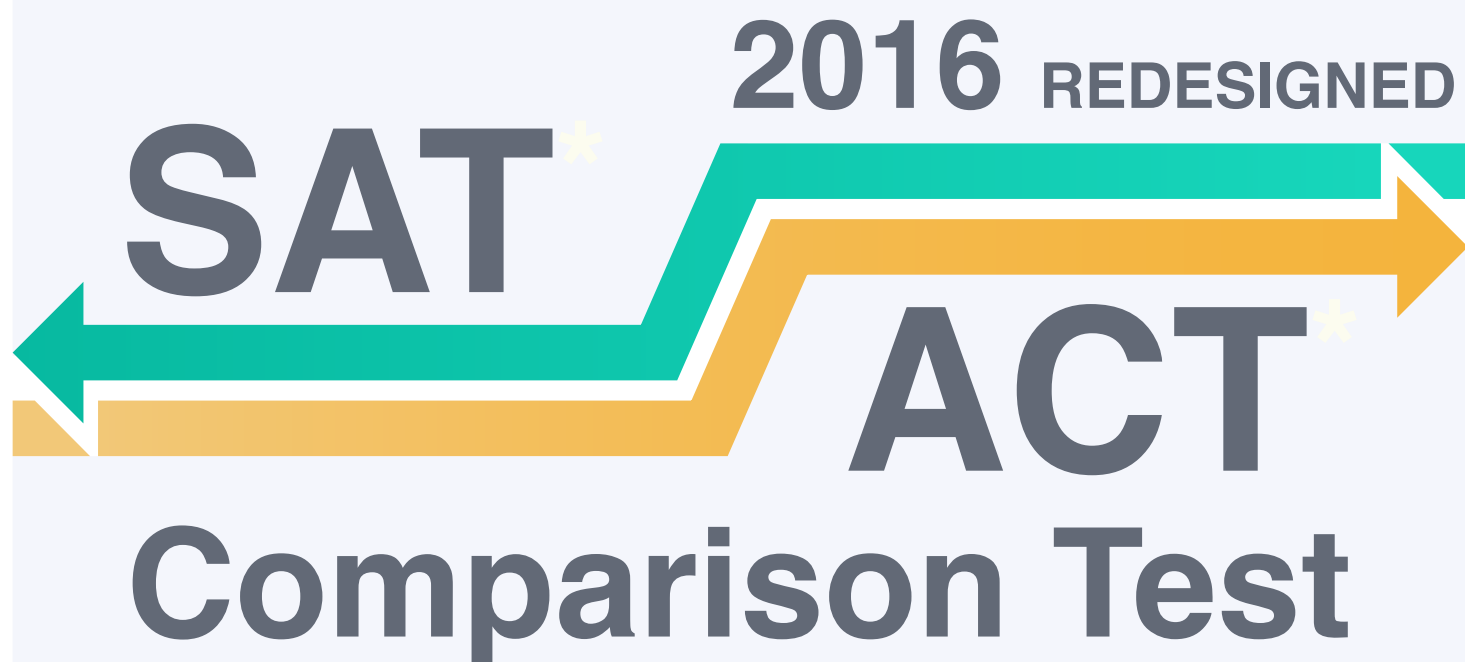




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## The Redesigned SAT/ACT Diagnostic

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### Welcome To The Redesigned SAT/ACT Diagnostic

Thank you for your interest in the SAT/ACT Diagnostic. Standardized testing, though no one's favorite pastime, is still a critical part of the college application process. Studying for the right test is critical.

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Enclosed, you will find the exam booklet (with proctoring instructions), bubblesheets, and a solution guide. Before you begin, it is absolutely critical that you:

- Read all of the instructions carefully, especially the paragraph about guessing.
- Find a quiet space that will remain quiet for about 4 hours. The closer you can simulate test conditions, the better. Make sure you have at least three sharpened pencils, as well as a calculator.
- Have a watch or clock in view of your testing area. It is important that you do not exceed the allotted time on any single section. If you do so, your results may not be valid.

We wish you the best of luck. Please give us a call at 860-664-9857 if you have any questions.



# The SAT/ACT Diagnostic

## The Redesigned SAT/ACT Diagnostic

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### Directions:

#### Administering The Diagnostic:

If a proctor is available for the exam, he/she should do the following before conducting the test. If not, the student must do the following.

- Remove the bubblesheets at the back of the exam. Students should write their name on each bubblesheet and fill in all of page one.
- Ensure that the student has at least three pencils, an eraser, and a calculator (to be used on sections 3 and 7 ONLY).
- Ensure that any electronic device is turned off for the duration of the exam.
- Remove any earplugs, which may not be worn during testing, any highlighters, rulers, dictionaries or other books, pens or colored pencils, pamphlets and papers of any kind, including scratch paper.
- Read the student instructions (located on the next page) aloud. Answer any questions.

Before each passage, the proctor should post the start and end time for the section and say:

- This section is [X] minutes long. It will end at [time].
- (Only before section 6): This section contains 12 questions, of which nine are multiple choice, and three require student-produced responses. Please follow the directions for submitting responses to Questions 10 through 12 carefully. They can be found immediately before Question 10.
- (Only before section 7): This section contains This section contains 24 questions, of which 19 are multiple choice, and five require student-produced responses. Please follow the directions for submitting responses to Questions 20 through 24 carefully. They can be found immediately before Question 20.
- If you finish before time is called, you MAY NOT turn to any other section.

(Recommended) With five minutes remaining in the section, say:

- You have five minutes remaining in this section.

| Section                  | Time (Minutes) | Questions | Calculator |
|--------------------------|----------------|-----------|------------|
| ACT English              | 27             | 45        | No         |
| SAT Reading              | 42             | 33        | No         |
| ACT Math                 | 40             | 40        | Yes        |
| <b>Break</b>             | 5              | N/A       | N/A        |
| SAT Writing & Language   | 26             | 33        | No         |
| ACT Reading Test         | 27             | 30        | No         |
| SAT Math (No Calculator) | 15             | 12        | No         |
| <b>Break</b>             | 5              | N/A       | N/A        |
| SAT Math (Calculator)    | 34             | 24        | Yes        |
| ACT Science              | 26             | 29        | No         |
| Total                    | 247            | 246       |            |

**CONTINUE READING ON THE NEXT PAGE**

## Directions:

### Read This Before You Take The Test:

This booklet contains tests in English, Writing, Mathematics, Reading, and Science. **CALCULATORS MAY BE USED ON SECTIONS 3 AND 7 ONLY.** Use a number 2 pencil and make your marks heavy and dark. Do not use a pen or any other ink pen.

The questions in each section are numbered, and the suggested answers for each question are lettered. On the bubblesheet, the rows of circles are numbered to match the questions, and the circles in each row are lettered to correspond to the answers.

For each multiple-choice question decide which answer is best and fill in the corresponding circle on the bubblesheet. Make sure to fill in the circle completely. For the grid-ins in Section 6 and 7, eight questions do not have answer choices. Write your answer choices in the designated areas provided on the bubblesheet. Mark only one answer for each question.

If you decide to change an answer, erase your answer thoroughly before marking a new answer. Make sure to fill in the correct answer on the bubblesheet.

Only answers marked on your bubblesheet will be scored. Your score on all sections will be based only on the number of questions you answer correctly. You will **NOT** be penalized for guessing on any test sections. **IT IS TO YOUR ADVANTAGE TO ANSWER EVERY QUESTION EVEN IF YOU HAVE TO GUESS.**

You may work on a section **ONLY** when your test supervisor tells you to do so. If you finish a section before time is called, you may use the remaining time to return to questions you are unsure of. You may **NOT** go back to a previous section. You may **NOT** proceed to another section until you are advised.

You may **NOT** fill in or alter circles within a section after time is called for that section.

**DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.**

**ACT ENGLISH TEST**

45 Questions — 27 Minutes

**DIRECTIONS:** There are three passages in this section. In the column next to the text you will find questions that correspond to the underlined portions in the text. Choose the best answer choice. **NO CHANGE** is the correct answer choice if the underlined portion does not need improvement.

Read the entire passage once before you start to answer. Some questions pertain to a larger portion of the text, or the passage in its entirety. Make certain that you've read enough of the text beyond the question to derive the right answer. Bubble your answers on the bubblesheet.

**PASSAGE I****Harvesting Strawberries**

The guide, my new mentor, handed me a basket  
and showing me which row to begin with.

1

“Sparkle Supreme are down here,” he said. “Three rows  
over are Early Glow.”

2

From afar, the rows looked pleasant and inviting,  
they were clustered with red fruit. The sun shone down,  
dissipating the morning chill. It was a perfect June morning

3

to pick fruit. For example, the paths between rows were  
littered with sharp rocks, and swarms of gnats hovered

4

overhead. The bushy plants formed dense mounds, visual

5

appealing. The sky was crystal clear. Dull red berries hid  
beneath the leaves where previous pickers had missed them.

6

- A. NO CHANGE  
B. and showed  
C. by showing  
D. had shown
- If the writer wanted to connect the opening paragraph to the setting of the rest of the essay, which of the following choices – assuming all are true – would best do this?  
F. NO CHANGE  
G. I had spent several days finding the right farm.  
H. You can't always get Early Glow and Sparkle Supremes.  
J. I thanked him for giving me a large basket.
- A. NO CHANGE  
B. all of them were  
C. they're  
D. DELETE the underlined portion
- F. NO CHANGE  
G. In the far distance,  
H. Up close,  
J. Or else,
- A. NO CHANGE  
B. visually  
C. so visually  
D. visual so
- If all of the choices are accurate, which one provides the greatest contrast to the description of the rows in the first sentence of this paragraph?  
F. NO CHANGE  
G. Bright berries glowed  
H. Ripe berries glistened  
J. Sun-soaked berries rested

**PROCEED TO NEXT PAGE.**



I saw the earlier gatherers far ahead down the row.

7

Sparkle Supreme and Early Glow—the words

themselves make your mouth water—being cultivated in

8

New England for decades. Many farmers now grow it

9

commercially and in increased quantities. Locals and out-  
of-towners can't seem to get enough of them. Early Glows  
are larger than average and have perfect shape. Sparkle  
Supremes are bright red, medium-sized, and loaded with  
intense, super-sweet flavor.

Usually, the best way to pick a strawberry is to  
pinch the stem above the berry and allow it to roll into your  
palm. This will minimize bruising of the fruit. Don't throw  
the berries into the basket, and don't overfill the basket.  
Fruit should not be picked during the hottest part of the day  
because the berries become soft and damaged.

Early Glow berries set and come into maturity  
earlier than any other strawberry. But when the

11

fruit, which grows on farms, is clustered among the

12

leaves, so that a picker can have a hard time finding all of  
the berries. My guide advised me to be sure to push back

13

the leaves in order to find all the berries. Being careful not  
to overfill my basket, I walked back to the stand where  
several baskets rested out of the sunlight. I popped a berry

14

7. Assuming that all choices are true, which most effectively concentrates on one person's picking the strawberries?
- A. NO CHANGE  
B. I bent down and searched through the leaves for the ripest fruit.  
C. This farm was well-known throughout the area.  
D. We have a tradition in my family of picking strawberries every June.
8. F. NO CHANGE  
G. have been cultivated  
H. to be cultivated  
J. DELETE the underlined portion
9. A. NO CHANGE  
B. there own  
C. their one  
D. them
10. If all of the the choices are true, which one provides information that is most relevant to the topic of the paragraph?
- F. NO CHANGE  
G. The farm has been in the same family for years.  
H. The day was already hot, and it wasn't yet noon.  
J. Strawberries are my favorite fruit.
11. A. NO CHANGE  
B. become old enough to pick  
C. ripen  
D. grow into ripeness
12. F. NO CHANGE  
G. that features prominently in supermarket displays  
H. which has always been popular  
J. DELETE the underlined portion
13. A. NO CHANGE  
B. a picker  
C. so a picker  
D. so that pickers
14. F. NO CHANGE  
G. I was careful not to overfill the basket,  
H. Carefully avoiding the mistake of making the basket overfull,  
J. The basket being not overfull,

**PROCEED TO NEXT PAGE.**

into my mouth, spat out the hull, and allowed the sweet  
<sup>15</sup>  
flavor to make all the work worthwhile.

15. A. NO CHANGE  
B. would of spit  
C. have spat  
D. spitted

## PASSAGE II

### Saving the Whooping Cranes

[1]

Each fall a magical event takes place—the annual migration of whooping cranes from their summer breeding range to their winter habitat in Florida. Their route includes croplands, marshes, and submerged sandbars in rivers in the  
<sup>16</sup>  
eastern United States. [A] Because the cranes fly relatively

lowly when landing or taking off, however,  
<sup>17</sup>

the risk for them of colliding with wind turbines and  
<sup>18</sup>  
transmission towers that are proliferating along the route.

[2]

[1] In the mid-1900's, whooping cranes were near extinction (only 21 birds) due to over-hunting and reduction of habitat. [B] [2] Now the birds have relapsed because of  
<sup>19</sup>  
conservation efforts. [3] Private donations has funded this  
<sup>20</sup>

16. The writer would like to insert the following accurate information:

“In Wisconsin”

Should the writer do so?

- F. Yes, because it gives a detail that connects the cranes' near extinction to a specific region.  
G. Yes, because it balances the sentence – winter habitat in Florida and summer breeding range in Wisconsin.  
H. No, because it creates a confusion whether the cranes summer in Florida or Wisconsin.  
J. No, because it gives details that makes the essay less focused.
17. A. NO CHANGE  
B. lower  
C. more lowly  
D. low
18. F. NO CHANGE  
G. they are at risk of  
H. while risking  
J. their risk of
19. A. NO CHANGE  
B. recovered  
C. rebuild  
D. remain
20. F. NO CHANGE  
G. been funding  
H. have funded  
J. is funding

**PROCEED TO NEXT PAGE.**

program by scientists, from the Whooping Crane Eastern Partnership. <sup>21</sup> [4] One such effort, Operation Migration, aims <sup>21</sup> to teach the cranes to avoid the flight corridor in

areas where the endangered cranes may fly and <sup>22</sup>

establishing a new flight path. <sup>23</sup> 24

[3]

The Partnership engages pilots of ultra-light aircraft to lead the birds on training flights over the White River Marsh State Wildlife Area in Wisconsin throughout the summer. This builds the cranes' stamina for their fall migration to their Florida wintering grounds. [C] Each year since 2001 a class of cranes has been led by the aircraft on <sup>25</sup>

their first migration south via a flight path that avoids <sup>26</sup> wind farms and power lines. During these flights

through the eastern United States pilots lead the birds to rich <sup>27</sup> feeding grounds.

[4]

By avoiding the highly hazardous route over the Great Plains where wind farms are increasingly plentiful, the birds are safer because they encounter less power lines and <sup>28</sup>

21. A. NO CHANGE  
B. scientists from the Whooping Crane Eastern Partnership  
C. scientists, from the Whooping Crane, Eastern Partnership  
D. scientists – from the Whooping Crane Eastern Partnership
22. F. NO CHANGE  
G. in areas that have many power lines and turbines  
H. in areas where the cranes would like to fly  
J. in areas
23. A. NO CHANGE  
B. they would establish  
C. having established  
D. establish
24. To improve Paragraph 2, Sentence 3 should be placed  
F. where it is now.  
G. before Sentence 1.  
H. after Sentence 1.  
J. after Sentence 4.
25. A. NO CHANGE  
B. have  
C. are  
D. is
26. F. NO CHANGE  
G. by means of  
H. with  
J. as
27. A. NO CHANGE  
B. flights, through the eastern United States, pilots lead  
C. flights through the eastern United States, pilots lead  
D. flights through the eastern, United States pilots lead
28. F. NO CHANGE  
G. fewer than  
H. fewer  
J. lesser

**PROCEED TO NEXT PAGE.**

windmill blades during take-off and landing. Scientists at Operation Migration are optimistic that the new flight path will alleviate this condition. [D]

29. The writer of the essay wants to incorporate the following sentence:

Normally, the birds fly between 500 and 5000 feet and are quite safe.

If the writer uses this sentence it should be placed at which point:

- A. A in Paragraph 1
- B. B in Paragraph 2
- C. C in Paragraph 3
- D. D in Paragraph 4

Question 30 asks about the preceding passage as a whole.

30. If the writer's primary goal were to explain the rate of success of a recent project to save whooping cranes from extinction, would this essay accomplish this goal?
- F. Yes, because it contains information about the number of cranes alive today.
  - G. Yes, because it describes how the project described in this essay has led to new ways to protect the cranes.
  - H. No, because it only provides an overview of a project and does not report results.
  - J. No, because the essay is focused on the use of ultra-light aircraft.

### PASSAGE III

#### Mark Rothko — Who Painted Color

American painter Mark Rothko (1903-1970) loved color, in the late 1940's Rothko abandoned all suggestion of <sup>31</sup> figures and instead exploited the expressive power of color by deploying it in large fields of color that surround the viewer when seen up close. Each viewer will have his own personal response to a swath of red-purple: <sup>32</sup> from a Christian's vision of the supreme sacrifice of Christ's blood <sup>32</sup> to the Buddhist's view of the casting off of title and privilege <sup>32</sup> by Siddhartha as he achieved enlightenment. <sup>32</sup>

Rothko believed that because color affects our mental state and <sup>33</sup> mood. It is the dramatic element that

31. A. NO CHANGE  
B. color during  
C. color, during  
D. color. In
32. If the writer omitted the phrase "from a Christian's... achieved enlightenment" and placed a period after the word "purple", the paragraph would lose:
- F. a sense of the variety of Rothko's viewers' reactions to the colors
  - G. a hint as to why Rothko painted few people
  - H. an explanation of why Rothko appreciated color
  - J. examples of how light affected Rothko's work
33. A. NO CHANGE  
B. mood, or it  
C. mood, it  
D. mood that it

**PROCEED TO NEXT PAGE.**

conveys life and immediacy in a painting. His art is deeply grounded in his spirituality. “Art to me is an anecdote of the spirit,” he said. Rothko believed that the rectangles of color in his work, “*Four Darks in Red* (1958)”, <sup>34</sup> offered a new way to represent the presence of the spirits he had tried to capture in earlier works that employed actual figures. These new

<sup>35</sup> shapes themselves say what the figures once said. The artist imagined that the colors and shapes would create a kind of

direct <sup>36</sup> communication, between himself and the viewer which might touch the viewer with a higher spirituality.

His original technique of applying color helped Rothko achieve the power and spirituality of his work. In *Orange and Yellow* (1956) he layered color on color, placing the bright, rich yellow and orange on a background of duller, softer orange. <sup>37</sup> The result is a remarkable effect of light: the radiance of the yellow interacts with the smoldering orange, and both are tempered by the gentle orange

<sup>38</sup> which has been placed behind the other two colors.

The entire painting <sup>39</sup> one of Rothko’s most famous, is imbued with a luminous quality.

Fourteen Rothko paintings can be seen at the Rothko Chapel at Saint Thomas Catholic University in Texas. All of these paintings are in hues of dark purple, maroon, and black. The darkness of the works <sup>40</sup> floods the

34. F. NO CHANGE  
G. offer  
H. presents  
J. offering
35. A. NO CHANGE  
B. shapes himself  
C. shapes; themselves  
D. shapes, themselves
36. F. NO CHANGE  
G. communication, with  
H. communication, with,  
J. communication between
37. A. NO CHANGE  
B. (Do not begin a new paragraph) Nevertheless the  
C. (Begin a new paragraph) Nevertheless the  
D. (Begin a new paragraph) In the
38. F. NO CHANGE  
G. in the background.  
H. being placed in the background.  
J. color.
39. A. NO CHANGE  
B. painting, one of Rothko’s most famous  
C. painting, one of Rothko’s most famous,  
D. painting, one of Rothko’s most, famous
40. Which choice best reinforces the feeling that the darkness was intense?  
F. NO CHANGE  
G. appears to  
H. makes aware  
J. seeps through to

**PROCEED TO NEXT PAGE.**

viewer and expresses Rothko's mood of melancholy, and  
sense of loss in his last years. 42<sup>41</sup>

As it turns out, these works, but they would not be  
unveiled until the Chapel's opening in 1971, are his final  
statement to the world. Rothko committed suicide on  
February 25, 1970. The beautiful hues in the works  
foreshadowed his tragic death. 45<sup>44</sup>

41. A. NO CHANGE  
B. mood of melancholy and, sense of loss  
C. mood of melancholy and sense of loss,  
D. mood of melancholy and sense of loss
42. Which of the following true statements would draw a conclusion consistent with the information presented in the paragraph?
- F. Landscapes were other types of work Rothko created in earlier times.  
G. These fourteen paintings stand as a final testament to Rothko's belief in the power of color.  
H. Color was also an important element in Rothko's earlier work.  
J. Other examples of Rothko's use of these colors can be found in the Yale Art Gallery.
43. A. NO CHANGE  
B. however they  
C. which  
D. and
44. If all the choices are true, which one is most consistent with the tone of the essay?
- F. NO CHANGE  
G. luminous qualities of his art  
H. Chapel's impressive size  
J. melancholic colors of the Chapel

Question 45 asks about the preceding passage as a whole.

45. If the writer had intended to convey an aspect of Rothko's talent, would this essay successfully attain the goal?
- A. Yes, because the essay describes the central role of color in Rothko's paintings.  
B. Yes, because the essay includes biographical information on Rothko.  
C. No, because the essay gives no examples of Rothko's portraiture.  
D. No, because the essay focuses more on Rothko's subjects than on his technique.

**STOP. BE CERTAIN NOT TO EXCEED THE ALLOTTED TIME. YOU MAY PROCEED TO SECTION 2 WHEN TOLD TO DO SO.**

**No Testing Material On This Page**

# SAT Reading Test

42 MINUTES, 33 QUESTIONS

Locate Section 2 of your bubblesheet to record the questions in this section.

## DIRECTIONS

Read the passages below and then choose the best answer for each question based on what was written or implied in the passage or passages as well as the accompanying graphics (such as a table, graph, or diagram).

### Question 1–11 are based on the following passage.

This passage is adapted from Daniel Defoe, *Robinson Crusoe*, originally published in 1719.

I was born in the year 1632, in the city of York, of a good family, though not of that country, my father being a foreigner of Bremen, who settled first at Hull. He got a good estate by merchandise, and leaving off his trade, lived afterwards at York, from whence he had married my mother, whose relations were named Robinson, a very good family in that country, and from whom I was called Robinson Kreutznaer; but, by the usual corruption of words in England, we are now called - nay we call ourselves and write our name - Crusoe; and so my companions always called me.

I had two elder brothers, one of whom was lieutenant-colonel to an English regiment of foot in Flanders, formerly commanded by the famous Colonel Lockhart, and was killed at the battle near Dunkirk against the Spaniards. What became of my second brother I never knew, any more than my father or mother knew what became of me.

Being the third son of the family and not bred to any trade, my head began to be filled very early with rambling thoughts. My father, who was very ancient, had given me a competent share of learning, as far as house-education and a country free school generally go, and designed me for the law; but I would be satisfied with nothing but going to sea; and my inclination to this led me so strongly against the will, nay, the commands of my father, and against all the entreaties and persuasions of my mother and other friends, that there seemed to be something fatal in that propensity of nature, tending directly to the life

of misery which was to befall me.

My father, a wise and grave man, gave me serious and excellent counsel against what he foresaw was my design. He called me one morning into his chamber, where he was confined by the gout, and expostulated very warmly with me upon this subject. He asked me what reasons, more than a mere wandering inclination, I had for leaving father's house and my native country, where I might be well introduced, and had a prospect of raising my fortune by application and industry, with a life of ease and pleasure. He told me it was men of desperate fortunes on one hand, or of aspiring, superior fortunes on the other, who went abroad upon adventures, to rise by enterprise, and make themselves famous in undertakings of a nature out of the common road; that these things were all either too far above me or too far below me; that mine was the middle state, or what might be called the upper station of low life, which he had found, by long experience, was the best state in the world, the most suited to human happiness, not exposed to the miseries and hardships, the labour and sufferings of the mechanic part of mankind, and not embarrassed with the pride, luxury, ambition, and envy of the upper part of mankind. He told me I might judge of the happiness of this state by this one thing - viz. that this was the state of life which all other people envied; that kings have frequently lamented the miserable consequence of being born to great things, and wished they had been placed in the middle of the two extremes, between the mean and the great; that the wise man gave his testimony to this, as the standard of felicity, when he prayed to have neither poverty nor riches.

**PROCEED TO NEXT PAGE.**



65 He bade me observe it, and I should always find  
that the calamities of life were shared among the  
upper and lower part of mankind, but that the middle  
station had the fewest disasters, and was not exposed  
to so many vicissitudes as the higher or lower part of  
70 mankind.

1

The main purpose of the passage is to

- A) discuss some grave character flaws in Robinson Crusoe.
- B) focus on the efforts of a father to convince his son on how best to live his life.
- C) provide an overview of how a family in the early 1600s decided on the best way to live a life of ease and pleasure.
- D) explain the relationship between a father and his son.

2

Which best summarizes the third and fourth paragraphs of the passage (lines 32–64)?

- A) A father, who is deeply concerned about his son's choice to leave home and country, tries to make a strong case for him to stay.
- B) A son's fatal attraction to the sea and why he misjudges happiness.
- C) A wise and grave father convinces his son to pursue what he called "the upper station of low life."
- D) A son has to wrestle with his decision to go along with the wishes of his father and mother.

3

The narrator indicates that his choice to go to sea led him to a life of

- A) solitude.
- B) fortune.
- C) misery.
- D) self-satisfaction.

4

Which choices provide the best evidence for the answer to the previous question?

- A) Lines 12–16 ("I...Spaniards")
- B) Lines 21–31 ("My...me")
- C) Lines 38–41 ("I...pleasure")
- D) Lines 65–70 ("He...mankind")

5

As used in line 9, "corruption" most nearly means

- A) evolution.
- B) dishonesty.
- C) crime.
- D) misuse.

6

It can most reasonably be inferred that after the narrator left home, his parents

- A) missed him enormously.
- B) realized he had a propensity to travel and seek adventure.
- C) were greatly pleased with his success after all.
- D) did not know what happened to him.

7

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 4–11 ("He...me")
- B) Lines 16–18 ("What...me")
- C) Lines 41–55 ("He...mankind")
- D) Lines 55–64 ("He ... riches")

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8

Which situation is most similar to the one described in lines 1–11 (“I was ... me”)?

- A) A son who is born into a well-to-do family decides to change his name after being corrupted by society.
- B) A sea captain decides to shorten his long, foreign-sounding name so that everyone will remember his name.
- C) A family placed in the middle of something larger than itself reluctantly agrees to its name being shortened.
- D) A long family name that originated in Germany is shortened when the family moves to France and the family does not fight to retain the original pronunciation of the name.

9

As used in line 28, “entreaties” most nearly means

- A) peace offerings.
- B) pleas.
- C) discussions.
- D) tears.

10

Which choice best summarizes the father’s view on what was most suited to a life of happiness?

- A) Seeking neither fortune nor fame, but rather aiming for the middle state.
- B) Resisting a life of ease and pleasure.
- C) Cherishing what one has and not wishing for what one doesn’t have.
- D) Seeking true adventure and ignoring a materialistic life.

11

The author’s father can best be described as

- A) wise and unconcerned.
- B) serious and distrustful.
- C) caring and inquisitive.
- D) trusting and ambitious.

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**Question 12–22 are based on the following passage.**

This passage is adapted from news accounts published by The Washington Post, The New York Times and The Associated Press during the first few days that followed the historic Supreme Court ruling that struck down campaign finance reform in April of 2014.

The Supreme Court’s controversial landmark decision in 2014 to abolish the limits on campaign contributions, struck down the ceilings on the maximum amount of money an individual can  
Line 5 contribute to federal candidates in a two-year election cycle. The justices said that the old campaign finance laws violated free-speech rights.

The divisive 5–4 decision put an end to the limit on the amount of money wealthy donors can  
10 contribute to candidates and political committees. The decision illustrates a deeply divided court: the liberal justices were in favor of keeping in place the current campaign finance restrictions that they argue are key to ensuring that the rich do not  
15 have undue influence over the electoral process, while the conservative justices argued that the First Amendment (freedom of expression) prohibits Congress from creating laws that restrict the exercise of First Amendment rights in the form of campaign  
20 contributions.

The justices’ contentious decision drew a distinction between contributions, which the court said could be limited to prevent corruption or the appearance of corruption, and expenditures, which  
25 the court determined were a form of direct personal expression.

“There is no right more basic in our democracy than the right to participate in electing our political leaders,” wrote Chief Justice John G. Roberts Jr. in  
30 the court’s main opinion. “We have made clear that Congress may not regulate contributions simply to reduce the amount of money in politics, or to restrict the political participation of some in order to enhance the relative influence of others.”

The liberal justices represented by Justice Stephen G. Breyer sharply disagreed with the court’s ruling. Breyer read his dissent from the bench: “Today’s decision, we fear, will open a floodgate,” He underscored that the ruling “overturns key precedent,  
40 creates serious loopholes in the law and undermines, perhaps devastates, what remains of campaign finance reform.”

U.S. Senator John McCain, a republican from the state of Arizona, who sponsored the 2002 Bipartisan  
45 Campaign Finance Reform ACT with U.S. Senator

Russell Feingold, a democrat from Wisconsin, said the current ruling “may represent the latest step in an effort by a majority of the court to dismantle entirely the long-standing structure of campaign finance  
50 law erected to limit the undue influence of special interests on American politics.”

It was almost as if Justice Roberts had anticipated responses similar to McCain’s. “Money in politics may at times seem repugnant to some, but so  
55 too does much of what the First Amendment vigorously protects,” Roberts wrote. “If the First Amendment protects flag burning, funeral protests and Nazi parades—despite the profound offense such spectacles cause—it surely protects political  
60 campaign speech despite popular opposition.”

The decision struck down a law that very few Americans could afford to violate; the amount of money an individual could contribute over two years to candidates and political committees. Under the  
65 old law, individuals could not contribute more than \$48,600 to candidates, plus an additional \$74,600 to political committees.

Republican Party officials cheered the opinion. The ruling “is an important first step toward restoring  
70 the voice of candidates and party committees and a vindication for all those who support robust, transparent political discourse,” said Reince Priebus, chairman of the Republican National Committee.

Justice Breyer’s dissent, argues that the court’s  
75 decision is unconstitutional. “The First Amendment advances not only the individual’s right to engage in political speech, but also the public’s interest in preserving a democratic order in which collective speech matters,” Breyer wrote. “Where enough  
80 money calls the tune, the general public will not be heard . . . And a cynical public can lose interest in political participation altogether.”

Breyer argued that removing the aggregate limits on campaign contributions created large  
85 loopholes that will allow the rich to unduly influence government. An individual he called “Rich Donor” could write a check for \$3.6 million to benefit his political party and its candidates because of the loopholes, he said.

Roberts took issue with Breyer’s reasoning. Roberts wrote that the counter arguments presented by the dissenters and the government, “are either  
90 illegal under current campaign finance laws or divorced from reality.”

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12

As used in line 3, “ceilings” is closest in meaning to

- A) excesses.
- B) upper limits.
- C) amounts.
- D) glass floors.

13

The judges struck down the current campaign law that limited the amount of money an individual could contribute based on the fact that

- A) money in politics is not repugnant.
- B) it’s a violation of the Campaign Finance Reform Act.
- C) people are free to elect and support the candidates of their choice.
- D) it’s a violation of the First Amendment.

14

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 11–20 (“The decision ... contributions”)
- B) Lines 27–34 (“There is ... others”)
- C) Lines 68–72 (“Republican Party ... Committee”)
- D) Lines 90–94 (“Roberts ... reality”)

15

What is Justice Stephen G. Breyer’s biggest concern (lines 35–42) about the new ruling?

- A) It may put an end to campaign finance reform.
- B) It might encourage more unqualified candidates to run for office.
- C) It could jeopardize the First Amendment.
- D) It will overturn other key precedents that the middle class is dependent upon.

16

The statements made in paragraph eight (lines 61–67) indicates that the ruling will most likely help

- A) the wealthiest Americans.
- B) the disenfranchised.
- C) the middle class.
- D) the candidates who have little financial support.

17

What is one of the impacts that Justice Breyer believes “Rich Donor” may ultimately have on voting in the United States?

- A) It may encourage more people to run for office.
- B) It will make more candidates think twice before the run for office.
- C) It may discourage the public from participating in politics.
- D) It will prove to be a benefit to the Republican party candidates.

18

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1–6 (“The Supreme ... cycle”)
- B) Lines 8–20 (The divisive ... contributions”)
- C) Lines 35–42 (“The liberal ... reform”)
- D) Lines 74–82 (“Justice Breyer’s ... altogether”)

19

As used in line 83, “aggregate” most nearly means

- A) most.
- B) complete.
- C) highest.
- D) total.

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20

Chief Justice Roberts (lines 90–94) counters Breyer’s argument in a manner that could best be categorized as

- A) cold and scholarly
- B) respectful but strong
- C) legal and sarcastic
- D) rhetorical but direct

21

Based on the U.S. Supreme Court’s decision to abolish limits on campaign finance, it is reasonable to conclude that

- A) Supreme Court Justices, while they don’t always agree on legal matters, have great admiration for one another when they’re off the bench.
- B) Supreme Court Justice have no issue with writing highly critical and biting remarks about their colleagues’ legal decisions.
- C) Supreme Court Justices believe that their legal actions will come under fierce attack.
- D) Supreme Court Justices care deeply about the U.S. and work to uphold the Constitution to the letter of the law.

22

What is the author’s main point about the Supreme Court’s 2014 decision?

- A) Rich people will now have more influence over government.
- B) Poor people will now have less influence over government.
- C) The decision will only limit the wealthiest Americans.
- D) The decision has further ignited a controversial debate over campaign reform.

**Question 23–33 are based on the following passage.**

Passage 1 is adapted from Gurdev S Khush, “Genetically modified crops: the fastest adopted crop technology in the history of modern agriculture” by Agriculture & Food Security. Passage 2 is adapted from Charles Benbrook, “Impacts of genetically engineered crops on pesticide use in the U.S. – the first sixteen years” by Environmental Sciences Europe.

**Passage 1**

Over the last thirty years, many of the crops that humans eat—corn, soybeans, wheat, for example—have been modified on a genetic level. Like other genetically modified (GM) crops, corn is still corn, *Line* 5 but the DNA of the corn has been altered to provide the maximum amount of utility to both the consumer and the farmer.

The continued adoption of GM crops has helped the environment as well as the farmer, opines Clive *10* James, founder of The International Service for the Acquisition of Agri-biotech Applications. James, who has published annual reports on the global status of commercialized GM crops since 1990, cites sources that estimate the value of increased crop production *15* from planting GM crops between 1996 and 2010 at \$78 billion. These plantings, he said, also effected savings of 443,000,000 kg of pesticides, thereby contributing to environmental sustainability. In 2010 alone, GM crops helped reduce CO2 emissions by *20* 19 billion kg, the equivalent to taking approximately nine million cars off the road.

GM crops are beneficial to farmers’ livelihoods. They produce foods that last longer before perishing than their non-GM counterparts. They produce *25* bigger yields than non-GM crops because farmers can more efficiently combat pests, weeds, and diseases. Because of these multifarious benefits, GM crops have helped alleviate poverty by increasing incomes for 15 million small farmers who are among *30* the poorest in the world.

While opponents of GM farming categorize its bounty as unsafe for human consumption, distinguished international scientific organizations such as the American Association for the *35* Advancement of Science and U.S. National Academy of Sciences have offered volumes of compelling and internationally accepted scientific data that demonstrate that GM foods are as safe as those harvested from conventionally raised crops.

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**Passage 2**

40 Genetically engineered crops have not come without a cost to the consumer, the farmer and the environment. A growing number of herbicide-resistant (HR) weeds, a byproduct of the burgeoning genetically modified (GM) agribusiness, are forcing  
45 farmers to increase herbicide application rates and to apply different herbicides to prevent new, unforeseen blights before they manifest.

At one time, the notion of applying herbicides such as glyphosate to commercial crops was  
50 unimaginable. Glyphosate, a non-selective herbicide, killed both crops and weeds alike. However, as early as 1996, scientists created and planted the first genetically modified soybean and canola to resist glyphosate. Farmers could now easily combat the  
55 weeds that disturbed their crops.

These developments led to a substantial increase in the use of herbicide per hectare\* from 1996 through 2011. This increase has had harmful effects on the environment and the actual fruits of its  
60 efforts. The upward trend in herbicide use on GM crops compared to non-GM crops not only led to the emergence and rapid spread of herbicide-resistant weeds, but also resulted in more toxins disseminating

into drinking water sources.

65 An estimated 94 percent of the soybean crop in the U.S. in 2011 was planted as a GM variety. Similarly, 72 percent of maize (corn) and 96 percent of cotton planted in 2011 were planted as GM varieties. The frequency of human exposures to  
70 toxic herbicides and levels of exposure via food, drinking water, and the air have risen in the U.S. in recent years. More than two-thirds of air and rainfall samples tested in Mississippi and Iowa in 2007 and 2008 contained glyphosate.

75 Heightened risk of public health impacts can be expected with more intensive herbicide use to protect GM crops. Stephanie Seneff, a research scientist at the Massachusetts Institute of Technology, noted that when ingested, some common herbicides can slowly  
80 disrupt normal body functions and induce diseases such as Parkinson's and various forms of cancer. Though they may make the life of a farmer easier, it is imperative that the use of glyphosate is halted until regulators determine whether it is fully safe when  
85 ingested by humans.

\* a metric unit of square measure, equal to 2.471 acres or 10,000 square meters.

The following table is adapted from Charles Benbrook, "Impacts of genetically engineered crops on pesticide use in the U.S. – the first sixteen years" by Environmental Sciences Europe.

Projected rates of change in herbicide use, 2005-2011

| <b>Corn</b>      | <b>2010–2011</b> | <b>2005–2010 (aggregate)</b> | <b>2005–2010 (per year)</b> |
|------------------|------------------|------------------------------|-----------------------------|
| Total Herbicides | 2%               | 10.2%                        | 2.0%                        |
| Glyphosate       | 2.5%             | 12.9%                        | 2.6%                        |
| <b>Soybeans</b>  | <b>2010–2011</b> | <b>2005–2010 (aggregate)</b> | <b>2005–2010 (per year)</b> |
| Total Herbicides | 3.2%             | 35.2%                        | 5.9%                        |
| Glyphosate       | 3.3%             | 53.4%                        | 8.9%                        |
| <b>Cotton</b>    | <b>2010–2011</b> | <b>2005–2010 (aggregate)</b> | <b>2005–2010 (per year)</b> |
| Total Herbicides | 2.2%             | 3.1%                         | 0.06%                       |
| Glyphosate       | -1%              | -10.3%                       | -2.1%                       |

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23

The author of Passage 1 suggests that the usefulness of GM crops may benefit

- A) the environment.
- B) consumer and farmers.
- C) research scientists and farmers.
- D) consumer, farmers and the environment.

24

Which best describes the evidence for the answer to the previous question?

- A) Lines 1–11 (“Over ... Applications”)
- B) Lines 16–21 (“These plantings ... off the road”)
- C) Lines 22–24 (“GM crops ... non-GM counterparts”)
- D) Lines 27–30 (“Because of these ... world”)

25

As used in line 33, “distinguished” most nearly means

- A) woefully undermined.
- B) easily discerned.
- C) eminently royal.
- D) highly respected.

26

The author of Passage 2 indicates that ultimately the use of glyphosate primarily should be seen as the catalyst that led to

- A) scientists creating and planting genetically modified plants.
- B) harmful effects on crops and the environment.
- C) unimaginable commercial crops.
- D) an overall decrease in the use of herbicide.

27

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 50–54 (“Glyphosate ... resist glyphosate”)
- B) Lines 56–59 (“These developments ... efforts”)
- C) Lines 65–72 (“An estimated ... years”)
- D) Lines 82–85 (“Though they ... humans”)

28

As used in line 55, “disturbed” most nearly means

- A) unbalanced.
- B) worried.
- C) hindered.
- D) interrupted.

29

The reference to the percentages of soybean, maize and cotton planted in the U.S. in 2011 (lines 65–69) serves mainly to

- A) make the case that due to rainfall alone more than 66 percent of Americans have been exposed to toxic herbicides.
- B) argue that Mississippi and Iowa are two states one should avoid due to toxic air and rainfall.
- C) make the case that a very large percentage of Americans who eat GM crops are exposed to toxic herbicides.
- D) argue that people should avoid eating GM varieties of soybean and maize (corn) based products.

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30

According to the table, which statement is true about the projected change in glyphosate use from the year 2010 to the year 2011?

- A) The rate of change of glyphosate on corn crops is projected to be wildly out of proportion to the rate of change in each of the five years previous.
- B) The amount of glyphosate used on cotton crops is projected to decrease for the first time since 2005.
- C) About 53.4% of all soybean crops planted between 2005 and 2010 received glyphosate applications at some point during their growth.
- D) The rate of increase of glyphosate use on soybean crops is projected to be smaller between 2010 and 2011 than it typically was between 2005 and 2010.

31

Which choice best states the relationship between the two passages?

- A) Passage 1 states that genetically modified crops will reduce the cost of food in the marketplace, while Passage 2 states that GM crops will increase the cost of food.
- B) Passage 1 argues that genetically modified crops benefit the consumer, the farmers, and the environment, while Passage 2 argues that GM crops pose a risk to the consumer and the environment.
- C) Passage 1 states that genetically modified crops do not benefit the consumer, while Passage 2 states that genetically modified crops are unhealthy.
- D) Passage 1 argues that genetically modified crops have increased dramatically since 1990, while Passage 2 argues that this increase is not as large as it appears to be.

32

How would the author of Passage 2 most likely respond to the assertion made in paragraph three (lines 22–30) that GM crops are beneficial to farmers' livelihoods and alleviating poverty?

- A) With disdain, because a thorough examination of farmers' wages illustrates that GM crops have not increased their livelihoods.
- B) With approval, because GM crops have increased farmers' livelihoods and reduced poverty.
- C) With concern, because while GM crops may be beneficial to farmers' livelihoods and alleviating poverty, this type of farming is likely to heighten the risk of public health issues.
- D) With excitement, because GM crops are the best way to rid the world of hunger.

33

Which choice would best support how the author of Passage 1 would most likely respond to the charge of "heightened risk of public impact" (line 75, Passage 2) due to intensive herbicide use to protect GM crops?

- A) Lines 9–11 (The ... applications)
- B) Lines 11–21 (James ... road)
- C) Lines 22–30 (GM ... world)
- D) Lines 31–39 (While ... crops)

**STOP. BE CERTAIN NOT TO EXCEED THE ALLOTTED TIME. YOU MAY PROCEED TO SECTION 3 WHEN TOLD TO DO SO.**



**No Testing Material On This Page**

**ACT MATHEMATICS TEST**

40 Questions — 40 Minutes

**DIRECTIONS:** Solve the problems, select the correct answer, and fill the corresponding bubble on your bubblesheet.

Do not spend too much time on a single problem. Solve as many problems as you are able; once finished, return to any problem in the remaining time.

You are allowed to use a calculator on this section of the exam, but some problems on the exam may actually be

easier to solve without the use of a calculator.

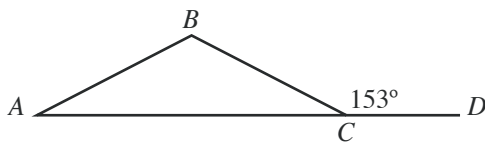
**NOTE:** Unless stated otherwise, the following may be assumed.

1. Illustrated figures are NOT always drawn to scale.
2. Geometric figures are in a plane.
3. The word *line* means a straight line.
4. The word *average* means arithmetic mean.

1. Ashwin purchased 100 shares of stock at \$22.50 per share. Each share rose \$0.40 during his first month of ownership, dropped \$0.25 during the second, and rose \$0.05 during the third. What is the current value of Ashwin's investment?
  - A. \$2260
  - B. \$2270
  - C. \$2320
  - D. \$2950
  - E. \$3250

**DO YOUR WORK HERE.**

2. For what value of  $x$  is the equation  $\frac{5(x-3)}{4} = 20$  true?
  - F. 13
  - G. 16
  - H. 19
  - J. 22
  - K. 28
3. A bag of licorice candies contains 28 red licorice pieces and 32 black licorice pieces. What is the ratio of red pieces to black pieces?
  - A. 1:7
  - B. 1:8
  - C. 7:8
  - D. 7:15
  - E. 8:7
4. In the figure below,  $\overline{AB}$  is congruent to  $\overline{BC}$  and  $A, C,$  and  $D$  are collinear. What is the measure of  $\angle ABC$  ?
  - F.  $36^\circ$
  - G.  $63^\circ$
  - H.  $117^\circ$
  - J.  $126^\circ$
  - K.  $153^\circ$

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5. What is the result of the subtraction problem below?

$$(4x^2 + 3) - (-3x^2 - x + 5)$$

- A.  $x^2 - x - 2$
- B.  $x^2 + x - 2$
- C.  $x^2 + x + 8$
- D.  $7x^2 - x - 2$
- E.  $7x^2 + x - 2$

6. A swimming pool in the shape of a right rectangular prism has length 14 feet and width 18 feet. The volume of the water in the pool is 3780 cubic feet. To the nearest foot, what is the depth of the water in the pool?

- F. 7
- G. 10
- H. 15
- J. 25
- K. 120

7. Which of the following is the least common denominator

of the fractions  $\frac{a}{4}$ ,  $\frac{b}{5}$ , and  $\frac{c}{30}$  ?

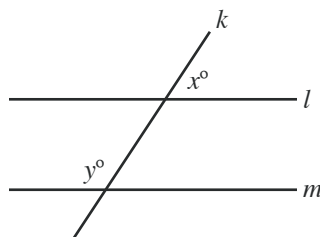
- A. 30
- B. 60
- C. 120
- D. 240
- E. 600

8. The average of  $x$ ,  $2x$ ,  $4x$  and  $8x$  is 67.5. What is the value of  $x$  ?

- F.  $\frac{9}{8}$
- G.  $\frac{9}{2}$
- H. 6
- J. 9
- K. 18

9. In the figure below, lines  $l$  and  $m$  are parallel and intersect at line  $k$  as shown. Which of the following equations must be true?

- A.  $x = 2y$
- B.  $x = y$
- C.  $x = 90 - y$
- D.  $x = 180 - y$
- E.  $x = 360 - 2y$



**DO YOUR WORK HERE.**

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10. Which of the following expressions is equivalent to  $(4a^3b^2)(5ab^3)$  ?

F.  $9a^3b^{10}$   
 G.  $9a^4b^7$   
 H.  $20a^3b^7$   
 J.  $20a^3b^{10}$   
 K.  $20a^4b^7$

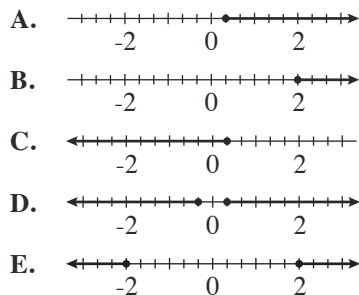
11. Which of the following translations shifts all points graphed in the  $(x,y)$  coordinate plane to the left by 3 units?

A.  $(x,y) \rightarrow (x,y-3)$   
 B.  $(x,y) \rightarrow (x,y+3)$   
 C.  $(x,y) \rightarrow (-3x,y)$   
 D.  $(x,y) \rightarrow (x-3,y)$   
 E.  $(x,y) \rightarrow (x+3,y)$

12. Carlie flipped a coin 162 times. The coin landed with the heads side up 52 more times than it landed with the tails side up. How many times did it land with the heads side up?

F. 87  
 G. 93  
 H. 103  
 J. 107  
 K. 110

13. Which of the following number line graphs represents the solution set of the inequality  $6x + 5 \geq 7$  ?



14. In the standard  $(x,y)$  coordinate plane, what is the slope of the line with equation  $4x + 5y = 10$  ?

F.  $-2$   
 G.  $-\frac{5}{4}$   
 H.  $-\frac{4}{5}$   
 J.  $\frac{4}{5}$   
 K.  $\frac{5}{4}$

**DO YOUR WORK HERE.**

**PROCEED TO NEXT PAGE.**



15. The table below shows the daily noon temperatures for Minneapolis, Minnesota between Monday, March 9, 1987, and Sunday, March 15, 1987. If the median noon temperature for this week was  $33^\circ\text{F}$ , which of the following could NOT have been Sunday's noon temperature?

| Day       | Noon Temperature ( $^\circ\text{F}$ ) |
|-----------|---------------------------------------|
| Monday    | $29^\circ$                            |
| Tuesday   | $33^\circ$                            |
| Wednesday | $40^\circ$                            |
| Thursday  | $22^\circ$                            |
| Friday    | $35^\circ$                            |
| Saturday  | $36^\circ$                            |
| Sunday    |                                       |

- A.  $11^\circ$   
 B.  $29^\circ$   
 C.  $32^\circ$   
 D.  $33^\circ$   
 E.  $35^\circ$
16. What is the solution set of the equation  $x^2 - 2x = 15$ ?
- F.  $\{-5, 3\}$   
 G.  $\{-3, 5\}$   
 H.  $\{-3, 2\}$   
 J.  $\{0, 2\}$   
 K.  $\{3, 5\}$
17. Will earns a weekly salary of  $P$  dollars, of which  $Q$  dollars is withheld for federal and state taxes and  $R$  dollars is withheld for his retirement savings. The remaining money represents Will's take-home pay. What fraction of Will's weekly salary is his take-home pay?

- A.  $\frac{Q+R}{P}$   
 B.  $\frac{P}{Q+R}$   
 C.  $\frac{P-Q-R}{P}$   
 D.  $\frac{Q+R-P}{P}$   
 E.  $\frac{P}{P+Q+R}$

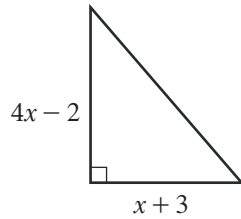
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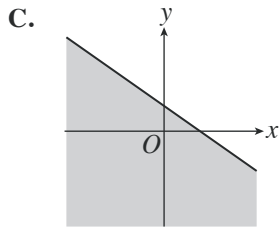
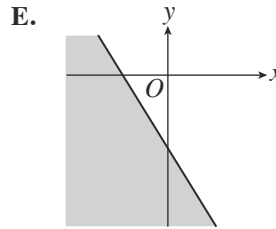
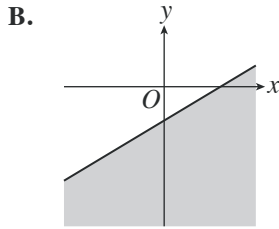
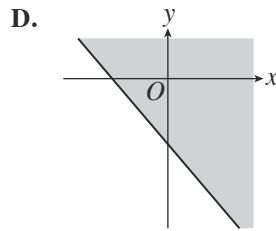
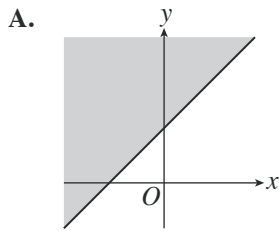
18. The dimensions of the right triangle shown below are given in feet. What is the area, in square feet of the triangle?

- F.  $2x^2 - 3$   
 G.  $2x^2 + 5x - 3$   
 H.  $4x^2 - 6$   
 J.  $4x^2 + 10x - 3$   
 K.  $4x^2 + 10x - 6$



**DO YOUR WORK HERE.**

19. Which of the following graphs in the standard  $(x,y)$  coordinate plane is the graph of  $y \leq ax + b$ , where  $a > 0$  and  $b < 0$ ?



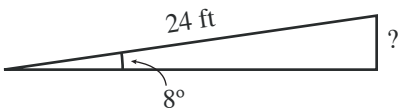
20. If  $|x - 9| = 11$ , what are the possible values of  $x$ ?

- F.  $-20$  and  $2$   
 G.  $-20$  and  $20$   
 H.  $-2$  and  $2$   
 J.  $-2$  and  $20$   
 K.  $9$  and  $20$

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21. As shown below, a 24-foot ramp forms an angle of  $8^\circ$  with the ground, which is horizontal. Which of the following is an expression for the vertical rise, in feet, of the ramp?



- A.  $24 \sin 8^\circ$   
 B.  $24 \cos 8^\circ$   
 C.  $24 \tan 8^\circ$   
 D.  $24 \sec 8^\circ$   
 E.  $24 \csc 8^\circ$
22. Rami took a survey of the entire junior class at Highland Park High School. When he reported his results, he noticed that 68% of the class preferred weekly homework to daily homework. If 289 students in the junior class prefer weekly homework to daily homework, how many students are there in the junior class?
- F. 136  
 G. 289  
 H. 351  
 J. 425  
 K. 714
23. On October 1, the price of gasoline at Quick Mart was \$2.25 per gallon. On November 1, the price of gasoline was \$2.43. By what percent did the price of gasoline rise between October 1 and November 1?
- A. 7.4%  
 B. 8.0%  
 C. 9.0%  
 D. 12.5%  
 E. 18.0%
24. If  $f(x) = 2x + 1$  and  $g(x) = x^2$ , what is the value of  $f(g(4))$ ?
- F. 33  
 G. 51  
 H. 65  
 J. 81  
 K. 144

**DO YOUR WORK HERE.**

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25. If the circumference of a circle is  $\frac{7}{2}\pi$  inches, how many inches long is its radius?

- A.  $\frac{2}{7}$
- B.  $\frac{4}{7}$
- C.  $\frac{7}{4}$
- D.  $\frac{7}{2}$
- E.  $\sqrt{\frac{7}{2}}$

26. In the standard  $(x,y)$  coordinate plane, the point  $(6, -6)$  is the midpoint of the line segment with endpoints  $(4, -2)$  and:

- F.  $(2, 2)$
- G.  $(5, -4)$
- H.  $(5, -2)$
- J.  $(8, -10)$
- K.  $(8, 2)$

27. A toy rocket is launched from the ground. Its height,  $h$  ft. above the ground,  $t$  seconds after it is launched, is given by the function  $h = -16t^2 + 64t$ . How much did the rocket descend between 2 seconds and 3 seconds after it was launched?

- A. 8 ft.
- B. 16 ft.
- C. 24 ft.
- D. 32 ft.
- E. 64 ft.

28. Which of the following value is equal to  $(-2i)^4$  ?

- F.  $-16$
- G.  $-2$
- H.  $2i$
- J.  $16i$
- K.  $16$

**DO YOUR WORK HERE.**

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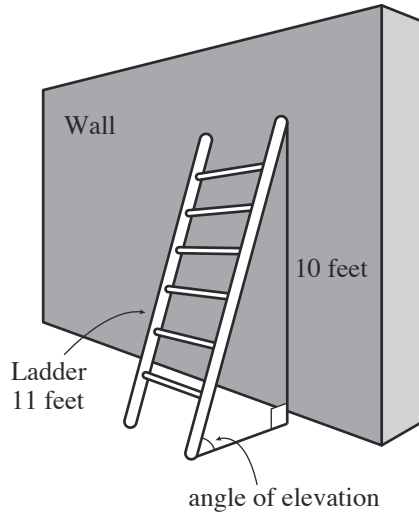




Use the following information to answer questions  
29–31.

DO YOUR WORK HERE.

In the diagram below, a ladder is leaned up against a wall. The top of the ladder reaches 10 feet up the wall. The angle of elevation is shown on the diagram.



29. What is the distance, in feet, from the base of the wall to the bottom of the ladder?
- A. 1  
 B.  $\sqrt{21}$   
 C. 5  
 D. 9  
 E.  $\sqrt{221}$

30. Suppose a 25-foot ladder was placed against the same wall so that its angle of elevation was congruent to the angle of elevation of the 11-foot ladder. Which of the following proportions correctly determines how far up the wall this ladder would reach?

- F.  $\frac{10}{x} = \frac{11}{25}$   
 G.  $\frac{10}{25} = \frac{11}{x}$   
 H.  $\frac{10}{x} = \frac{25}{11}$   
 J.  $\frac{\sqrt{21}}{x} = \frac{11}{25}$   
 K.  $\frac{\sqrt{21}}{10} = \frac{x}{11}$

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31. Which of the following calculations correctly determines the angle of elevation labeled in the diagram?

- A.  $\arcsin\left(\frac{10}{11}\right)$   
 B.  $\arccos\left(\frac{10}{11}\right)$   
 C.  $\arctan\left(\frac{10}{11}\right)$   
 D.  $\operatorname{arccot}\left(\frac{10}{11}\right)$   
 E.  $\operatorname{arccsc}\left(\frac{10}{11}\right)$

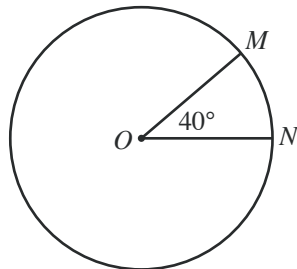
32. On a map in the standard  $(x,y)$  coordinate plane, the cities of Allentown and Burnham are represented by the points  $(-2,3)$  and  $(7,7)$ , respectively. Each unit on the map represents an actual distance of  $\frac{1}{2}$  mile. Which of the following is closest to the distance, in miles, between the two cities?

- F. 4.9  
 G. 6.5  
 H. 8.3  
 J. 9.2  
 K. 13.0

33. The distance from the Sun to Neptune is approximately  $4.503 \times 10^9$  km. The distance from the Sun to Venus is approximately  $1.08 \times 10^8$  km. About how much further away from the Sun than Venus is Neptune?

- A.  $4.169 \times 10^1$   
 B.  $4.395 \times 10^1$   
 C.  $4.169 \times 10^8$   
 D.  $2.137 \times 10^9$   
 E.  $4.395 \times 10^9$

34. In the circle shown below, central angle  $\angle MON$  measures  $40^\circ$  and  $\widehat{MN}$  is  $2\pi$  centimeters long. How many centimeters long is the radius?



- F. 4  
 G. 6  
 H. 9  
 J. 12  
 K. 18

**DO YOUR WORK HERE.**

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35. In the standard  $(x,y)$  coordinate plane, what are the coordinates of the center and the length of the radius of the circle with the equation  $(x - \sqrt{5})^2 + (y + 3)^2 = 4$  ?

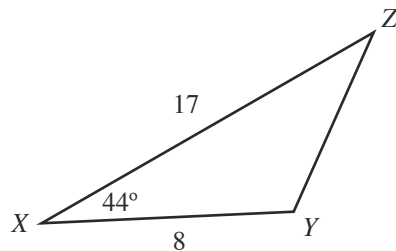
|    | <u>Center</u>     | <u>Radius</u> |
|----|-------------------|---------------|
| A. | $(-\sqrt{5}, 3)$  | 2             |
| B. | $(-\sqrt{5}, -3)$ | 4             |
| C. | $(\sqrt{5}, -3)$  | 2             |
| D. | $(\sqrt{5}, 3)$   | 4             |
| E. | $(\sqrt{5}, -3)$  | 16            |



DO YOUR WORK HERE.

36. In  $\triangle XYZ$  shown below, lengths given are in centimeters, and the measure of  $\angle X$  is  $44^\circ$ . Which of the following is closest to the length, in centimeters, of  $YZ$  ?

(Note: for any triangle with side lengths  $a$ ,  $b$ , and  $c$ ,  $a^2 = b^2 + c^2 - 2bc \cos \theta$ , where  $\theta$  is the measure of the angle opposite the side of length  $a$ . The value of  $\cos 44^\circ$  is approximately 0.72)



- F. 10.3  
G. 12.5  
H. 15.0  
J. 16.0  
K. 23.4

37. After five weeks of his new training regimen, Luke notices that the number of miles he has run each week forms a geometric sequence. During the first three weeks, Luke ran  $2\frac{2}{7}$ ,  $3\frac{3}{7}$ , and  $5\frac{1}{7}$  miles, respectively. How many miles did he run during the fifth week?

- A.  $8\frac{4}{7}$   
B.  $10\frac{1}{7}$   
C.  $10\frac{6}{7}$   
D.  $11\frac{4}{7}$   
E.  $13\frac{1}{7}$

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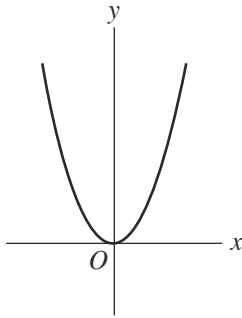
38. The system of equations below has multiple solutions all of which satisfy the equation  $y = \frac{5}{4}x - 2$ . What is the value of  $b$ ?

$$\begin{aligned} 15x - 12y &= 24 \\ 5x + by &= -2b \end{aligned}$$

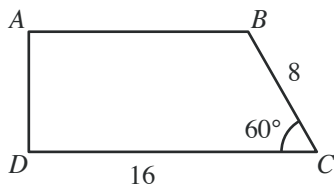
- F. -6
- G. -4
- H. -2
- J. 4
- K. 6

**DO YOUR WORK HERE.**

39. A parabola with equation  $y = ax^2$  is graphed in the standard  $(x,y)$  coordinate plane below. The value of  $a$  is greater than 1. Which of the following statements must be true?



- A. If  $(p,q)$  lies on the parabola, then  $(-p,q)$  lies on the parabola.
  - B. If  $(p,q)$  lies on the parabola, then  $(-p,-q)$  lies on the parabola.
  - C. The point  $(10,100)$  lies on the this parabola.
  - D. For all  $(p,q)$  on the parabola,  $|q| > |p|$ .
  - E. The graph of this parabola lies entirely in the first and fourth quadrants.
40. In trapezoid  $ABCD$  shown below,  $\angle C$  measures  $60^\circ$  and  $AD$  is perpendicular to  $CD$ . Which of the following values is closest to the area, in square units, of  $ABCD$ ?



- F. 48
- G. 83
- H. 97
- J. 111
- K. 128

**STOP. BE CERTAIN NOT TO EXCEED THE ALLOTTED TIME. YOU MAY PROCEED TO SECTION 4 WHEN TOLD TO DO SO.**

**No Testing Material On This Page**

**No Testing Material On This Page**

# SAT Writing and Language Test

26 MINUTES, 33 QUESTIONS

Locate Section 4 of your bubblesheet to record the questions in this section.

## DIRECTIONS

Read each passage carefully and then choose the answer choice that either improves the quality of writing or that conforms to the conventional standards of written English.

Each passage has questions that require you to correct errors in sentence structure, usage or punctuation. Other questions ask that you revise sentences to improve the expression of ideas.

There will also be questions that directly refer you to a portion of the passage and other questions will require you to consider the passage as a whole. This portion of the test also involves evaluating graphs, tables, and figures.

Choose “NO CHANGE” if you believe that the sentence is grammatically correct and does not need to be improved.

### Questions 1–11 are based on the following passage

#### Solunar Fishing

In the early hours of dawn, Angelo Agostinelli **1** sat in the cockpit of his fishing boat outside the Gloucester Harbor, a seascape dotted **2** with other boats, buoys, and lobster pot markers. Agostinelli fishes for whatever the sea yields, and he does so according to the relationship of the sun and the moon relative to each other. He didn’t always fish this way. When he began, he used methods familiar to most of his colleagues: sonar, tide tables, weather forecasts; but as he gained experience, he became convinced that “fish become more active during solunar periods than at other times” and that these periods were the best times to catch the fish.

1

- A) NO CHANGE
- B) sits;
- C) sat—
- D) had sat

2

- A) NO CHANGE
- B) between
- C) for
- D) on

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This type of fishing is based on the belief that a natural day for fish and many other animal species accords with a diurnal (twice daily) ‘biological clock’ that seems to coincide with lunar time. Solunar fishermen believe, **3** for instance, that the times of the new moon (the dark of the moon) and full moon are the periods of maximum intensity of fish movement and feeding. **4** Although the sun’s position also influences fish and animal behavior, solunar theory posits that the pull of the two celestial objects—sun and moon—is naturally strongest when the two are aligned, as in the new and full phases of the moon.

**5** Nature is nothing new. Pliny the Elder, a Roman observer of nature in the first century, stated that the moon “replenishes the Earth; when she approaches it, she fills all bodies, while, when she recedes, she empties them.” Ancient Egyptians and Chinese people performed tasks according to the lunar calendar, and, to this day, the vaunted *Old Farmer’s Almanac* includes regional lunar calendars and advice on **6** fishing and hunting. The **7** almanacs editor, Jason Booker, says: “This information is of value to our readers who practice solunar methods — and find great success.”

3

- A) NO CHANGE
- B) however,
- C) by contrast,
- D) therefore,

4

- A) NO CHANGE
- B) Because
- C) So
- D) DELETE the underlined portion and begin the sentence with a capital letter.

5

- A) NO CHANGE
- B) People all over the world fish by the moon.
- C) Fishing by the moon is not new.
- D) Talk of the moon’s influence is far-reaching.

6

- A) NO CHANGE
- B) actions relevant to fishing.
- C) points in time at which to undertake certain tasks.
- D) optimal times to find and catch the most fish.

7

- A) NO CHANGE
- B) almanacs’s
- C) almanac’s
- D) almanacs’

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Solunar fishing has its **8** skeptics, who are not sure of the method's efficacy. Recalling advice on the best lunar time to fish for bass, a Florida angler says her first reaction was “in a pig’s eye.” Current mainstream science does not factor lunar tables into **9** their explanation of fish behavior, so using them may seem quaint or even irrational. Additionally, solunar fishing owes as much to astrology as to astronomy, and few scientific studies have been conducted to measure the moon’s overall influence on fish behavior, **10** so supporters continue to wait for their practices to be verified.

Booker says, “We are of the mind that you accept or reject by choice.” Indeed, despite her doubts, the skeptical Florida angler wound up going after her bass according to solunar tables and claims her catch was “the best I ever had.” Marine biologist Zoe Burgard has a similar response to Agostinelli’s bounty in Massachusetts. **11** “Look at the number of fish, and the wide variety,” she says. “How can you say his methods don’t work?” At this stage, one could only conclude that the evidence must be experienced to be believed.

8

- A) NO CHANGE
- B) skeptics, who have yet to be convinced.
- C) skeptics — those who doubt this method.
- D) skeptics.

9

- A) NO CHANGE
- B) those
- C) it’s
- D) its

10

The writer wants to conclude the paragraph effectively while also reinforcing the point that doubt still exists about the efficacy of solunar fishing. Which choice accomplishes this goal?

- A) NO CHANGE
- B) and therefore no scientific data on the subject exist at this time.
- C) yet many continue to practice solunar fishing.
- D) leading many to conclude that solunar fishing is unsustainable.

11

Which choice gives an additional supporting example that emphasizes the importance of the senses in judging the success of the solunar fishing method?

- A) NO CHANGE
- B) “Look at the beauty of the seascape here in Gloucester!”
- C) “I’ve taken notes on the size of the catch for the last three trips out.”
- D) “Most of the solunar tables predict that tomorrow will be an excellent day to fish.”

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**Questions 12–22 are based on the following passage****Vanishing Forests: A Threat to Global Agriculture**

Forests play an important role in the agriculture industry by combating soil erosion and transpiring precipitation. Most studies indicate that global agriculture depends on appropriate growing conditions, including **12** fertile soil—to increase crop output.

The importance of soil **13** highlights the potentially disastrous affects of an emerging crisis: loss of forests leads to loss of soil and to disruption of the water cycle.

**14** They know it as deforestation, this phenomenon will have a detrimental impact on global agriculture if its causes and solutions are not quickly determined. As forest areas diminish, their ability to keep soil from eroding and precipitation to be regulated also declines. This loss of forest follows a pattern suggested by forest transition (FT) theory. Global population increase and the need for wood products create an expected decline in forest area, but the actual decline over the last fifty years **15** exceeded 2.5 percent of the forest area each recorded year. There was one sign of hope when the actual rate of decline slowed during the 1970's, yet in the following decades the loss of forest world-wide has accelerated. Between 2007 and 2012, the **16** rate of deforestation was an alarming 1 percent, with a loss of 3.6% of the world's total forest area.

12

- A) NO CHANGE
- B) fertile soil: this is
- C) fertile soil,
- D) fertile soil;

13

- A) NO CHANGE
- B) highlights the potentially disastrous effects
- C) highlight the potentially disastrous effects
- D) highlight the potentially disastrous affects

14

- A) NO CHANGE
- B) Known as deforestation,
- C) It is known as deforestation,
- D) Deforestation,

15

Which choice offers the most accurate interpretation of the data in the chart?

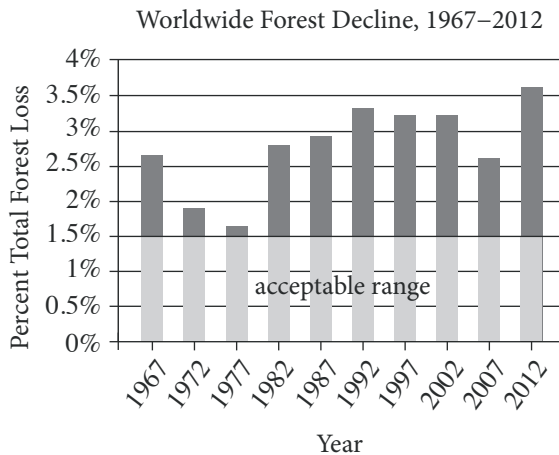
- A) NO CHANGE
- B) was over double what it had been five years previous.
- C) exceeded the acceptable level in all but one of the recorded years.
- D) exceeded the 1.5 percent acceptable range each recorded year.

16

Which choice offers an accurate interpretation of the data in the chart?

- A) NO CHANGE
- B) rate of deforestation was an alarming 3.2 percent,
- C) rate of deforestation rose over 1 percent,
- D) number of tree losses grew by 2.5 percent,

**PROCEED TO NEXT PAGE.**



Adapted from Dennis van Engelsdorp et al., "Preliminary Results: Honey Bee Colony Losses in the United States, Winter 2012-2013." ©2013 by the Bee Informed Partnership.

**17** Studies have offered several possible reasons for the loss of forest. One reason that is often cited is, paradoxically, the clearing of forest to create areas suitable for farming. **18** Deforestation for lumbering and to make space for city expansion and highways also play a role.

17

Which choice most smoothly and efficiently introduces the writer's discussion of studies of deforestation in this paragraph?

- A) NO CHANGE
- B) Trees are vanishing, and according to studies there are numerous possible reasons for this alarming trend.
- C) Several possible reasons, offered by different studies, may explain why so many trees are vanishing.
- D) DELETE the underlined sentence.

18

At this point the writer is considering adding the following sentence. "Another reason is the damage caused by insects and diseases introduced to areas where no natural protection exists." Should the writer make this addition here?

- A) Yes, because it provides another reason to explain loss of forest.
- B) Yes, because it introduces a new idea that will become important later in the passage.
- C) No, because it introduces a new idea that will not become important later in the passage.
- D) No, because it contradicts the main idea of the passage.

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Given the importance of forest cover to agriculture, the impact of this accelerating loss on soil erosion and water cycle regulation **19** is not to be scoffed at. A reduction in forest area leads to less ability to hold soil in place and less rainfall, which in turn leads to smaller food production and higher prices for scarce commodities. Some countries will have to resort to importing food **20** supplies; when there is a loss of food production, this being an expensive proposition. Other countries will have to ration food supplies for **21** they're population or try to change the eating habits of people. Furthermore, there may be sociological repercussions. Agroecologist Gilbert Rehbun has suggested that rising food prices could lead to an increase in obesity as people turn to cheaper, more filling but less wholesome, fare.

Though the causes of deforestation are clear, political and economic pressures make it difficult to reverse the process. More stringent control of slash-and-burn clearing operations, as well as more extensive tree replacement programs, could begin a shift in a more favorable direction. **22**

19

- A) NO CHANGE
- B) is a pretty big deal.
- C) can't be put on the back burner.
- D) cannot be ignored.

20

- A) NO CHANGE
- B) supplies, when there is a loss of food production and this is an expensive proposition.
- C) supplies, an expensive proposition when there is a loss of food production.
- D) supplies; an expensive proposition when there is a loss of food production.

21

- A) NO CHANGE
- B) there
- C) their
- D) it's

22

The writer wants a conclusion that addresses the future of efforts to combat deforestation. Which choice results in the passage having the most appropriate concluding sentence?

- A) NO CHANGE
- B) Still, forests have experienced such devastating losses that the consequences of the issue have been felt worldwide.
- C) Although deforestation is a relatively new phenomenon, scientists have been studying all aspects of the problem for over a century.
- D) The political will to address this issue is lacking, so there seems to be little that can be done.

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**Questions 23–33 are based on the following passage****Louis A. Lauder**

In 2013, cosmetics billionaire Louis A. Lauder donated his collection of Cubist masterpieces to New York City’s Metropolitan Museum of Art. The gift included 78 Cubist works—23 including paintings by Picasso, Braque, Leger, and Gris. The gift is estimated to be worth over a billion dollars.

24 Because of the astonishing size and value of the 25 donation to the Metropolitan Museum, choosing an area to display the items within the museum was a challenge. Working in conjunction with the architecture firm of Greenberg and Reichenbach, the museum staff developed plans for a new wing to be devoted exclusively to the Cubist collection. Soon viewers will be able to enjoy Picasso’s “Woman in an Armchair (Eva)” and Braque’s “Terrace at the Hotel Mistral”, 26 so as of now the collection is unavailable.

23

The writer is considering deleting the underlined portion (ending the sentence with a period). Should the writer do this?

- A) Yes, because the underlined portion detracts from the paragraph’s focus on Cubism.
- B) Yes, because the information in the underlined portion is provided in the previous sentence.
- C) No, because the underlined portion helps specify what is included in the gift.
- D) No, because the underlined portion gives an example of a particular Cubist work.

24

- A) NO CHANGE
- B) Regardless of
- C) In contrast to
- D) In addition to

25

- A) NO CHANGE
- B) donation of so many Cubist works,
- C) massive donation of art works,
- D) donation,

26

- A) NO CHANGE
- B) for
- C) and
- D) but

**PROCEED TO NEXT PAGE.**

This all is relatively new to the Met, which, surprisingly, acquired **27** their first Cubist work only in 1996. Although the museum loved Picasso, for example, one critic notes that “while the Museum of Modern Art was swallowing huge gulps of Cubism, the Met was satisfied with a menu made up primarily of Blue Period, Rose Period, and neo-Classical dishes.” The Met, **28** moreover, lacked examples of an important movement in art history.

The word Cubism was coined in 1908 to describe the paintings that took familiar shapes and turned them upside down, transforming traditional views of objects into broken planes. Artists like Picasso and Braque redefined concepts of space in their work and further dismantled tradition by incorporating **29** such esoteric entities as sawdust, rope, and bits of newspaper into their paintings, sculptures, and collages. This made viewers uncomfortable; they found **30** access with the new work difficult. But the new movement took hold and paved the way for abstraction, which became dominant for the next fifty years.

27

- A) NO CHANGE
- B) his/her
- C) its
- D) it's

28

- A) NO CHANGE
- B) therefore,
- C) however,
- D) in short,

29

- A) NO CHANGE
- B) anachronistic elements like
- C) everyday objects like
- D) commonplace, ordinary items as

30

- A) NO CHANGE
- B) access to
- C) excess of
- D) excess to

**PROCEED TO NEXT PAGE.**

[1] Mr. Lauder's gift, consequently, has a historical significance. [2] Braque's "Trees at L'Estaque" is thought to be one of the first Cubist pictures, creating a new form of space that the artist arrived at after he **31** study Cezanne's landscapes. [3] And both artists introduced new media—**32** Braque with his first collage "Fruit Dish and Glass" and Picasso with his sculpture "Head of a Woman"—into Cubism. **33**

The collection looks both forward to abstraction and backward through Picasso's embrace of African tribal art in his use of nontraditional forms. It pays homage to a movement that not only inspired Western artists but also became significant throughout the world. As Met curator Ethan Lucas said, "We will now be able to tell many different stories that we were never able to tell before."

31

- A) NO CHANGE
- B) had studied
- C) would be studying
- D) could have studied

32

- A) NO CHANGE
- B) Braque with his first collage "Fruit Dish and Glass" and Picasso, with his sculpture "Head of a Woman"
- C) Braque, with his first collage "Fruit Dish and Glass" and Picasso with his sculpture "Head of a Woman"
- D) Braque with his first collage, "Fruit Dish and Glass", and Picasso with his sculpture "Head of a Woman"

33

The writer plans to add the following sentence to this paragraph.

Picasso's "Oil Mill," also in the Lauder collection, influenced the Italian Futurist School.

To make the paragraph most logical, the sentence should be placed

- A) after Sentence 1.
- B) before Sentence 1.
- C) after Sentence 2.
- D) after Sentence 3.

**STOP. BE CERTAIN NOT TO EXCEED THE ALLOTTED TIME. YOU MAY PROCEED TO SECTION 5 WHEN TOLD TO DO SO.**

## ACT READING TEST

30 Questions—27 Minutes

**DIRECTIONS:** There are three passages. Each passage is followed by ten questions. After reading a passage, choose the best answer to each question and mark it on the bubblesheet. You may refer to the passages as often as you like.

## PASSAGE I

**PROSE FICTION:** This passage is adapted from the short story *The Story Girl* by Lucy Maud Montgomery (© 1911, Grosset & Dunlap, Publishers, n.d.)

“I do like a road, because you can be always wondering what is at the end of it.” The Story Girl said that once upon a time.

Felix and I, on the May morning when we left Toronto for Prince Edward Island, had not then heard her say it, and, indeed, were but barely aware of the existence of such a person as the Story Girl. We did not know her at all under that name. We supposed we should get acquainted with her when we reached there, and we had an idea, from Aunt Olivia’s letters to father, that she would be quite a jolly creature. Further than that we did not think about her. We were more interested in Felicity and Cecily and Dan, who lived on the homestead and would therefore be our roommates for a season.

But the spirit of the Story Girl’s yet unuttered remark was thrilling in our hearts that morning, as the train pulled out of Toronto. We were faring forth on a long road; and, though we had some idea what would be at the end of it, there was enough glamour of the unknown about it to lend a wonderful charm to our speculations concerning it.

We were delighted at the thought of seeing father’s old home, and living among the haunts of his boyhood. He had talked so much to us about it, and described its scenes so often and so minutely, that he had inspired us with some of his own deep-seated affection for it—an affection that had never waned in all his years of exile. We had a vague feeling that we, somehow, belonged there, in that cradle of our family, though we had never seen it. We had always looked forward eagerly to the promised day when father would take us “down home,” to the old house with the spruces behind it and the famous “King Orchard” before it—when we might ramble in “Uncle Stephen’s Walk,” drink from the deep well with the Chinese roof over it, stand on “the Pulpit Stone,” and eat apples from our “birthday trees.”

The time had come sooner than we had dared to hope; but father could not take us after all. His firm asked him to go to Rio de Janeiro that spring to take charge of their new branch there. It was too good a

chance to lose, for father was a poor man and it meant promotion and increase of salary; but it also meant the temporary breaking up of our home. Our mother had died before either of us was old enough to remember her; father could not take us to Rio de Janeiro. In the end he decided to send us to Uncle Alec and Aunt Janet down on the homestead; and our housekeeper, who belonged to the Island and was now returning to it, took charge of us on the journey. I fear she had an anxious trip of it, poor woman! She was constantly in a quite justifiable terror lest we should be lost or killed; she must have felt great relief when she reached Charlottetown and handed us over to the keeping of Uncle Alec. Indeed, she said as much.

“The fat one isn’t so bad. He isn’t so quick to move and get out of your sight while you’re winking as the thin one. But the only safe way to travel with those young ones would be to have ‘em both tied to you with a short rope—a MIGHTY short rope.”

“The fat one” was Felix, who was very sensitive about his plumpness. He was always taking exercises to make him thin, with the dismal result that he became fatter all the time. He vowed that he didn’t care; but he DID care terribly, and he glowered at Mrs. MacLaren in a most undutiful fashion. He had never liked her since the day she had told him he would soon be as broad as he was long.

For my own part, I was rather sorry to see her going; and she cried over us and wished us well; but we had forgotten all about her by the time we reached the open country, driving along, one on either side of Uncle Alec, whom we loved from the moment we saw him. We felt at home with him and became very good friends with him on that twenty-four mile drive.

Much to our disappointment it was dark when we reached Carlisle—too dark to see anything very distinctly, as we drove up the lane of the old King homestead on the hill. Behind us a young moon was hanging over southwestern meadows of spring-time peace, but all about us were the soft, moist shadows of a May night. We peered eagerly through the gloom.

“There’s the big willow, Bev,” whispered Felix excitedly, as we turned in at the gate.

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There it was, in truth—the tree Grandfather King had planted. It had taken root and grown; our father and our  
85 uncles and aunts had played in its shadow; and now it was a massive thing.

“I’m going to climb it tomorrow,” I said joyfully.

1. The passage can best be described as:
  - A. a dialogue between two people in which both relate their memories of an event.
  - B. an account of the narrator’s remembrance of an important event in her life.
  - C. a character sketch of two children as related by the narrator.
  - D. a detailed description of a landscape at a particular time.
2. Which of the statements below best describes the relationship between the narrator of the story and Mrs. MacLaren?
  - F. The narrator regards Mrs. MacLaren as her favorite adult.
  - G. The narrator has mixed feelings about Mrs. MacLaren.
  - H. The narrator believes Mrs. MacLaren has to be a stern taskmaster.
  - J. The narrator is resentful of Mrs. MacLaren for calling her “the fat one.”
3. It can reasonably be inferred from the story that the narrator’s feelings toward Carlisle are primarily:
  - A. those of dreading an unfamiliar place.
  - B. those of joy at recalling a much-loved familiar place.
  - C. those of eager anticipation.
  - D. those of despair over the loss of a loved one.
4. The references to the Story Girl most likely suggest that the narrator:
  - F. planned to get to know her.
  - G. was intimidated by the stories she heard about her.
  - H. was related to Aunt Olivia.
  - J. knew her extremely well.
5. Based on the passage, which of the following happened to Bev first chronologically?
  - A. She heard about The Story Girl in a letter.
  - B. Her mother died.
  - C. She left Toronto to go to Prince Edward Isle.
  - D. Her father was transferred to Rio de Janeiro.
6. The narrator mentions all the following features of her father’s old home EXCEPT:
  - F. the deep well.
  - G. Aunt Olivia’s Bower.
  - H. King Orchard.
  - J. the big willow.
7. The author capitalizes the word in line 58 most likely to emphasize:
  - A. Felix’s plumpness.
  - B. the children’s hostile nature.
  - C. the children’s ability to get out of sight.
  - D. Bev’s strong ties to her father.
8. As used in line 22, “haunts” is closest in meaning to:
  - F. frightening presences in a house.
  - G. something difficult to forget.
  - H. spirits that inhabit one’s memories.
  - J. places one frequented.
9. The story indicates that the distance between Charlottetown and Carlisle is:
  - A. a long train ride.
  - B. twenty-four miles.
  - C. a three hour ride.
  - D. more than sixty miles.
10. According to the story, Felix and Bev are to live on Prince Edward Island:
  - F. permanently.
  - G. for part of a year.
  - H. with their father.
  - J. in April.

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## PASSAGE II

**HUMANITIES:** This passage is adapted from the journal article “Facebook Killed the Reunion Star: How Facebook is Changing Who We Are and What We Do” by Sara Ridenour which appears in *Fast Capitalism* (© 2011 Issue 8.1)

Do people create or mediate the identity that they display on Facebook? Of course, at some level, they must; you have to decide what to post on Facebook and what not to post. However, I wonder just how much true thought goes into this decision process. Before posting a picture on Facebook, do people really think about the effect the picture will have on their identity? Also, I believe that our society is moving towards a more “take me as I am” mentality, and if that is the case, can we really argue that a Facebook identity is drastically different than one’s true self?

We live in a world that allows us to construct our identity in a variety of ways—online via Facebook posts and statuses, by the clothes we wear, the color of our hair, even the brand of our shoes. So, the question begs, are we changing our identity by dyeing our hair or are we only becoming a truer version of the person we believe we really are? Is our constructed identity our true reality? I am not convinced that people really try to construct the best possible identity, rather than their true identity, online anymore; I think more and more people are putting their flawed selves out there. A quick perusal through my Facebook newsfeed and the recent picture postings by my friends supports this theory. As aforementioned, people overshare; if they were trying to construct a picture-perfect version of themselves, would they really post less-than-flattering pictures of themselves or discuss a battle with acne via a public wall post?

People no longer really worry about privacy so I would argue that the self they create online is a true representation of identity. People have the ability to be more “real” online than off; the shield of the keyboard and computer monitor provides a sense of security, protection from judgment. Shy people, like me, find it easier to share via email and on Facebook than face-to-face. Facebook allows us to be ourselves.

My Facebook profile is not just a copy of who I am; my Facebook profile shapes my identity. Now, I realize that taken out of context that concept may seem rather shallow, allowing Facebook to shape who I am; however, with the proliferation of Facebook in our society, it is not hard to believe that Facebook could play a role in establishing identity. Categories of relationship status, political status, and religion make people think about these labels and assign themselves an identity. Young people who may have not considered their political affiliation as part of their identity are now faced with a dilemma – who am I? And, what does it mean? Of course, you can opt not to provide this information on Facebook, but not providing certain information can speak louder to your identity than

just providing the information in the first place.

Facebook is not only involved in creating identity; it is plays a major role by displaying your identity to others. Before Facebook, we may not have known as much about our friends as we do now. We have all been told to steer clear of two topics with friends, family, and company – religion and politics; however, Facebook puts these topics front and center. When I accept a Facebook friend, he/she can go to my Info page and obtain far more information about me than I might normally provide (and I am rather cautious about the information I offer on Facebook). I do not have anything on my Facebook profile that I think is private, sensitive information, but, at the same time, most people would not come up to me and ask me what religion or political party to which I belong. I am not ashamed of either, and was I asked, I would answer honestly, but the fact of the matter is, before Facebook, it is not likely that I would have been asked.

It is not only friends that are interested in their peers Facebook profiles and the information provided there. Employers look at Facebook to determine the “real” person instead of the best-foot-forward, rehearsed identity that people use during an interview. Recently, there have been several news stories about people being reprimanded, and even facing termination, for Facebook posts. This brings up all kinds of first amendment and privacy issues, and I am not going to get into that here; however, it does make me think about identity. People will say and do things on Facebook that they would not do in their daily life, and that makes me think that people are more true to themselves on Facebook – thus creating a real identity, not a simulation. They are more willing to portray their flaws on Facebook, and our flaws make us who we are.

Facebook is not merely a reflection of an identity that is already established; Facebook is taking part in the establishment of identity. From his Harvard dorm room, Mark Zuckerberg created a phenomenon that not only changes the way we act, it is changing who we are.

Facebook is a significant social force. There is so much information available to sociologists that it is overwhelming. Jokingly, I told my professor that Facebook ruined my high school reunion. I thought that I did not mean it literally, but I did; Facebook really did ruin my high school reunion. But, in ruining my high school reunion, Facebook may have improved my daily life. I have more friends now that I have ever had in my entire life! And, I know more about them, and myself, than ever before. I am certain that a plethora of research concerning Facebook is in the works as I type, and I look forward to it. These are interesting times and I am excited to be a part of it.

Chances are I will not see any of my high school friends until our next reunion (in ten years). That may

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- 105 seem sad, but really, why do I need to see them? I have Facebook to keep me company.
11. The main idea of this passage is that:
- A. Facebook destroys privacy and is therefore dangerous.
  - B. Facebook offers opportunities for people to inform others about whom they care about.
  - C. Facebook allows people to create their identity and display that identity to others.
  - D. Facebook can be used by employers to screen candidates for jobs.
12. The author mentions each aspect of Facebook EXCEPT:
- F. people are less true to themselves in real life than they are on Facebook.
  - G. Facebook helps shy people share things about themselves.
  - H. people are willing to share aspects of themselves on Facebook that are not necessarily flattering.
  - J. Facebook causes people to present the most perfect picture of themselves that they can create.
13. The word “shield” as it is used in line 32 most nearly means:
- A. a cover over a machine to protect it from damage.
  - B. a means of keeping others from judging you.
  - C. a physical barrier to protect you from assault.
  - D. a way of keeping outside elements from bothering you.
14. It can reasonably be inferred from the passage that:
- F. fewer people attended the author’s high school reunion than would have before Facebook.
  - G. people at the author’s high school reunion were more willing to share information about religion and politics than they would have been before Facebook.
  - H. Facebook is likely to become less used in the future than it is now.
  - J. Facebook will become a means of helping people protect their real selves from scrutiny by others.
15. The passage suggests that the most important aspect of Facebook is that it:
- A. allows people to share their views on politics and religion.
  - B. allows employers to screen prospective job applicants.
  - C. eliminates the need to attend school reunions.
  - D. gives people a chance to shape the identity they wish to present to others.
16. Based on the passage, why might the author share information on Facebook that he would not divulge in a face-to-face encounter?
- F. Facebook allows him to overcome shyness.
  - G. Facebook creates an identity that presents him in better light.
  - H. Facebook makes it unnecessary to attend social events.
  - J. Facebook forces people to create a simulated identity.
17. The main purpose of the fifth paragraph is to:
- A. tell why the author hides sensitive information from Facebook.
  - B. explain why religion and politics are topics people should avoid on Facebook.
  - C. establish that Facebook is instrumental in getting people to share their identity with others.
  - D. help friends hide the truth about themselves from each other.
18. The author puts the word “real” in quotation marks in line 32 in order to:
- F. suggest that there is no such thing as a person’s real identity.
  - G. point out that one’s true self can only be recognized on Facebook.
  - H. question the idea that people seek to hide their true identities on Facebook.
  - J. reinforce the argument that people try to present the best possible picture of themselves on social media.
19. According to the passage, why does the author believe it is important for people to share their weaknesses to others on Facebook?
- A. Sharing weaknesses brings people closer together.
  - B. Sharing weaknesses is an example of how people overshare information on social media.
  - C. Sharing weaknesses creates a sense of self-worth.
  - D. Sharing weaknesses establishes a person’s honest identity, not an idealized version.
20. According to the passage, the development of Facebook is:
- F. a phenomenon that potentially will eliminate all face-to-face interaction.
  - G. likely to provide information for sociologists to use in current and future research.
  - H. significant in that it changes what most people want from life.
  - J. not a matter of first amendment concern.

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## PASSAGE III

**NATURAL SCIENCE:** This passage is adapted from an article “Concerning Human Understanding” by Maxwell Lowe (©2013 by Maxwell Lowe), which appeared in *Scientific Inquiries*.

The known facts about John Locke’s theory of the tabula rasa have intrigued philosophers and scientists since the 17th Century. Locke, an English philosopher and physician who is also known as the father of classical liberalism, set out the case that the human mind is devoid of all knowledge or ideas at the time of birth. At the moment an infant takes his first breath his mind is a blank slate (tabula rasa). He argued that all of our ideas are constructed in the mind via a process of constant composition and decomposition of the input that we receive through our senses.

In his essay *Concerning Human Understanding*, Locke rejected the notion that the human mind was invested with innate ideas and the power of intuition. He posited that all of our concepts are derived from sense experience and that we have no basis of knowledge prior to or independent of sense experience.

For centuries it was widely accepted that babies at birth were intellectual equals. No one had a head start; one baby was not born with a better predilection for learning, retaining knowledge, finding creative solutions to mathematical problems or discovering how DNA determines a person’s capabilities.

Recent scientific findings in the United States and Europe suggest that we are not a blank slate at birth. In fact, it is spiritedly argued that some people are better intellectually endowed to grasp concepts, retain information or solve complex problems. In 2011 Kenneth Heilman and his team at the Department of Neurology and Neuroscience at Cornell University discovered that some people are born with a greater capacity for creativity. The new research suggested that a person’s DNA determines why some people are better at solving creative problems than others.

“Creativity is related to the connectivity of large scale-brain networks,” said Szabolcs Keri of the National Institute of Psychiatry and Addictions in Budapest. “How brain areas talk to each other is critical when it comes to originality, fluency and flexibility.” Highly creative people have widespread connectivity to the different brain networks, and it is believed that genes create these broad and healthy thoroughfares in the brain. Studies have shown that specific genes can make people less inhibited, provide the ground for better memory, and permit people to become more aware of their surroundings and themselves.

People with duplicate DNA strands that contain a gene that influences the processing of a key neurotransmitter called serotonin have demonstrated themselves

to be better at finding creative solutions to social, economic and academic problems. A recent neuroimaging study found that the elevating serotonin levels in the brain created more connections to the posterior cingulate cortex (PCC), which plays a central role in supporting internally-directed cognition.

Other evidence suggests that the PCC region is highly heterogeneous and may play a direct role in regulating the focus of attention, which can determine the ability of a person to gather and parse information. Only after spending several minutes looking at the ocean can a person begin to see that the ocean is at once the color blue, and bright cerulean, electric indigo, slate blue and royal blue.

A recent study conducted at Duke University discovered that PCC monitors a person’s performance and maintains a person’s motivation when learning new material, particularly when the person is challenged. Although this research is important in and of itself, more knowledge about the PCC is critical because this region of the brain is also one of the first to deteriorate when a person has Alzheimer’s disease.

Locke’s tabula rasa theory has given way to an almost accepted belief in nativism, or what is sometimes referred to as innatism, the notion that preexisting ideas are present in the mind at time of birth. Those who share this view make the case that there are two ways in which a human can gain knowledge: The first is by learning. The baby gathers information from his surroundings and then uses it. He learns that when he cries long enough he will magically make his mother appear from another room. The second way a baby acquires knowledge is through innate knowledge, that which is genetically inherited. No one had to teach the baby to cry when he is hungry or uncomfortable in the middle of the night. No one had to teach the baby to smile to signal when he is pleased.

While the argument for nativism is compelling (a baby doesn’t need to be taught to look for his mother when he hears her voice), Locke’s theory of tabula rasa can be argued persuasively as well. While a person’s genetic makeup may make him more likely to solve abstract problems quickly, focus longer, and have an inherent self-rewarding system to encourage him to stay the course when he learns, he still arrives as a blank slate. While the interior structure of our brains may be very different, and allow some to learn more and to solve problems faster than others, at birth the mind is blank until it starts to process what it perceives. Science has not demonstrated that the newborn who knows to cry when he wants his mother’s attention knew this prior to birth.

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21. The statement in lines (82–85) “No one had to teach the baby to cry when he is hungry . . . no one had to teach the baby to smile to signal when he is pleased” serves as:
- A. an illustration that innate knowledge exists in the mind prior to birth.
  - B. further support for Locke’s tabula rasa theory.
  - C. an example of how quickly babies learn to manipulate others.
  - D. an example that babies acquire knowledge that they can put to use.
22. It can be reasonably inferred that the PCC region may first help a person to:
- F. enjoy a tennis match.
  - G. focus more on a tennis match.
  - H. gather more information about tennis matches.
  - J. make better sense of tennis matches.
23. The main function of the fourth paragraph is to:
- A. demonstrate how robust scientific research is making the case for Locke’s 17th century theory.
  - B. demonstrate how the recent scientific findings in the United States and Europe differed on the importance of intellectual endowment.
  - C. highlight the importance of DNA in determining why some people are better at solving problems.
  - D. provide scientific evidence that counters Locke’s belief that the human being is devoid of knowledge at the time of birth.
24. As it is used in line 8, the word *blank* most nearly means:
- F. expressionless.
  - G. free.
  - H. clean.
  - J. simple.
25. The passage mentions that Locke’s theory has led to all of the following EXCEPT:
- A. nativism.
  - B. infantillism.
  - C. how brain areas talk to one another.
  - D. innativism.
26. The passage indicates the elevated levels of serotonin create more connections to:
- F. discovering why long-term ailments persist.
  - G. internally-directed cognition.
  - H. neuroimaging.
  - J. the posterior cingulate cortex.
27. In the last paragraph, which stance does the author take on Locke’s tabula rasa theory?
- A. While the counter argument against Locke’s tabula rasa theory is compelling, modern science has not unequivocally disproved it.
  - B. Nativism is so compelling that it disproves Locke’s tabula rasa theory.
  - C. Because each person’s genetic makeup cannot be completely determined Locke’s tabula rasa theory is accurate.
  - D. Science has demonstrated that Locke’s tabula rasa theory is invalid.
28. In his essay, *Concerning Human Understanding*, Locke made the case that:
- F. babies know more than they are often credited with knowing.
  - G. it’s not absolutely clear how knowledge is derived.
  - H. knowledge is derived from sense experience.
  - J. babies have thoughts independent of sense experience.
29. The Department of Neurology and Neuroscience at Cornell University and the National Institute of Psychiatry and Addictions in Budapest would most likely agree that:
- A. the mind is blank at birth.
  - B. some people are born with a poorer capacity for learning.
  - C. the PCC plays a role in Alzheimer’s disease.
  - D. Locke placed too big an emphasis on nativism.
30. The scientists who have rejected Locke’s argument would most likely agree that:
- F. more research on PCC is necessary before the tabula rasa theory can be proven false.
  - G. what a person learns is up to that person.
  - H. people have a unique ability to discover what motivates them to learn new material.
  - J. a person’s ability to learn is based to a large degree on genetic inheritance.

**STOP. BE CERTAIN NOT TO EXCEED THE ALLOTTED TIME. YOU MAY PROCEED TO SECTION 6 WHEN TOLD TO DO SO.**



# SAT Math Test—No Calculator

15 MINUTES, 12 QUESTIONS

Turn to Section 6 of your bubblesheet to answer the questions in this section.

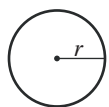
## DIRECTIONS

For questions 1–9, solve each problem, select the best answer from the list of choices, and be sure to mark your selection by filling in the appropriate circles on the bubblesheet. For questions 10–12, solve each problem and record your response by filling in the appropriate circles on the bubblesheet. Please carefully read the detailed directions before question 10, and then proceed. You may use blank areas in the test booklet to do any figuring.

## NOTES

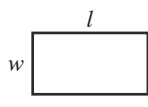
- Use of a calculator **is not permitted**.
- Unless otherwise indicated, all variables and expressions used represent real numbers.
- Unless otherwise indicated, figures provided in this test are drawn to scale.
- Unless otherwise indicated, all figures lie in a plane.
- The domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number, unless otherwise indicated.

## REFERENCE

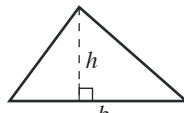


$$A = \pi r^2$$

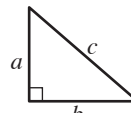
$$C = 2\pi r$$



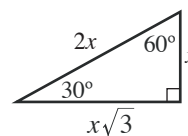
$$A = lw$$



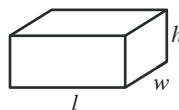
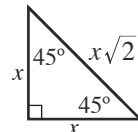
$$A = \frac{1}{2}bh$$



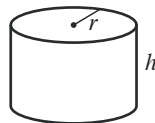
$$c^2 = a^2 + b^2$$



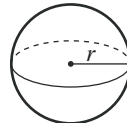
Special Right Triangles



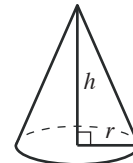
$$V = lwh$$



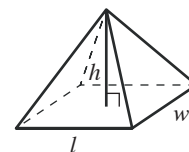
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

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1

A girls youth lacrosse coach earns \$9.25 an hour for coaching a team of 12 girls and an additional bonus of \$20 if the team wins the regional championship. If the team wins the regional championship, what expression could be used to determine the coach's total earnings?

- A)  $9.25x + 20$ , where  $x$  is the number of hours
- B)  $20x + 9.25$ , where  $x$  is the number of hours
- C)  $x(9.25 + 12) + 20$ , where  $x$  is the number of girls
- D)  $20x + (9.25 + 12)$ , where  $x$  is the number of girls

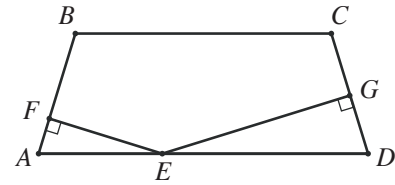
2

$$5(x - y) = x$$

If  $(x, y)$  is a solution to the equation above and  $x \neq 0$ , what is the ratio  $\frac{y}{x}$ ?

- A)  $-\frac{5}{4}$
- B)  $-\frac{4}{5}$
- C)  $\frac{4}{5}$
- D)  $\frac{5}{4}$

3



Note: Figure not drawn to scale

Trapezoid  $ABCD$  above is isosceles with  $AB = CD$  and  $AD = 44$ . The ratio of  $FE$  to  $GE$  is  $3:8$ . What is the length of  $\overline{ED}$ ?

- A) 12
- B) 22
- C) 28
- D) 32

4

If  $x > \frac{3}{2}$ , which of the following is equivalent to

$$\frac{1}{\frac{1}{2x-3} + \frac{1}{x+4}}?$$

- A)  $\frac{3x+1}{2x^2+5x-12}$
- B)  $\frac{2x^2+5x-12}{3x+1}$
- C)  $3x+1$
- D)  $2x^2+5x-12$

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5

To design a small business's website Nathan charges an initial consultation fee of \$120 and \$50 per hour spent developing a website. Jeremy charges \$180 for his initial consultation fee and \$35 per hour spent developing a website. If  $h$  represents the number of hours spent developing a website, what are all values  $h$  for which Jeremy's total charge is greater than Nathan's total charge?

- A)  $h > 3$
- B)  $3 \leq h \leq 4$
- C)  $4 \leq h \leq 5$
- D)  $h < 4$

6

$$t = 37 + \frac{2}{5}P$$

Quinn sells t-shirts at lacrosse tournaments. She uses the function above to model the relationship between the number of t-shirts,  $t$ , sold per tournament and the number of parents,  $P$ , in attendance. According to the model, what is the meaning of the  $\frac{2}{5}$  in the function?

- A) For every increase of 2 parents in attendance, five more t-shirts are sold
- B) For every decrease of 2 parents in attendance, five more t-shirts are sold
- C) For every increase of 5 parents in attendance, two more t-shirts are sold
- D) For every decrease of 5 parents in attendance, two more t-shirts are sold

7

A cyclist turns onto a stretch of highway that descends 8 meters in elevation for every 100 meters traveled along the length of the highway. The stretch the cyclist turns onto begins at an elevation of 2743 meters, and the cyclist travels at a rate of 17 meters per second. What is the elevation of the highway, in meters, at the point where the cyclist passes  $s$  seconds after turning onto this stretch of highway?

- A)  $2743 - 0.08s$
- B)  $2743 - 1.36s$
- C)  $2743 - 8s$
- D)  $2743 - 17s$

**PROCEED TO NEXT PAGE.**





8

Which of the following is equivalent to  $(2a - b)\left(\frac{b^2}{a}\right)$  ?

- A)  $\frac{2b^2}{a} - \frac{b^3}{a}$
- B)  $2ab^2 - ab$
- C)  $2b^2 - \frac{b^3}{a}$
- D)  $2b^2 - \frac{b^2}{a}$

9

In the  $xy$ -plane, the cubic with the equation  $y = ax^3 + bx^2 + cx + d$ , where  $a$ ,  $b$ ,  $c$ , and  $d$  are constants, passes through the point  $(-2, 5)$ , which of the following must be true?

- A)  $-2c + d = 5$
- B)  $-8a + 4b - 2c = 5$
- C)  $8a + 4b + 2c + d = 5$
- D)  $-8a + 4b - 2c + d = 5$

**PROCEED TO NEXT PAGE.**

**DIRECTIONS**

**For questions 10–12:** Solve the problem and record your answer in the grid on your bubblesheet, as described below.

- It is suggested, though not required, that you write your answers in the boxes at the top of the columns to help you mark the circles accurately. You will only receive credit if the circles are filled in correctly.
- Only mark one circle in each column.
- There are no negative answers.
- Some problems may have more than one correct answer. In such cases, please grid only one answer.

- Mixed numbers** such as  $3\frac{1}{2}$  must be

gridded as 3.5 or 7/2. (If 

|                       |                       |                       |                       |
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 is

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entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

- Decimal answers:** If a solution is a decimal and the decimal does not terminate after 1 or 2 places, carry it out to a third place, to fill the entire grid.

Answer:  $\frac{7}{12}$

Write → answer in boxes.

|                       |                                  |                       |                       |
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| 7                     | /                                | 1                     | 2                     |
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> |
| ①                     | ①                                | ①                     | ①                     |
| ②                     | ②                                | ②                     | ②                     |
| ③                     | ③                                | ③                     | ③                     |
| ④                     | ④                                | ④                     | ④                     |
| ⑤                     | ⑤                                | ⑤                     | ⑤                     |
| ⑥                     | ⑥                                | ⑥                     | ⑥                     |
| ⑦                     | ⑦                                | ⑦                     | ⑦                     |
| ⑧                     | ⑧                                | ⑧                     | ⑧                     |
| ⑨                     | ⑨                                | ⑨                     | ⑨                     |

← Fraction line

Grid-in result.

Answer: 2.5

|                       |                       |                       |                                  |
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|                       | 2                     | .                     | 5                                |
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| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            |
| ①                     | ①                     | ①                     | ①                                |
| ②                     | ②                     | ②                     | ②                                |
| ③                     | ③                     | ③                     | ③                                |
| ④                     | ④                     | ④                     | ④                                |
| ⑤                     | ⑤                     | ⑤                     | ⑤                                |
| ⑥                     | ⑥                     | ⑥                     | ⑥                                |
| ⑦                     | ⑦                     | ⑦                     | ⑦                                |
| ⑧                     | ⑧                     | ⑧                     | ⑧                                |
| ⑨                     | ⑨                     | ⑨                     | ⑨                                |

← Decimal point

Acceptable ways to grid in  $\frac{2}{3}$  are:

|                       |                       |                                  |                       |
|-----------------------|-----------------------|----------------------------------|-----------------------|
|                       | 2                     | /                                | 3                     |
| <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/> |
| ①                     | ①                     | ①                                | ①                     |
| ②                     | ②                     | ②                                | ②                     |
| ③                     | ③                     | ③                                | ③                     |
| ④                     | ④                     | ④                                | ④                     |
| ⑤                     | ⑤                     | ⑤                                | ⑤                     |
| ⑥                     | ⑥                     | ⑥                                | ⑥                     |
| ⑦                     | ⑦                     | ⑦                                | ⑦                     |
| ⑧                     | ⑧                     | ⑧                                | ⑧                     |

|                                  |                       |                       |                       |
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| .                                | 6                     | 6                     | 6                     |
| <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| ①                                | ①                     | ①                     | ①                     |
| ②                                | ②                     | ②                     | ②                     |
| ③                                | ③                     | ③                     | ③                     |
| ④                                | ④                     | ④                     | ④                     |
| ⑤                                | ⑤                     | ⑤                     | ⑤                     |
| ⑥                                | ⑥                     | ⑥                     | ⑥                     |
| ⑦                                | ⑦                     | ⑦                     | ⑦                     |
| ⑧                                | ⑧                     | ⑧                     | ⑧                     |

|                                  |                       |                       |                       |
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| .                                | 6                     | 6                     | 7                     |
| <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
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| ①                                | ①                     | ①                     | ①                     |
| ②                                | ②                     | ②                     | ②                     |
| ③                                | ③                     | ③                     | ③                     |
| ④                                | ④                     | ④                     | ④                     |
| ⑤                                | ⑤                     | ⑤                     | ⑤                     |
| ⑥                                | ⑥                     | ⑥                     | ⑥                     |
| ⑦                                | ⑦                     | ⑦                     | ⑦                     |
| ⑧                                | ⑧                     | ⑧                     | ⑧                     |

Answer: 201 – either position is correct

|                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
|                       | 2                     | 0                     | 1                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| ①                     | ①                     | ①                     | ①                     |
| ②                     | ②                     | ②                     | ②                     |
| ③                     | ③                     | ③                     | ③                     |

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| 2                     | 0                     | 1                     |                       |
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| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| ①                     | ①                     | ①                     | ①                     |
| ②                     | ②                     | ②                     | ②                     |
| ③                     | ③                     | ③                     | ③                     |

**NOTE:** You may start your answers in any columns, space permitting. Columns don't need to use should be left blank.

**PROCEED TO NEXT PAGE.**



10

For what value of  $n$  is  $-3 = \frac{4}{n} - 9$  ?

11

If  $i = \sqrt{-1}$ , what is the value of  $i^3(2 + 2i)^2$  ?

12

If  $x + 6$  is a factor of  $x^2 + 3kx + 6k$ , where  $k$  is a constant, what is the value of  $k$  ?

**STOP. BE CERTAIN NOT TO EXCEED THE  
ALLOTTED TIME. YOU MAY PROCEED TO  
SECTION 7 WHEN TOLD TO DO SO.**



# SAT Math Test—Calculator

34 MINUTES, 24 QUESTIONS

Turn to Section 7 of your bubblesheet to answer the questions in this section.

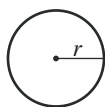
## DIRECTIONS

For questions 1–19, solve each problem, select the best answer from the list of choices, and be sure to mark your selection by filling in the appropriate circles on the bubblesheet. For questions 20–24, solve each problem and record your response by filling in the appropriate circles on the bubblesheet. Please carefully read the detailed directions before question 20, and then proceed. You may use blank areas in the test booklet to do any figuring.

## NOTES

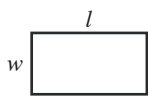
1. Use of a calculator **is permitted**.
2. Unless otherwise indicated, all variables and expressions used represent real numbers.
3. Unless otherwise indicated, figures provided in this test are drawn to scale.
4. Unless otherwise indicated, all figures lie in a plane.
5. The domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number, unless otherwise indicated.

## REFERENCE

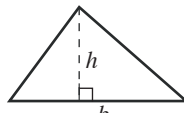


$$A = \pi r^2$$

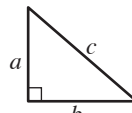
$$C = 2\pi r$$



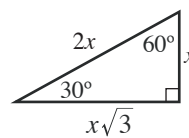
$$A = lw$$



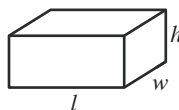
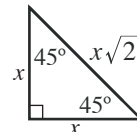
$$A = \frac{1}{2}bh$$



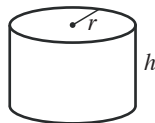
$$c^2 = a^2 + b^2$$



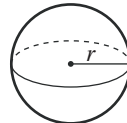
Special Right Triangles



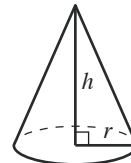
$$V = lwh$$



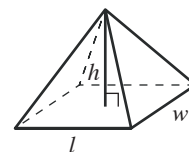
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

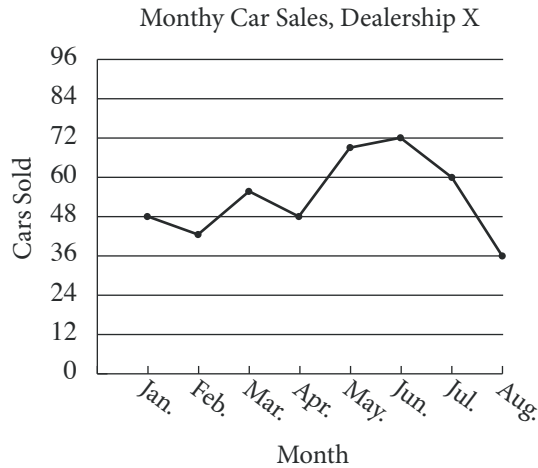
The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

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1



The line graph above shows the number of cars sold between January and August last year by Dealership X. According to the graph, what was the greatest change (in absolute value) in the number of cars sold between two consecutive months?

- A) 18 cars
- B) 24 cars
- C) 30 cars
- D) 36 cars

2

A circle has circumference  $C$  and radius  $r$ . Which of the following represents  $r$  in terms of  $C$ ?

- A)  $r = \frac{2C}{\pi}$
- B)  $r = \frac{C}{2\pi}$
- C)  $r = \frac{C}{\pi}$
- D)  $r = \frac{2\pi}{C}$

3

Which ordered pair  $(x,y)$  satisfies the system of equations shown below?

$$4x - y = 18$$

$$x + 3y = -2$$

- A)  $(-2,2)$
- B)  $(2,-2)$
- C)  $(4,-2)$
- D)  $(5,2)$

4

A production plant owned by a company that produces energy drinks has the ability to fill 250 milliliter cans from a 3000-liter tank. What is the maximum number of 250 milliliter cans that can be filled from the tank? (1 liter = 1,000 milliliters)

- A) 120,000
- B) 12,000
- C) 1,200
- D) 12

**PROCEED TO NEXT PAGE.**



5

Sheila drove at an average speed of 75 miles per hour for 4 hours. If her car consumed gasoline at a rate of 23 miles per gallon, approximately how many gallons of fuel did the car use for the entire 4-hour trip?

- A) 3
- B) 4
- C) 13
- D) 14

6

A electronics store sells the Cheetah brand of flash storage devices as individual drives or in boxes of 4 drives. On a busy day, the store sold a total of 346 Cheetah brand flash drives, of which 38 were sold as individual drives. Which of the following equations gives the number of boxes of 4 drives,  $b$ , sold that day?

- A)  $b = \frac{346 - 38}{4}$
- B)  $b = \frac{346 + 38}{4}$
- C)  $b = \frac{346}{4} - 38$
- D)  $b = \frac{346}{4} + 38$

7

What is the slope of the line in the  $xy$ -plane that passes through the points  $(-\frac{9}{2}, 7)$  and  $(-\frac{1}{2}, 2)$ ?

- A)  $-\frac{5}{4}$
- B)  $-1$
- C) 1
- D)  $\frac{4}{5}$

8

$$0.9x + y = 8.1$$

The city of Boston was recently hit with a major snowstorm. The equation above can be used to model the depth of the snow,  $y$ , in inches, that still covers the ground  $x$  days after the storm began. What does it mean that  $(9, 0)$  is a solution to this equation?

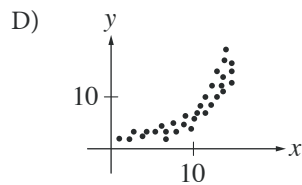
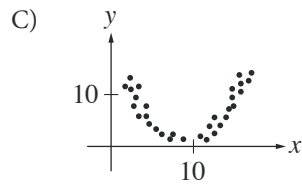
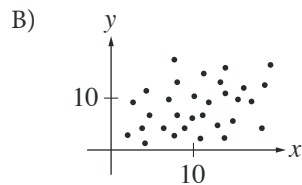
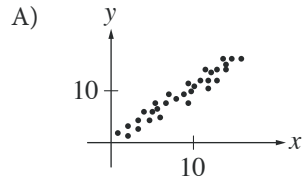
- A) During the days immediately following the snowfall, 9 inches of snow melt each day.
- B) It takes 9 days for 8.1 inches of snow to fall.
- C) When snow began to melt, 9 inches of snow covered the ground.
- D) It will take 9 days for the ground to be completely clear of snow.

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9

Which scatterplot shows a positive association that is not linear? (Note: A positive association between two variables is one in which higher values of one variable correspond to higher values of the other variable.)



10



The histogram above shows the distribution of salaries, in thousands of dollars, of 22 employees working in a specific division of Globex Corporation. Which of the following could be the median salary of the 22 employees shown in the histogram?

- A) \$46,000
- B) \$51,000
- C) \$61,000
- D) \$77,000

**PROCEED TO NEXT PAGE.**


**Questions 11–13 refer to the following information.**

A survey of 220 randomly selected registered voters aged 25 through 44 in Minnesota was conducted to gather data on political preferences across various age groups. The data are shown in the table below.

|              | Prefer Candidate X | Prefer Candidate Y | Total |
|--------------|--------------------|--------------------|-------|
| Ages 25 – 34 | 40                 | 89                 | 129   |
| Ages 35 – 44 | 53                 | 38                 | 91    |
| Total        | 93                 | 127                | 220   |

11

Which of the following is closest to the percent of those surveyed who preferred Candidate X?

- A) 31%
- B) 42%
- C) 48%
- D) 73%

12

In 2015, the total population of individuals in Minnesota between the ages of 25 and 44 was approximately 2.2 million. If the survey results are used to estimate information about political preferences of voters across the state, which of the following is the best estimate of the total number of individuals between the ages of 35 and 44 who prefer Candidate X in 2015?

- A) 1,280,000
- B) 530,000
- C) 400,000
- D) 53,000

13

Based on the data, how many times more likely is it for a 25 – 34 year old to prefer Candidate Y than for a 35 – 44 year old to prefer Candidate Y? (Round the answer to the nearest hundredth)

- A) 0.43 times as likely
- B) 0.61 times as likely
- C) 1.65 times as likely
- D) 2.34 times as likely

14

A researcher conducted a survey to determine whether people in a certain large city prefer Mango brand mobile operating systems to Cyborg brand mobile operating systems. The researcher asked 186 people who visited a local coffee shop their opinion, and 8 refused to respond. Which of the following factors makes it least likely that a reliable conclusion can be drawn about the technological preferences of all the people in the city?

- A) Sample size
- B) Population size
- C) Number of people who refused to respond
- D) Where the survey was given

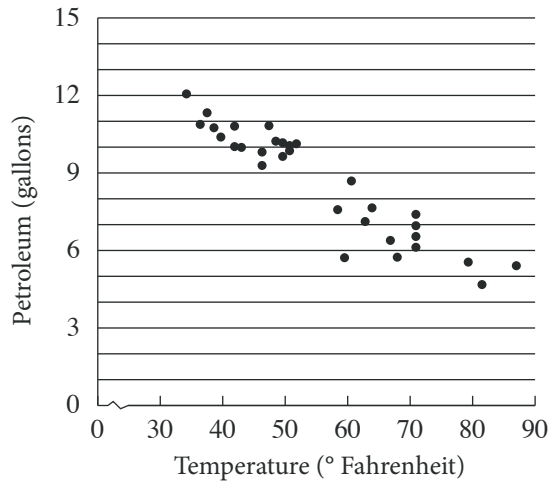
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**Questions 15–16 refer to the following information.**

A local power company collects the data shown below. The graph plots daily petroleum usage required to power a specific neighborhood (consisting of 120 homes) in Boston, MA against daily local high temperatures throughout the month of March 2013.



The power company's data can be modeled by the equation  $P = 16 - 0.15d$ , where  $d$  is the local daily high temperature in Boston, in degrees Fahrenheit, and  $P$  is the amount of petroleum, in gallons, used by the neighborhood on that day. Assume that relationship is also valid for temperatures colder than those shown on the graph.

15

There were four days in March 2013 in which the daily high temperature in Boston was  $71^\circ\text{F}$ . Which of the following is closest to the range of petroleum used by the neighborhood, in gallons, on these days?

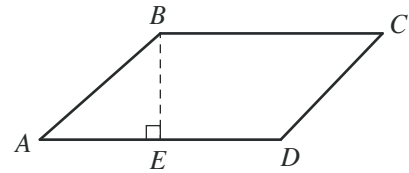
- A) 0.55
- B) 0.75
- C) 0.85
- D) 1.30

16

Based on the model, what is the petroleum usage, in gallons, of this neighborhood on a day on which the daily high temperature in Boston was  $10^\circ\text{F}$ ?

- A) 16.0
- B) 14.5
- C) 13.0
- D) 11.5

17

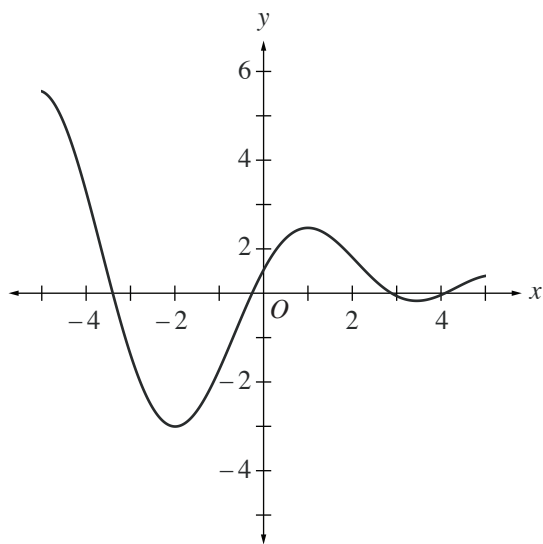


In quadrilateral  $ABCD$ ,  $\overline{AB}$  is parallel to  $\overline{CD}$  and  $\overline{BC}$  is parallel to  $\overline{AD}$ . If the length of  $AD$  and  $BC$  were each doubled and the length of  $BE$  was reduced by 50 percent, how would the area of  $ABCD$  change?

- A) The area of  $ABCD$  would be decreased by 50 percent.
- B) The area of  $ABCD$  would be increased by 50 percent.
- C) The area of  $ABCD$  would not change.
- D) The area of  $ABCD$  would be multiplied by 2.



18



What is the minimum value of the function graphed in the  $xy$ -plane above, for  $-5 \leq x \leq 5$  ?

- A)  $-3$
- B)  $-2$
- C)  $0$
- D)  $3$

19

Which of the following solids has the greatest volume?

- A) A right circular cylinder whose radius is 6 cm and whose height is 3 cm.
- B) A right circular cylinder whose radius is 3 cm and whose height is 6 cm.
- C) A cone whose radius is 6 cm and whose height is 6 cm.
- D) A sphere whose radius is 3 cm.

**PROCEED TO NEXT PAGE.**



**DIRECTIONS**

**For questions 20–24:** Solve the problem and record your answer in the grid on your bubblesheet, as described below.

- It is suggested, though not required, that you write your answers in the boxes at the top of the columns to help you mark the circles accurately. You will only receive credit if the circles are filled in correctly.
- Only mark one circle in each column.
- There are no negative answers.
- Some problems may have more than one correct answer. In such cases, please grid only one answer.

5. **Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If 

|                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 3                     | 1                     | /                     | 2                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

 is

entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

6. **Decimal answers:** If a solution is a decimal and the decimal does not terminate after 1 or 2 places, carry it out to a third place, to fill the entire grid.

Answer:  $\frac{7}{12}$

|                       |                                  |                       |                       |
|-----------------------|----------------------------------|-----------------------|-----------------------|
| 7                     | /                                | 1                     | 2                     |
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1                     | 0                                | 0                     | 0                     |
| 2                     | 1                                | 2                     | 3                     |
| 3                     | 2                                | 3                     | 4                     |
| 4                     | 3                                | 4                     | 5                     |
| 5                     | 4                                | 5                     | 6                     |
| 6                     | 5                                | 6                     | 7                     |
| 7                     | 6                                | 7                     | 8                     |
| 8                     | 7                                | 8                     | 9                     |
| 9                     | 8                                | 9                     | 0                     |

← Fraction line

Answer: 2.5

|                       |                       |                                  |                       |
|-----------------------|-----------------------|----------------------------------|-----------------------|
|                       | 2                     | .                                | 5                     |
| <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| 1                     | 0                     | 0                                | 0                     |
| 2                     | 1                     | 2                                | 3                     |
| 3                     | 2                     | 3                                | 4                     |
| 4                     | 3                     | 4                                | 5                     |
| 5                     | 4                     | 5                                | 6                     |
| 6                     | 5                     | 6                                | 7                     |
| 7                     | 6                     | 7                                | 8                     |
| 8                     | 7                     | 8                                | 9                     |
| 9                     | 8                     | 9                                | 0                     |

← Decimal point

Acceptable ways to grid in  $\frac{2}{3}$  are:

|                       |                       |                                  |                       |
|-----------------------|-----------------------|----------------------------------|-----------------------|
|                       | 2                     | /                                | 3                     |
| <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| 1                     | 0                     | 0                                | 0                     |
| 2                     | 1                     | 2                                | 3                     |
| 3                     | 2                     | 3                                | 4                     |
| 4                     | 3                     | 4                                | 5                     |
| 5                     | 4                     | 5                                | 6                     |
| 6                     | 5                     | 6                                | 7                     |
| 7                     | 6                     | 7                                | 8                     |
| 8                     | 7                     | 8                                | 9                     |

|                                  |                       |                       |                       |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| .                                | 6                     | 6                     | 6                     |
| <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1                                | 0                     | 0                     | 0                     |
| 2                                | 1                     | 2                     | 3                     |
| 3                                | 2                     | 3                     | 4                     |
| 4                                | 3                     | 4                     | 5                     |
| 5                                | 4                     | 5                     | 6                     |
| 6                                | 5                     | 6                     | 7                     |
| 7                                | 6                     | 7                     | 8                     |
| 8                                | 7                     | 8                     | 9                     |

|                                  |                       |                       |                       |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| .                                | 6                     | 6                     | 7                     |
| <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1                                | 0                     | 0                     | 0                     |
| 2                                | 1                     | 2                     | 3                     |
| 3                                | 2                     | 3                     | 4                     |
| 4                                | 3                     | 4                     | 5                     |
| 5                                | 4                     | 5                     | 6                     |
| 6                                | 5                     | 6                     | 7                     |
| 7                                | 6                     | 7                     | 8                     |
| 8                                | 7                     | 8                     | 9                     |

Answer: 201 – either position is correct

|                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
|                       | 2                     | 0                     | 1                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1                     | 0                     | 1                     | 0                     |
| 2                     | 1                     | 2                     | 3                     |
| 3                     | 2                     | 3                     | 4                     |
| 4                     | 3                     | 4                     | 5                     |
| 5                     | 4                     | 5                     | 6                     |
| 6                     | 5                     | 6                     | 7                     |
| 7                     | 6                     | 7                     | 8                     |
| 8                     | 7                     | 8                     | 9                     |

|                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
|                       | 2                     | 0                     | 1                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1                     | 0                     | 1                     | 0                     |
| 2                     | 1                     | 2                     | 3                     |
| 3                     | 2                     | 3                     | 4                     |
| 4                     | 3                     | 4                     | 5                     |
| 5                     | 4                     | 5                     | 6                     |
| 6                     | 5                     | 6                     | 7                     |
| 7                     | 6                     | 7                     | 8                     |
| 8                     | 7                     | 8                     | 9                     |

**NOTE:** You may start your answers in any columns, space permitting. Columns don't need to use should be left blank.

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20

The maximum seating capacity of a restaurant is 68 patrons. All tables at this restaurant seat either 2 or 4 patrons. If the restaurant has 22 tables, how many of the tables seat 4 patrons?

21

|        |    |   |    |   |    |
|--------|----|---|----|---|----|
| $x$    | 2  | 4 | 6  | 8 | 10 |
| $f(x)$ | -1 | 3 | 10 | 2 | 1  |

Let  $f(x)$  be defined for various values of  $x$ . If  $g(x) = \frac{3}{2}x + 4$ , what is the value of  $f(g(4))$ ?

22

| Annual Income         | Tax Rate |
|-----------------------|----------|
| \$0 to \$20,000       | 10%      |
| \$20,000 to \$50,000  | 16%      |
| \$50,000 to \$100,000 | 22%      |
| \$100,000 +           | 25%      |

Country X uses the progressive tax system summarized in the chart above. Using this chart, a person making \$35,000 would be taxed 10% for their first \$20,000 of annual income and 16% for their next \$15,000. How much would Bill, who made \$53,000 last year, be taxed under this system? (Ignore the dollar sign when bubbling-in in your answer. For example: if your answer is \$21, grid in 21.)

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Questions 23–24 refer to the following information.

$$p(t) = 1.5t^2 - 0.2t^3 \quad (\text{position-time})$$

$$v(t) = 3.0t - 0.6t^2 \quad (\text{velocity-time})$$

$$a(t) = 3.0 - 1.2t \quad (\text{acceleration-time})$$

A bullet train leaving Daegu bound for Seoul accelerates toward its maximum speed. The equations above describe the acceleration,  $a$  (in  $\text{km}/\text{min}^2$ ), the velocity,  $v$  (in  $\text{km}/\text{min}$ ), and position,  $p$  (in  $\text{km}$ ), of the train. The time,  $t$ , in minutes, is measured after the train departs. Assume the model is valid for  $0 \leq t \leq 2.5$ .

(Note: position is measured in kilometers from Daegu)

---

23

After how many minutes will the velocity of the train equal 3.6 kilometers per minute?

---

24

According to the model, what is the total distance traveled of the train, in kilometers, over the first 2.5 minutes of its journey?

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**STOP. BE CERTAIN NOT TO EXCEED THE  
ALLOTTED TIME. YOU MAY PROCEED TO  
SECTION 8 WHEN TOLD TO DO SO.**

**ACT SCIENCE TEST**

29 Questions — 26 Minutes

**DIRECTIONS:** There are four passages in this section. Each of them is followed by either five or six questions. Read the passage, choose the best answer, and fill in the corresponding letter on your bubblesheet. You may refer to any passage on the exam as many times as you need.

You may NOT use a calculator on this section.

**Passage I**

Radioactive decay is the spontaneous breakdown of an atomic nucleus resulting in the release of energy and matter from the nucleus. When radioactive isotopes undergo radioactive decay, these atoms transform into different isotopes. An isotope's *half-life* is the time required for half of the radioactive nuclei in a substance to decay in this manner.

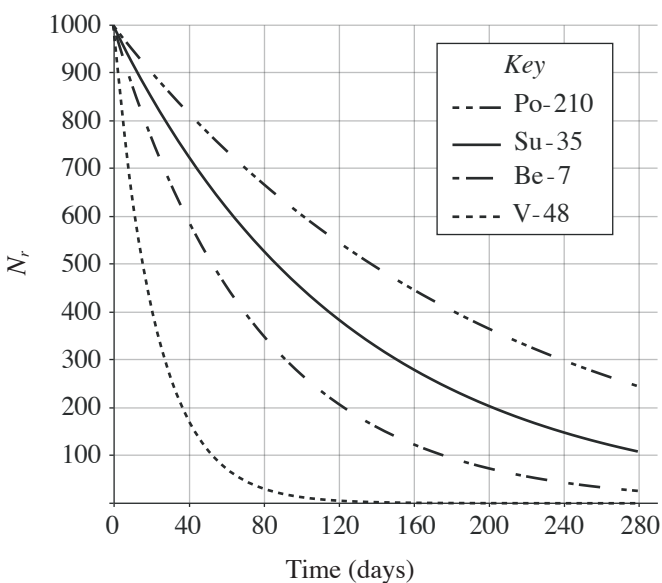


Figure 1

Figure 1 shows, for four isotopes, the change over time of the number of nuclei remaining,  $N_r$ , in a sample initially containing 1,000 of the nuclei.

Table 1 shows the recorded half-lives for seven different isotopes of carbon.

| Table 1 |                        |
|---------|------------------------|
| Isotope | Half-life (seconds)    |
| C-14    | $1.81 \times 10^{11}$  |
| C-11    | $1.22 \times 10^3$     |
| C-10    | $1.99 \times 10^1$     |
| C-15    | 2.45                   |
| C-20    | $1.60 \times 10^{-2}$  |
| C-21    | $3.00 \times 10^{-8}$  |
| C-8     | $2.00 \times 10^{-21}$ |

- According to Figure 1, for which isotope, V-48 or Be-7, will the average rate of decay be greater over the first 280 days?
  - V-48, because at any given time after zero, V-48 will have the higher  $N_r$ .
  - V-48, because at any given time after zero, V-48 will have the lower  $N_r$ .
  - Be-7, because at any given time after zero, Be-7 will have the higher  $N_r$ .
  - Be-7, because at any given time after zero, Be-7 will have the lower  $N_r$ .
- According to Figure 1, the half-life of Be-7 is approximately:
  - 15 days.
  - 50 days.
  - 140 days.
  - 280 days.
- Based on Table 1 and Figure 1, which of the following correctly orders the half-lives of C-8, C-15, and Po-210 from least to greatest?
  - C-8, C-15, Po-210
  - C-15, C-8, Po-210
  - Po-210, C-8, C-15
  - Po-210, C-15, C-8

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4. A student observed a sample of 2,000 nuclei of C-10 and a sample of 2,000 nuclei of C-8 over the span of 20 seconds. Which of the following statements best describes the results of this observation?
- F. After 20 seconds, there were approximately 1,000 C-10 nuclei remaining in the first sample and approximately 1,000 C-8 nuclei remaining in the second sample.
  - G. After 20 seconds, there were approximately 1,000 C-10 nuclei remaining in the first sample and few or no C-8 nuclei remaining in the second sample.
  - H. After 20 seconds, there were approximately 500 C-10 nuclei remaining in the first sample and approximately 500 C-8 nuclei remaining in the second sample.
  - J. After 20 seconds, there were approximately 500 C-10 nuclei remaining in the first sample and few or no C-8 nuclei remaining in the second sample.
5. A researcher observed a sample of 1,000 Co-56 nuclei for 120 days. After 40 days, the  $N_r$  of this sample was approximately 660. Based on Figure 1, the  $N_r$  of Co-56 after 120 days was most likely:
- A. greater than 400.
  - B. between 200 and 400.
  - C. between 80 and 200.
  - D. less than 80.

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**Passage II**

Caffeine is a stimulant found in energy drinks, coffee, tea, and most colas. Caffeine begins to take effect within five minutes of consumption, and reaches its peak effect approximately 30 minutes after consumption. Table 1 lists the typical caffeine content, in grams per liter, of commonly consumed beverages.

| Substance     | Caffeine Content (g/L) |
|---------------|------------------------|
| 7 Hour Energy | 3.384                  |
| Espresso      | 1.736                  |
| Hot Coffee    | 0.688                  |
| Iced Coffee   | 0.307                  |
| Green Tea     | 0.217                  |
| Diet Cola     | 0.127                  |
| Decaf         | 0.000                  |

Researchers conducted a series of experiments to determine whether caffeine affected students' typing speed in *wpm* (the number of words per minute that a person produces using a standard keyboard) and error rate in *epm* (the number of errors per minute that a person produces using a standard keyboard).

**Study 1**

Each student sat at a computer terminal. The researchers tested each student's typing speed and error rate by directing them to type a passage from *The Fox and the Grape*, one of Aesop's Fables. Students then were divided into four groups. Depending on which group they were assigned to, each student consumed 8 oz. of one of the beverages listed in Table 1.

Thirty minutes later, student typing speed and error rate were tested again using a similar procedure. The results for each group were averaged after each test and the results of both tests are shown in Table 2.

| Group | Before Consumption |                  | Beverage   | After Consumption  |                  |
|-------|--------------------|------------------|------------|--------------------|------------------|
|       | Typing Speed (wpm) | Error Rate (epm) |            | Typing Speed (wpm) | Error Rate (epm) |
| A     | 43.7               | 2.1              | Espresso   | 53.3               | 3.6              |
| B     | 43.4               | 2.1              | Hot Coffee | 47.9               | 3.0              |
| C     | 44.1               | 2.2              | Green Tea  | 46.3               | 2.5              |
| D     | 43.5               | 2.2              | Decaf      | 44.1               | 2.3              |

**Study 2**

One week later, the experiment in Study 1 was repeated with four new groups. However, during this study, the researchers waited three hours to retest students.

| Group | Before Consumption |                  | Beverage   | After Consumption  |                  |
|-------|--------------------|------------------|------------|--------------------|------------------|
|       | Typing Speed (wpm) | Error Rate (epm) |            | Typing Speed (wpm) | Error Rate (epm) |
| E     | 43.6               | 2.1              | Espresso   | 48.0               | 2.8              |
| F     | 43.4               | 2.1              | Hot Coffee | 45.5               | 2.5              |
| G     | 44.2               | 2.2              | Green Tea  | 45.2               | 2.4              |
| H     | 43.1               | 2.2              | Decaf      | 43.7               | 2.2              |

6. A student from Study 1 recorded typing speeds of 41.1 wpm and 56.9 wpm on the two typing tests given. Which group was this student most likely a part of?
- F. Group A  
G. Group B  
H. Group C  
J. Group D
7. Which of the groups served as a control in Study 2?
- A. Group E  
B. Group F  
C. Group G  
D. Group H
8. A fifth group of students repeated Study 1 using Iced Coffee. If the initial typing speed of the group was 43.8 wpm and the initial error rate of the group was 2.1 epm, which of the following most likely gives the typing speed and error rate of the group thirty minutes later?
- |    | <u>Typing Speed</u> | <u>Error Rate</u> |
|----|---------------------|-------------------|
| F. | 45.2                | 2.5               |
| G. | 47.1                | 2.7               |
| H. | 47.9                | 3.0               |
| J. | 55.1                | 3.8               |
9. Suppose the students in Group B were also tested 15 minutes after consuming their caffeinated beverages. Based on the results of Study 1, the average typing speed the researchers recorded for this trial most likely would have been:
- A. less than 43.4 wpm  
B. between 43.4 wpm and 47.9 wpm  
C. between 47.9 wpm and 53.3 wpm  
D. greater than 53.3 wpm

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10. Based on the results of Studies 1 and 2, if the students in Group E had also been retested 30 minutes after consuming the caffeinated beverage, average student typing speed most likely would have been:
- F. greater than the average student typing speed measured three hours after students consumed the caffeinated beverage.
  - G. equal to the average student typing speed measured three hours after students consumed the caffeinated beverage.
  - H. less than the average student typing speed measured three hours after students consumed the caffeinated beverage.
  - J. less than the average student typing speed measured before students consumed the caffeinated beverage
11. Suppose the data for all of the groups, before and after drinking the caffeinated beverages, were plotted on a graph with typing speed on the  $x$ -axis and error rate on the  $y$ -axis. Suppose also that the best-fit line for these data was determined. Which of the following would most likely characterize the slope of this line?
- A. The line would not have a slope, because the line would be vertical.
  - B. The slope of the line would be zero.
  - C. The slope of the line would be negative.
  - D. The slope of the line would be positive.

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**Passage III**

An elevated inclined chute makes an angle,  $\theta$ , with a table. Points A and B, endpoints of the chute, are 0.75 m apart. Point B is at a height  $H$  meters above the floor (see Diagram 1).

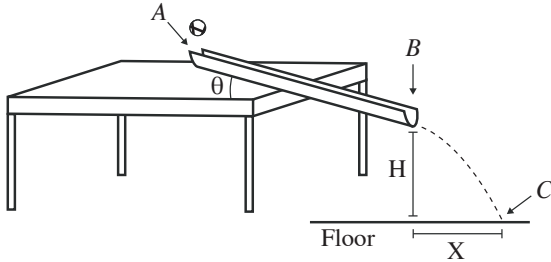


Diagram 1

A marble is released at Point A and travels down the inclined chute to Point B. In some trials, the marble is released from rest; in others, an initial force,  $F$ , is applied to the marble. The sphere is in free fall between Points B and C and first hits the floor at Point C, a horizontal distance  $X$  from the bottom of the inclined plane.

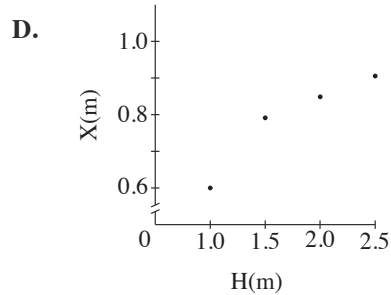
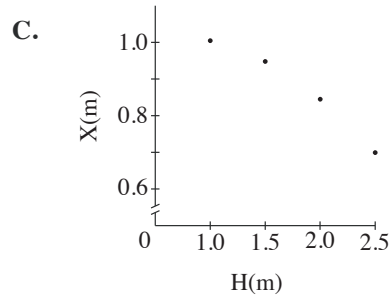
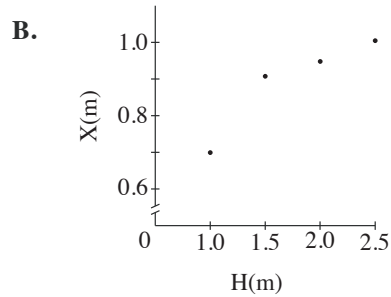
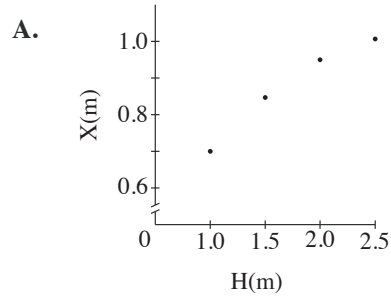
The table below shows how  $X$ , in meters (m), varies for different values of  $H$ , in meters (m);  $\theta$ , in degrees; and  $F$ , in newtons (N).

| Combination | $H$<br>(m) | $\theta$ <sup>(°)</sup> | $F$<br>(N) | $X$<br>(m) |
|-------------|------------|-------------------------|------------|------------|
| 1           | 1.0        | 25                      | 0          | .70        |
| 2           | 1.5        | 25                      | 0          | .85        |
| 3           | 2.0        | 25                      | 0          | .94        |
| 4           | 2.5        | 25                      | 0          | 1.01       |
| 5           | 1.5        | 15                      | 0          | 0.60       |
| 6           | 1.5        | 20                      | 0          | 0.77       |
| 7           | 1.5        | 25                      | 0          | 0.85       |
| 8           | 1.5        | 30                      | 0          | 0.90       |
| 9           | 1.5        | 35                      | 0          | 0.85       |
| 10          | 1.5        | 40                      | 0          | 0.77       |
| 11          | 1.5        | 25                      | 0          | 0.85       |
| 12          | 1.5        | 25                      | 5          | 0.93       |
| 13          | 1.5        | 25                      | 10         | 0.97       |
| 14          | 1.5        | 25                      | 15         | 0.99       |

12. According to Table 1 and Combinations 5 through 10, as  $\theta$  increases,  $X$ :

- F. increases only
- G. decreases only
- H. increases, then decreases
- J. decreases, then increases.

13. Based on Combinations 1 through 4, the relationship between  $H$  and  $X$  is best represented by which of the following graphs?



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14. Based on the table,  $X$  will be greatest for which of the following  $H$ ,  $\theta$ , and  $F$ ?

|    | $H(m)$ | $\theta(^{\circ})$ | $F(N)$ |
|----|--------|--------------------|--------|
| F. | 1.0    | 20                 | 5      |
| G. | 1.0    | 30                 | 15     |
| H. | 2.0    | 20                 | 15     |
| J. | 2.0    | 30                 | 15     |

15. If experimental trials were conducted in the same manner in which Combinations 11 through 14 were tested, what would be the independent variable and what would be the dependent variable?

|    | <u>Independent</u> | <u>Dependent</u> |
|----|--------------------|------------------|
| A. | $\theta$           | $X$              |
| B. | $X$                | $\theta$         |
| C. | $F$                | $X$              |
| D. | $X$                | $F$              |

16. When the ball was released, a transformation of energy occurred which included the marble's potential energy ( $P_e$ ), kinetic energy ( $K_e$ ), and heat ( $Q$ ). Which of the following statements best describes this transformation?

- F.  $P_e$  and  $Q$  were converted to  $K_e$   
 G.  $K_e$  and  $Q$  were converted to  $P_e$ .  
 H.  $P_e$  was converted to  $K_e$  and  $Q$ .  
 J.  $K_e$  was converted to  $P_e$  and  $Q$ .

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**Passage IV***Introduction*

During the *Hadean Eon* (the time period that began with the formation of the Earth approximately 4.5 billion years ago), Earth's only satellite, the Moon, was formed. The Moon orbits the Earth approximately once every 24 hours. The Moon's *apogee* (the maximum distance between the center of the Earth and the center of the Moon) is approximately 405,400 kilometers and its *perigee* (the minimum distance between the center of the Earth and the center of the Moon) is approximately 362,600 kilometers.

An astronomy class discusses possible scenarios of how the Moon was formed. Below are three separate hypotheses that the class came to collectively.

*Hypothesis 1*

The Moon was created independently of the Earth during the early stages of our Solar System. The two objects had their own distinct orbits around the sun. Over time, the two orbits moved closer together. Eventually, the two objects were close enough to be influenced by the forces of gravity. The Earth's gravitational field, being much stronger than that of the Moon's due to its size, captured the Moon.

*Hypothesis 2*

The outer layers of the Moon bear a striking resemblance to that of the Earth. Earth's crust is made up of approximately 47% oxygen, 28% silicon, 8.1% aluminum, 5% iron, 3.6% calcium, 2.1% magnesium, and 6.2% other materials. The Moon was created from excess material that was spun out from the Earth as it rotated during its early years of development. It gathered in a cloud of debris that orbited around the Earth and slowly melded together.

*Hypothesis 3*

The Moon was created from material that was ejected from Earth's crust after a massive impact occurred. An object with the approximate size of Mars collided with Earth during Earth's early evolutionary stage. The impact was so massive that it sent a significant amount of Earth's surface hurtling into space. However, the materials could not escape Earth's gravitational forces and were trapped in orbit. These objects remained hot after impact and continued to crash into each other and bonded together as they orbited Earth. After the material cooled the end result was the Moon.

17. Based on the information provided, which of these is most likely a true statement about the Moon?
- At some point during any given day the Moon is 390,000 km from the Earth.
  - At some point during any given day the Moon is 410,000 km from the Earth.
  - At some point during any given day the Moon is 390,000 km from the Sun.
  - At some point during any given day the Moon is 410,000 km from the Sun.
18. It is known that the gravitational pull of the Earth is strong enough to force an object with the Moon's velocity and mass to orbit the Earth if it is within 900,000 km of the Earth. Given that this information is true which of the hypotheses, if any, are weakened?
- None
  - Hypothesis 1
  - Hypothesis 2 and 3
  - Hypothesis 1, 2 and 3
19. Supporters of Hypothesis 2 would most likely agree with which of the following chemical compositions for the Moon's crust?
- 43% O, 26% Si, 9% Al, and 22% Other
  - 43% O, 16% Si, 16% Al, and 25% Other
  - 55% O, 26% Si, 9% Al, and 10% Other
  - 55% O, 16% Si, 16% Al, and 13% Other
20. Which of the following processes is most responsible for the formation of the Moon in Hypothesis 2 and 3?
- Electromagnetic Force
  - Nuclear Force
  - Fusion
  - Fission
21. It is known that one of the moons of Mars, Phobos, is a *captured asteroid* (an asteroid that passed close enough to Mars that it was unable to escape its gravitational pull). Which of the following statements, if true, undermines the claim that Earth's Moon is a captured asteroid?
- The average temperature of the Moon is approximately  $-5^{\circ}$  Celsius, significantly cooler than that of the Earth.
  - The surface of the Moon is heavily cratered.
  - The Moon is approximately  $\frac{1}{80}$  times the mass of the Earth, where as Phobos is approximately  $\frac{1}{10^8}$  times the mass of Mars.
  - The chemical compositions of Phobos and the Moon are significantly different.

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22. Supporters of Hypothesis 1 would most likely agree that the materials that compose the Moon came from which of the following places?
- F. Materials present during the Hadean Eon
  - G. Earth
  - H. Mars
  - J. An asteroid field
23. If Hypothesis 1 is true, which of the following statements must be true about the gravitational pulls of the Earth and the Sun? When the Moon was created, the effect of the Sun's gravity on the Moon was:
- A. at first weaker than but eventually equal to the effect of Earth's gravity.
  - B. at first weaker than but eventually stronger than the effect of Earth's gravity.
  - C. at first equal to but eventually weaker than the effect of Earth's gravity.
  - D. at first stronger than but eventually weaker than the effect of Earth's gravity.

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## Passage V

### Introduction

High Fructose Corn Syrup, or HFCS, is a low-cost alternative to sucrose (table sugar) commonly found in American soft drinks. While sucrose is typically derived from sugarcane or beet, HFCS is produced by milling corn and then adding enzymes until 42% of the mixture, by weight, consists of fructose.

The enzymes involved in converting corn starch into HFCS are: *Alpha-amylase*, which produces shorter chains of sugars called oligosaccharides from raw cornstarch, and *Glucoamylase*, which breaks the oligosaccharides down even further to yield pure glucose, and *Xylose Isomerase*, which converts glucose into fructose.

Because the increased introduction of HFCS in the American diet has coincided with an increase in obesity, a team of researchers did two experiments to determine whether the rise in obesity may be at least partially explained by the use of HFCS.

### Experiment 1

The researchers selected 24 adolescent male rats for the experiment. The rats were divided into 3 groups each containing 8 rats such that each group of rats had roughly the same average bodyweight—300 g—at the beginning of the experiment. All groups were placed on a diet that consisted of a specific brand of dry rat food ad libitum (available at all times), but no other food. All groups also had access to unsweetened water. Only some of the groups had access to water sweetened with HFCS or sucrose.

The researchers measured the average bodyweight within each group at various times, as shown in the figure below.

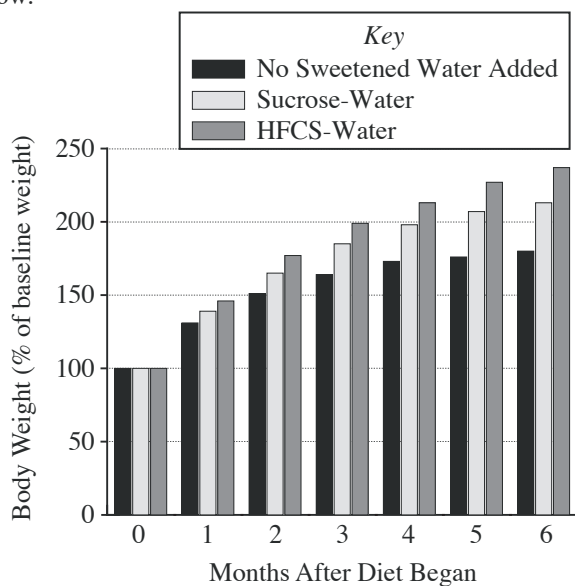


Figure 1

### Experiment 2

The researchers selected 16 adolescent male rats for the Experiment. The rats were divided into 2 groups each containing 8 rats such that each group of rats had roughly the same average bodyweight—300 g—at the beginning of the experiment. Both groups were given access to a specific brand of dry rat food ad libitum, but no other food. Both groups had access to unsweetened water. Only one group had access to water sweetened with HFCS.

Researchers measured the average daily caloric intake of the rats in each group, the average bodyweight of the rats in each group after 2 months, and the average triglyceride level of the rats in each group after 2 months. The results are given in the table below.

| Group | Access to HFCS-Water? | Daily Caloric Intake (kcal) | Bodyweight after 2 mo. (% of baseline weight) | Triglyceride Level (mg/dL) |
|-------|-----------------------|-----------------------------|---|----------------------------|
| A     | Yes                   | 84                          | 177   | 201                        |
| B     | No                    | 86                          | 151   | 147                        |

Experiments and data adapted from High-fructose corn syrup causes characteristics of obesity in rats: Increased body weight, body fat and triglyceride levels by Bocarsly, Powell, Avena, and Hoebel. Originally published in *Pharmacology, Biochemistry and Behavior*, 2010.

24. Suppose Experiment 1 had continued for a seventh month. The average bodyweight of rats that had access to sucrose-water after seven months most likely would have been:
- F. Less than 213% of their baseline weight.
  - G. Between 213% and 237% of their baseline weight.
  - H. Between 237% and 250% of their baseline weight.
  - J. Greater than 250% of their baseline weight.
25. The researchers hypothesized that the rats with access to HFCS-water for two months would consume more calories than rats without access to HFCS-water. Do the results of Experiment 2 support this hypothesis?
- A. Yes, the rats in Group A consumed more calories than the rats in Group B.
  - B. Yes, the rats in Group A consumed fewer calories than the rats in Group B.
  - C. No, the rats in Group A consumed more calories than the rats in Group B.
  - D. No, the rats in Group A consumed fewer calories than the rats in Group B.

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26. Suppose the researchers measure the total amount of HFCS consumed by rats over the 2 experiments to be 1000g. Approximately how much fructose did the rats consume between the experiments?
- F. 42g
  - G. 58g
  - H. 420g
  - J. 580g
27. During which month of Experiment 1 did the rats in each group gain the most weight? The rats in all three groups gained the most weight:
- A. between zero and one months after beginning the diet.
  - B. between one and two months after beginning the diet.
  - C. between four and five months after beginning the diet.
  - D. between five and six months after beginning the diet.
28. Based on the results of Experiment 1, approximately how many months after the experiment began did the average weight of the rats in the group that had access to HFCS-water equal 600 g?
- F. 3 months
  - G. 4 months
  - H. 5 months
  - J. 6 months
29. Which of these is a question that can be answered by analyzing the results of these experiments?
- A. Does access to HFCS-water cause female rats to carry more bodyweight?
  - B. Does HFCS cause diseases such as pancreatitis and diabetes in humans?
  - C. Do triglyceride levels rise in male rats that consume HFCS?
  - D. What effect does a higher ratio of glucose to fructose in HFCS have on bodyweight in male rats who consume HFCS-water?

**STOP. END OF DIAGNOSTIC. MAKE SURE  
TO HAND YOUR BUBBLESHEET IN.**



# Answer Key & Solutions



## ANSWER KEY

**Section 1**

1. B
2. F
3. D
4. H
5. B
6. F
7. B
8. G
9. D
10. F
11. C
12. J
13. B
14. F
15. A
16. G
17. D
18. G
19. B
20. H
21. B
22. G
23. D
24. J
25. A
26. F
27. C
28. H
29. A
30. H
31. D
32. H
33. C
34. G
35. A
36. J
37. A
38. G
39. C
40. F
41. D
42. G
43. C
44. J
45. A

**Section 2**

1. B
2. A
3. C
4. B
5. D
6. D
7. B

8. D
9. B
10. A
11. C
12. B
13. D
14. A
15. A
16. A
17. C
18. D
19. D
20. C
21. B
22. D
23. D
24. A
25. D
26. B
27. B
28. C
29. C
30. D
31. B
32. C
33. D

**Section 3**

1. B
2. H
3. C
4. J
5. E
6. H
7. B
8. K
9. D
10. K
11. D
12. J
13. A
14. H
15. E
16. G
17. C
18. G
19. B
20. J
21. A
22. J
23. B
24. F
25. C
26. J
27. B

28. K
29. B
30. F
31. A
32. F
33. E
34. H
35. C
36. G
37. D
38. G
39. A
40. H

**Section 4**

1. A
2. A
3. D
4. B
5. C
6. D
7. C
8. D
9. D
10. A
11. A
12. C
13. B
14. B
15. D
16. C
17. A
18. A
19. D
20. C
21. C
22. A
23. C
24. A
25. D
26. D
27. C
28. B
29. C
30. B
31. B
32. A
33. C

**Section 5**

1. B
2. G
3. C
4. F
5. B

6. G
7. C
8. J
9. B
10. G
11. C
12. J
13. B
14. F
15. D
16. F
17. C
18. F
19. D
20. G
21. A
22. G
23. D
24. H
25. B
26. J
27. A
28. H
29. B
30. J

**Section 6**

1. A
2. C
3. D
4. B
5. D
6. C
7. B
8. C
9. D
10.  $\frac{2}{3}$
11. 8
12. 3

**Section 7**

1. B
2. B
3. C
4. B
5. C
6. A
7. A
8. D
9. D
10. B
11. B
12. B
13. C
14. D

15. D
16. B
17. C
18. A
19. A
20. 12
21. 1
22. 7460
23. 2
24. 6.25

**Section 8**

1. B
2. G
3. A
4. G
5. B
6. A
7. J
8. B
9. G
10. A
11. J
12. H
13. A
14. J
15. C
16. H
17. A
18. F
19. A
20. H
21. C
22. F
23. D
24. G
25. D
26. H
27. A
28. F
29. C

SECTION 1 | ACT ENGLISH | SOLUTIONS

Passage I – Harvesting Strawberries

- Question 1.** The best answer is **B** because both “handed” and “showed” are in the same verb tense.
- Question 2.** The best answer is **F** because it is the only answer choice that mentions details of the farm’s setting.
- Question 3.** The best answer is **D** because it avoids creating a run-on sentence.
- Question 4.** The best answer is **H** because it provides the best contrast to how “inviting” the rows originally looked.
- Question 5.** The best answer is **B** because it is the adverb that modifies the adjective “appealing”.
- Question 6.** The best answer is **F** because the strawberries were “dull” and they “hid” rather than looking “pleasant and inviting”.
- Question 7.** The best answer is **B** because it is the only one that shows the narrator doing something.
- Question 8.** The best answer is **G** because it is the right tense and voice.
- Question 9.** The best answer is **D** because “them” refers back to the two types of strawberries.
- Question 10.** The best answer is **F** because the rest of the paragraph discusses two types of strawberry.
- Question 11.** The best answer is **C** because it is the least wordy.
- Question 12.** The best answer is **J** because it eliminates unnecessary information.
- Question 13.** The best answer is **B** because the verb “can have” requires a subject “a picker”.
- Question 14.** The best answer is **F** because it avoids a run-on (as in B) and is less wordy than C. Choice D creates a dangling modifier.
- Question 15.** The best answer is **A** because it is the right past tense of “to spit”.

Passage II – Saving the Whooping Cranes

- Question 16.** The best answer is **G** because the addition does create such balance.
- Question 17.** The best answer is **D** because the birds fly low.
- Question 18.** The best answer is **G** because it is the only answer which provides a subject and a verb to the independent clause that follows the comma.
- Question 19.** The best answer is **B** because the birds are recovering as their numbers increase.
- Question 20.** The best answer is **H** because the subject “donations” requires a plural auxiliary -- “have” rather than “has”.
- Question 21.** The best answer is **B** because there is no need to separate the noun “scientists” from the prepositional phrase that modifies it.
- Question 22.** The best answer is **G** because it makes clear that the birds need to avoid specific dangers.
- Question 23.** The best answer is **D** because it is parallel in construction with the verb “teach”.

## SECTION 1 | ACT ENGLISH | SOLUTIONS

**Question 24.** The best answer is **J** because placed after sentence 4, “this program” refers to “Operation Migration”, which must be mentioned before “this program”. Also, the following paragraph begins with “The Partnership”.

**Question 25.** The best answer is **A** because the subject of the sentence is “A class”, which requires a singular auxiliary — “has”, not “have”.

**Question 26.** The best answer is **F** because “Via” means “by means of” and says it in fewer words.

**Question 27.** The best answer is **C** because the introductory phrase “During these flights through the eastern United States” must be separated from the main clause by a comma.

**Question 28.** The best answer is **H** because “power lines” and “windmill blades” are count nouns and therefore require “fewer” rather than “less”.

**Question 29.** The best answer is **A** because placed here, the sentence provides a contrast with the following sentence that describes the dangers of low flying.

**Question 30.** The best answer is **H** because the essay does not report a “rate of success”.

**Passage III – Mark Rothko — Who Painted Color**

**Question 31.** The best answer is **D** because these are two separate sentences and must be punctuated as such.

**Question 32.** The best answer is **H** because the contrast between the two viewers’ reactions indicates how various they were.

**Question 33.** The best answer is **C** because the use of “because” makes an independent clause necessary to complete the sentence.

**Question 34.** The best answer is **G** because “rectangles” is plural, so the verb must also be plural.

**Question 35.** The best answer is **A** because “shapes” is plural, so they must be “themselves”.

**Question 36.** The best answer is **J** because there is no comma needed between the noun “communication” and the phrase that modifies it.

**Question 37.** The best answer is **A** because no transitional word is necessary.

**Question 38.** The best answer is **G** because it identifies where the color is in the fewest words.

**Question 39.** The best answer is **C** because the appositive “one of Rothko’s most famous” must be surrounded by commas.

**Question 40.** The best answer is **F** because “floods” accurately gives a sense of how strong and numerous these feelings are.

**Question 41.** The best answer is **D** because the compound direct object of the verb “expresses” requires no comma separation.

**Question 42.** The best answer is **G** because it is the only one that focuses on the works in the Chapel.

**Question 43.** The best answer is **C** because the entire clause modifies “works” and must be introduced by “which”

**Question 44.** The best answer is **J** because it mentions “colors”, the central theme of the essay, and uses “melancholy” to emphasize the mood.

**Question 45.** The best answer is **A** because color is central to the essay and is clearly an aspect of Rothko’s talent/genius.

SECTION 2 | SAT CRITICAL READING | SOLUTIONS

Passage I – Robinson Crusoe

**Question 1. The best answer is B** because the author states in (lines 26–27) that his plan to go to sea was against his father’s commands. In the fourth and fifth paragraphs (lines 32–70) the father gives many examples of a lifestyle he believes would bring his son more happiness than a life at sea.

**Question 2. The best answer is A** because throughout the fourth and fifth paragraphs of the passage (lines 32–70) the father expresses grave misgivings about his son’s plans to go to sea, and offers various reasons why (lines 48–51) living in “the middle state... , was the best state in the world, the most suited to human happiness.”

**Question 3. The best answer is C** because the author states in (lines 24–31) that “I would be satisfied with nothing but going to sea...tending directly to the life of misery which was to befall me.”

**Question 4. The best answer is B** because lines 21–31 end with statement “tending directly to the life of misery which was to befall me.”

**Question 5. The best answer is D** because “misuse” most accurately describes the way the name Kreutznaer was changed to “Crusoe” upon the family’s move from Bremen to England, and that the family chose to call itself by that name even though it was not its name. Had this change evolved over a long period of time, “evolution” would have been the correct answer.

**Question 6. The best answer is D** because in lines 16–18 the author states “...any more than my father or mother knew what became of me.”

**Question 7. The best answer is B.** Choice B is the best answer because in lines 16–18 the author states “What became of my second brother I never knew, any more than my father or mother knew what became of me.”

**Question 8. The best answer is D** because in lines 2–11 we learn that the author’s name, Robinson Kreutznaer, originated in Bremen and was changed in England. That the family did not object to this is implied in (lines 9–11) “...we are now called— nay we call ourselves and write our name—Crusoe...”

**Question 9. The best answer is B** because an “entreaty” is a plea. The use of the word “persuasions” right after the word entreaties in the text (line 28) helps the reader to see that the word in context is a plea, not an outburst, a discussion or tears.

**Question 10. The best answer is A** because the author recounts his father’s advice that neither fortunes (lines 42–43), “... desperate fortunes on one hand, or of aspiring, superior fortunes on the other...”, nor fame (line 45), “...make themselves famous”, are as suitable for happiness as the “middle state”, which was (lines 50–51), “the best state in the world, the most suited to human happiness”.

**Question 11. The best answer is C** because that the author’s father cares is demonstrated in lines 35–36 and that he is inquisitive is demonstrated in lines 36–41.

Passage II – Supreme Court

**Question 12. The best answer is B** because the sentence in lines 8–9 wants to convey that the Supreme Court struck down the “upper limits” on the maximum amount of money an individual can contribute. Plug your answer choice in and then to reread the sentence. That will show you why maximum doesn’t work.

**Question 13. The best answer is D** because the text notes (lines 16–20) that “the conservative justices argued that the first Amendment (freedom of expression) prohibits Congress from creating laws that restrict the exercise of the First Amendment rights in the form of campaign contributions.

**Question 14. The best answer is A** because lines 16–20 state “that the conservative justices argued that the First Amendment (freedom of expression) prohibits Congress from creating laws that restrict the exercise of First Amendment rights in the form of campaign contributions.”

## SECTION 2 | SAT CRITICAL READING | SOLUTIONS

**Question 15. The best answer is A** because lines 32–35 state that the new decision might devastate (ruin, end) “what remains of campaign finance reform.”

**Question 16. The best answer is A** because lines 61–67 state that the law pertains to very few Americans since it limits political contributions to no more than \$48,600 to candidates, plus an additional \$74,600 to political committees.

**Question 17. The best answer is C** because in lines 74–82 Breyer noted that “Where enough money calls the tune, the general public will not be heard ... And a cynical public can lose interest in political participation altogether.”

**Question 18. The best answer is D** because in lines 74–82, Breyer noted that “where enough money calls the tune, the general public will not be heard ... And a cynical public can lose interest in political participation altogether.”

**Question 19. The best answer is D** because the sentence in question (line 83–86) conveys the following: “Breyer argued that removing the aggregate limits (the total limits) on campaign contributions created large loopholes to unduly influence government. lines 61–67 note the new law struck down the amount of money an individual could contribute to candidates and political committees.

**Question 20. The best answer is C** because on lines 91–94 Roberts counters that the arguments are “either illegal under current campaign finance laws,” or made by people who are “divorced from reality.”

**Question 21. The best answer is B** because both Justice Roberts (lines 91–94) and Justice Breyer (lines 74–82) have written highly critical and biting remarks about the justices whose rulings differed from theirs. Breyer wrote that the justices’ decision was unconstitutional. He added the decision could well drive citizens from voting. Justice Roberts wrote that the dissenting justices’ position was “either illegal” or that the justices were “divorced from reality.”

**Question 22. The best answer is D** because in the first three paragraphs the author notes in the topic sentence that the decision is controversial; divisive; contentious. The article goes on to present opposing points of view on the decision from Senator McCain, Justice Roberts and Justice Breyer.

## Passage III – GM Crops

**Question 23. The best answer is D** because lines 6–7 state that the crops “have been altered to provide maximum amount of benefit to the both the consumer and the farmhands. The first sentence in the next paragraph (line 8–11) notes the benefit to the environment.

**Question 24. The best answer is A** because lines 1–7 state that the crops “have been altered to provide maximum amount of benefit to the both the consumer and the farmhands. The first sentence in the next paragraph (line 8–11) notes the benefit to the environment.

**Question 25. The best answer is D** because the organizations’ data are accepted internationally, which is why they are highly respected. Lines 35–37 note that the scientific organizations have offered reams of compelling and internationally accepted scientific data.

**Question 26. The best answer is B** because the authors states (lines 56–59) the use of glyphosate led to the substantial increase in the use of herbicides that had harmful effects on the environments and the actual fruits of its efforts.

**Question 27. The best answer is B** because harmful effects on crops and the environment can be found on lines 56–59. “This increase has had harmful effects on the environment and the actual fruits of its efforts”

**Question 28. The best answer is C** because the text states (lines 54–55) that “Farmers could now easily combat the weeds that disturbed their crops.” The word combat implies that the weeds hindered the growth of the crops.

**Question 29. The best answer is C** because a very large percentage of Americans who eat GM varieties of soybean (94 percent) and maize (72 percent) are exposed to toxic herbicides (lines 65–69)

## SECTION 2 | SAT CRITICAL READING | SOLUTIONS

**Question 30.** The best answer is **D** because the rate of increase of glyphosate use on soybean crops is projected to be 3.3% between 2010 and 2011, which is smaller than the typical growth of 8.9% between 2005 and 2010. (Table 1).

**Question 31.** The best answer is **B** because Passage 1 (lines 1–11) makes the case the modified crops benefit the consumer, the farmer, and the environment. On the other hand, Passage 2 argues (lines 40–42) that GM crops propose a risk to the consumer and the environment.

**Question 32.** The best answer is **C** because Passage 2 expresses concern that (lines 75–81) “Heightened risk of public health impacts can be impacted with more intensive herbicide use to protect GM crops. ”

**Question 33.** The best answer is **D** because the author of passage 1, who disagrees with this statement in Passage 2, recognizes it and then goes on to refute it in (lines 31–39).

## SECTION 3 | ACT MATHEMATICS | SOLUTIONS

## Multiple Choice

**Question 1.** The correct answer is **B**. One share of Ashwin’s stock was worth \$22.90 after the first month, \$22.65 after the second, and \$22.70 after the third. Therefore, 100 shares of stock is worth  $100 \cdot \$22.70 = \$2,270$ .

**Question 2.** The correct answer is **H**. If we multiply both sides of the original equation by 4, we are left with  $5(x - 3) = 80$ . Therefore, we divide both sides by 5 to obtain the results  $x - 3 = 16$ . Add 3 to both sides and find that  $x = 19$ .

**Question 3.** The correct answer is **C**. We are asked for the ratio of red pieces to black pieces, so we must simplify  $\frac{28}{32}$  to  $\frac{7}{8}$ .

**Question 4.** The correct answer is **J**. Because  $\angle ACB$  and  $\angle BCD$  are supplementary,  $\angle ACB = 27^\circ$ . Because  $\overline{AB} = \overline{BC}$ ,  $\triangle ABC$  is isosceles and  $\angle BAC = 27^\circ$ . Therefore,  $\angle ABC = (180 - 27 - 27)^\circ = 126^\circ$ .

**Question 5.** The correct answer is **E**. We must distribute the minus sign through the second parentheses so that the expression becomes  $4x^3 + 3 + 3x^2 + x - 5$ . Now combine like terms:  $7x^2 + x - 2$ .

**Question 6.** The correct answer is **H**. The volume of a right rectangular prism is calculated using the formula  $V = lwh$ . The problem tells us that  $l = 14$  and  $w = 18$ . Therefore,  $3780 = 14 \cdot 18 \cdot h$ . Solve, and  $h = 15$ .

**Question 7.** The correct answer is **B**. The least common denominator is the smallest number that divides by 4, 5, and 30 evenly. The number 30 does not divide 4 evenly, but 60 works.

**Question 8.** The correct answer is **K**. The average of  $x$ ,  $2x$ ,  $4x$ , and  $8x$  is  $\frac{x + 2x + 4x + 8x}{4}$ . Therefore,  $67.5 = \frac{x + 2x + 4x + 8x}{4}$ . Thus, combining like terms,  $67.5 = \frac{15x}{4}$ . Multiply 4 by both sides and obtain  $270 = 15x$ . Thus,  $x = 18$ .

**Question 9.** The correct answer is **D**. The angle vertical to the angle marked with  $x^\circ$  (which also is  $x^\circ$ ) and the angle marked  $y^\circ$  are consecutive interior angles. Therefore,  $x + y = 180$ , and  $x = 180 - y$ .

**Question 10.** The correct answer is **K**. The additive rule of exponents says that the product of  $a^3$  and  $a$  is  $a^4$ . Similarly, the product of  $b^2$  and  $b^5$  is  $b^7$ . Additionally, choices F and G are wrong because  $4 \cdot 5 = 20$ .

**Question 11.** The correct answer is **D**. A shift to the left by three units indicates that  $x$  must decrease by 3.

## SECTION 3 | ACT MATHEMATICS | SOLUTIONS

**Question 12. The correct answer is J.** If  $x$  of the flips landed with the heads side up, then  $x - 52$  landed with the tails side up. Therefore,  $x + (x - 52) = 162$ . Therefore,  $2x = 214$ , so  $x = 107$ .

**Question 13. The correct answer is A.** Subtract 5 from the initial inequality to obtain  $6x \geq 2$ . Therefore,  $x \geq \frac{2}{6}$ , which can be simplified as  $x \geq \frac{1}{3}$ .

**Question 14. The correct answer is H.** We can isolate  $y$  and put the equation into slope-intercept form. Subtract  $4x$  from each side to obtain  $5y = -4x + 10$ . Divide both sides by 5 to obtain  $y = -\frac{4}{5}x + 2$ . The slope of this line is the coefficient of  $x$ , which is  $-\frac{4}{5}$ .

Alternatively, we can use the property that the slope of a line in standard form ( $ax + by = c$ ) is  $-\frac{a}{b}$ .

**Question 15. The correct answer is E.** In order for the median temperature for the seven days to be  $33^\circ$ , there must be one data point equal to  $33^\circ$  in our data set, three other values that are at most  $33^\circ$  in the data set, and three other values that are at least  $33^\circ$  in the data set.

An inspection of our data set reveals that there are currently three values greater than  $33^\circ$ , so the remaining value must be at most  $33^\circ$ . Therefore, Sunday's temperature cannot be  $35^\circ$ .

**Question 16. The correct answer is G.** The equation is quadratic, so we set it equal to zero (so that we can factor and use the zero product rule in our next step). If we subtract 15 from both sides, the equation becomes  $(x - 5)(x + 3) = 0$ . Therefore, the possible values of  $x$  are the numbers that make the equations  $x - 5 = 0$  and  $x + 3 = 0$  true, which are  $x = 5$  and  $x = -3$ .

**Question 17. The correct answer is C.** Once  $\$Q$  and  $\$R$  are both deducted from  $P$ , the remaining  $\$P - Q - R$  represents Will's take home pay. The fraction of his weekly salary is therefore  $\$ \frac{P - Q - R}{P}$ .

**Question 18. The correct answer is G.** The area of a triangle is calculated using the formula  $A = \frac{1}{2}bh$ . The problem tells us that  $b = x + 3$  and  $h = 4x - 2$ . Therefore,  $A = \frac{1}{2}(x + 3)(4x - 2)$ . Expand, and  $A = 2x^2 + 5x - 3$ .

**Question 19. The correct answer is B.** The line must have a positive slope (which rules out options C, D, and E). Because  $y$  is less than or equal to the other side of the equation, the shading must be below the line (which rules out option A).

**Question 20. The correct answer is J.** If  $|x - 9| = 11$ , then  $x - 9 = 11$  or  $x - 9 = -11$ . Add 9 to both sides of both equations and  $x = -2$  or  $x = 20$ .

**Question 21. The correct answer is A.** The sine of an angle in a right triangle is equal to the side opposite it divided by the hypotenuse of the triangle. Therefore, if we label the side that we are solving for  $x$ , it is true that  $\sin 8^\circ = \frac{x}{24}$ . Multiply both sides by 24 and we get  $24 \sin 8^\circ = x$ .

**Question 22. The correct answer is J.** If  $x$  represents the number of students in the junior class, then 68% of  $x$  equals 289. Therefore,  $0.68x = 289$ . Divide both sides by 0.68 and we obtain  $x = 425$ .

**Question 23. The correct answer is B.** The formula for percentage change is  
 Percent Change =  $\frac{\text{New Value} - \text{Original Value}}{\text{Original Value}} \cdot 100$ . Therefore, we must calculate  $\frac{\$2.43 - \$2.25}{\$2.43} \cdot 100$ , which is equal to 9%.

**Question 24. The correct answer is F.** The value of  $g(4)$  is 16, so the value of  $f(g(4))$  is equal to  $f(16)$ , which is 33.

## SECTION 3 | ACT MATHEMATICS | SOLUTIONS

**Question 25. The correct answer is C.** The circumference of a circle is calculated using the formula  $C = 2\pi r$ . The problem tells us that  $C = \frac{7}{2}\pi$ . Therefore,  $\frac{7}{2}\pi = 2\pi r$ . Divide both sides by  $2\pi$ . We are left with  $\frac{7}{4} = r$ .

**Question 26. The correct answer is J.** The formulas for the midpoint of two coordinates on the  $(x,y)$  coordinate plane are  $x_m = \frac{x_1 + x_2}{2}$  and  $y_m = \frac{y_1 + y_2}{2}$ , where the values with  $m$  subscripts are the coordinates of the midpoint and all other values are coordinates of the endpoints. Therefore,  $\frac{4 + x_2}{2} = 6$  and  $\frac{-2 + y_2}{2} = -6$ . Multiply both fractions by two and isolate the variable to obtain  $x_2 = 8$  and  $y_2 = -10$ .

**Question 27. The correct answer is B.** Plug in  $t = 2$  and  $t = 3$  to the function and solve for  $h$ . The height at  $t = 2$  is 64 ft., the height at  $t = 3$  is 48 ft. Therefore, the rocket descended 16 ft. between  $t = 2$  and  $t = 3$ .

**Question 28. The correct answer is K.** The expression  $(-2i)^4$  is equivalent to  $(-2)^4 i^4$ . Because  $i = \sqrt{-1}$ ,  $i^2 = -1$  and  $i^4 = 1$ . Therefore,  $(-2)^4 i^4 = 16 \cdot 1 = 16$ .

**Question 29. The correct answer is B.** We can calculate the third side of the right triangle formed by the ladder, wall, and ground using Pythagorean theorem. Since the ladder is opposite the right angle, 11 is the hypotenuse, and  $11^2 = 10^2 + x^2$ , where  $x$  is the distance from the base of the wall to the bottom of the ladder. Therefore,  $21 = x^2$ , and  $\sqrt{21} = x$ .

**Question 30. The correct answer is F.** A correct proportion must align 11 and 25 (as they both correspond to the ladder), 10 and  $x$  (as they both correspond to the wall), 10 and 11 (as they both correspond to the triangle in the figure), and  $x$  and 25 (as they both correspond to the similar figure described in the problem). Only Choice A does this.

**Question 31. The correct answer is A.** To calculate the angle, we must use the correct inverse trig function. Because 10 is the side opposite the angle of elevation and 11 is the hypotenuse, we must use sine.

**Question 32. The correct answer is F.** The distance between 2 points in the  $(x,y)$  coordinate plane is calculated using the formula  $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ . If we plug in  $(-2,3)$  and  $(7,7)$  for  $(x_1,y_1)$  and  $(x_2,y_2)$ , respectively, we get that  $d = \sqrt{(-2 - 7)^2 + (3 - 7)^2} = 9.8$  coordinate units. However each coordinate unit is equal to  $\frac{1}{2}$  mile. Therefore,  $\frac{1}{2} \cdot 9.8 = 4.9$  miles.

**Question 33. The correct answer is E.** The distance from the Sun to Neptune is approximately 4503000000 miles, and the distance from the Sun to Venus is approximately 108000000 miles. The difference of these numbers is 4395000000 miles, which can be expressed as  $4.395 \times 10^9$  miles.

**Question 34. The correct answer is H.** A central angle of  $40^\circ$  means that the arc  $\widehat{MN}$  is  $\frac{40}{360} = \frac{1}{9}$  of the circumference. Therefore, the total circumference is  $9 \cdot 2\pi$  centimeters, or  $18\pi$  centimeters.

The circumference of a circle is calculated using the formula  $C = 2\pi r$ , so  $18\pi = 2\pi r$ . Divide both sides by  $2\pi$  and obtain  $r = 9$ .

**Question 35. The correct answer is C.** The standard form of a circle in the  $(x,y)$  coordinate plane is  $(x - h)^2 + (y - k)^2 = r^2$ , where  $(h,k)$  is the center of the circle and  $r$  is the radius. Therefore, according to the equation given in the problem,  $h = \sqrt{5}$ ,  $k = -3$ , and  $r = 2$ .

**Question 36. The correct answer is G.** Use the formula given in the note, where  $b = 8$ ,  $c = 17$ , and  $\cos\theta = .72$ . We obtain  $a^2 = 64 + 289 - 252(0.72)$ , so  $a^2 = 157.16$  and therefore  $a = 12.5$ .



## SECTION 3 | ACT MATHEMATICS | SOLUTIONS

**Question 37. The correct answer is D.** We can obtain the common ratio of the sequence by dividing  $3\frac{3}{7}$  by  $2\frac{2}{7}$ . Thus, the common ratio of the sequence is  $\frac{3}{2}$ . We can obtain Luke's mileage during week 5 by multiplying  $5\frac{1}{7}$  by  $\frac{3}{2}$  and multiplying the result by  $\frac{3}{2}$  again, which results in  $11\frac{4}{7}$ .

**Question 38. The correct answer is G.** The fact that a linear system of equations has multiple solutions implies that each equation is a linear multiple of each other equation in the system. Since the  $x$ -coefficient in the first equation (15) is three times the  $x$ -coefficient in the second equation (5), the  $y$ -coefficient in the first equation ( $-12$ ) must also be three times the  $y$ -coefficient in the second equation. Therefore,  $b = -4$ .

**Question 39. The correct answer is A.** If  $(p, q)$  is on the parabola, then  $q = ap^2$ . Therefore,  $q = a(-p)^2$ , and the point  $(-p, q)$  must also be on the parabola.

**Question 40. The correct answer is H.** Draw a line from point  $B$  to  $\overline{DC}$ . Label the intersection point  $E$ . The line  $\overline{BE}$  must be the height of the trapezoid.

Because  $\angle BEC$  is a right angle,  $\triangle BEC$  is a  $30^\circ - 60^\circ - 90^\circ$  right triangle. Therefore, the height of the trapezoid must be  $4\sqrt{3}$  units. Additionally,  $\overline{CE}$  is 4 units long. Because  $\overline{CE}$  is 4,  $\overline{AB}$  is 12 units long.

The area of a trapezoid is calculated using the formula  $A = \frac{1}{2}(b_1 + b_2)h$  where  $b_1$  and  $b_2$  are bases and  $h$  is the height of the trapezoid. We know that  $b_1 = 16$ ,  $b_2 = 12$ , and  $h = 4\sqrt{3}$ . Therefore,  $A = \frac{1}{2}(28)4\sqrt{3}$ , which is approximately equal to 97 square units.

## SECTION 4 | SAT WRITING | SOLUTIONS

## Passage I – Solunar Fishing

**Question 1. The best answer is A** because it creates a grammatically complete sentence with the right verb tense.

Choices B and C are incorrect because each inserts unnecessary punctuation that disrupts the meaning of the sentence. Choice D is incorrect because it is the wrong verb tense.

**Question 2. The best answer is A** because the preposition “with” correctly reflects the relationship between the verbal adjective “dotted” and the nouns “boats, buoys, and lobster pot markers.”

Choices B, C, and D are incorrect because each provides a preposition that does not appropriately represent the relationship between “dotted” and the following nouns. A seascape can be dotted “with” boats and buoys; it cannot be dotted “between,” “for,” or “on” boats and buoys.

**Question 3. The best answer is D** because the information in the sentence elaborates on and follows from the claim in the previous sentence: animal species respond to a diurnal clock.

Choices A, B, and C are incorrect because they do not appropriately signal that the information in the sentence follows from the claim in the previous sentence. Rather, Choice A suggests the writer is offering an example, and Choices B and C suggest that the writer is drawing a contrast.

**Question 4. The best answer is B** because it creates a grammatically complete and standard sentence. It also correctly reflects the relationship specified in the passage between lunar phases and strength of influence.

SECTION 4 | SAT WRITING | SOLUTIONS

Choice A is incorrect because “Although” suggests that the second clause will contradict the first. Choices C and D are incorrect because each results in a grammatically incomplete or run-on sentence.

**Question 5. The best answer is C** because it acts effectively as a transition between the previous paragraph and this one. It also reflects the content of the new paragraph.

Choices A, B, and D are incorrect because none of them introduces the main idea of the paragraph: the long history of solunar fishing.

**Question 6. The best answer is D** because it contains “the most specific” actions which the lunar calendar advises.

Choices A, B, and C are incorrect because each is vague. “Actions,” “certain tasks,” and “fishing and hunting” are all nebulous terms.

**Question 7. The best answer is C** because it provides the grammatically correct option for a possessive singular noun. The editor belongs to, or is affiliated with, the almanac.

Choices A is incorrect because it does not indicate possession. Choices B, and D are incorrect because they suggest there is more than one almanac.

**Question 8. The best answer is D** because it does not repeat information. If one is a skeptic, one is not sure of the truth of something.

Choices A, B, and C are incorrect because they all provide redundant information about skeptics.

**Question 9. The best answer is D** because it provides the possessive pronoun that grammatically corresponds to the singular noun “science.”

Choices A, B, and C are incorrect because: A provides a plural pronoun for a singular antecedent; B’s “those” is too vague; and C confuses “it is” with the possessive pronoun “its.”

**Question 10. The best answer is A** because it satisfies the directions of the question by reinforcing the point that skepticism about solunar fishing still exists.

Choice B is incorrect because it concludes the paragraph on too neutral a note. Choice C does nothing to suggest there is still doubt. Choice D addresses a different problem: that of sustainability.

**Question 11. The best answer is A** because it focuses on the size and variety of the catch as seen by the biologist and displayed to the viewer.

Choice B is incorrect because, even though it appeals to the sense of sight, it fails to focus on the fish. Choices C and D are incorrect because they lack sensory details.

**Passage II – Deforestation**

**Question 12. The best answer is C** because it provides the appropriate punctuation for the nonrestrictive modifying phrase “including fertile soil.” Because the phrase is not essential to the sentence, it should be offset with commas (or other matching punctuation). Since a comma is used before the phrase, a comma must be used after it as well.

Choices A and D are incorrect because the punctuation does not match the comma that sets off the nonrestrictive modifying phrase “including fertile soil.”

Choice B is incorrect because “this is” is unnecessarily wordy.

**Question 13. The best answer is B** because the verb “highlights” grammatically corresponds with the singular noun

## SECTION 4 | SAT WRITING | SOLUTIONS

“importance.” Additionally, “effects” is the correct noun to describe outcomes.

Choices A and D are incorrect because “affects” is the incorrect word in this context. Choice C is incorrect because there is no subject-verb agreement between the noun “importance” and the verb “highlight.”

**Question 14. The best answer is B** because it provides an introductory phrase that adequately modifies the sentence subject “this phenomenon.”

Choices A and C are incorrect because they create run-on sentences. Choice D is incorrect because it creates a redundancy with the following noun “this phenomenon.”

**Question 15. The best answer is D** because it accurately represents the information in the chart.

Choices A and C are incorrect because eight of the ten recorded years exceeded 2.5 percent. Choice B is incorrect because there is no recorded year in which losses were double five years previous.

**Question 16. The best answer is C** because the percent of forest loss rose from about 2.5 percent in the 2007 period to about 3.5 percent in 2012.

Choice A is incorrect because the rate of 1 percent forest loss is too low. Choice B is also incorrect because the rate of tree loss was not 3.2 percent in either five-year period. Choice D is incorrect because it overstates the growth in the tree loss percentage.

**Question 17. The best answer is A** because it adequately introduces the main idea of the paragraph, it is grammatically correct, and it is in the passive voice, as will the following sentence be.

Choices B and C are incorrect because each is redundant. In B there is no need to refer to trees vanishing and “this alarming trend” in the same sentence. In C there is no need to specify that “reasons...may explain” in the same sentence. Choice D is incorrect because if the paragraph were to begin with the sentence “One reason that is often cited...”, the writer’s discussion of reasons for deforestation would not be introduced smoothly and effectively.

**Question 18. The best answer is A** because it provides another reason to account for deforestation. The previous sentence notes “One reason” why forests are disappearing, and this proposed sentence supplies another.

Choices B, C, and D are incorrect because the information does not introduce a new idea that will become important later in the passage, nor does it contradict the main idea of the passage.

**Question 19. The best answer is D** because the diction is consistent with the article’s tone and style.

Choices A, B, and C are incorrect because the casual tone and style of “is not to be scoffed at,” “is a pretty big deal,” and “can’t be put on the back burner” deviate from the more formal tone of the passage.

**Question 20. The best answer is C** because it creates a grammatically correct relationship between an independent clause and a dependent one.

Choices A and D are incorrect because a semicolon should be used to link two independent clauses, but in these cases the second clause is dependent. Choice B is incorrect because it creates a comma splice.

**Question 21. The best answer is C** because it provides the correct possessive form of a plural pronoun, referring to the noun “countries.”

Choice A is incorrect because it is a contraction of “they are,” while choice B is an adverb that refers to a place or a particular point of time. Choice D is incorrect because it is the contraction of “it is.”

**Question 22. The best answer is A** because the passage already has an appropriate concluding sentence that addresses the future of efforts to combat deforestation.

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Choices B and C fail to address the futures and are therefore incorrect. Choice D fails to preserve the tone of cautious optimism.

Passage III – Louis A. Lauder

**Question 23. The best Answer C** because the underlined portion provides specific information that helps clarify the nature of the gift.

Choice A is incorrect because it does not detract from the focus on Cubism. Choice B is incorrect because it does not repeat information from the previous sentence. Choice D is incorrect because it mentions only one specific example rather than the ones actually included in the underlined portion.

**Question 24. The best Answer A** because “Because of” supports the cause-effect relationship between the two clauses in the sentence, which state that the size of the donation caused the “challenge.”

Choices B, C, and D are incorrect because they do not support the cause-effect relationship.

**Question 25. The best Answer D** because it does not contain information which has already been stated in the previous sentences.

Choices A, B, and C are incorrect because they do contain information that was already stated.

**Question 23. The best Answer D** because it provides a conjunction “but” that accurately reflect the relationship between the two clauses. This relationship contrasts the ability to view the paintings with the fact that such availability does not currently exist.

Choices A, B, and C are not correct because each provides a conjunction that does not reflect the relationship between the two clauses.

**Question 27. The best Answer C** because it provides the possessive pronoun “its” that agrees with the noun “the Met” in number.

Choice A is incorrect because “their” is plural and therefore not in agreement with “the Met.” Choice B is incorrect because “the Met” would normally not be referred to as “he or she.” Choice D is incorrect because it is the contracted form of “it is.”

**Question 28. The best Answer B** because it provides a conjunction “therefore” which captures the cause-effect relationship between the two sentences. Since the Met had not bought Cubist works, it therefore lacked examples of such work.

Choices A, C, and D are incorrect because each fails to capture the relationship between the sentences. A is incorrect because it suggests that the second sentence is building on information in the first. C is incorrect because it suggests a contrast between not acquiring and not possessing Cubist works. Choice D is incorrect because it suggests that the second sentence is a shortened version of the previous one.

**Question 29. The best Answer C** because it succinctly labels the items as all belonging to the category “everyday objects.”

Choices A, B, and D are all either incorrect descriptions of the items or wordier versions of the same idea and are therefore incorrect.

**Question 30. The best Answer B** because “to” always patterns with “access.”

Choices A and C incorrectly use “with” and “of” as words that pattern with “access.” Choice D is incorrect because it confuses “excess” with “access.”

**Question 31. The best Answer B** because it presents the appropriate time indication. He “had studied” Cezanne then “created” a new form of space.

## SECTION 4 | SAT WRITING | SOLUTIONS

Choice A is not correct because without an auxiliary or an ending that denotes time, there is no specific verb tense. Choices C and D are incorrect because they do not indicate that the study of Cezanne pre-dated the creation of a new form.

**Question 32. The best Answer A** because it presents two items - the collage and the sculpture - as nonrestrictive elements of the sentence. It does not add unnecessary punctuation.

Choices B, C, and D are all incorrect because of misplacing commas within the nonrestrictive phrase.

**Question 33. The best Answer C** because the proposed sentence logically follows information about how the Cubist works were influential. The word “also” in the proposed sentence precludes the sentence from being placed earlier than after sentence 2. The term “both artists” in sentence 3 demands that the proposed sentence appear before sentence 3

Choices A and B are incorrect because “also” in the proposed sentence requires the sentence to be placed after mention of the Braque work. Choice D is incorrect because there would be no sensible way that “both artists” in sentence 3 could refer only to the Braque painting mentioned.

## SECTION 5 | ACT READING | SOLUTIONS

## Passage I – Prose Fiction

**Question 1. The best answer is B** because the whole story is told from the narrator’s point of view (not a dialogue) and focuses on events as well as characters and landscapes.

**Question 2. The best answer is G** because the narrator refers to Mrs. MacLaren as “poor woman” in line 49, but she also recognizes that the housekeeper is thoughtlessly cruel in referring to Felix as “the fat one.”

**Question 3. The best answer is C** because the narrator states in line 29 that she and Felix had “always looked forward eagerly” to visiting their father’s old home.

**Question 4. The best answer is F** because the narrator states in lines 8–9 “We supposed we should get acquainted with her when we reached there”.

**Question 5. The best answer is B** because the narrator says in lines 42–43 that her mother had died before either she or her brother could remember her.

**Question 6. The best answer is G** because the deep well is mentioned in line 33, the King Orchard in line 31, and the willow in line 81.

**Question 7. The best answer is C** because the housekeeper states in lines 56–58 “... the only safe way to travel with those young ones is have ‘em both tied to you with a short rope.”

**Question 8. The best answer is J** because the narrator’s father had described the boyhood home in such a way as to “inspire...some of his deep-seated affection for it”.

**Question 9. The best answer is B** because the evidence can be seen in lines 71–73, “We felt at home with him and became very good friends with him on that twenty-four mile drive”.

**Question 10. The best answer is G** because the narrator notes in line 14 that her relatives on the old homestead would be her roommates “for a season”. Line 79 notes they were there in April.

SECTION 5 | ACT READING | SOLUTIONS

Passage II – Humanities

**Question 11. The best answer is C** because answer choices A and D are mentioned in only one paragraph each, and B is not mentioned at all.

**Question 12. The best answer is J** because nowhere in the passage is it suggested that “Facebook causes people to present the most perfect picture of themselves that they can create.”

**Question 13. The best answer is B** because as used in the passage, “shield” is not a physical thing as A and C suggest, and it cannot prevent attacks, only ward them off.

**Question 14. The best answer is F** because the author’s high school reunion was spoiled thanks to Facebook’s making it unnecessary for people to meet face to face.

**Question 15. The best answer is D** because although the other answer choices are mentioned one time each, Facebook’s power as identity-shaper is evident throughout the passage.

**Question 16. The best answer is F** because line 32, “Shy people, like me, find it easier to share via email and on Facebook than face-to-face. Facebook allows us to be ourselves” shows the author as shy.

**Question 17. The best answer is C** because Facebook’s ability to get individuals to share their identity with others can be seen in the first sentence of the fifth paragraph (line 52–53), “Facebook is not only involved in creating identity; it plays a major role by displaying your identity to others.”

**Question 18. The best answer is F** because the rest of the passage makes the case that identity is created and changeable, not something permanent. For example lines 81–85 state, “Facebook is not merely a reflection of an identity that is already established; Facebook is taking part in the establishment of identity. From his Harvard dorm room, Mark Zuckerberg created a phenomenon that not only changes that way we act, it is changing who we are.”

**Question 19. The best answer is D** because as the author states in lines 79–80 “our flaws make us who we are.”

**Question 20. The best answer is G** because lines 90–91 state that “there is so much information available to sociologists” and lines 99–101 state that “a plethora of research is in the works.”

Passage III – Natural Science

**Question 21. The best answer is A** because in the preceding sentence the author states, “The second way a baby acquires knowledge is through innate knowledge, that which is genetically inherited.” If the knowledge is inherited it existed before birth. This statement is in direct opposition to Locke’s tabula rasa theory, which argues that the mind at first is a blank slate.

**Question 22. The best answer is G** because the text states, “... the PCC may play a direct role in regulating the focus of attention, which can determine the ability of a person to gather and parse information. Note that focus of attention occurs first.”

**Question 23. The best answer is D** because the first sentence of the paragraph states, “Recent scientific findings in the United States and Europe suggest that we are not a blank slate (devoid of knowledge) at time of birth.”

**Question 24. The best answer is H** because if the human mind is devoid of all knowledge or ideas, it is a clean slate (not expressionless, free, or simple).

**Question 25. The best answer is B** because nativism can be found on line 73; how the brain areas link to one another can be found on lines 37–39; innativism can be found on lines 74–75.

**Question 26. The best answer is J** because lines 51–54 state: “A recent neuroimaging study found that the elevating serotonin levels in the brain created more connections to the posterior cingulate cortex (PCC).”

## SECTION 5 | ACT READING | SOLUTIONS

**Question 27. The best answer is A** because the first sentence of the paragraph introduces the position that while the counter argument against Locke's tabula rasa theory is strong, modern science has not disproved it. The paragraph concludes with the author stating: "Science has not demonstrated that the newborn who knows to cry when he wants his mother's attention knew this prior to birth."

**Question 28. The best answer is H** because in lines 15–16 it's stated that "all of our concepts are derived from sense experience."

**Question 29. The best answer is B** because in lines 31–34 it's stated: "The new research suggested that a person's DNA determines why some people are better at solving creative problems than others." If that is the case we can then deduce that some people are born with a poorer capacity for learning.

**Question 30. The best answer is J** because of what's stated in the fifth paragraph, lines 35–46, and the sixth paragraph, lines 47–55.

## SECTION 6 | SAT MATHEMATICS (NO CALCULATOR) | SOLUTIONS

## Multiple Choice

**Question 1. The correct answer is A.** The coach is paid \$9.25 per hour, so we must multiply \$9.25 by the number of hours and then add the bonus for winning the regional championship.

**Question 2. The correct answer is C.** Distribute the 5 through the left side of the equation and obtain  $5x - 5y = x$ .

Subtract  $5x$  on both sides of the equation and obtain  $-5y = -4x$ . Divide both sides by  $-5$  to obtain  $y = \frac{4}{5}x$ . If we divide both sides by  $x$ , we obtain  $\frac{y}{x} = \frac{4}{5}$ .

**Question 3. The correct answer is D.** Because the trapezoid is isosceles,  $\angle FAE = \angle GDE$ . This fact combined with the fact that  $\angle EFA$  and  $\angle EGD$  are both right angles implies that  $\triangle AFE$  and  $\triangle DGE$  are similar.

Because the ratio of  $FE$  to  $GE$  is 3:8, the ratio of  $AE$  to  $ED$  is also 3:8. Therefore,  $ED$  is  $\frac{8}{11}$  of  $AD$ . Because  $AD$  is 44,  $ED$  is  $\frac{8}{11} \cdot 44 = 32$ .

**Question 4. The correct answer is B.** The denominator of the expression can be rewritten as

$\frac{x+4}{(2x-3)(x+4)} + \frac{2x-3}{(2x-3)(x+4)} = \frac{3x+1}{(2x-3)(x+4)}$ . Because the numerator of the expression is 1, the end result is the reciprocal:  $\frac{(2x-3)(x+4)}{3x+1}$ . Simplify the top to obtain  $\frac{2x^2+5x+12}{3x+1}$ .

**Question 5. The correct answer is D.** Nathan's fee can be expressed as  $120 + 50h$ . Jeremy's fee can be expressed  $180 + 35h$ . Therefore, the values for which Jeremy's total charge is greater than Nathan's total charge are all those for which the inequality  $180 + 35h > 120 + 50h$  is true. Subtract  $35h$  from both sides to obtain  $180 > 120 + 15h$ . Subtract 120 from both sides to obtain  $60 > 15h$ . Divide both sides by 15 and we learn that  $4 > h$ .

**Question 6. The correct answer is C.** A slope of  $\frac{2}{5}$  indicates that increasing  $P$  by 5 will cause an increase of  $t$  by  $\frac{2}{5} \cdot 5 = 2$ . Therefore, an increase of 5 parents will result in an increase of 2 t-shirts.

**Question 7. The correct answer is B.** The highway descends 8 meters for each 100 meters traveled along the highway.

Therefore, the slope of the highway is  $-\frac{8}{100} = -.08$

## SECTION 6 | SAT MATHEMATICS (NO CALCULATOR) | SOLUTIONS

If the cyclist travels 17 meters per second along the highway, then we can calculate his change in elevation per second,  $x$ , by solving  $-.08 = \frac{x}{17}$ . Therefore, the change in elevation per second is  $-1.36$  meters. Therefore, after  $s$  seconds, the cyclist has descended  $1.36s$  meters from his initial elevation of 2943 meters, and his elevation is therefore expressed as  $2943 - 1.36s$ .

**Question 8. The correct answer is C.** We must distribute  $\frac{b^2}{a}$  to each term in the first parentheses, using the additive rule of exponents for the second term.

**Question 9. The correct answer is D.** The cubic passes through the point  $(-2, 5)$ , so plug in  $x = -2$  and  $y = 5$  to obtain  $5 = a(-2)^3 + b(-2)^2 + c(-2) + d$ . Therefore,  $-5 = -8a + 4b - 2c + d$ .

## Grid-Ins

**Question 10. The correct answer is  $\frac{2}{3}$ .** Add 9 to both sides to obtain  $6 = \frac{4}{n}$ . Multiply both sides by  $n$  to move the variable to the numerator, so  $6n = 4$ . Now divide both sides by 6 and obtain  $n = \frac{4}{6} = \frac{2}{3}$ .

**Question 11. The correct answer is 8.** First expand  $(2 + 2i)^2$  to obtain  $4 + 8i + 4i^2$ . Because  $i^2 = -1$ ,  $4 + 8i + 4i^2 = 4 + 8i - 4 = 8i$ . Now multiply by  $i^3$  to obtain  $8i^4$ . Because  $i^4 = i^2 \cdot i^2 = (-1)(-1) = 1$ , the value of  $8i^4$  is 8.

**Question 12. The correct answer is 3.** If  $x + 6$  is a factor, then the value of the  $x^2 + 3kx + 6k$  must equal 0 when we plug in  $x = -6$ . Doing so yields  $36 - 18k + 6k$ . Therefore,  $36 - 12k = 0$ , so  $36 = 12k$  and  $3 = k$ .

## SECTION 7 (CALCULATOR) | SAT MATHEMATICS | SOLUTIONS

## Multiple Choice

**Question 1. The correct answer is B.** The greatest change in car sales was between July (60 cars sold) and August (36 cars sold).

**Question 2. The correct answer is B.** The circumference of a circle is calculated using the formula  $C = 2\pi r$ . We are asked to solve for  $r$ , so divide both sides by  $2\pi$  and obtain  $r = \frac{C}{2\pi}$ .

**Question 3. The correct answer is C.** Rearrange the first equation to isolate  $y$  and obtain  $y = 4x - 18$ . Substitute into the second equation:  $x + 3(4x - 18) = -2$ . Therefore,  $13x - 54 = -2$ , so  $13x = 52$  and  $x = 4$ .

Plug  $x = 4$  into the first equation to obtain  $16 - y = 18$ . Therefore,  $-y = 2$  and  $y = -2$ .

**Question 4. The correct answer is B.** The tank holds  $3000 \cdot 1000 = 3000000$  milliliters of liquid. Therefore, the tank can fill  $\frac{3000000}{250} = 12000$  cans.

**Question 5. The correct answer is C.** Over 4 hours, Sheila travels  $75 \cdot 4 = 300$  miles. At the rate of 23 miles per gallon, Sheila's car consumes  $\frac{300}{23} = 13.04$  gallons throughout the trip.

**Question 6. The correct answer is A.** The number of flash drives sold in boxes of 4 is  $346 - 38$ . Therefore, the number of boxes of four sold is equal to  $\frac{346 - 38}{4}$ .

**Question 7. The correct answer is A.** The slope of a line passing through  $(x_1, y_1)$  and  $(x_2, y_2)$  is calculated using the equation  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Therefore, the slope of this line is  $\frac{2 - 7}{-1/2 - (-9/2)} = -\frac{5}{4}$ .



## SECTION 7 (CALCULATOR) | SAT MATHEMATICS | SOLUTIONS

**Question 8. The correct answer is D.** Because  $y$  means the depth of the snow and  $x$  means the number of days after the storm began, the point  $(9,0)$  means that the depth of the snow reaches zero inches 9 days after the storm began.

**Question 9. The correct answer is D.** Only choices A and D show positive associations. The correct answer is the choice that does not appear to show a relationship that forms a line, which is D.

**Question 10. The correct answer is B.** There are 22 employee salaries represented in the histogram. Therefore, the median salary must be greater than or equal to 11 salaries and less than or equal to 11 salaries. Because 5 of the salaries are less than \$48,000 and 14 of the salaries are less than \$60,000, the median salary must be between \$48,000 and \$60,000. The only option possible is B.

**Question 11. The correct answer is B.** Of the 220 people surveyed, 93 prefer Candidate X. Because  $\frac{93}{220} = .4227$ , the percentage of those surveyed who preferred Candidate X is closest to 42%.

**Question 12. The correct answer is B.** Of the 220 people surveyed, 53 both were aged 35 to 44 and supported Candidate X. Therefore, we can estimate the total population of these individuals by solving the proportion  $\frac{53}{220} = \frac{x}{2200000}$ . Therefore,  $x = 530000$ .

**Question 13. The correct answer is C.** The percentage of survey respondents between the ages of 25 and 34 who preferred Candidate Y is  $\frac{89}{129} \cdot 100 = 68.99\%$ . The percentage of survey respondents between the ages of 35 and 44 who preferred Candidate Y is  $\frac{38}{91} \cdot 100 = 41.76\%$ . Therefore, a 25-34 year old is  $\frac{.6899}{.4176} = 1.65$  times as likely to support Candidate Y.

**Question 14. The correct answer is D.** By obtaining his data at a local coffee shop, the researcher failed to collect a random sample of the population (i.e., the city) that he was attempting to draw conclusions about.

**Question 15. The correct answer is D.** The smallest petroleum usage for the four days whose temperature-values are 71 is about 6.2 and the largest is about 7.5, so the range of these values is  $7.5 - 6.2 = 1.3$ .

**Question 16. The correct answer is B.** We can plug in 10 into the model for  $d$  and solve for  $P$ :  $P = 16 - .15(10)$ , so  $P = 14.5$ .

**Question 17. The correct answer is C.** The area of a parallelogram is calculated using the formula  $A = bh$ . The problem asks us to double  $b$  and reduce  $h$  by 50 percent. Thus, the new area is  $A = (2b)(0.5h) = bh$ .

**Question 18. The correct answer is A.** The function reaches a minimum at approximately  $(-2, -3)$ , so the minimum value of the function (aka the smallest  $y$ -value) is  $-3$ .

**Question 19. The correct answer is A.** The volumes of the four solids can be calculated using the three formulas: the volume of a cylinder is calculated using  $V = \pi r^2 h$ , the volume of a cone is calculated using  $V = \frac{1}{3} \pi r^2 h$ , and the volume of a sphere is calculated using  $V = \frac{4}{3} \pi r^3$ .

The volume of the cylinder in Choice A is  $V = \pi \cdot 6^2(3) = 108\pi$ .

The volume of the cylinder in Choice B is  $V = \pi \cdot 3^2(6) = 54\pi$ .

The volume of the cone in Choice C is  $V = \frac{1}{3} \pi \cdot 6^2(6) = 72\pi$ .

The volume of the sphere in Choice D is  $V = \frac{4}{3} \pi \cdot 3^3 = 36\pi$ .

## SECTION 7 (CALCULATOR) | SAT MATHEMATICS | SOLUTIONS

## Grid-Ins

**Question 20. The correct answer is 12.** Let  $x$  be the number of tables that seat 4 patrons. Because there are a total of 22 tables, there must be  $22 - x$  tables that seat 2 people. Therefore,  $2(22 - x) + 4x = 68$ . Simplify the left side and obtain  $44 - 2x + 4x = 68$ . Therefore,  $2x = 24$  and  $x = 12$ .

**Question 21. The correct answer is 1.** The value of  $g(4)$  is  $\frac{3}{2}(4) + 4$ , or 10. The value of  $f(10)$  is determined using the table to be  $-7$ .

**Question 22. The correct answer is 7460.** Bill must pay 10% on his first \$20,000 – a total of  $0.10 \cdot \$20,000 = \$2,000$ . He must pay 16% on his next \$30,000, a total of  $0.16 \cdot \$30,000 = \$4,800$ . He must pay 22% on his next \$3,000, a total of  $0.22 \cdot \$3,000 = \$660$ . Bill's total tax bill is therefore  $\$2,000 + \$4,800 + \$660 = \$7,460$ .

**Question 23. The correct answer is 2.** The train reaches a velocity of 3.6 when  $v(t) = 3.6$ . Therefore,  $3.6 = 3t - 0.6t^2$ . Set the equation equal to zero:  $0.6t^2 - 3t + 3.6 = 0$ . Divide both sides by 0.6 so that the coefficient on  $t^2$  is equal to 1, and we obtain  $t^2 - 5t + 6 = 0$ , which factors to  $(t - 3)(t - 2) = 0$ . Therefore, the possible answers are  $t = 2$  and  $t = 3$ . However, the model is only valid for  $0 \leq t \leq 2.5$ , so  $t = 3$  is extraneous.

**Question 24. The correct answer is 6.25.** The total distance traveled over 2.5 minutes is equal to  $p(2.5)$ . Thus,  $p(2.5) = 1.5(2.5)^2 - 0.2(2.5)^3 = 6.25$ .

## SECTION 8 | ACT SCIENCE | SOLUTIONS

## Passage I – Chemistry

**Question 1. The best answer is B** because according to Figure 1  $N_r$ , the number of nuclei remaining in a given sample, for V-48 achieves the lowest value over the 280 days. The passage defines radioactive decay as the spontaneous breakdown of an atomic nucleus resulting in the release of energy and matter from the nucleus so because V-48 is losing the largest amount of nuclei over the 280 days it must have the greatest average rate of decay in comparison to Be-7

**Question 2. The best answer is G** because an isotope's *half-life* is defined as the time required for half of the radioactive nuclei in a substance to decay and according to Figure 1 it takes Be-7 somewhere between 40 and 80 days to reach an  $N_r$  of 500, half of the starting 1,000 nuclei. Because 50 is the only answer choice between the range of 40 and 80 it is reasonable to infer that 50 days must be the half-life of Be-7.

**Question 3. The best answer is A** because according to Table 1 C-8 has the lowest half-life of  $2.00 \times 10^{-21}$  seconds, the next largest half-life is that of C-15 which is 2.45 seconds, and the largest half-life, according to Figure 1, is Po-210 which is between 120 and 160 days.

**Question 4. The best answer is G** because according to Table 1 the half-life of C-10 is approximately  $1.99 \times 10^1$  seconds, so in a time period of 20 seconds approximately one half of the starting 2,000 nuclei will decay leaving approximately 1,000 nuclei remaining. According to Table 1 the half-life of C-8 is  $2.0 \times 10^{-21}$  seconds so in a time period of 20 seconds a very large number of half-lives occur leaving a negligible number of nuclei remaining.

**Question 5. The best answer is B** because when the  $N_r$  of 660 is charted on Figure 1 the data point lies between the  $N_r$  for Su-35 and Be-7. It is reasonable to infer that trend for Co-56 will mimic those of Po-210, Su-35, Be-7, and V-48. Because the  $N_r$  for Su-35 and Be-7 at 120 days is approximately 400 and 200 respectively the  $N_r$  for Co-56 would most likely lie between those two values.

## SECTION 8 | ACT SCIENCE | SOLUTIONS

## Passage II – Chemistry

**Question 6. The best answer is A** because typing speed in Group A before consumption was 43.7 words per minute (wpm) and a typing speed of 53.3 wpm after consumption. Of all of the groups, Group A demonstrated the greatest change in typing speed over the thirty minute period, with an increase of 9.6 words per minute. The change described in the question from 41.1 wpm to 56.9 wpm is a change of 15.8 wpm, so the best answer would be to choose the group with the greatest change, which is Group A.

**Question 7. The best answer is J** because Group H exhibited the smallest amount of change and was given Decaf coffee as the beverage, which has a caffeine content of 0.000 according to Table 1. The purpose of the experiment was to study how caffeinated beverages affected students' typing speeds and error rates. The control would be the group that consumed the least amount of caffeine so that changes in typing speed and error rate could be measured against that group's results.

**Question 8. The best answer is B** because Iced Coffee has a measured caffeine content of 0.307 g/L, which is in between the caffeine contents of Hot Coffee and Green Tea as seen in Table 1. In Study 1 both Hot Coffee and Green Tea are administered to the students in Groups B and C producing typing speeds and error rates of 47.9 wpm / 3.0 epm and 46.3 wpm / 2.5 epm, respectively. Because the caffeine content of Iced Coffee is between that of Hot Coffee and Green Tea it is reasonable to infer that the wpm and epm of a student who consumed Iced coffee thirty minutes after consumption should be between the recorded values of Group B and C. The only values that fit into this range are those found in answer choice B, 47.1 wpm and 2.7 epm.

**Question 9. The best answer is G** because according to the passage, "Caffeine begins to take effect within five minutes, and reaches its peak effect in about 30 minutes." This means that if Group B was tested at 15 minutes the average typing speeds must be between 43.4wpm, the average typing speed measured before the administration of the caffeinated beverage, and 47.9wpm, the average typing speed measured 30 minutes after the administration of the caffeinated beverage.

**Question 10. The best answer is A** because by comparing the results of Group E after consumption in Table 3 (recorded three hours after consumption) to the results of Group A, who also consumed Espresso, in Table 2 (recorded thirty minutes after consumption), the greatest increase in wpm occurred after thirty minutes. Compare 48.0 wpm to 53.3 wpm. It is then correct to assume that if the students in Group E were tested again after thirty minutes their typing speeds, on average, would be greater than those measured three hours after consuming the caffeinated beverage.

**Question 11. The best answer is J** because wpm values are, for the most part, directly proportional to epm values in both Tables 2 and 3 before and after consumption. If charted on an ( $x$ - $y$ ) coordinate plane, the slope of the line of best fit would be positive.

## Passage III – Physics

**Question 12. The best answer is H** because from  $\theta = 15$  to  $\theta = 30$  (Combinations 5–8) on Table 1  $X$  increases from 0.60 to 0.90. From  $\theta = 30$  to  $\theta = 40$  (Combinations 8–10) on Table 1  $X$  decreases from 0.90 to 0.77, hence as  $\theta$  increases,  $X$  increases and then decreases.

**Question 13. The best answer is A** because the graph represented in answer choice A has the correct  $X$  values for  $H$  values 1.0, 1.5, 2.0, and 2.5 as written for Combinations 1–4. Choice B is incorrect because at  $H = 1.5$   $X \neq 0.90$ . Choice C is incorrect because the relationship described in Table 1 for Combinations 1–4 is directly proportional. Choice D is incorrect because at  $H = 1.0$   $X \neq 0.60$ .

**Question 14. The best answer is J** because Table 1 outlines in Combinations 1–4 that the values of  $H$  and  $X$  are directly proportional. Table 1 outlines in Combinations 5–10 that the largest value of  $X$  occurs when  $\theta = 30$ . Lastly, Table 1 outlines in Combinations 11–14 that  $F$  is directly proportional to  $X$ . So it is reasonable to infer that the best answer will have the largest  $H$  and  $F$  values with a  $\theta$  value of 30.

**Question 15. The best answer is C** because the force,  $F$ , is being manipulated by the experimenter and would be described as the input or cause of the experiment. The horizontal distance,  $X$ , from the bottom of the inclined plane to where the marble ultimately lands is what is being measured and would be described as the output or the effect of the experiment.

SECTION 8 | ACT SCIENCE | SOLUTIONS

**Question 16.** The best answer is **H** because potential energy depends on an object or body’s position in space so before the ball starts rolling down the inclined plane it has potential energy stored. That energy is then converted into kinetic energy, which is the energy the ball possesses due to its motion of rolling down the inclined plane. Lastly, due to friction, the marble’s kinetic energy is converted into thermal energy, or heat.

Passage IV – Astronomy

**Question 17.** The best answer is **A** because the introduction states, “The Moon’s *apogee* (the maximum distance between the center of the Earth and the center of the Moon) is approximately 405,400 kilometers and its *perigee* (the minimum distance between the center of the Earth and the center of the Moon) is approximately 362,600 kilometers.” This means that distance from Earth to the Moon at some point during the day should be between these two values.

**Question 18.** The best answer is **F** because all of the hypotheses rely on the gravitational forces of earth to explain how the Moon came into existence. Hypothesis 1 states, “The Earth’s gravitational field, being much stronger than that of the Moon’s due to its size, captured the Moon.” Hypothesis 2 states, “The Moon was created from excess material that was spun out from the Earth as it rotated during its early years of development. It gathered in a cloud of debris that orbited around the Earth and slowly melded together.” Lastly, Hypothesis 3 states, “The impact was so massive that it sent a significant amount of Earth’s surface hurtling into space. However, the materials could not escape Earth’s gravitational forces and were trapped in orbit.” Hence, none of the Hypotheses are weakened by the given information.

**Question 19.** The best answer is **A** because Hypothesis 2 states, “Earth’s crust is made up of approximately 47% oxygen, 28% silicon, 8.1% aluminum, 5% iron, 3.6% calcium, 2.1% magnesium, and 6.2% other materials. The Moon was created from excess material that was spun out from the Earth as it rotated during its early years of development.” Supporters of Hypothesis 2 would then agree that the Moon should have a similar chemical composition. Answer Choice A is the most similar.

**Question 20.** The best answer is **H** because Hypothesis 2 states, “It (excess material) gathered in a cloud of debris that orbited around the Earth and slowly melded together.” The words ‘melded together’ point toward fusion which is the process of combining two or more distinct entities into a new whole. Hypothesis 3 states, “These objects remained hot after impact and continued to crash into each other and bonded together as they orbited Earth.” The words ‘bonded together’ point toward fusion as well.

**Question 21.** The best answer is **C** because the question defines a *captured asteroid* as “an asteroid that passed close enough to Mars that it was unable to escape its gravitational pull”, and if the claim in answer choice C that “The Moon is approximately  $\frac{1}{80}$  times the mass of the Earth, where as Phobos is approximately  $\frac{1}{10^8}$  times the mass of Mars” was correct it would undermine the claim that the Moon is a captured asteroid because Phobos is considerably smaller than the Moon in relation to its planet so it is reasonable to infer that the gravitational pull of Earth may not be able to capture an object as large as the Moon. Answer choices A, B, and D would not have any effect or influence on how the gravitational forces of two objects would interact with one another.

**Question 22.** The best answer is **F** because Hypothesis 1 states, “The Moon was created independently of the Earth during the early stages of our Solar System.” and the Introduction states, “During the *Hadean Eon* (the time period that began with the formation of the Earth approximately 4.5 billion years ago), Earth’s only satellite, the Moon, was formed.” It is reasonable to infer that the Moon must have been created by material present during the *Hadean Eon*.

**Question 23.** The best answer is **D** because Hypothesis 1 states, “The two objects had their own distinct orbits around the sun. Over time, the two orbits moved closer together. Eventually, the two objects were close enough to be influenced by the forces of gravity”, which means that the effect of the Sun’s gravity must have originally been stronger than that of Earth, but then weaker because Earth was able to capture the moon from the gravitational force of the Sun once it orbited close enough.

## SECTION 8 | ACT SCIENCE | SOLUTIONS

## Passage V – Biology

**Question 24. The best answer is G** because according to Figure 1 the average bodyweight of rats that had access to sucrose-water after five months is approximately 205% of the baseline weight and after six months is approximately 213% of the baseline weight. It is also true that the average bodyweight of the rats in this group increased each month and that the magnitude of change between each month decreased as time progressed. Therefore, it is reasonable to infer that the seventh month should be between 213% and 237%.


**Question 25. The best answer is D** because according to Table 1 the rats in Group A consumed 84 calories per day in comparison to Group B, which consumed 86 calories per day. This evidence does not support the hypothesis that rats with access to HFCS-water for two months would consume more calories than rats without access to HFCS-water.

**Question 26. The best answer is H** because according to the Introduction, "...HFCS is produced by milling corn and then adding enzymes until 42% of the mixture, by weight, consists of fructose." Because the researchers measured the amount of HFCS consumed by the rats over the two experiments to be 1000g, 42% of that must be fructose.

**Question 27. The best answer is A** because according to Figure 1, from month zero to one rats who had access to water with no sweetener increased their weight by approximately 35%, rats who had access to Sucrose-water increased their weight by approximately 40%, and rats who had access to HFCS-water increased their weight by approximately 50%. There is no other one-month-periods where the gains are as high as these.

**Question 28. The best answer is F** because according to Experiment 1 the rats being tested in the experiment started with an approximate average body weight of 300g. The rats who had access to HFCS-water reached 600g in weight when, according to Figure 1, the rats reach a Body Weight 200% of its baseline weight of 300g. This occurs 3 months after the diet began.

**Question 29. The best answer is C** because in Table 1 triglyceride levels of rats who had access to HFCS-water were 201mg/dL compared to 147mg/dL in rats who did not have access to HFCS-water. This shows a concrete rise in triglyceride levels. Answer choice A is incorrect because only male rats were used in the experiments. Answer choice B is incorrect because nowhere in the passage is pancreatitis mentioned. Choice D is incorrect because the passage only depicts HFCS with 42% fructose so there is nothing to compare it with.



# 3 Comparing The SAT & ACT

## Comparing The ACT & Redesigned SAT

The ACT requires students to do more work in a shorter period of time than does the SAT.  
 The SAT is based more on reasoning than content. The ACT is based more on content than reasoning.

|   |  |
|---|--|
| <b>The Basics of The ACT</b>  | <b>The Basics of The SAT</b>   |
| <ul style="list-style-type: none"> <li>• More of a content-based exam</li> <li>• Favors faster students as there is more work to do in less time</li> <li>• Favors students who are better at math and science because those subjects comprise half of the score</li> <li>• Favors students who are good at synthesizing a lot of information in a short time as there is more reading on the ACT than the SAT</li> </ul> | <ul style="list-style-type: none"> <li>• More of a reasoning-based exam</li> <li>• Favors students who are better in mathematics as it comprises one-half of the score</li> <li>• Favors students who are better at reasoning and deduction</li> <li>• No penalty for incorrect responses</li> </ul> |
| <b>ACT Reading</b>  | <b>SAT Critical Reading</b>  |
| <i>40 questions in 35 minutes</i>   | <i>53 questions in 65 minutes</i>  |
| <ul style="list-style-type: none"> <li>• Single Passages</li> <li>• Occasional Dual Passages</li> <li>• Does not include graphs, figures, and diagrams</li> </ul>   | <ul style="list-style-type: none"> <li>• Single Passages</li> <li>• Dual Passages</li> <li>• Includes graphs, figures, and diagrams</li> </ul>   |
| <b>ACT English (grammar)</b>  | <b>SAT Writing &amp; Language (grammar)</b>  |
| <i>75 questions in 45 minutes</i>   | <i>44 questions in 35 minutes</i>  |
| <ul style="list-style-type: none"> <li>• Edit and answer questions for five different essays</li> <li>• No graphs or charts included</li> </ul>   | <ul style="list-style-type: none"> <li>• Edit and answer questions for 5 different essays</li> <li>• Will emphasize student command of evidence, both verbal and graphical.</li> </ul>   |
| <b>ACT Mathematics</b>  | <b>SAT Mathematics</b>   |
| <i>60 problems to solve in 60 minutes</i>   | <i>38 problems to solve in 55 minutes (Calculator Section)<br/>20 problems to solve in 25 minutes (No Calculator Section)</i>  |
| <ul style="list-style-type: none"> <li>• Can always use a calculator</li> <li>• Provides no reference formulas</li> <li>• Includes questions about equation of a circle &amp; ellipse</li> <li>• Includes logarithms</li> <li>• Includes imaginary numbers</li> </ul>   | <ul style="list-style-type: none"> <li>• Has a no calculator section</li> <li>• Provides some geometric formulas for reference</li> <li>• Does not include formula of a circle or ellipse</li> <li>• Does not include logarithms</li> <li>• Does not include imaginary numbers</li> </ul>            |
| <b>ACT Essay</b>  | <b>SAT Essay</b>   |
| <i>1 essay topic in 30 minutes</i>  | <i>1 essay topic in 50 minutes</i>   |
| <ul style="list-style-type: none"> <li>• The Essay section is optional</li> <li>• Is not part of composite score</li> <li>• If taken, schools see essay score listed separately</li> <li>• Scored by two graders, max score is 12</li> </ul>  | <ul style="list-style-type: none"> <li>• The Essay section is optional</li> <li>• Optional and given at the end.</li> <li>• Students produce a written analysis of a provided source text.</li> </ul>  |
| <b>ACT Science</b>  |  |
| <i>40 questions in 35 minutes</i>   |  |
| <ul style="list-style-type: none"> <li>• Includes a science section</li> </ul>  |  |





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## Tips for the SAT Reading and Writing/Language Sections

1. **It's an open book test:** The SAT Critical Reading exam is an open book test. You can always put your finger on the correct answers. It's never what you think the text is saying, it's what the text is saying.
2. **Dual passages:** Do only the questions pertaining to the first passage, skipping comparisons. Then do only questions pertaining to the second passage, skipping comparisons. Once you've completed both passages then do the comparison questions.
3. **Writing/Language:** Read the first paragraph in its entirety, looking for grammar mistakes and to fully understand what the author is trying to convey, because you will be asked both content and content and grammar questions. After you complete the paragraph go back and answer the questions. After you answer each question, plug it back into the text and read it to make sure it's the best answer choice.
4. **Prepare while doing your homework:** Each night when you do your homework, spend 25 minutes reading the homework you're least interested in as if it were SAT text. It boils down to understanding what you're reading and that takes focus. It also helped to remember that the SAT is not as easy as the exams in school and that you have to gear up for the test.

## Tips for the ACT Reading and English Sections

1. **Test the three Reading approaches:** You are likely to find one that works for you.
  - Start with line reference questions then go into the text to find the answers
  - Read entire passage then answer the questions
  - Preview questions then read the text and answer the questions
2. **Practice your timing:** The reading portion of the ACT is a speed exam. You have 8 minutes and 45 seconds to read each passage and answer 10 questions.
3. **English:** Read the first paragraph in its entirety, looking for grammar mistakes and to fully understand what the author is trying to convey, because you will be asked both content and content and grammar questions. After you complete the paragraph go back and answer the questions. After you answer each question, plug it back into the text and read it to make sure it's the best answer choice.
4. **Prepare while doing your homework:** Each night when you do your homework, spend 25 minutes reading the homework you're least interested in as if it were ACT text. It boils down to understanding what you're reading and that takes focus. It also helped to remember that the ACT is not as easy as the exams in school and that you have to gear up for the test.

### Helpful Tips for the SAT Math Section

1. **Know what you're solving for:** Be sure to underline the question and glance at the answer choices. Always keep in mind what the question is asking for.
2. **You've done this before:** While some are in a different format, these are still the same concepts as you learned in class.
3. **The answers are all on the page:** As a last resort, you can plug-in answer choices until one satisfies the conditions of the problem.
4. **No Calculator:** From this point forward start to do your homework without a calculator when possible. Any practice without a calculator will be beneficial come test day.

### Helpful Tips for the ACT Math Section

1. **It's a speed test:** There are more problems and less time to do them than on the SAT. Work quickly, but do not rush. Going too fast can lead to careless errors. There is no partial credit! Make sure you use all of the time you are allotted.
2. **Don't be intimidated:** Problems that contain a large amount of text are generally simpler than they appear, and are designed to look intimidating. Read and interpret each sentence before proceeding to the next one, and then piece the puzzle together when you get to the end.
3. **Tips #3 on the SAT also apply here:** Use the answer choices to your advantage - all of the answers are already on the page.
4. **Questions 1 through 30 are generally easier, and questions 31 through 60 are generally harder:** All questions are worth the same amount. Because of the time constraints, be aware of where you are in the exam and strategize accordingly.

### Helpful Tips for the ACT Science Section

1. **It's an open book:** The ACT Science exam, like the reading exam, is an open book test. You can always put your finger on the correct answer.
2. **Figures, Tables, Charts:** The science test on the ACT is not testing how well you remember biology, chemistry, natural science, or physics. It's testing how well you can read graphs, read tables, predict trends, and extract information efficiently. Spend less time reading for understanding and more time attacking the data directly.
3. **The test will let you know where to look:** If a problem begins In Experiment 1, that should tell you where to look! Keywords and units can also give you hints when it is still unclear.
4. **Identify the one passage worth reading:** There is one passage that will have seven questions and very few figures and tables. That is the only passage you need to read for information. Treat this just like an ACT Reading passage, and note that it will probably take you an extra two minutes than the other passages. Budget your time accordingly!
5. **There's no substitute for (timed) practice:** Given three hours to complete the exam, any student could score in the 30s. The trick is to learn how the exam asks questions and recognize its patterns so you can do it in the time allotted. Practice, timing upward, and analyze why you spent a long time on passages where you went over the allotted time.

## 60 Facts, Formulas, and Concepts that ALL Students Must Know

### Arithmetic Concepts

- Integers** are all **whole** numbers- positive, negative, and zero. Decimals, fractions, and imaginaries are not integers.
- Real Numbers** can be thought of as points on an infinitely long line called, you guessed it, the number line. The real numbers include:
  - All the **rational numbers** which are numbers that can be expressed as the ratio of any two integers  $\frac{a}{b}$  and include:
    - All the **integers**, which are all whole numbers, both positive and negative.
    - All the **wholes**, which are non-negative integers including 0.
    - All the **natural numbers**. Do not worry about naturals. These are positive integers used for counting, ordering, and naming only. This will not come up on the test. They DO NOT include 0. **Irrational numbers**, are numbers that CANNOT be expressed as the ratio of any two integers  $\frac{a}{b}$  and include numbers such as  $\pi$  and  $\sqrt{2}$
- Prime Numbers** are numbers that have exactly two factors. The number 1 only has one factor, so it is not prime. The smallest primes are 2, 3, 5, 7, 11, 13, 17, and 19. The only even prime is 2.
- Perfect Squares** are the product of some integer and itself. For example, 25 is a perfect square, since it can be written as  $5 \times 5$ . Perfect squares include: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169...
- Perfect Cubes** are numbers that are the result of the number multiplied by itself twice: For example, 27 is a perfect cube because it can be written as  $3 \times 3 \times 3$ . Perfect cubes include: 1, 8, 27, 64, 125, 216...
- Consecutive Numbers** are numbers that come one after the next in a sequence, like 3, 4, 5... etc. Can be written as  $x$ ,  $x + 1$ ,  $x + 2$  ... etc.
  - Consecutive Odd** (3, 5, 7...) and **Consecutive Even** (4, 6, 8...) can both be written as  $x$ ,  $x + 2$ ,  $x + 4$  ... etc.
- Evens and Odds**: Remember: Even + Even = Even, Even + Odd = Odd, Odd + Odd = Even. Even  $\cdot$  Even = Even, Even  $\cdot$  Odd = Even, Odd  $\cdot$  Odd = Odd. If you forget the rules, test an example.
- Remainders**:
  - The remainder is the whole number left over after division. For example,  $\frac{26}{10}$  is equal to 2 with a remainder of 6. Note that if you express the result as a mixed, unreduced fraction, (in this example,  $2\frac{6}{10}$ ), the numerator is always equal to the remainder.
  - Remainders are additive: if  $\frac{a}{7}$  has remainder 3 and  $\frac{b}{7}$  has remainder 2, then  $\frac{a+b}{7}$  has remainder 5.
  - Remainders cannot be larger than the divisor. If  $\frac{a}{4}$  has remainder 3 and  $\frac{b}{4}$  has remainder 2, then  $\frac{a+b}{4}$  has remainder 1, because there are 5 leftover, but 4 of the leftover form another "group".
- Rules of Fractions**.
  - The number on top is the *numerator* and on bottom is the *denominator*
  - Fractions can be reduced by dividing both the top and the bottom by the same number. For example,  $\frac{6}{8} = \frac{3}{4}$ . You can also multiply the top and bottom by the same number.
  - To multiply fractions, just multiply the numerators and denominators straight across. For example,  $\frac{2}{3} \cdot \frac{5}{7} = \frac{2 \cdot 5}{3 \cdot 7} = \frac{10}{21}$ .
  - To divide fractions, flip the divisor and multiply. For example,  $\frac{2}{3} \div \frac{5}{7} = \frac{2}{3} \cdot \frac{7}{5} = \frac{2 \cdot 7}{3 \cdot 5} = \frac{14}{15}$ .

## The Redesigned SAT/ACT Diagnostic

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- To add or subtract fractions, you need a common denominator.  $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ .
  - Fractions that are less than one behave just the opposite of integers when exponents or roots are applied. The square of  $\frac{1}{16}$ , less than  $\frac{1}{4}$ . The square root of  $\frac{1}{4}$  is  $\frac{1}{2}$ , more than  $\frac{1}{4}$ .
10. **Ratios, Fractions, Percentages: Identify the Whole.** The key to solving most story problems involving ratios, fractions, and percents is to identify the whole. Very frequently, the “whole” comes immediately after the word “of” - for example, “one-half of the students are boys” indicates that the whole group in this problem are the students.
11. **Percentages.** Percent means “out of 100”. You can write 13% as .13 or  $\frac{13}{100}$ . You can write  $k$  percent as  $\frac{k}{100}$  or  $.01k$ . The word “of” ALWAYS means multiplication.
12. **Percent Change.** When dealing with **percent change**, you are going to have a new value and an original value. Here is the formula used to calculate the change: 
$$\text{Percent Change} = \frac{\text{New Value} - \text{Original Value}}{\text{Original Value}}$$
13. **Mean, Median, Mode & Range:**
- **Mean:** Add the numbers up and divide by the amount. Same as Average.
  - **Median:** List lowest to highest, pick the one in the middle. If there are two, add those and divide by 2.
  - **Mode:** The one that occurs most often.
  - **Range:** The difference between the highest and the lowest values in a set.
14. **Probability.** The **probability** of an event happening at random if each possible event is equally likely is:  
$$\text{Probability} = \frac{\text{Number of Possible Successes}}{\text{Number of Possibilities}}$$
15. **Counting Possibilities.** If event 1 can happen  $a$  ways and event 2 can happen  $b$  ways, the two events can happen  $ab$  ways. Remember that they are sometimes dependent- if you are filling four actors for four roles, event  $a$  (filling the first role) can happen four ways and event  $b$  (filling the second) can happen three since one of the actors is now ineligible.
16. **Sequences.** Look for sequences that repeat and group terms. When faced with arithmetic sequences (where the difference between consecutive terms is always the same), label that difference  $x$ , and rewrite all of the other values in terms of  $x$ . For example, if the first term is 11, the second term must be  $11 + x$ , the third term must be  $11 + 2x \dots$  etc.
17. **Arithmetic Sequence** can be defined as a sequence of numbers where the difference between consecutive terms is constant. For example, the sequence 6, 10, 14, 18, 22 ... is an arithmetic sequence with a common difference of 4.
18. **Finding a specific term in an Arithmetic Sequence:** the formula you will need to remember is  $a_1 + (n - 1)d =$  the term you are looking for, where  $a_1$  equals the first term,  $n$  equals the term you are looking for, and  $d$  equals the common difference.
19. **Summing an Arithmetic Sequence:**  $(a_{\text{first}} + a_{\text{last}})\left(\frac{n}{2}\right)$  where  $a_{\text{first}}$  equals the relative first term in the sequence,  $a_{\text{last}}$  equals the relative last term in the sequence, and  $n$  equals the total number of terms in the sequence.
20. **Geometric Sequence** can be defined as a sequence of numbers where each term after the first is found by multiplying the previous one by a non-zero constant called the common ratio. For example, the sequence 4, 12, 36, 108, ... is a geometric progression with common ratio 3. Similarly 20, 10, 5, 2.5, ... is a geometric sequence with common ratio  $\frac{1}{2}$ .

### Algebra I Concepts

21. **PEMDAS.** Parentheses, Exponents, Multiplication, Division, Addition, Subtraction, always left to right. Absolute value bars function like parentheses. Wrong answer choices very frequently involve PEMDAS mistakes, so always be aware.
22. **Inequalities:** Flip the inequality signs when multiplying or dividing the entire inequality by  $-1$ . Combine inequalities by testing all four pairs of endpoints.
23. **Nonlinear Inequalities:** Solve the inequality as an equation and plot the answers on a number line. Test one point from each segment to determine which portions of the number line are parts of your solution set.

24. **Systems of Equations.** Two ways to solve multiple equations and multiple variables: substitute, or stack and add/subtract. Substitute when you have an equation with an isolated variable and stack when you have coefficients that match in each equation.

- **Infinite Solutions** occur when the two lines, represented graphically are identical. This means the lines have the same slope and same y-intercept.
- **No Solutions** occur when the two lines, represented graphically, are parallel (see tip #45). This means the lines have the same slope but different y-intercept.

25. **Rules of Exponents.** You must ALWAYS have the same base before working with exponents.

$$\begin{aligned}
 & \bullet x^a \cdot x^b = x^{a+b} & \bullet \frac{x^a}{x^b} = x^{a-b} & \bullet (x^a)^b = x^{ab} & \bullet x^{-n} = \frac{1}{x^n} \\
 & \bullet x^{\frac{1}{2}} = \sqrt{x} & \bullet x^{\frac{m}{n}} = \sqrt[n]{x^m} & \bullet (xy)^n = x^n y^n
 \end{aligned}$$

26. **Square Root Simplification & Rules of Roots:**

$$\bullet \sqrt{32} = \sqrt{16 \cdot 2} = 4\sqrt{2} \quad \bullet \sqrt{a}\sqrt{b} = \sqrt{ab} \quad \bullet \sqrt{a} + \sqrt{b} \neq \sqrt{a+b} \quad \bullet \frac{n}{\sqrt{2}} = \frac{n\sqrt{2}}{2}$$

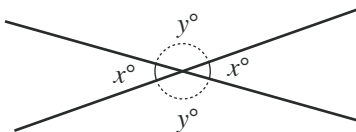
27. **Made-Up Functions.** When dealing with made-up functions, identify the guide given in the problem and simply plug-in. For example, if told that  $x \nabla y = xy + y^2$ , then  $3 \nabla 5 = 5(3) + 5^2 = 15 + 25 = 40$ .

*Plane Geometry Concepts*

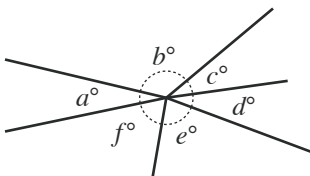
28. **Complementary Angles** are angles that sum to 90 degrees.

29. **Supplementary Angles** are angles that sum to 180 degrees.

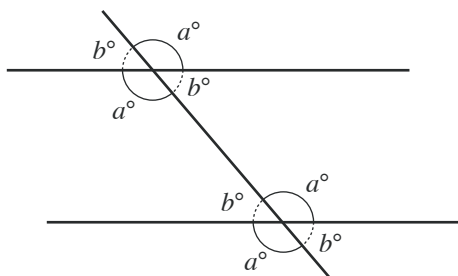
30. **Vertical Angles** occur when two lines intersect each other creating two pairs of congruent angles. For example,  $x = x$ ,  $y = y$ , and  $x + y = 180$ .



31. **Degrees Around a Single Point** will always sum to 360 degrees. For example,  $a + b + c + d + e + f = 360$



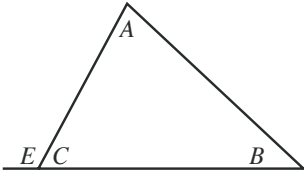
32. **Parallel lines.** When parallel lines are crossed by another line, you get two types of angles. All angles labeled  $a^\circ$  are the same and all labeled  $b^\circ$  are the same, and  $a + b = 180$ . When you see parallel lines on the test, ALWAYS extend them.



## The Redesigned SAT/ACT Diagnostic

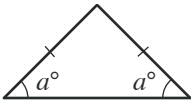
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33. **Angles of a Triangle** will always sum to 180 degrees. The exterior angle of a triangle will always be equal to the sum of the two opposite interior angles.

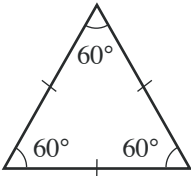


- $A + B + C = 180$
- $E + C = 180$
- $E = A + B$

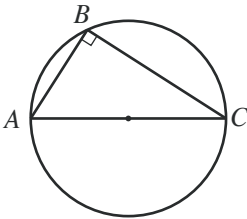
34. **Isosceles Triangles** are triangles that have two sides of equal length and the two angles opposite the equal sides are equal as well.



35. **Equilateral Triangle** is a triangle in which all three sides are equal and all angles are equal to 60 degrees.



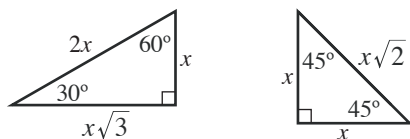
36. **Any angle inscribed in a semi-circle is a right angle.**



37. **Area, Circumference/Perimeter, Volume Formulas** are given to you on the SAT, but not on the ACT. Here are the ones that will (generally) be tested without being provided to you in the problem:

- **Area of a Circle:**  $A = \pi r^2$
- **Area of a Sector** of a Circle with central angle measuring  $x^\circ$ :  $A = \frac{x}{360} \pi r^2$
- **Area of a Rectangle:**  $A = lw$
- **Area of a Triangle:**  $A = \frac{1}{2}bh$
- **Area of a Parallelogram:**  $A = bh$
- **Area of a Trapezoid:**  $A = \frac{1}{2}(b_1 + b_2)h$
- **Surface Area of a Box:**  $A = 2lw + 2hl + 2hw$
- **Surface Area of a Cube:**  $A = 6s^2$
- **Circumference of a Circle:**  $C = 2\pi r$
- **Arc Length** of a sector of a circle with central angle measuring  $x^\circ$ :  $\text{arc length} = \frac{x}{360} 2\pi r$

- **Perimeter of a Rectangle:**  $P = 2(l + w)$
  - **Volume of a Box:**  $V = lwh$
  - **Volume of a Cube:**  $V = s^3$
  - **Volume of a Right Circular Cylinder:**  $V = \pi r^2 h$
  - **Volume of a Sphere:**  $V = \frac{4}{3}\pi r^3$
  - **Volume of a Cone:**  $V = \frac{1}{3}\pi r^2 h$
  - **Volume of a Pyramid:**  $V = \frac{1}{3}lwh$
38. **Pythagorean Theorem** states that the square of the hypotenuse is equal to the sum of the squares of the other two sides. It can be written as  $a^2 + b^2 = c^2$  where  $c$  is the hypotenuse.
- **Pythagorean Triples and Multiples:** 3-4-5, 6-8-10, 9-12-15, 12-16-20. 5-12-13, 10-24-26, 7-24-25.
39. **Special Right Triangles.** Students should be familiar with the side lengths of 45-45-90 and 30-60-90 right triangles as displayed below. A tip off to when these concepts are being tested are if students see  $\sqrt{2}$  or  $\sqrt{3}$  in your answer choices.



40. **Triangle Side Lengths.** The lengths of any two sides of a triangle must sum to greater than the length of the third side.

### Coordinate Geometry Concepts

41. **Midpoint Formula.** If you want to find the midpoint  $(x_m, y_m)$  where the endpoints are  $(x_1, y_1)$  and  $(x_2, y_2)$ , then  $x_m = \frac{x_1 + x_2}{2}$ , and  $y_m = \frac{y_1 + y_2}{2}$ .
42. **Distance Formula.** To calculate the distance between  $(x_1, y_1)$  and  $(x_2, y_2)$ , use the distance formula:  $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ . Note that you can often also draw a right triangle and use the Pythagorean Theorem.
43. **Vectors** represent physical quantities that have both magnitude and direction. Let  $\vec{u} = \langle u_1, u_2 \rangle$  and  $\vec{v} = \langle v_1, v_2 \rangle$ . The sum of  $\vec{u}$  and  $\vec{v}$  is the vector  $\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2 \rangle$  and the difference of  $\vec{u}$  and  $\vec{v}$  is the vector  $\vec{u} - \vec{v} = \langle u_1 - v_1, u_2 - v_2 \rangle$ .
44. **Norm (or Magnitude).** The norm or magnitude of a vector is the distance from zero. The norm can be calculated using  $|\langle u, v \rangle| = \sqrt{u^2 + v^2}$ , for example, the norm of  $\langle -3, -4 \rangle = \sqrt{(-3)^2 + (-4)^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ .
45. **Slope and Slope-Intercept Form.**
- When you are given a linear function or graph, often the test will refer to slope-intercept form. Slope-intercept form is when the equation of a line is expressed as  $y = mx + b$ , where  $m$  is the slope and  $b$  is the y-intercept (the value at which the line crosses the y-axis). You can then plug in coordinate pairs  $(x, y)$ .
  - You can calculate the slope by the formula  $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{Rise}}{\text{Run}}$
  - Finally, it is important to know that two **parallel lines** have the same slope and never intersect, while two **perpendicular lines** have slopes that are the negative reciprocals of one another.
46. **Functions.** When we see function notation such as  $f(x) = 2x + 7$ , we are simply giving the function a name ( $f$ ) so that we can refer to it, and indicating that the output of the function is dependent on the variable  $x$ .

## The Redesigned SAT/ACT Diagnostic

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- When we're told that  $f(x) = y$ , that simply means that  $(x,y)$  lies on the graph of  $f(x)$ . When we're asked for  $f(3)$ , plug in (3) for  $x$  to the initial equation and simplify. DON'T forget to substitute the parentheses.
47. **General Form of a Parabola + Shifts.** The general form of a parabola is  $y = a(x - h)^2 + k$ , where  $(h,k)$  is the vertex of the parabola. If  $a > 0$ , the vertex is the lowest point on the parabola it opens upward. If  $a < 0$ , the vertex is the highest point on the parabola and it opens downward.
- When  $k$  is positive you must shift the graph up that many units. If  $k$  is negative (subtraction), shift down.
  - When  $h$  is positive the parabola must shift right that many units. If  $h$  is negative (addition inside the parentheses), the parabola shifts left.
  - When  $a$  is greater than one the parabola becomes skinnier. If  $a$  is a number between zero and one, it becomes wider.
  - Finally, remember that if  $a$  is negative, the graph is flipped upside down.
  - These shifts also apply generally to absolute value functions, for example,  $f(x) = a|x - h| + k$ .
48. **General Form of a Circle:** The general form of a circle is  $(x - h)^2 + (y - k)^2 = r^2$ , where  $(h,k)$  is the center of the circle, and  $r$  is the radius of the circle.
49. **General Form of an Ellipse:** The general form of an ellipse is  $\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ , where  $(h,k)$  is the center of the ellipse and  $a$  and  $b$  are the semi-major and semi-minor axes, you can think of these values as the radii of the  $x$ - and  $y$ -axes respectively.

### Algebra II Concepts

50. **Absolute Value:** When  $|x|$  is set equal to something else, remove the absolute value sign and set the other side equal to its current value OR the current value's additive inverse.
- Example 1:  $|x| = 4 \Rightarrow x = -4, 4$
  - Example 2:  $|-x| = 8 \Rightarrow x = -8, 8$
- This applies basically the same way if something besides  $x$  is inside the absolute value. You'll just have to do a step or two afterwards.
- Example 3:  $|4x - 2| = 6 \Rightarrow 4x - 2 = 6$  OR  $4x - 2 = -6 \Rightarrow x = -1, 2$ .
- However, if you have stuff OUTSIDE the absolute value sign on the same side, you need to isolate the absolute value before proceeding.
- Example 4:  $2|x + 2| + 1 = 9 \Rightarrow 2|x + 2| = 8 \Rightarrow |x + 2| = 4 \Rightarrow x + 2 = 4$  OR  $x + 2 = -4 \Rightarrow x = -6, 2$ .
51. **Absolute Value Inequalities:** You can identify a conjunction by a less than ( $<$ ) sign: conjunctions are AND statements.
- Example 5:  $2|x + 3| \leq 10 \Rightarrow |x + 3| \leq 5 \Rightarrow -5 \leq x + 3 \leq 5 \Rightarrow -8 \leq x \leq 2$
- You can identify a disjunction by a greater sign ( $>$ ): disjunctions are OR statements.
- Example 6:  $2|x + 3| \geq 10 \Rightarrow |x + 3| \geq 5 \Rightarrow x + 3 \geq 5$  OR  $x + 3 \leq -5 \Rightarrow x \geq 2$  OR  $x \leq -8$
52. **Direct and Inverse Proportions.** Remember, if  $x$  is directly proportional to  $y$ , then  $y = kx$  where  $k$  is a constant. If  $y$  is INVERSELY proportionate to  $x$ , then  $y = \frac{k}{x}$  where  $k$  is a constant. Sometimes you'll run into  $y$  is directly or inversely proportional to  $x^2$ . Then  $y = kx^2$  or  $y = \frac{k}{x^2}$ .
53. **Factoring, FOIL and the Quadratic Identities:**
- $(x + y)^2 = x^2 + 2xy + y^2$  •  $(x - y)^2 = x^2 - 2xy + y^2$  •  $(x + y)(x - y) = x^2 - y^2$

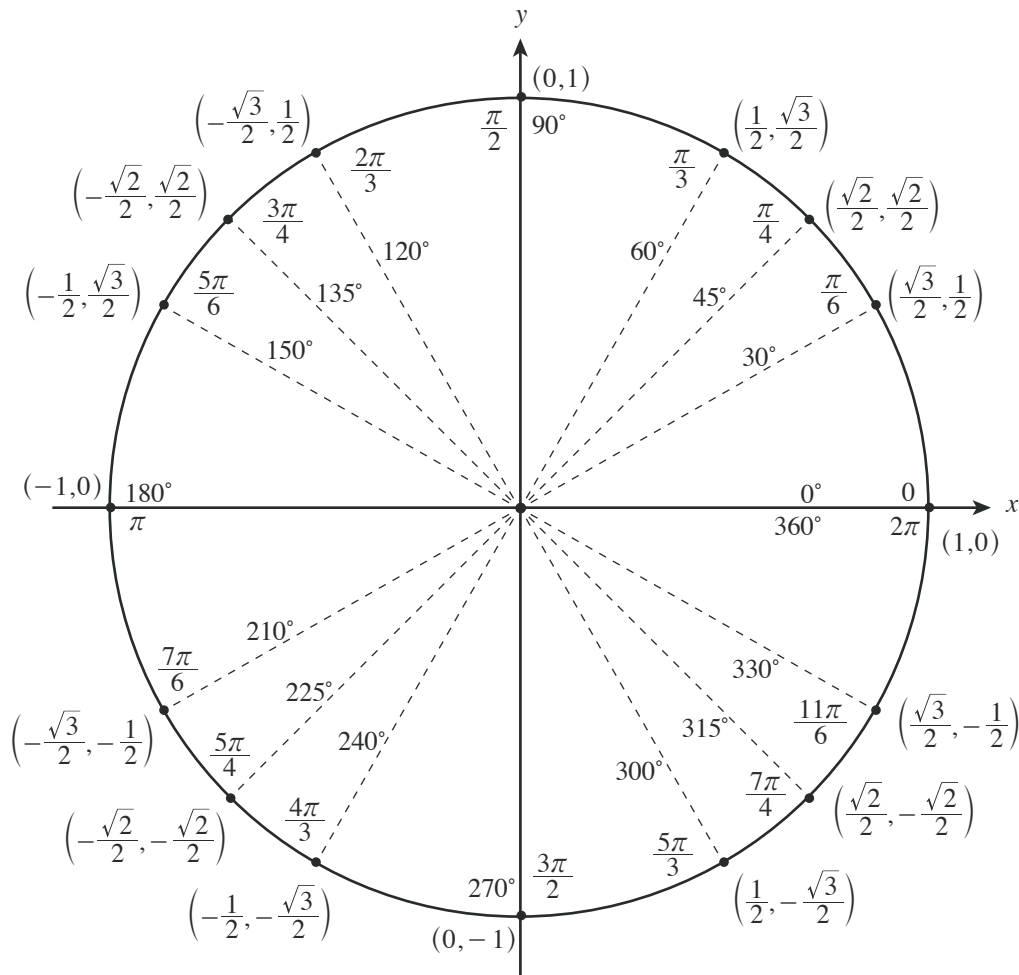


54. **Quadratics and Factoring when  $a \neq 1$ .** To factor a quadratic in the form  $ax^2 + bx + c = 0$ , find two numbers whose product is  $ac$  and sum is  $b$ , and use that to fill in the gaps. For example:
- $2x^2 - 17x + 30 \Rightarrow$  What're two numbers that multiply to 60 and add to  $-17$ ? (Answer:  $-5$  and  $-12$ )  $\Rightarrow$   
 $2x^2 - 12x - 5x + 30 \Rightarrow 2x(x - 6) - 5(x - 6) \Rightarrow$  so the factors are  $(2x - 5)(x - 6)$ .
55. **Quadratics and the Discriminant.** The discriminant of a quadratic in the form  $ax^2 + bx + c = 0$  is defined as  $b^2 - 4ac$ .
- If the discriminant is **positive**, the quadratic has **two distinct roots**.
  - If the discriminant is **negative**, the quadratic has **two imaginary roots**.
  - If the discriminant is **zero**, the quadratic has **one double real root**.
56. **Quadratic Formula, Sum/Product of Roots.** The roots of a quadratic of the form  $ax^2 + bx + c = 0$  are  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
- The **sum of roots** of this quadratic is  $-\frac{b}{a}$ .
  - The **product of roots** of this quadratic is  $\frac{c}{a}$ .
57. **Imaginary Numbers:** When you see  $i$ , it means  $\sqrt{-1}$ . Don't be intimidated! Treat it like any other variable, but always remember:
- $i^2 = \sqrt{-1} \cdot \sqrt{-1} = -1$  •  $i^3 = i^2 \cdot i = -1 \cdot i = -i$  •  $i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$  • ...and so on.
58. **Logarithms:** Remember the three rules of logs and you will be good to go:
- $\log_a b + \log_a c = \log_a bc$   $\log_a b - \log_a c = \log_a \frac{b}{c}$   $\log_a b^n = n \log_a b$
59. **Matrices:**
- When **adding matrices**, add each respective term (ie, adding the second row and third column of matrix  $A$  with the second and third column of matrix  $B$  will give the second row and third column of  $AB$ . For example:
    - $\begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \end{bmatrix} + \begin{bmatrix} 0 & 1 & 1 \\ 6 & 9 & 2 \end{bmatrix} = \begin{bmatrix} 1+0 & 3+1 & 2+1 \\ 3+6 & 0+9 & 4+2 \end{bmatrix} = \begin{bmatrix} 1 & 4 & 3 \\ 9 & 9 & 6 \end{bmatrix}$
  - When **multiplying matrices**, multiply the elements of each row of the first matrix by the elements of each column in the second matrix, and then add the products (ie, multiplying each term in the second row of matrix  $A$  with its respective term in the third column of matrix  $B$  and then adding these values will give the second row and third column of matrix  $AB$ ).
    - Scalar Multiplication:**  $2 \begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \end{bmatrix} = \begin{bmatrix} 2 \times 1 & 2 \times 3 & 2 \times 2 \\ 2 \times 3 & 2 \times 0 & 2 \times 4 \end{bmatrix} = \begin{bmatrix} 2 & 6 & 4 \\ 6 & 0 & 8 \end{bmatrix}$
    - Matrix  $\times$  Matrix ('Dot Product'):**  $\begin{bmatrix} 1 & 2 & 5 \\ 3 & 0 & 4 \end{bmatrix} \times \begin{bmatrix} 0 & 1 \\ 5 & 6 \\ 8 & 2 \end{bmatrix} = \begin{bmatrix} (1 \cdot 0) + (2 \cdot 5) + (5 \cdot 8) & (1 \cdot 1) + (2 \cdot 6) + (5 \cdot 2) \\ (3 \cdot 0) + (0 \cdot 5) + (4 \cdot 8) & (3 \cdot 1) + (0 \cdot 6) + (4 \cdot 2) \end{bmatrix} = \begin{bmatrix} 50 & 23 \\ 32 & 11 \end{bmatrix}$
    - Determinant of a  $2 \times 2$  Matrix:**  $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

## The Redesigned SAT/ACT Diagnostic

### 60. Trigonometry:

- You should remember SOH CAH TOA:  $\text{Sine} = \frac{\text{Opp}}{\text{Hyp}}$ ,  $\text{Cosine} = \frac{\text{Adj}}{\text{Hyp}}$ ,  $\text{Tangent} = \frac{\text{Opp}}{\text{Adj}}$ .
- You should also know that  $\text{Sine} = \frac{1}{\text{cosecant}}$ ,  $\text{Cosine} = \frac{1}{\text{secant}}$ ,  $\text{Tangent} = \frac{1}{\text{cotangent}}$ .
- You should be familiar with the mnemonic “All Students Take Calculus” that tells you where each of the three major trigonometric functions is positive - All in the 1st quadrant, Sine in the 2nd, Tangent in the 3rd, and Cosine in the 4th.
- Finally, you should be relatively familiar with the unit circle below. If you draw a right triangle such that one side is along the  $x$ -axis and the hypotenuse forms the angle whose trig value you are looking to calculate, the  $x$  value of the point on the circle (in the figure below, A) will be the value of Cosine and the  $y$ -value will be the value of sine.



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# Returning Your Results

### Submitting Results for Scoring (Direct to CPP)

1. You may scan the bubblesheets (preferably into a single .PDF file) and send in an email to [diagnostic@satprepct.com](mailto:diagnostic@satprepct.com).

Your email should include your name, consultant group, student name, and email address you would like the results sent back to.

2. You may fax the results to us at  
+1 (860) 552-4771

Your cover sheet must include your name, consultant group, student name, and email address you would like the results sent back to.

### Further Detail

We prefer that you scan your bubblesheets; however, faxes work just the same. We must have all of the information requested above in order to process the exam.

We aim to return test results within 72 hours of receipt. If we receive test scores on a Friday, it's unlikely that they will be returned until the following Monday. If you need the report returned in 24 hours, please call the office for details pertaining to the surcharge.

We look forward to hearing from you,

The College Planning Partnerships Team

**No Testing Material On This Page**

# 6 Bubblesheets



**Marking Directions:** Mark only **one** circle for each question.  
Fill in response completely. Erase errors cleanly without smudging.

**Correct mark:**    A B ● D E


**Do NOT use these** incorrect or bad marks.

Incorrect marks:    D E

Overlapping mark:   E

Cross-out mark:   E

Smudged erasure:   E

Mark is too light:   E

**D** Student Name:

**Section 1 | ACT English** - Bubble in your responses to the multiple choice questions

|   |         |    |         |    |         |    |         |    |         |
|---|---------|----|---------|----|---------|----|---------|----|---------|
| 1 | A B C D | 10 | F G H J | 19 | A B C D | 28 | F G H J | 37 | A B C D |
| 2 | F G H J | 11 | A B C D | 20 | F G H J | 29 | A B C D | 38 | F G H J |
| 3 | A B C D | 12 | F G H J | 21 | A B C D | 30 | F G H J | 39 | A B C D |
| 4 | F G H J | 13 | A B C D | 22 | F G H J | 31 | A B C D | 40 | F G H J |
| 5 | A B C D | 14 | F G H J | 23 | A B C D | 32 | F G H J | 41 | A B C D |
| 6 | F G H J | 15 | A B C D | 24 | F G H J | 33 | A B C D | 42 | F G H J |
| 7 | A B C D | 16 | F G H J | 25 | A B C D | 34 | F G H J | 43 | A B C D |
| 8 | F G H J | 17 | A B C D | 26 | F G H J | 35 | A B C D | 44 | F G H J |
| 9 | A B C D | 18 | F G H J | 27 | A B C D | 36 | F G H J | 45 | A B C D |

**Section 2 | SAT Reading** - Bubble in your responses to the multiple choice questions

|   |         |    |         |    |         |    |         |    |         |
|---|---------|----|---------|----|---------|----|---------|----|---------|
| 1 | A B C D | 8  | A B C D | 15 | A B C D | 22 | A B C D | 29 | A B C D |
| 2 | A B C D | 9  | A B C D | 16 | A B C D | 23 | A B C D | 30 | A B C D |
| 3 | A B C D | 10 | A B C D | 17 | A B C D | 24 | A B C D | 31 | A B C D |
| 4 | A B C D | 11 | A B C D | 18 | A B C D | 25 | A B C D | 32 | A B C D |
| 5 | A B C D | 12 | A B C D | 19 | A B C D | 26 | A B C D | 33 | A B C D |
| 6 | A B C D | 13 | A B C D | 20 | A B C D | 27 | A B C D |    |         |
| 7 | A B C D | 14 | A B C D | 21 | A B C D | 28 | A B C D |    |         |

**Section 3 | ACT Math** - Bubble in your responses to the multiple choice questions

|   |           |    |           |    |           |    |           |    |           |
|---|-----------|----|-----------|----|-----------|----|-----------|----|-----------|
| 1 | A B C D E | 9  | A B C D E | 17 | A B C D E | 25 | A B C D E | 33 | A B C D E |
| 2 | F G H J K | 10 | F G H J K | 18 | F G H J K | 26 | F G H J K | 34 | F G H J K |
| 3 | A B C D E | 11 | A B C D E | 19 | A B C D E | 27 | A B C D E | 35 | A B C D E |
| 4 | F G H J K | 12 | F G H J K | 20 | F G H J K | 28 | F G H J K | 36 | F G H J K |
| 5 | A B C D E | 13 | A B C D E | 21 | A B C D E | 29 | A B C D E | 37 | A B C D E |
| 6 | F G H J K | 14 | F G H J K | 22 | F G H J K | 30 | F G H J K | 38 | F G H J K |
| 7 | A B C D E | 15 | A B C D E | 23 | A B C D E | 31 | A B C D E | 39 | A B C D E |
| 8 | F G H J K | 16 | F G H J K | 24 | F G H J K | 32 | F G H J K | 40 | F G H J K |





**Marking Directions:** Mark only **one** circle for each question.  
Fill in response completely. Erase errors cleanly without smudging.

**Correct mark:** (A) (B) (●) (D) (E)

**Do NOT use these** incorrect or bad marks.

Incorrect marks: (A) (B) (C) (D) (E)

Overlapping mark: (A) (B) (C) (D) (E)

Cross-out mark: (A) (B) (C) (D) (E)

Smudged erasure: (A) (B) (C) (D) (E)

Mark is too light: (A) (B) (C) (D) (E)

**D Student Name:**

**Section 7 | SAT Math (With Calculator) - Bubble in your responses to the multiple choice questions**

- |                          |                          |                           |                           |                           |
|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|
| <b>1</b> (A) (B) (C) (D) | <b>5</b> (A) (B) (C) (D) | <b>9</b> (A) (B) (C) (D)  | <b>13</b> (A) (B) (C) (D) | <b>17</b> (A) (B) (C) (D) |
| <b>2</b> (A) (B) (C) (D) | <b>6</b> (A) (B) (C) (D) | <b>10</b> (A) (B) (C) (D) | <b>14</b> (A) (B) (C) (D) | <b>18</b> (A) (B) (C) (D) |
| <b>3</b> (A) (B) (C) (D) | <b>7</b> (A) (B) (C) (D) | <b>11</b> (A) (B) (C) (D) | <b>15</b> (A) (B) (C) (D) | <b>19</b> (A) (B) (C) (D) |
| <b>4</b> (A) (B) (C) (D) | <b>8</b> (A) (B) (C) (D) | <b>12</b> (A) (B) (C) (D) | <b>16</b> (A) (B) (C) (D) |                           |

| Q. 20 |   |   |   |   |
|-------|---|---|---|---|
|       |   |   |   |   |
|       | ○ | ○ | ○ | ○ |
| 1     | 0 | 0 | 0 | 0 |
| 2     | 1 | 1 | 1 | 1 |
| 3     | 2 | 2 | 2 | 2 |
| 4     | 3 | 3 | 3 | 3 |
| 5     | 4 | 4 | 4 | 4 |
| 6     | 5 | 5 | 5 | 5 |
| 7     | 6 | 6 | 6 | 6 |
| 8     | 7 | 7 | 7 | 7 |
| 9     | 8 | 8 | 8 | 8 |

| Q. 21 |   |   |   |   |
|-------|---|---|---|---|
|       |   |   |   |   |
|       | ○ | ○ | ○ | ○ |
| 1     | 0 | 0 | 0 | 0 |
| 2     | 1 | 1 | 1 | 1 |
| 3     | 2 | 2 | 2 | 2 |
| 4     | 3 | 3 | 3 | 3 |
| 5     | 4 | 4 | 4 | 4 |
| 6     | 5 | 5 | 5 | 5 |
| 7     | 6 | 6 | 6 | 6 |
| 8     | 7 | 7 | 7 | 7 |
| 9     | 8 | 8 | 8 | 8 |

| Q. 22 |   |   |   |   |
|-------|---|---|---|---|
|       |   |   |   |   |
|       | ○ | ○ | ○ | ○ |
| 1     | 0 | 0 | 0 | 0 |
| 2     | 1 | 1 | 1 | 1 |
| 3     | 2 | 2 | 2 | 2 |
| 4     | 3 | 3 | 3 | 3 |
| 5     | 4 | 4 | 4 | 4 |
| 6     | 5 | 5 | 5 | 5 |
| 7     | 6 | 6 | 6 | 6 |
| 8     | 7 | 7 | 7 | 7 |
| 9     | 8 | 8 | 8 | 8 |

| Q. 23 |   |   |   |   |
|-------|---|---|---|---|
|       |   |   |   |   |
|       | ○ | ○ | ○ | ○ |
| 1     | 0 | 0 | 0 | 0 |
| 2     | 1 | 1 | 1 | 1 |
| 3     | 2 | 2 | 2 | 2 |
| 4     | 3 | 3 | 3 | 3 |
| 5     | 4 | 4 | 4 | 4 |
| 6     | 5 | 5 | 5 | 5 |
| 7     | 6 | 6 | 6 | 6 |
| 8     | 7 | 7 | 7 | 7 |
| 9     | 8 | 8 | 8 | 8 |

| Q. 24 |   |   |   |   |
|-------|---|---|---|---|
|       |   |   |   |   |
|       | ○ | ○ | ○ | ○ |
| 1     | 0 | 0 | 0 | 0 |
| 2     | 1 | 1 | 1 | 1 |
| 3     | 2 | 2 | 2 | 2 |
| 4     | 3 | 3 | 3 | 3 |
| 5     | 4 | 4 | 4 | 4 |
| 6     | 5 | 5 | 5 | 5 |
| 7     | 6 | 6 | 6 | 6 |
| 8     | 7 | 7 | 7 | 7 |
| 9     | 8 | 8 | 8 | 8 |

**Section 8 | ACT Science - Bubble in your responses to the multiple choice questions**

- |                          |                           |                           |                           |                           |
|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| <b>1</b> (A) (B) (C) (D) | <b>7</b> (A) (B) (C) (D)  | <b>13</b> (A) (B) (C) (D) | <b>19</b> (A) (B) (C) (D) | <b>25</b> (A) (B) (C) (D) |
| <b>2</b> (F) (G) (H) (J) | <b>8</b> (F) (G) (H) (J)  | <b>14</b> (F) (G) (H) (J) | <b>20</b> (F) (G) (H) (J) | <b>26</b> (F) (G) (H) (J) |
| <b>3</b> (A) (B) (C) (D) | <b>9</b> (A) (B) (C) (D)  | <b>15</b> (A) (B) (C) (D) | <b>21</b> (A) (B) (C) (D) | <b>27</b> (A) (B) (C) (D) |
| <b>4</b> (F) (G) (H) (J) | <b>10</b> (F) (G) (H) (J) | <b>16</b> (F) (G) (H) (J) | <b>22</b> (F) (G) (H) (J) | <b>28</b> (F) (G) (H) (J) |
| <b>5</b> (A) (B) (C) (D) | <b>11</b> (A) (B) (C) (D) | <b>17</b> (A) (B) (C) (D) | <b>23</b> (A) (B) (C) (D) | <b>29</b> (A) (B) (C) (D) |
| <b>6</b> (F) (G) (H) (J) | <b>12</b> (F) (G) (H) (J) | <b>18</b> (F) (G) (H) (J) | <b>24</b> (F) (G) (H) (J) |                           |

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