0.25m - \$2.50 = \$0.40m$$
$$\$7.50 = \$0.15m$$
$$m = 50$$

So, the cost of the two services would be the same for a 50-mile ride.

9. C: In a 45-45-90 triangle, the legs can be found by dividing the hypotenuse by $\sqrt{2}$, so one leg is $\frac{4}{\sqrt{2}}$. We simplify $\frac{4}{\sqrt{2}}$ by multiplying by $\frac{\sqrt{2}}{\sqrt{2}}$.

$$\frac{4\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$$

Therefore, the three sides of the triangle are $2\sqrt{2}$, $2\sqrt{2}$, and 4. We add these sides together to obtain the perimeter: $4 + 4\sqrt{2}$.

Answer choice A is incorrect because it is the area rather than the perimeter. Answer choice B is incorrect because it is the area without the last step of dividing by 2. Answer choice D is incorrect because it is only two of the three sides.

10. B: To simplify the given inequality, first move all the terms to one side.

$$x^2 + 3 > 2x + 2$$
$$x^2 + 3 - 2x - 2 > 0$$
$$x^2 - 2x + 1 > 0$$

Now, factor the left-hand side.

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

The original inequality is equivalent to $(x - 1)^2 > 0$. Since the square of a negative number is positive, $(x - 1)^2 > 0$ everywhere except where $x - 1 = 0$, i.e. at $x = 1$. Therefore, $x \neq 1$ is equivalent to $x^2 + 3 > 2x + 2$.

11. D: 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.

$$y = 3x - 2$$

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

$$y = \frac{-n}{3}x - \frac{5}{3}$$

Therefore, the slope here is $-\frac{n}{3}$. We can set the slopes equal to each other to solve for n.

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

Then we cross-multiply.

$$-n(1) = 3(3)$$

Finally, we divide both sides by -1 to find that $n = -9$. Answer choice B is incorrect because it is the value of the slope. Answer choice A is the negative reciprocal of the slope, which would be used if we were looking for a perpendicular line, not a parallel one. Answer choice C is the y-intercept of the second line.

12. D: The expression representing the monthly charge for Plan A is $\$20 + \$15(d - 2.5)$, where d is the data used. This can be found by adding the flat rate to the price of any data used over the provided amount. Set this expression equal to the monthly charge for Plan B, which is \$50. Solve for d to find the number of GB for which the two plans charge the same amount.

$$\begin{aligned} \$20 + \$15(d - 2.5) &= \$50 \\ \$15(d - 2.5) &= \$30 \\ d - 2.5 &= 2 \\ d &= 4.5 \end{aligned}$$

So, the plans have the same cost when Gillian uses 4.5 GB of data.

13. B: Call the number of people present at the meeting x. If each person hands out a card to every other person (that is, every person besides himself), then each person hands out $x - 1$ cards. The total number of cards handed out is therefore $x(x - 1)$. Since we are told there are a total of 30 cards handed out, we have the equation $x(x - 1) = 30$, which we can rewrite as the quadratic equation $x^2 - x - 30 = 0$. We can solve this equation by factoring the quadratic expression. One

way to do this is to find two numbers that add up to the coefficient of x (in this case, -1) and that multiply to the constant term (in this case, -30). Those two numbers are 5 and -6. Our factored equation is therefore $(x + 5)(x - 6) = 0$. To make the equation true, one or both of the factors must be zero: either $x + 5 = 0$, in which case $x = -5$, or $x - 6 = 0$, in which case $x = 6$. Obviously, the number of people at the meeting cannot be negative, so the second solution, $x = 6$, must be correct. There are 6 people at the meeting.

14. D: Manipulate the inequality to isolate the variable. Start by adding 12 to each side.

$$\begin{gathered} 4x - 12 < 4 \\ 4x - 12 + 12 < 4 + 12 \\ 4x < 16 \end{gathered}$$

Then divide both sides by 4.

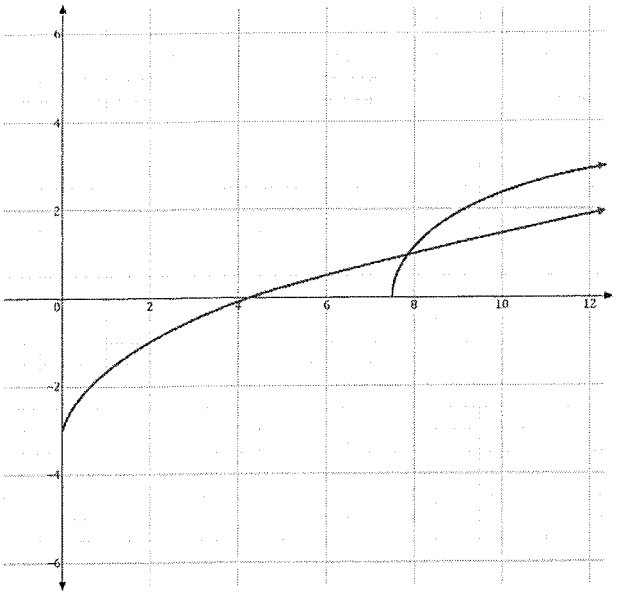
$$\begin{gathered} \frac{4x}{4} < \frac{16}{4} \\ x < 4 \end{gathered}$$

Since x must be less than and not equal to 4, only choice D works.

15. D: We can see from the table that 8 people ordered a cup of veggie soup and that a total of 42 orders were placed. So, the probability is 8 out of 42, or $\frac{8}{42}$. We can divide both numerator and denominator by 2 to reduce the fraction to $\frac{4}{21}$. Choice A is the probability of choosing veggie soup given that a cup was selected (not the overall probability). Choice B is the probability of choosing a cup of chicken soup ($\frac{7}{42}$ reduces to $\frac{1}{6}$). Choice C is the probability of choosing a cup, given that veggie soup was selected ($\frac{8}{20}$ reduces to $\frac{2}{5}$).

16. C: If there is one white petunia for every three red petunias, we can write that red petunias $= 3$(white petunias). We can then substitute 8 for the white petunias and r for the red petunias: $r = 3(8)$. We look through the answer choices to see which matches this. Answer choice A can be rewritten as $r = \frac{8}{3}$. Answer choice B can be rewritten as $r = \frac{3}{8}$. Answer choice C can be rewritten as $r = 3(8)$. Answer choice D can be rewritten as $r = 8 - 3$. So only answer choice C matches.

17. C: When solving radical equations, check for extraneous solutions.



$$\sqrt{2x} - 3 = \sqrt{2x - 15}$$
$$\left(\sqrt{2x} - 3\right)^2 = \left(\sqrt{2x - 15}\right)^2$$
$$2x - 6\sqrt{2x} + 9 = 2x - 15$$
$$-6\sqrt{2x} + 9 = -15$$
$$-6\sqrt{2x} = -24$$
$$\sqrt{2x} = 4$$
$$2x = 16$$
$$x = 8$$

Check: $\sqrt{2(8)} - 3 = \sqrt{2(8) - 15}$

$$\sqrt{16} - 3 = \sqrt{16 - 15}$$
$$4 - 3 = \sqrt{1}$$
$$1 = 1$$

Since the solution checks, it is a valid solution. Notice that the graphs $y = \sqrt{2x} - 3$ and $y = \sqrt{2x - 15}$ intersect, which confirms there is a solution.

18. D: The radical equation may be solved by first subtracting 8 from both sides of the equation.

$$4\sqrt{x} + 8 = 24$$

$$4\sqrt{x} = 16$$

Then, divide both sides of the equation by 4.

$$\sqrt{x} = 4$$

Finally, square both sides.

$$x = 16$$

19. C: We need to simplify the equation so we can factor it. First, we subtract 2 from each side.

$$3x^2 - 3x - 36 = 0$$

Then we can divide each term by 3.

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

Finally, we can factor.

$$(x + 3)(x - 4) = 0$$

Setting each factored term equal to 0 yields $x + 3 = 0$ and $x - 4 = 0$, or $x = -3$ and $x = 4$. The sum of –3 and 4 is 1.

20. C: A rectangle's area is found by multiplying length by width. Here, length is $5x$ and width is x.

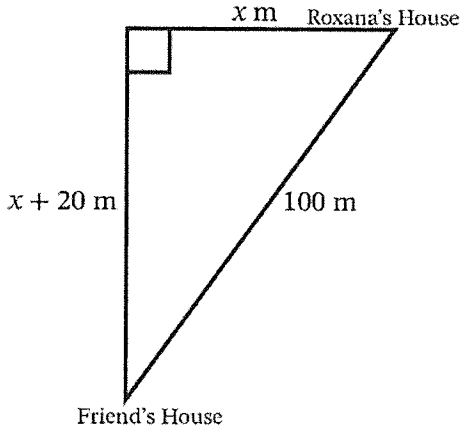
$$\begin{aligned} 245 \text{ in}^2 &= x \cdot 5x \\ 245 \text{ in}^2 &= 5x^2 \\ 49 \text{ in}^2 &= x^2 \\ 7 \text{ in} &= x \end{aligned}$$

Therefore, the longest side is $5 \times 7 \text{ in} = 35 \text{ in}$.

21. D: We can use the table to find the linear equation in slope-intercept form, $y = mx + b$, where m is the slope and b is the y-intercept. The table shows the y-intercept (the y value at $x = 0$) to be -5. The slope is the ratio of the change in y-values to the corresponding change in x-values. As the x-value increases by 1, the y-value increases by 3. Thus, the slope is $\frac{3}{1}$, or 3. So the equation is $y = 3x - 5$.

Only the graphs in choices B and D have a y-intercept at -5. Of these two graphs, only choice D has a y-value increase of 3 for each x-value increase of 1, indicating a slope of 3.

22. 140: If the distance between the two houses is 10 cm on the map, then the actual distance between the houses is 100 m. To find x, use the Pythagorean theorem:



$$\begin{aligned} x^2 + (x + 20)^2 &= (100)^2 \\ x^2 + x^2 + 40x + 400 &= 10{,}000 \\ 2x^2 + 40x - 9{,}600 &= 0 \\ 2(x^2 + 20x - 4{,}800) &= 0 \\ 2(x - 60)(x + 80) &= 0 \\ x = 60 \quad x &= -80 \end{aligned}$$

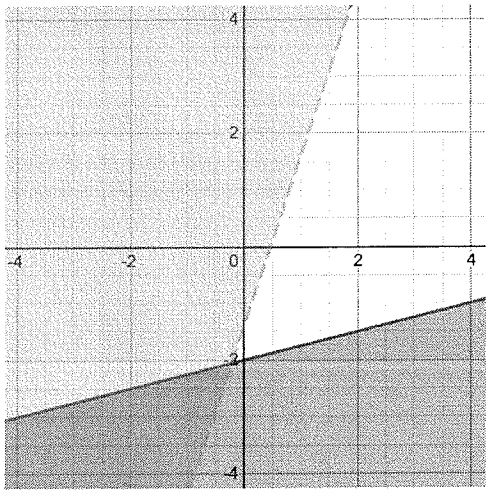
Since x represents a distance, it cannot equal -80. Since $x = 60$, $x + 20 = 80$. Roxana walks a total of 140 m to get to her friend's house.

Mathematics—Module 2

1. D: To solve, we first rewrite the equation. We can write $\sqrt[3]{x}$ as $x^{\frac{1}{3}}$ and rewrite the fraction by making the exponent negative: $\frac{1}{x^{\frac{1}{3}}} = x^{-\frac{1}{3}}$. Then we can raise each side to the -3 power. This yields

$\left(x^{-\frac{1}{3}}\right)^{-3} = a^{-3}$. We can simplify to $x = \frac{1}{a^3}$. Answer choice A is incorrect because it raises a to the power of 3, not –3. Answer choice B is incorrect because it adds in a constant (1) and does not raise a to the power of –3. Answer choice C is incorrect because it raises a to the power of –2, not –3.

2. A: 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 –2, so we plot the point $(0, -2)$. Then we use the slope $\left(\frac{1}{4}\right)$ to plot another point by moving up 1 and 4 to the right, to $(4, -1)$. 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 $-\frac{7}{5}$, so we plot the point $\left(0, -\frac{7}{5}\right)$. Then we use the slope (3) to plot another point by moving up 3 and over 1, to $\left(1, \frac{8}{5}\right)$. Now we can draw a line passing through the two points. It is a dotted line because the solution is greater than 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 is only in quadrant III.



3. C: To make \$820 in profit, Nursery B needs to earn \$5,500 + \$820 = \$6,320 to compensate for overhead costs. We can calculate the amount earned by selling plants: $100(30) + 100(20) =$ \$5,000. We subtract this from \$6,320 to find that they need to earn an additional \$1,320 from landscaping charges. Letting the number of hours be x, we can write out our equation: $55x = 1{,}320$. We divide each side by 55 to find that $x = 24$. So, Nursery B needs at least 24 hours of work.

4. D: We can calculate the cost of each nursery's trees and bushes. Nursery A's cost is:

$$25(10) + 15(8) = 250 + 120 = \$370$$

Nursery C's cost is:

$$20(10) + 15(8) = 200 + 120 = \$320$$

So, we can set up an inequality, letting x be the number of hours to plant the bushes and trees. For Nursery A's services to be a better deal, they must cost less than Nursery C's.

$$370 + 45x < 320 + 50x$$

We solve for x by subtracting $45x$ and 320 from each side.

$$50 < 5x$$

We rewrite this as $5x > 50$ and divide each side by 5 to obtain $x > 10$. 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 $x < 10$ (answer choice B).

5. C: The side of the square is equal to the diameter of the circle, or twice the radius, $2r$. The area of the square is this quantity squared, or $4r^2$. The area of the circle is πr^2. Subtracting the area of the circle from the area of the square gives the difference between the two areas.

$$4r^2 - \pi r^2$$

A common r^2 can be factored out of each term to get the expression $r^2(4 - \pi)$.

6. A: The equation can be translated:

$$\text{investment} = (\text{initial lump sum}) + 4{,}500(\text{number of months since beginning})$$

In other words, it grows 4,500 cents every month. The answer choices are in dollars, so we divide by 100 to obtain \$45 per month.

7. D: To solve, isolate n by putting all the other terms on the other side of the equal sign.

$$4n - p = 3r$$

$$4n = 3r + p$$

$$n = \frac{3r}{4} + \frac{p}{4}$$

8. D: We solve for x and y by using elimination. We can multiply the first equation by 2 to eliminate the y-terms.

$$6x - 4y = 0$$

$$-2x + 4y = -8$$

Adding these two equations together yields $4x = -8$, or $x = -2$. We can solve for y by plugging the x-value back into one of the equations. Using the first equation, this yields:

$$3(-2) - 2y = 0$$

We add 6 to each side.

$$-2y = 6$$

Divide each side by -2.

$$y = -3$$

So, the solution is $(-2, -3)$. Now we can use these values to find $2x^2 - y$.

$$2(-2)^2 - (-3) = 8 + 3 = 11$$

Choices A and B are incorrect because they are the values of y and x, respectively. Choice C is incorrect because it involves adding the negative term instead of subtracting it.

9. $\frac{1}{2}$: We need to rewrite the equation to be in standard form of a circle.

$$(x-h)^2+(y-k)^2=r^2$$

First, we isolate the x- and y-terms.

$$(x^2-6x)+(y^2-y)=-\frac{21}{4}$$

Next, we can complete the square to simplify the equation.

$$(x^2-6x+9)-9+\left(y^2-y+\frac{1}{4}\right)-\frac{1}{4}=-\frac{21}{4}$$

$$(x-3)^2+\left(y-\frac{1}{2}\right)^2-\frac{37}{4}=-\frac{21}{4}$$

$$(x-3)^2+\left(y-\frac{1}{2}\right)^2=\frac{16}{4}$$

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

Now we can solve for the center point of the circle by setting the parts of the equations in parentheses equal to 0.

$$x-3=0 \text{ becomes } x=3$$

$$y-\frac{1}{2}=0 \text{ becomes } y=\frac{1}{2}$$

So, the coordinates of the center are $\left(3,\frac{1}{2}\right)$, meaning that the y-coordinate is $\frac{1}{2}$.

10. 6: Since the total is a multiple of ten and the \$5 bill is the only one that is not already a multiple of \$10, we can conclude that Riley must have an even number of \$5 bills. 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 eight \$5 bills, this leaves only one other bill to make up the difference.

$$\$80-8(\$5)=\$80-\$40=\$40$$

Since there is no such thing as a \$40 bill, there cannot be eight \$5 bills.

If there are six \$5 bills, this leaves three other bills to make up the difference.

$$\$80-6(\$5)=\$80-\$30=\$50$$

This \$50, made up of three bills, could be formed by a combination of two \$20 bills and one \$10 bill. Since this satisfies the parameters, Riley has a maximum of six \$5 bills.

11. A: The expression may be factored as $(x-8)(x+5)$. The factorization may be checked by distributing each term in the first factor to each term in the second factor by using the FOIL method. Doing so gives $x^2+5x-8x-40$, which can be rewritten as $x^2-3x-40$.

12. D: We need to find the point at which d is equal to p, so set the two equations equal to each other.

$$4a = 9{,}660 + 1.2a$$

Subtract $1.2a$ from each side.

$$2.8a = 9{,}660$$

Divide each side by 2.8.

$$a = 3{,}450$$

We then plug a into the first equation to find that $d = 9{,}660 + 1.2(3{,}450) = 13{,}800$. Therefore, \$13,800 of investment is required.

13. C: Write the first part of the sentence as an equation.

$$3x^2 = 48$$

Then, divide each side by 3.

$$x^2 = 16$$

Take the square root of each side.

$$x = \pm 4$$

Since we are told that it is a positive number, we know the answer is 4. Finally, we multiply the number by 2 and subtract from 15.

$$15 - 2(4) = 7$$

Choice A is incorrect because it is obtained by subtracting 15 from 8 rather than vice versa. Choice B is incorrect because it is the value of x, not the final answer. Choice D is incorrect because it is obtained by subtracting x from 15 without first doubling x.

14. B: The point marked on the scatterplot for Day 8 shows that Zac worked for 3 hours, while the line of best fit crosses the 2-hour mark on the same day. The difference between 3 and 2 is 1 hour.

15. 4: Solve for x in the equation by first adding 7 to each side.

$$x^2 = 16$$

Then, solve by taking the square root of each side to yield $x = \pm 4$. Since $x > 0$, this means that $x = 4$.

16. A: We solve for q by dividing each side by $\frac{3}{7}$. We do this by multiplying each side by the reciprocal, $\frac{7}{3}$.

$$q = -\frac{6}{1} \times \frac{7}{3} = -\frac{42}{3} = -14$$

Choice B is incorrect because it involves multiplying $\frac{3}{7}$ instead of dividing. Choice C is incorrect because it involves subtracting $\frac{3}{7}$ from each side instead of dividing. Choice D is incorrect because it is only the numerator of the multiplied fraction.

17. D: Use the difference of squares rule that states that $(a + b)(a - b) = a^2 - b^2$, or multiply the binomials using the FOIL method: multiply together the *first* term of each factor, then the *outer* terms, then the *inner* terms, and finally the *last* terms. Then add the products together.

$$\begin{aligned}(x + 6)(x - 6) &= x \times x + x \times (-6) + 6 \times x + 6 \times (-6) \\ &= x^2 - 6x + 6x - 36 \\ &= x^2 - 36\end{aligned}$$

18. A: The graph shows that Miguel had 6 quarters in the jar at the end of the day on Sunday, and there were still 6 at the end of Monday. So, he did not add any quarters that day.

19. C: The line climbs the most sharply between Wednesday and Thursday, growing by 3 (from 9 to 12). Since the measurement is taken at the end of each day, we know there were 9 quarters in the jar at the end of Wednesday and 12 at the end of Thursday, so 3 quarters were added on Thursday.

20. 38: We start with the formula $y(t) = ae^{kt}$ where a is the starting amount and t is the time in hours. Since the half-life is 5, we can write $0.5 = 1e^{k(5)}$. We then solve by taking the natural logarithm of each side.

$$\begin{aligned}\ln(0.5) &= \ln(e^{5k}) \\ \ln(0.5) &= 5k \\ -0.693 &\approx 5k \\ -0.139 &\approx k\end{aligned}$$

At 2:00 p.m., it has been 7 hours since Rafe drank the cup of coffee, so we can put that into the equation.

$$y(7) = 1e^{(-0.139)(7)} \approx 0.378$$

This translates to 37.8%, or approximately 38%.

21. 0.8: The sine of an angle can be calculated as the opposite side (4) divided by the hypotenuse (5). If angle Z measures $z°$, then angle X measures $(90 - z)°$, so we are looking for the cosine of angle X. We can find the cosine of angle X by taking the adjacent side (4) and dividing by the hypotenuse (5). So, the answer is $\frac{4}{5}$, or 0.8.

22. 15: If $WX = XZ$, we can write $WX = XY + YZ$. We then substitute the expressions into this equation.

$$a + 9 = 4a - 9 + 2a + 3$$

Moving a-values to the left and numerical values to the right yields $-5a = -15$, or $a = 3$. Now we can solve for WX and XY.

$$WX = a + 9 = 3 + 9 = 12$$

$$XY = 4a - 9 = 4(3) - 9 = 3$$

So $WY = WX + XY = 12 + 3 = 15$.