



Practice Test

for the ACT[®] Exam

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**ENGLISH TEST***45 Minutes – 75 Questions*

DIRECTIONS: In the passages below, selected words and phrases have been underlined and numbered. The corresponding questions provide alternatives to the underlined part. Select the choice that best expresses the idea, adheres to standard written English conventions, and matches the style and tone of the overall passage.

When the underlined version of the selected text is best, choose NO CHANGE. In some cases, a question will be provided that asks about the underlined portion, about a section of the passage indicated by a boxed number, or about the overall passage. Choose the best answer to these questions.

PASSAGE I**An Object of Affection**

[1]

[A] I was standing near the snake exhibit during a family vacation when an employee came over. After ¹sizing us up, she asked if we wanted to pet a snake. [B] Everyone except me seemed enthusiastic.

[2]

I don't like snakes. They're strange, slimy-looking creatures that belong in uninhabited deserts, going along the ground or resting beneath some ₂

cacti, which are shaded from the heat. ₃

1. **A.** NO CHANGE
B. over to the snake exhibit where my family and I stood.
C. over, and there we were, looking at the snakes.
D. over while we were standing there.

2. Which choice provides the most vivid description of snakes on the floor of the desert?
A. NO CHANGE
B. slithering through barren sand
C. living in the arid dunes
D. moving above the dry earth

3. **A.** NO CHANGE
B. cacti, they are
C. cacti,
D. cacti;



[C] Wanting to be agreeable, but with great apprehension
in my voice, I told the woman “Okay.” She left and then
returned with the snake.

[3]

I instinctively backed away as the rest of my family
moved closer. An oversized worm, it was wrapped
around the lady’s arm like a decorative greenish-gray
bracelet. It had a body with brown and yellow patches,
and I thought they might reveal a hidden picture.
Everyone in the family was commenting on how smooth it
was, but my hand was frozen at my side.

[4]

The snake’s keeper began to give us more
information about the snake, like its native habitat and
diet. Through it all, the snake’s calmness amazed me, as
did the caress that was given bravely from my family to
the snake and stood so close to it. With regret, I thought
about how sad it was for people to give so much affection
to something that couldn’t return the feeling.

[5]

At that moment, the snake slowly opened its eyes,
which shone big and clear, from its scaly face. [D] Head
slightly raised, it looked at me without wavering, like a
lawyer questioning a witness.

4. The writer is considering deleting the underlined portion. Should the underlined portion be kept or deleted?
- A. Kept, because it suggests that the narrator had previously touched a snake, but it had been an unpleasant experience.
 - B. Kept, because it emphasizes the narrator’s feelings about the worker bringing out a snake for the family to touch.
 - C. Deleted, because it presents the narrator in a way that’s different from how the narrator is shown in the rest of the essay.
 - D. Deleted, because it detracts from the paragraph’s purpose of providing information about where snakes live.
5. Given that all the choices are accurate, which one provides the most precise description of the pattern on the snake?
- A. NO CHANGE
 - B. I saw brown and yellow marks that looked like they were leading somewhere,
 - C. There were brown and yellow markings on its scaly back,
 - D. Mysterious brown and yellow dotted circular paths lined its body,
6. A. NO CHANGE
B. braveness with which my family caressed the snake
C. brave caressing of the snake by my family
D. braveness my family showed
7. A. NO CHANGE
B. my family
C. me
D. you
8. A. NO CHANGE
B. big and clear from,
C. big, and clear from
D. big and clear from
9. Which of the following alternatives to the underlined portion would NOT be acceptable?
- A. probed
 - B. gathered
 - C. inspected
 - D. scrutinized
10. A. NO CHANGE
B. having the questioning of
C. in question with
D. question



[6]

“Who are you,” it seemed to ask me, “to be the only one withholding love?”

[7]

The snake holder indicated to my family, and me ¹¹ after a while ¹¹ that the time for petting had ended. A bit relieved, I moved away and beckoned my family to follow me. As we left that nightmare and walked toward the turtles, I looked back and saw the snake cling to the woman’s arm, looking ¹² as careless as a baby, and shut its eyes for a nap.

11. A. NO CHANGE
 B. family, and me after a while,
 C. family and me after a while,
 D. family and me after a while
12. A. NO CHANGE
 B. like as if it was appearing to be
 C. seeming something like
 D. kind of like it was

Question 13 and 14 ask about the preceding passage as a whole.

13. Upon reviewing the essay and finding that some information has been left out, the writer composes the following sentence incorporating that information.
- She told us that the snake especially liked to be petted by different people, and that this would be something we could do as a family.
- If the writer were to add this sentence to the essay, it would most logically be placed at:
- A. Point A in Paragraph 1.
 B. Point B in Paragraph 1.
 C. Point C in Paragraph 2.
 D. Point D in Paragraph 5.
14. Suppose the writer’s primary purpose had been to describe a moment in which a person realizes something significant while observing his or her surroundings. Would this essay accomplish this purpose?
- A. Yes, because it describes what the narrator, while watching her family pet a snake, perceived to be a surprising connection between them and the reptile.
 B. Yes, because it describes a time when the narrator, while watching her family, realized that people don’t always know when something is dangerous.
 C. No, because it instead tells the story of why the narrator is afraid of snakes.
 D. No, because it instead focuses on giving information about the color of and best environment for snakes.



PASSAGE II

Jim Thorpe Wins Gold

[1] Athlete Jim Thorpe participated in 17 events in the 1912 Stockholm Olympics, but at the time he was better known as a football player. [2] In Stockholm, however, Thorpe became the only athlete to ever win Olympic gold medals in both the pentathlon and decathlon. [3] In a 1911 championship win against Harvard, Thorpe played running back, defensive back, placekicker, and punter, scoring all 18 through his team's points with four field goals and a touchdown. 18

Thorpe, a Sac and Fox (Saulk) Native American, grew up in Oklahoma. After the deaths of both Jim's twin brother and then his mother, his father sent Thorpe to the Carlisle Indian Industrial School in Pennsylvania. While there, Thorpe was a two-time All American for the school's football team. However, Thorpe was a versatile athlete who didn't play just professional football but also professional baseball and basketball. His athletic abilities earned him the title of "greatest athlete" for the first half of the 20th century by the Associated Press.

His schedule in the Olympics was busy, and competing first in the pentathlon, four of the five events Thorpe won, which earned him the gold medal. That same day, he qualified for the high jump final, finishing in a tie for fourth, and a few days later, he placed seventh in the long jump.

- 15. A. NO CHANGE
B. nonetheless,
C. in fact,
D. DELETE the underlined portion.
- 16. A. NO CHANGE
B. Olympic gold medals,
C. Olympic gold, medals
D. Olympic, gold medals
- 17. A. NO CHANGE
B. around
C. of
D. from
- 18. Which of the following sequences of sentences makes this paragraph most logical?
A. NO CHANGE
B. 1, 3, 2
C. 2, 1, 3
D. 2, 3, 1
- 19. A. NO CHANGE
B. Thorpe a Sac and Fox (Saulk) Native American
C. Thorpe a Sac and Fox (Saulk) Native American,
D. Thorpe, a Sac and Fox (Saulk) Native American
- 20. Given that all the choices are true, which one most effectively concludes this paragraph and provides a transition to the following paragraph?
A. NO CHANGE
B. In fact, he played in 289 professional baseball games and 52 NFL games in his career.
C. His all-around athleticism made him perfect for the pentathlon and decathlon.
D. In the spring of 1912, Thorpe started training for the summer Olympics held that same year.
- 21. A. NO CHANGE
B. his win consisted of four of the five events,
C. Thorpe won four of the five events,
D. winning four of the five events,



Always facing adversity, Thorpe had his shoes²² stolen just before he competed in the decathlon. This rather unknown occurrence is one that makes his accomplishment even more legendary, especially given that Thorpe found a mismatched replacement pair that included one from a garbage can. 23

Ultimately, Thorpe won the Olympic decathlon²⁴

wearing someone else's cast-off shoes. 25

Although commentators expected strong competition from Hugo Wieslander, the previous world

commander in pentathlon, Thorpe won by almost²⁶

700 points. In fact, Thorpe, who had placed in the top²⁷ four in all ten events, scored an Olympic record of²⁷ 8,413 points. When it was all said and done, Thorpe

22. Given that all the choices are accurate, which one most effectively introduces the paragraph by returning to the topic of the essay's opening paragraph?
- A. NO CHANGE
 B. At this point in his illustrious international debut,
 C. Though an amazingly successful athlete,
 D. Experiencing yet another setback,
23. If the writer were to delete the word *rather* from the preceding sentence, the sentence would primarily lose a word that:
- A. implies that some people are aware of what happened with Thorpe's shoes.
 B. helps describe Thorpe's determination to win another gold medal.
 C. explains Thorpe's challenge of not being able to buy new shoes.
 D. emphasizes that Thorpe had many talents that were unrelated to sports.
24. Which choice best emphasizes Thorpe's commitment to competing no matter the circumstances?
- A. NO CHANGE
 B. Fortunately,
 C. Undeterred,
 D. Intensifying,
25. At this point the writer is considering adding the following true statement:
- Two other US gold medalists who competed later at the 1964 Tokyo Olympics, Billy Mills and Bob Hayes, also had to run their races in borrowed shoes.
- Should the writer make this addition here?
- A. Yes, because it adds important details about two other US Olympic gold medalists who experienced a similar problem.
 B. Yes, because it reveals that other runners have had to use other people's shoes before succeeding in their track and field events.
 C. No, because it shifts the essay's focus from one US Olympic athlete's mismatched shoes to two others with borrowed shoes.
 D. No, because it interrupts the essay's discussion of Thorpe's success in various events at the 1912 Olympic games.
26. A. NO CHANGE
 B. director
 C. authority
 D. leader
27. A. NO CHANGE
 B. Thorpe who had placed in the top four in all ten events,
 C. Thorpe, who had placed in the top four in all ten events
 D. Thorpe who had placed in the top four in all ten events



had run, thrown, and jumped his way to victory in 8 of the
₂₈

15 pentathlon and decathlon events, easily defeating his
closest competitor. When presenting him with his gold
₂₉
medal, King Gustav V of Sweden called Jim Thorpe “the
₂₉
greatest athlete in the world.”

28. A. NO CHANGE
B. has ran,
C. has run,
D. had ran,

29. The writer is considering deleting the underlined portion (adjusting the punctuation as needed). Should the underlined portion be kept or deleted?
- A. Kept, because it connects the last paragraph to the first paragraph.
B. Kept, because it adds a detail to the recounting of Thorpe’s win.
C. Deleted, because it repeats a point already made clear by the paragraph.
D. Deleted, because it strays from the main point of the paragraph.

PASSAGE III

Making Realistic Sounds

Moviegoers watch a fight, the combatants throwing
punches struggle as furniture collapses while other
₃₀
characters cheer or groan. As the battle progresses, one
fighter might hit the wall while the other lands on the floor.
Now, imagine how realistic this scene would be without
any sound. Part of what encourages the audience to buy
into an onscreen fight like this, with that in mind, are the
sounds that are heard as the action unfolds: the punch,
₃₁
the moan, the smash, the collapse.

In many movies, Foley artists record these sounds
after the scene has been filmed. This process was named
after Jack Foley, who started adding sounds to Universal
Studios’ movies in 1914, several years before “talkies”
expelled silent movies from the theaters. Foley was the
₃₂

one whom discovered that a reversed and looped
₃₃

30. A. NO CHANGE
B. fight the combatants,
C. fight. The combatants
D. fight the combatants

31. A. NO CHANGE
B. this, at the same time,
C. this, nonetheless,
D. this

32. Which choice best suggests that talkies forcefully and decisively ended the era of films without sound?
- A. NO CHANGE
B. began a new time for the film industry.
C. created a new reality for moviegoers.
D. were seen on Hollywood screens.

33. A. NO CHANGE
B. he
C. who
D. whom himself



burp, a sound like that of a comical motor. He could
³⁴ create the sound of different footsteps to match
 different actors: Marlon Brando had a soft step whereas
 Rock Hudson was a more solid stepper, and Tony Curtis
 had feet that moved more quickly. To replicate the
 sound of several people walking, Foley used a cane to
provide the allusion of multiple individuals moving on
³⁵ foot. Cost-effective solutions to difficult problems
 that ultimately earned him the respect of Hollywood
³⁶ producers. Movies that contained sound were new at the
³⁷ time Foley began his career.
³⁷

The necessity for the “Foley technique”
arises due to the distracting sounds that occur on
³⁸ movie sets. The responsibility of a sound technician
 (whose job is different than that of a “Foley artist”) is to
³⁹ capture the actors speaking without also recording any
 extra background sounds. A car passing. A clock ticking.

A sneeze. Afterward, during the process of watching the
⁴⁰ movie in a Foley studio: a tiny space with a microphone,
⁴¹ screen, and numerous sound effect items—the Foley
 artist reproduces the sounds that would be associated
 with what is occurring in the film. Many of these sounds
 originated from Jack Foley.

34. A. NO CHANGE
 B. burp, which produces
 C. burp creates
 D. burp to provide
35. A. NO CHANGE
 B. generate the elusion
 C. produce the illusion
 D. create the allusion
36. A. NO CHANGE
 B. for which they ultimately
 C. that ultimately even so
 D. ultimately
37. A. NO CHANGE
 B. Without Foley sounds, movies would be too quiet to be believable.
 C. The sounds produced by the Foley process are added after the movie has been filmed.
 D. DELETE the underlined portion.
38. A. NO CHANGE
 B. aroused due to
 C. arises
 D. arise
39. If the writer were to delete the underlined portion, the essay would primarily lose information that:
 A. establishes what a sound technician’s responsibility is during the making of a movie.
 B. indicates the meaning of the phrase “Foley artist.”
 C. clarifies that this occupation was greatly impacted by Jack Foley’s creations.
 D. lowers the possibility that “sound technicians” will be confused with “Foley artists.”
40. A. NO CHANGE
 B. The reverberating sneeze that is not part of the scene.
 C. The sound of a sneeze.
 D. A sneeze reverberating.
41. A. NO CHANGE
 B. studio—
 C. studio,
 D. studio



In fact, movie directors loved Foley. When challenged with creating a sound similar to that of Caesar's army in the movie *Spartacus*, Foley discovered that jangling a set of keys in front of the microphone would produce the desired noise. That one simple solution, a Jack Foley original, reduced the movie's cost by untold amounts of money. Before that, the director ⁴² thought he would have to send hundreds of horses and actors, the size of an army headed to a battlefield in another country before he could achieve the authentic sound needed. However, the whole group remained in the US without the moviegoers ever being the wiser. 44

42. A. NO CHANGE
B. anonymous
C. uncommunicated
D. infinite
43. A. NO CHANGE
B. army, being headed to
C. army, to
D. army
44. The writer is considering deleting the preceding sentence. Should the sentence be kept or deleted?
A. Kept, because it indicates that moviegoers ultimately came to appreciate Foley's authentic sound effects.
B. Kept, because it concludes the essay with a detail that indicates the importance of Foley's work on both those who made and watched movies.
C. Deleted, because it changes the focus of the paragraph from Foley to the movie's actors, creating a weak ending to an essay about Foley.
D. Deleted, because it implies that Foley's work was unimportant to the film's viewers.

PASSAGE IV

Communicating Antibodies

In their lab at UCLA, assistant bioengineering professor, Aaron Meyer ⁴⁵ and his research team have

compiled a map of complex interactions; his aim ⁴⁶ set on predicting how antibodies communicate with the immune system. This comprehensive model, based on that research, of human biology has accounted for the many ⁴⁷ ways that antibodies along with the rest of the immune

45. A. NO CHANGE
B. UCLA, assistant bioengineering professor Aaron Meyer,
C. UCLA, assistant bioengineering professor Aaron Meyer
D. UCLA assistant bioengineering professor, Aaron Meyer
46. A. NO CHANGE
B. interactions and his aim is
C. interactions, his aim is
D. interactions, his aim
47. A. NO CHANGE
B. research, of human biology,
C. research of human biology,
D. research of human biology



system communicate.

By showing how antibodies communicate with other

parts of the immune system, these researchers' and their findings could help speed up the development of new

therapies for cancer, infectious diseases, and autoimmune disorders; abnormal conditions in which the immune system produces antibodies that attack the body's own

tissues. An antibody formed a "Y"-shaped molecule that can find and neutralize unwanted and potentially dangerous pathogens, such as bacteria and viruses, as well as cancerous or infected cells.

A key antibody component called the "variable portion" is located on two prongs of the "Y." Similar to how a key opens a lock, these particular antibody components correlate to a specific part of a virus or bacteria known as an antigen. Once an antibody attaches to a targeted pathogen molecule, it can neutralize this unwanted cause of disease.

On the contrary, the "constant region" of the antibody acts as its antenna, communicating with the other parts of the complex immune system in the same part of the world to identify and target harmful bacteria and viruses. There are millions of possible forms this communication can take due to the many possible signal combinations.

Therefore, Aaron Myers found it quite a challenge for he and his research team to design a computational model that would allow them to custom design new antibodies in the lab. However, they realized how important it would be to have greater insight into how

48. A. NO CHANGE
B. has been communicating.
C. is communicating.
D. communicates.

49. A. NO CHANGE
B. researcher's and their
C. researchers'
D. researchers

50. A. NO CHANGE
B. disorders defined as
C. disorders,
D. disorders

51. A. NO CHANGE
B. would have formed
C. has formed
D. forms

52. A. NO CHANGE
B. key, antibody component, called
C. key, antibody component called
D. key antibody component called,

53. A. NO CHANGE
B. molecule—it
C. molecule. It
D. molecule it

54. A. NO CHANGE
B. Simultaneously,
C. Luckily,
D. Namely,

55. A. NO CHANGE
B. neighboring locales
C. surrounding proximity
D. vicinity

56. A. NO CHANGE
B. him and his research team
C. himself and them
D. him and them



effective these specific human-created antibodies might

57

be in fighting diseases, especially ones that are related to the immune system. So, when fighting diseases in which

58

antibodies are critical, medical researchers now have a new approach 59.

57. **A.** NO CHANGE
B. antibodies that researchers have studied
C. antibodies within the immune system
D. antibodies
58. Which of the following alternatives to the underlined portion would NOT be acceptable?
A. the kinds
B. diseases
C. those
D. them
59. At this point, the writer is considering adding the following information:
for both therapy design and understanding the disease
Given that the information is accurate, should the writer make this addition here?
A. Yes, because it clarifies that Meyer and his team are focusing their research on diseases that are difficult to cure.
B. Yes, because it specifies how the research being conducted by Meyer and his colleagues could be beneficial.
C. No, because it fails to specify which types of antibodies are being developed to benefit humans' immune systems.
D. No, because it fails to explain how Meyer and his fellow researchers plan to use their work in curing diseases.

PASSAGE V

Mapping the New York City Subway

[1]

Because the New York City Subway was originally built by three separate companies, an official map for these areas encroaching below was not created until 1940, when

60

they were consolidated under a single operator.
To be specific, earlier maps only showed the route of

61

the company that owned it, so passengers who wanted to go on a line owned by a different company needed a

60. **A.** NO CHANGE
B. subterranean routes
C. submerged areas
D. underground bypass
61. **A.** NO CHANGE
B. As one example, earlier
C. Next, earlier
D. Earlier



separate map. [A] The first route maps were aesthetically pleasing, but they were perceived as being more inscrutable

62

than the existing diagrams. 63

[2]

After the Board of Transportation took over the subway-operating companies in July 1940, separate maps continued to be issued until 1942. Focusing on providing

a simpler way to help travelers who needed to navigate the subway system, the Board used externally produced, integrated maps. More a way to convey Board service information beyond a helpful

64

65

map; it was all a traveler could get at the token booths. Then in 1953, the New York City Transit Authority (NYCTA) took over the subway from the Board of Transportation and looked for ways to save money on the map. [B] In 1955, George Salomon submitted a proposal to redesign the map based on a system of route names using also color schemes that mirrored Berlin's U-Bahn. His map also adopted the same modernist style as Harry Beck's London map. Even though the NYCTA rejected his naming system, Salomon created a map that ultimately

66

67

62. Which choice is clearest and suggests the highest degree of failure of early maps to precisely show the features of the subway area under New York City?

- A. NO CHANGE
- B. difficult in general
- C. geographically inaccurate
- D. unclear

63. At this point, the writer is considering adding the following true statement:

Today, the New York City Subway is the largest rapid transit system in the world by number of stations, offering 24-hour service every day of the year.

Should the writer make this addition here?

- A. Yes, because it provides detail about the New York City Subway that compares it with other underground transportation systems in the world.
- B. Yes, because it suggests the need for extensive, error-free maps for the massive New York City Subway.
- C. No, because it is only slightly connected to the information about the New York City Subway that is provided in the first paragraph.
- D. No, because it blurs the focus of the paragraph, which is about the universally approved map of the New York City Subway.

64. A. NO CHANGE
B. would help
C. had helped
D. helped

65. A. NO CHANGE
B. than
C. rather
D. for

66. A. NO CHANGE
B. map, but it
C. map, it
D. map. It

67. A. NO CHANGE
B. also featured
C. and including
D. and



gained acceptance and became the official one used by
the NYCTA from 1958 to 1967.

68

[3]

[1] To reform bottlenecks in the subway system,
a series of major works were carried out in the
1960s. [2] Realizing the need for a new mapping system,
a citywide Subway Map Competition was held by
the Transit Authority that was opened to the general
public. [3] R. Raleigh D'Adamo, one of the three winners,
submitted an innovative proposal to color-code the
subway by individual routes rather than by historic
operating company. [4] When the new connections
opened in 1967, the new map began being used. [5] One
of these was adding new lines that unified two older
divisions of the subway and made the three-colored
network maps obsolete. 71

[4]

New York City's unique approach to mapping, was
an anomaly in that it showed city streets, parks, and
neighborhoods juxtaposed among these, whereas other
worldwide subway maps with straight lines did not show
such aboveground features. [C] The color-coded map
was not well received and was ultimately redesigned
after the NYCTA became the Metropolitan Transportation
Authority (MTA). Extensive changes to this map were
made six times from 1973–1978. [D] The most recent
official map is not geographically accurate but does help

68. Given that all the choices are accurate, which one gives the clearest indication of whether Salomon's map "ultimately gained acceptance"?

- A. NO CHANGE
- B. was based on others that had been successful in other countries.
- C. followed a systematic visual language in diagrammatic form.
- D. had a minimalist design to which the NYCTA added tourist information.

69. A. NO CHANGE

- B. relieve
- C. reinstate
- D. refine

70. A. NO CHANGE

- B. the Transit Authority held a citywide Subway Map Competition
- C. a Subway Map Competition hosted by the Transit Authority was held
- D. a Subway Map Competition was held citywide by the Transit Authority

71. For the sake of logic and cohesion, Sentence 5 should be placed:

- A. where it is now.
- B. after Sentence 1.
- C. after Sentence 2.
- D. after Sentence 3.

72. A. NO CHANGE

- B. unique, approach to mapping
- C. unique approach to mapping
- D. unique approach, to mapping,

73. A. NO CHANGE

- B. these uniquely curved subway lines, which were repeatedly redesigned,
- C. the curved lines on the geographically inaccurate subway map,
- D. curved subway lines,



tourists navigate the city, as it's major streets are shown
alongside the subway stations serving them.

74. A. NO CHANGE
B. their
C. its
D. its'

Question 75 asks about the preceding passage as a whole.

75. The writer is considering adding the following sentence to the essay:

They used a free map designed by Stephen Vorrhies instead of the Hagstrom map, which cost money.

If the writer were to add this sentence, it would most logically be placed at:

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

END OF TEST 1

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

MATHEMATICS TEST

60 Minutes – 60 Questions

DIRECTIONS: For the questions below, solve each problem and choose the correct answer. Calculators are allowed for, but not required by, all questions.

Note: Assume the following unless otherwise indicated.

1. Figures are NOT necessarily drawn to scale.
2. Geometric figures lie on a plane.
3. *Line* refers to a straight line.
4. *Average* refers to the arithmetic mean.

1. In the standard (x,y) coordinate plane, a line contains the points $(-9,-2)$ and $(4,5)$. The slope of the line:

- A. is positive.
- B. is negative.
- C. is zero.
- D. is undefined.
- E. cannot be determined from the given information.

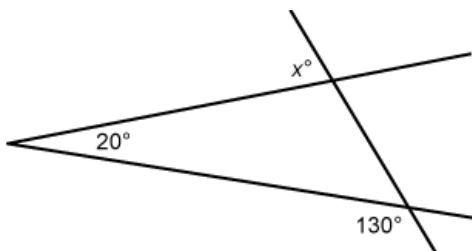
2. Which of the following is the sum of the complex numbers $4 - 5i$ and $2 + 4i$?

- A. 5
- B. 28
- C. $-1 + 6i$
- D. $6 - i$
- E. $8 - 20i$

3. Last month at the WH Company, the ratio of the number of satisfaction surveys received from customers to the number of surveys mailed to customers was 2 to 5. The WH Company received 350 surveys from customers last month. How many surveys did the WH company mail to customers last month?

- A. 490
- B. 700
- C. 875
- D. 1,225
- E. 1,750

4. In the figure below, 3 line segments intersect to form angles with measures of 130° , 20° , and x° , respectively. What is the value of x ?



- A. 40
- B. 65
- C. 70
- D. 75
- E. 105

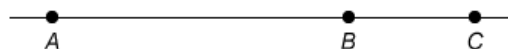
5. A sports game is played using a rectangular wall measuring 11 feet by 14 feet. A square target with side lengths of 6 feet is drawn on the wall. The game is played by throwing a ball at the wall. If the ball hits the target on the wall, the player scores. Assuming the ball is thrown at a random spot on the wall, which of the following is closest to the probability that the ball hits the target?

- A. 0.04
- B. 0.08
- C. 0.23
- D. 0.43
- E. 0.55

6. Which of the following is the slope-intercept form of $3x - y - 7 = 0$?

- A. $y = 7x - 3$
- B. $y = 3x - 7$
- C. $y = 3x + 7$
- D. $y = -3x - 7$
- E. $y = -3x + 7$

7. Points A , B , and C lie on the line below, in that order. The ratio of the length of \overline{AB} to the length of \overline{BC} is 7:3. If it can be determined, which of the following is the ratio of the length of \overline{AB} to the length of \overline{AC} ?



- A. 3:7
- B. 7:10
- C. 7:4
- D. 10:7
- E. Cannot be determined from the given information



8. For all real values of x , which of the following is the solution set of $3x + 9 \geq -12$?

A. $x \leq -1$
 B. $x \geq -1$
 C. $x \leq -7$
 D. $x \geq -7$
 E. $x \geq -9$

9. The expression $(a^4)^{12}$ is equivalent to:

A. $48a$
 B. $16a$
 C. $4a^{12}$
 D. a^{16}
 E. a^{48}

10. Given the function $g(x) = 2x^2 + 6x - 9$, what is $g(-4)$?

A. -49
 B. -1
 C. 1
 D. 31
 E. 47

11. The perimeter of a triangle is 69 inches. Two sides of the triangle are equal in length, and the third side is 6 inches longer than either of the other 2 sides. What is the length, in inches, of the longest side?

A. 19
 B. 21
 C. 23
 D. 27
 E. 29

12. Pavel plans to complete 180 math questions to practice for an upcoming test. Each day, he will complete 2 more questions than he did on the previous day. If he completes 9 questions on the first day, how many days will he need to complete all of them?

A. 9
 B. 10
 C. 11
 D. 14
 E. 27

13. A line segment in the standard (x,y) coordinate plane has a midpoint of $(2,-8)$ with endpoints $(6,-14)$ and:

A. $(4,-11)$
 B. $(2, 2)$
 C. $(2, -3)$
 D. $(-2, -2)$
 E. $(-2,-30)$

Use the following information to answer questions 14–16.

Nolan sold boxes of cookies to 5 local businesses to raise money for her school. For each business, the table below shows the total number of boxes sold and total dollar amount collected from sales.

Business	Number of boxes sold	Total sales
A	100	\$ 650
B	175	\$ 1,000
C	225	\$ 1,350
D	200	\$ 1,200
E	75	\$ 525

14. At Business A, Nolan sold 2 types of cookies: sugar cookies for \$8 per box and ginger cookies for \$6 per box. How many boxes of ginger cookies did Nolan sell at Business A?

A. 18
 B. 25
 C. 50
 D. 75
 E. 82

15. Each business made a donation to Nolan's school. Business D donated 10% of the cookie sales and a fixed amount of \$300. How much money did Business D donate to Nolan's school?

A. \$120
 B. \$300
 C. \$310
 D. \$312
 E. \$420

16. What is the difference between the median and the mean number of boxes of cookies sold at the 5 businesses?

A. 75
 B. 70
 C. 50
 D. 45
 E. 20

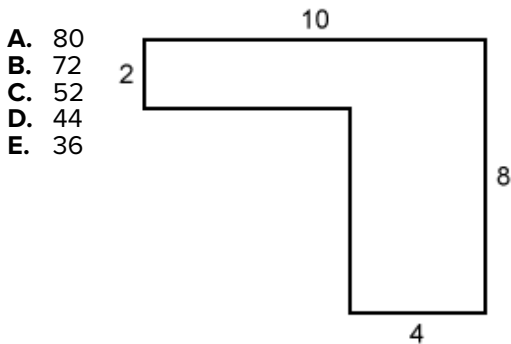
17. A right triangle has side lengths of 15 cm, 25 cm, and 20 cm. What is the area, in square centimeters, of the right triangle?

A. 400
 B. 375
 C. 300
 D. 250
 E. 150

18. A list of 6 numbers has a mean of 75. The first 5 numbers on the list are 71, 68, 84, 68, and 79. Which of the following is the 6th number on the list?
- A. 68
 - B. 74
 - C. 75
 - D. 76
 - E. 80

19. A right triangle has side lengths 8, 15, and 17 millimeters, respectively. What is the cosine of the smallest angle in the triangle?
- A. $\frac{8}{17}$
 - B. $\frac{8}{15}$
 - C. $\frac{15}{17}$
 - D. $\frac{17}{15}$
 - E. $\frac{15}{8}$

20. The dimensions in the figure shown below are in inches, and all the angles are right angles. What is the area, in square inches, of the figure?



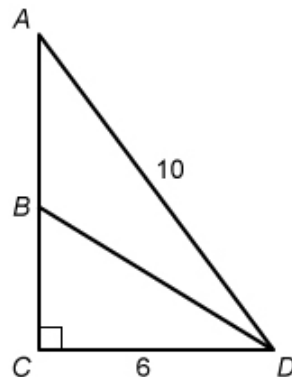
21. The lengths of the sides of a triangle are x ft, $(x + 7)$ ft, and $(x + 9)$ ft. If the triangle has a perimeter of 31 ft, what is the value of x ?
- A. 5
 - B. $10\frac{1}{3}$
 - C. 12
 - D. 14
 - E. 21

22. A cooler in the back of a trailer contained 720 ounces of drinking water when it started to drip. Assuming that the trailer travels at 25 mph and that the cooler drips 3 ounces of water per minute, how many *miles* will the trailer travel before all the water drips from the cooler?
- A. 240.0
 - B. 100.0
 - C. 28.8
 - D. 25.0
 - E. 6.3

23. A football team sells 3 types of season passes for its home games. The 3 types are value, standard, and premium. Last week, 51 season passes were purchased. Of the passes purchased, there were 7 more standard than value and 4 more value than premium. How many premium passes were purchased last week?
- A. 12
 - B. 16
 - C. 17
 - D. 19
 - E. 28

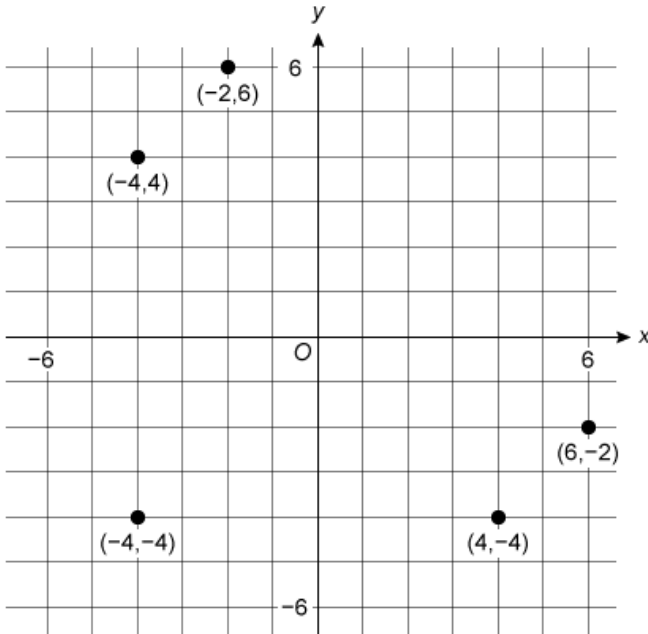
24. In the figure below, $\angle ACD$ is a right angle, and B is the midpoint of \overline{AC} . If $AD = 10$ ft and $CD = 6$ ft, what is BD , in feet?

- A. $\sqrt{34}$
- B. $\sqrt{52}$
- C. $\sqrt{68}$
- D. $\sqrt{84}$
- E. $\sqrt{102}$





25. After Jocelyn plots 5 points in the standard (x,y) coordinate plane below, she decides to plot a new point. She plots the new point using the mean of the x -coordinates of the 5 points already plotted as the x -coordinate, and the mean of the y -coordinates of the 5 points already plotted as the y -coordinate. What are the coordinates of the ordered pair for Jocelyn's new point?



- A. $(-4, -4)$
 B. $(-2, -2)$
 C. $(0, 0)$
 D. $(2, 2)$
 E. $(4, 4)$
26. The 1st and 2nd terms of a geometric sequence are -12 and 4 , respectively. What is the 4th term of the geometric sequence?
- A. $-\frac{4}{9}$
 B. $-\frac{4}{27}$
 C. $\frac{4}{9}$
 D. $\frac{4}{27}$
 E. $\frac{4}{81}$

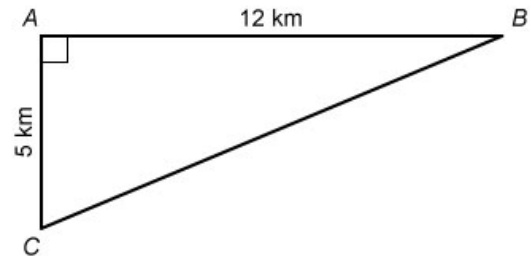
27. Reva works 6 hours per night 5 nights each week at a call center. Each night, Reva is paid either \$10 per hour or \$1 for each call that she answers, whichever nightly amount is higher. Reva answered the following numbers of calls: 50 calls on Tuesday, 34 calls on Wednesday, 65 calls on Thursday, 80 calls on Friday, and 60 calls on Saturday. What was Reva's total pay for these 5 nights?

- A. \$289.00
 B. \$300.00
 C. \$317.90
 D. \$325.00
 E. \$346.80

28. Which of the following best describes the roots of the equation $2x^2 + 3x + 1 = 0$?

- A. 2 rational roots
 B. 2 irrational roots
 C. 2 complex roots (with nonzero imaginary parts)
 D. 1 rational (double) root
 E. 1 irrational (double) root

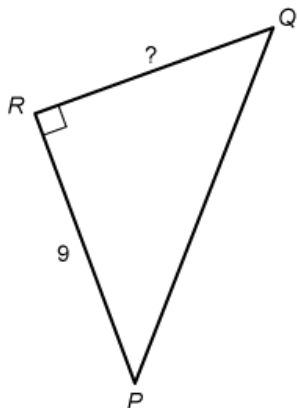
29. Megan is planning a hike through a national park. Her route will take the shape of a right triangle, as shown below. She will begin at A , follow a trail directly to B , go directly to C , and go directly back to A . Megan plans to stop at a landmark located at the halfway point of her route. How many kilometers past B is the landmark?



- A. 1
 B. 3
 C. $6\frac{1}{2}$
 D. 10
 E. 13
30. The Springtown Police Department has 200 employees, and $\frac{1}{4}$ of them are civilians. Of the employees who are NOT civilians, $\frac{1}{10}$ are inspectors. None of the civilian employees serve as inspectors. How many employees are inspectors?
- A. 150
 B. 50
 C. 20
 D. 15
 E. 5

31. For what value of x is the equation $\sqrt{x} + \sqrt{25} = \sqrt{100}$ true?
- A. 2
 - B. 4
 - C. 5
 - D. 25
 - E. 75

32. In right triangle $\triangle PQR$ shown below, \overline{PR} is 9 meters long and $\cos P = \frac{3}{4}$. What is the length, in meters, of \overline{QR} ?



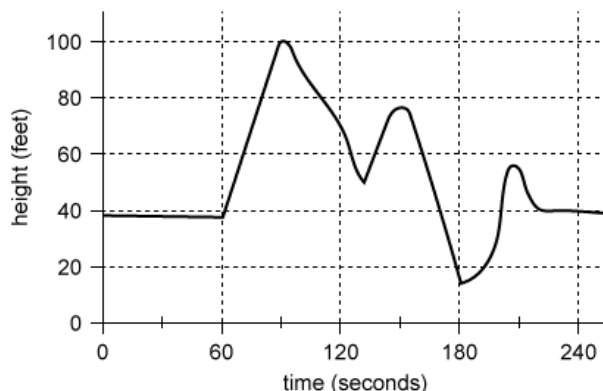
- A. $\sqrt{3}$
- B. 3
- C. $3\sqrt{7}$
- D. 12
- E. 15

33. Which of the following integers is equal to $4(\log_2 32)$?
- A. 20
 - B. 64
 - C. 256
 - D. 1,024
 - E. 4,096

34. A box contains several balls. On 4 successive draws with replacement, a green ball is drawn from the box each time. One of the following statements about the balls in the box *must* be true. Which one?
- A. At least 1 ball is green.
 - B. Exactly 1 ball is green.
 - C. Exactly 4 balls are green.
 - D. All the balls are green.
 - E. The box contains more green balls than balls of other colors.

Use the following information to answer questions 35–37.

Peter and his racing team participated in a mountain bike competition. Each event charged \$10 for individual entry and \$15 for team entry. Peter competed in the Cross-Country Xtreme Eliminator event, and after the event he was given the following information about his performance: he finished the event in 4.25 minutes at an average speed of 25 miles per hour. The graph below shows Peter's height above level ground, in feet, with respect to time after the start of the event, in seconds.



35. Which of the following is closest to the total distance Peter traveled, in miles, during the event?
- A. 0.4
 - B. 1.8
 - C. 4.3
 - D. 7.1
 - E. 10.2
36. During the event, Peter was at a height of at least 87 feet for a total of 7 seconds. Which of the following is closest to the percent of the time during the event that Peter was at a height of at least 87 feet?
- A. 3%
 - B. 5%
 - C. 50%
 - D. 54%
 - E. 61%
37. Which of the following is closest to the average slope, in feet per second, of the graph on the interval between 60 seconds and 90 seconds?
- A. $\frac{1}{9}$
 - B. $\frac{1}{2}$
 - C. $1\frac{1}{9}$
 - D. $1\frac{1}{2}$
 - E. 2



38. When $x = 10$, the value of $x^4(5 + 3.8x + 0.2x^2)$ is between:

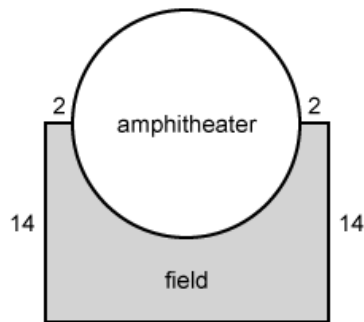
- A. 1×10^6 and 1×10^7
- B. 6×10^5 and 7×10^5
- C. 2×10^5 and 3×10^5
- D. 6×10^3 and 7×10^3
- E. 2×10^3 and 3×10^3

39. The difference between the mean and the median is greatest for which of the following data sets?

- A. {20, 20, 20, 20}
- B. {20, 20, 25, 30}
- C. {20, 25, 25, 25}
- D. {20, 25, 25, 150}
- E. {20, 30, 140, 150}

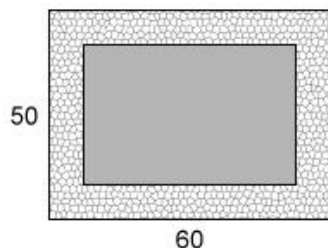
40. A small town has a field and an amphitheater in its park. The field's shape is a rectangle with a semicircle removed, as shown in the diagram below. The straight sides of the field are given in meters. A landscaper is hired to cover the field with fertilizer. To figure out how much fertilizer to purchase, the landscaper must find the area of the field. Which of the following is closest to the area of the field, in square meters?

- A. 26
- B. 100
- C. 124
- D. 154
- E. 180



41. A 4-foot-wide walking path surrounds a rectangular playground. The figure below shows that the outer edge of the walking path measures 50 feet by 60 feet. What is the perimeter, in feet, of the playground?

- A. 110
- B. 188
- C. 220
- D. 2,184
- E. 3,000



42. For functions f and g defined by $f(x) = x^3$ and $g(x) = \frac{1}{2-x}$, what is $g(f(x))$?

- A. $\frac{1}{2-x^3}$
- B. $\frac{1}{(2-x)^3}$
- C. $\frac{1}{8-x^3}$
- D. $\frac{x^3}{2-x^3}$
- E. $\frac{x^3}{2-x}$

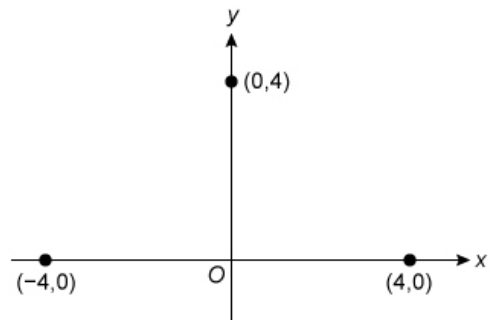
43. What is the area, in square inches, of a circle that has a circumference of $2\pi\sqrt{3}$ inches?

- A. $\pi\sqrt{3}$
- B. $2\pi\sqrt{3}$
- C. 3π
- D. 6π
- E. 12π

44. The coordinates of the y -intercept of the graph of the function $y = f(x)$ in the standard (x,y) coordinate plane are $(0,-3)$. What are the coordinates of the y -intercept of the graph of the function $y = f(x) - 5$?

- A. $(0,-8)$
- B. $(0,-5)$
- C. $(0,-3)$
- D. $(0, 2)$
- E. $(0, 15)$

45. A parabola passes through the 3 points labeled in the standard (x,y) coordinate plane below. Which of the following is an equation of this parabola?



- A. $y = -\frac{1}{4}(x-4)(x+4)$
- B. $y = -(x-4)^2(x+4)$
- C. $y = -(x-4)(x+4)^2$
- D. $y = (x-4)^2(x+4)$
- E. $y = \frac{1}{4}(x-4)(x+4)$



46. If the value of x continually increases without bound, what does the value of $\frac{x}{x+5}$ most closely approach?

- A. 0
- B. $\frac{1}{5}$
- C. 1
- D. 5
- E. ∞

47. Reginald plays a game in which each player randomly draws cards from a deck of 20 cards. Each card has a symbol on it. The number of cards with each symbol is shown in the table below.

Symbol	Number
Star	6
Arrow	5
Circle	4
Square	3
Triangle	2

Reginald randomly draws 2 cards from the deck, one after the other, without replacing the first card. What is the probability that Reginald draws a circle card first and a triangle card second?

- A. $\frac{1}{50}$
- B. $\frac{2}{95}$
- C. $\frac{3}{10}$
- D. $\frac{29}{95}$
- E. $\frac{2}{5}$

48. The expression $\frac{3a+b}{a-3b}$ is undefined when $a = ?$

- A. $-3b$
- B. $-\frac{1}{3}b$
- C. 0
- D. $\frac{1}{3}b$
- E. $3b$

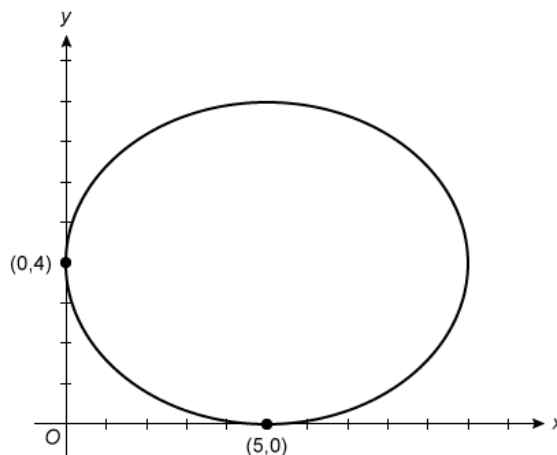
49. One of the following numbers is halfway between $\frac{4}{7}$ and $\frac{10}{9}$. Which one?

- A. $\frac{6}{2}$
- B. $\frac{7}{8}$
- C. $\frac{7}{16}$
- D. $\frac{34}{63}$
- E. $\frac{53}{63}$

50. Let the function f be defined as $f(x) = 5^{x^2-x-6}$. What 2 real numbers satisfy $f(x) = 1$?

- A. -3 and 3
- B. -3 and 0
- C. -2 and 3
- D. -2 and 0
- E. 0 and 3

51. The ellipse with equation $\frac{(x-5)^2}{25} + \frac{(y-4)^2}{16} = 1$ is shown in the standard (x,y) coordinate plane below. Which of the following ordered pairs are the foci of the ellipse?



- A. $(0, 4)$ and $(8, 4)$
- B. $(0, 4)$ and $(10, 4)$
- C. $(2, 4)$ and $(8, 4)$
- D. $(5, 0)$ and $(5, 4)$
- E. $(5, 4)$ and $(5, 8)$

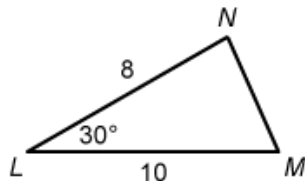


52. Alison has a box containing 12 solid-colored tickets: 3 red, 4 green, and 5 blue. Each ticket is labeled with a single number. The red tickets are labeled with 1–3 such that each number is used once, the green tickets are labeled with 1–4 such that each number is used once, and the blue tickets are labeled with 1–5 such that each number is used once. Alison randomly chooses a ticket from the box. What is the probability that the ticket will be green *or* labeled with a 4?

- A. $\frac{1}{12}$
 B. $\frac{2}{12}$
 C. $\frac{4}{12}$
 D. $\frac{5}{12}$
 E. $\frac{6}{12}$

53. The side lengths of triangle $\triangle LMN$ are given in decimeters in the figure below. What is the area, in square decimeters, of $\triangle LMN$?

- A. 20
 B. $20\sqrt{3}$
 C. 24
 D. 40
 E. 48

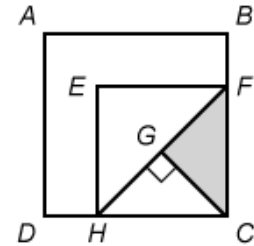


54. A certain spice has 35 calories in 15 grams, and 57% of those calories come from carbohydrates. When measuring the spice, 3 grams is equal to 1 teaspoon. Which of the following is closest to the number of calories from carbohydrates per teaspoon of the spice?

- A. 4
 B. 5
 C. 7
 D. 8
 E. 9

55. In the diagram below, F lies on \overline{BC} , H lies on \overline{CD} , G lies on \overline{FH} , and $\overline{FH} \perp \overline{CG}$. The area of square $EFCH$ is $\frac{1}{2}$ the area of square $ABCD$. What percent of the area of $ABCD$ is the shaded region?

- A. 0.125%
 B. 0.25%
 C. 0.5%
 D. 12.5%
 E. 25%



56. A data set consists of 20 distinct values. The largest value of the set is replaced with a much greater value to create a new data set. Which of the following statements best describes the values of the mean and median of the new data set as compared to the mean and median of the original data set?

- A. The mean stays the same, and the median increases.
 B. The mean increases, and the median stays the same.
 C. The mean and the median both stay the same.
 D. The mean and the median both increase.
 E. The means and medians of the data sets cannot be compared from the given information.

57. A business on Maple Street and a business on Oak Street both buy office supplies from a store that sells staplers for \$4 each and folders for \$2 each. One stapler and 12 folders were purchased by the Maple Street business last week, and 3 staplers and 23 folders were purchased by the Oak Street business that same week. Which of the following matrix products represents the supply costs, in dollars, for each business?

- A. $\begin{bmatrix} 4 & 2 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 12 & 23 \end{bmatrix}$
 B. $\begin{bmatrix} 4 & 2 \end{bmatrix} \begin{bmatrix} 1 & 12 \\ 23 & 3 \end{bmatrix}$
 C. $\begin{bmatrix} 4 & 2 \end{bmatrix} \begin{bmatrix} 1 & 23 \\ 3 & 12 \end{bmatrix}$
 D. $\begin{bmatrix} 4 \\ 2 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 12 & 23 \end{bmatrix}$
 E. $\begin{bmatrix} 4 \\ 2 \end{bmatrix} \begin{bmatrix} 1 & 12 \\ 3 & 23 \end{bmatrix}$

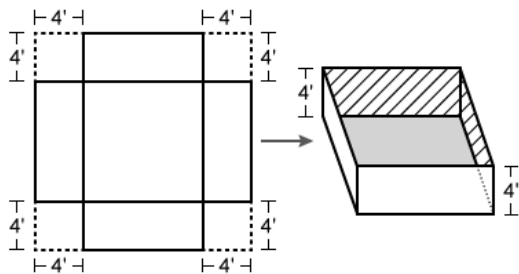
58. Adithya has created the notation k^∇ to denote the sum of the first k positive integers. For example, 4^∇ means $1 + 2 + 3 + 4$. Adithya is considering the following 3 statements as possible properties of k^∇ :

- I. $k^\nabla + (k + 1) = (k + 1)^\nabla$
- II. $k^\nabla + k^\nabla = (2k)^\nabla$
- III. $(k^2)^\nabla = (k^\nabla)^2$

Which of the statements above, if any, is(are) true for all positive integers k ?

- A. I only
- B. II only
- C. III only
- D. I, II, and III
- E. None

59. A manufacturing company needs to create an open container from a single square sheet of metal, as shown below. The company will cut a 4-foot square from each corner of the metal sheet and fold along the inside lines shown to form the sides of the container. The resulting container will have a volume of 400 cubic feet. What are the dimensions, in feet, of the original sheet of metal?



- A. 10×10
- B. 12×12
- C. 14×14
- D. 18×18
- E. 25×25

60. One of the following quadratic equations has the complex number $(2 + \sqrt{-2})$ as a solution. Which one?

- A. $x^2 + 2 = 0$
- B. $x^2 + 2x + 2 = 0$
- C. $x^2 - 2x + 2 = 0$
- D. $x^2 + 4x - 6 = 0$
- E. $x^2 - 4x + 6 = 0$

2 △ △ △ △ △ △ △ △ △ **2**

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.

READING TEST

35 Minutes – 40 Questions

DIRECTIONS: Each passage below is accompanied by a number of questions. Read the passage and choose the best answer to the corresponding questions, referring to the passage as necessary.

PASSAGE I

Literary Narrative: This passage is adapted from “The Olive Harvest in Crete” by Maria Kofou, originally published June 2017.

I walked out of my hotel into a beautiful October sunrise gilding the town of Heraklion on the island of Crete. I had skipped the early morning breakfast offered by the hotel. Along with a team of beauty product editors, I had received an invitation the previous month to come to Heraklion to tour the Messara olive groves. The tour’s purpose was to celebrate the launch of a new skincare brand claiming to use the finest extra virgin olive oil. The night before, the skincare product representatives had feted us at a moonlit dinner at the Restaurant Peskesi. Dinner on Crete is a late affair, usually beginning after 8 p.m., and if you’re a visitor who hasn’t remembered to grab a snack earlier, the locals may wryly note that you stranger has a lean and hungry look.

I had arrived in Heraklion from my hometown of Kalamata, proud to hail from a city known worldwide for its excellent olives produced by corporate growers with large processing factories. Even though the same olive wreath that encircles the ancient coat of arms of Messara also decorates the medieval walls of Kalamata, I had to admit that Messara’s golden Koroneiki olive oil at dinner had surpassed that of Kalamata. Increasingly, growers in Messara produce olives organically, a much slower process than the mass-produced olive oil that has dominated Greek production for the last century. As quality is of greater concern than quantity—the groves yield a tenth of large-scale producers’ tracts—organic trees are kept smaller so that their olives can be better nourished by the sun and watered naturally by rain.

Our day’s destination was Messara, a compact 22-square-mile area smaller than Manhattan Island, yet containing nearly 300,000 olive trees. Ancient Minoan olive mills—significant proof of olive oil’s importance throughout the centuries on Crete—have been discovered in Messara. The Koroneiki variety primarily grows here—my turn to feel proud of my roots, as we were told the Koroneiki originated near Kalamata. The sunny Messara Plain, with

its abundance of olives and its renowned extra virgin olive oil, is where our host skincare company had turned to create its new olive oil-based line of products in collaboration with the Organic Farmers Association of Messara.

As the sun rose higher on our short ride over the Asterousia Mountains, our bus seemingly left behind the 21st century to stop amid the same vast olive groves that have produced the “green gold” since as early as 8,000 BC. Chatting with the tanned olive growers, we learned the long history of Messara and the importance of its olive oil exports. Then we were handed our ntebles, the long-handled sticks used for centuries to harvest olives.

Our harvest efforts began with laughter and Instagram posing, but our arms began to ache from swinging the ntebles. We soon recognized the arduous work necessary for the harvest, a combination of exacting nteble-handling and loving treatment of the branches—the farmers called them “their girls”—as they explained their use of ntebles, decrying the fact that most large-scale producers have replaced them. On corporate farms, the ED-209, a giant machine, envelops the entire tree to shake loose the olives but often leaves the silvery tresses of the “girls” damaged, a result the organic farmers find abhorrent.

We then headed to the olive press, where the bright green olive oil’s slow ooze was so irresistibly aromatic. Not impersonal drums of stainless steel, but carefully joined staves of olive wood, formed the tubs. No cold electronic press mechanisms, but a hand-turned wooden screw’s golden patina, recalled the many hands that had drawn the golden oil from the olives. The fragrance of olives and olive oil, combined with the sight of the people employing methods and materials that Homer could have witnessed, inspired a reverence in us.

After the olive press, we made a short stop at the house of Kostis Mamalakis, the president of the Organic Farmers Association, where we enjoyed a cup of coffee with sweet Cretan delicacies. As we recovered from our harvest efforts, Mamalakis described how the precious oil of the famous Koroneiki olive tree groves is the same oil that ancient women of Crete used for their hair, face, and body

90 and the same oil that the male athletes of Crete used to cleanse and prepare their bodies for the ancient Greek games. The organically farmed olives are a natural source of vitamins, minerals, amino acids, and antioxidants, nourishing and restoring youthfulness to skin.

95 And now our hosts were cooperating with Kostis and the Organic Farmers Association not only to produce high-quality skincare products, but also to preserve the ancient organic tradition and promote scientific research in organic cultivation
100 methods. The first line on my invitation from the skincare company to travel to Crete had read, “The olive’s natural past beautifies our future.” My day in Messara had convinced me of that claim.

1. Which of the following events referred to in the passage happened first chronologically?
 - A. The author dined at the Restaurant Peskesi.
 - B. The author author received an invitation to tour the olive groves.
 - C. Kostis Mamalakis commented on olive oil’s history.
 - D. The author’s bus crossed the mountains to the olive groves.
2. The main idea of the second paragraph (lines 17–33) is that:
 - A. Kalamata produces olives superior to those of Messara.
 - B. The author takes pride in her connection to Kalamata olives.
 - C. Significant differences exist between Kalamata and Messara olive production.
 - D. Because of their smaller size, Messara olive trees enjoy better sunlight.
3. The author most strongly suggests that when witnessing olive production in Messara, a person will be impressed by Messara’s methods because:
 - A. producers in Messara have recently introduced the efficiency of the ED-209.
 - B. Messara producers use traditional methods in the olive-pressing process.
 - C. Messara producers now work hand in hand with an organic skincare company.
 - D. producers in Messara encourage entire families to share the harvesting experience.
4. The information between the dashes on line 62 most strongly suggests that the olive growers of Messara generally tend to:
 - A. employ entire families to harvest olives.
 - B. use olive oil for women’s skincare.
 - C. harvest the olives carefully.
 - D. combine several methods for a successful harvest.
5. Based on the author’s discussion of the “many hands” (line 76) involved in the pressing of olive oil in Messara, the author would most likely agree with the idea that Messara olive pressing:
 - A. is a highly specialized process.
 - B. is inefficient when done by hand.
 - C. results in personal benefits for its workers.
 - D. should be improved through automation.
6. Based on the passage, the main way Messara olives differ from those produced on large-scale producers’ tracts is that:
 - A. Messara olives are generally smaller.
 - B. Messara olives are consumed locally, rather than used for export.
 - C. there is a different standard for Messara olives.
 - D. there are a variety of aromas in Messara olives.
7. As it is used in lines 59–60, the word *arduous* most nearly means:
 - A. uphill.
 - B. demanding.
 - C. vigorous.
 - D. unmanageable.
8. Details in the second paragraph (lines 17–33) indicate that one similarity between Kalamata olives and Messara olives is that both:
 - A. are produced through organic farming methods.
 - B. originated on the Messara Plain.
 - C. are being used by a skincare company to create a new line of products.
 - D. are emblems of an age-old cultural heritage.
9. The author refers to Manhattan Island mainly to:
 - A. indicate the increased number of trees crowding the Messara Plain.
 - B. provide support for the idea that traditional methods are increasing on the Messara Plain.
 - C. suggest that large-scale olive oil factories will soon push out organic farmers.
 - D. help emphasize the limited area on which the many olive trees grow.
10. According to the passage, which of the following numbers represents the yield of organic olive trees?
 - A. 300,000 olives per year
 - B. Half of the olives grown in Kalamata
 - C. One-tenth of that of large-scale growers
 - D. Ten percent of the world’s production of olives

PASSAGE II

Social Science: This passage is adapted from “Faulkner’s Nobel Prize” (author unknown).

In 1949, after a contentious debate, the Nobel Prize committee in Stockholm, Sweden, awarded its prize for literature to William Faulkner “for his powerful and artistically unique contribution to the modern American novel.” Many observers thought that concern about escalating postwar tensions between the United States and the USSR may have led dissenting members of the committee to argue that the award should go to a more overtly political writer than the mostly unheralded novelist from Oxford, a small town in Mississippi with fewer than 4,000 residents.

When the committee eventually decided the prize would be awarded to the relatively unknown Faulkner, it was already too close to 1949’s ceremony date, so the committee agreed to reserve the award. In 1950, the committee announced the belated award in recognition of Faulkner’s novels and short stories which championed the human spirit and the ideals of courage and freedom. When the time came for Faulkner to receive the award, however, it was not his remarks on his own literary legacy but his words on tensions in the new post-World War II nuclear world for which his speech would be remembered.

Any student of the reticent Faulkner would not be surprised by his reaction to the award. When informed of his selection, Faulkner responded as he usually did to avoid attention; he invoked his rural identity, which was mostly a pretense: “I won’t be able to come to receive the prize myself. It’s too far away. I am a farmer down here and I can’t get away.” Faulkner seemed very apathetic toward the award, its attendant fame, and its \$30,000 prize, about which he said, “I haven’t earned it, and I don’t feel like it’s mine”; he would later use the cash to set up scholarships for young writers and African American students at Rust College in nearby Holly Springs.

The 52-year-old Faulkner insisted he wouldn’t go to Stockholm: “There just isn’t enough gas in the tank to go all that distance.” Persuading Faulkner to go that distance involved a tricky chess game. The first move came from the American ambassador to Sweden, Walton Butterworth, who pointed out to the State Department that “American relations with Sweden would be seriously wounded” if Faulkner did not make the trip. Butterworth noted that the Swedish journalist Thorsten Jonsson, who had visited Faulkner in 1946 and who had died only recently, was responsible for the author’s high reputation in Sweden; it would be an appropriate recognition of Jonsson’s efforts on his behalf for Faulkner

to accept the award. This argument had no effect on Faulkner, either. State Department efforts to enlist various Oxford friends of Faulkner failed to move the author off his square. Only after his wife, Estelle, pleaded that their sixteen-year-old daughter, Jill, who had never traveled outside Oxford, wanted to see Europe did Faulkner telegraph Stockholm that he would “be pleased to make the trip.” Estelle later commented, “The excuses he tried to hide behind were no barriers to Jill’s pleas.”

On December 10, 1950, as Faulkner approached the stage to accept his award, the tense look on the face of Anders Osterling, the chairman of the Nobel committee who had just introduced the author, did not seem unwarranted. Considering that Faulkner had been so reluctant to come to Stockholm at all, Osterling might have wondered if the speech about to be delivered would suit the occasion. As it turned out, only a few members of the audience could actually tell what Faulkner said. Faulkner was just a touch too far from his microphone, he spoke rapidly, and his Southern accent was too thick for all to take in the speech. It would not be until the following day, when a printed version of the speech was released, that the audience would realize it had witnessed one of the most memorable speeches in the history of the Nobel Prize. Joseph Blotner, a friend of Faulkner’s, would report, “The later impact of the hurried words was tremendous.”

With America and the Soviet Union beginning to build huge nuclear arsenals and confronting each other in a cold war that threatened human survival itself, an acceptance speech by a novelist who was best known for dark explorations of tragic Mississippi families seemed to promise little. And yet, in only two minutes and thirty seconds, Faulkner’s speech addressed the threat of nuclear annihilation, reflected on his mission as a writer, and reminded other writers that only “the human heart in conflict with itself...is worth writing about.”

Drafts of Faulkner’s acceptance speech indicate how far the author’s revisions went from personal concerns to the plight of the artist in the modern atomic age. “I don’t feel any different from what I did before this award. I am no wiser; I don’t think I know any more about the world or man’s place in it or his destiny—if any,” he stated in his original draft. But Faulkner made it clear in the speech he delivered that he had thought deeply about a world in crisis: “Our tragedy today is a general and universal physical fear so long sustained by now that we can even bear it. There are no longer problems of the spirit. There is only the question: When will I be blown up?” And yet he concluded with an optimistic declaration: “I decline to accept the end of man...I believe that man will not merely endure; he will prevail.”

11. Which of the following statements best captures the overall message of the passage?
- A. Awards are best given to those who combine personal accomplishment with a polished on-stage presence.
 - B. Leaving one's familiar environment for a foreign country may bring unforeseen difficulty.
 - C. Personal discomfort may be overcome to inspire others in troubled times.
 - D. Nominating someone for a high-profile award may be met with public opposition.
12. One function in the passage of including information about Faulkner's Oxford friends and Estelle Faulkner is to create a contrast between Faulkner's:
- A. concern for his family and his fear of interacting with Nobel committee officials.
 - B. reservations about traveling to the ceremony and the pressures he faced to do so.
 - C. divisive family life and his strong and ever-present desire for personal acclaim.
 - D. need to finish work on a novel and his concern about his own health.
13. As it is used in line 43, the phrase "tricky chess game" refers to Faulkner as he:
- A. gains prominence in Sweden through the efforts of Thorsten Jonsson.
 - B. contemplates an offer to move his family away from his farm in Oxford.
 - C. officially declines his prize money and suggests it go to provide scholarships.
 - D. responds to the invitation to travel to Stockholm to receive his prize.
14. The passage author argues that the look on Anders Osterling's face after he introduced Faulkner on December 10, 1950, suggested Osterling's:
- A. anticipation that Faulkner would be critical of the Nobel Prize committee.
 - B. regret in selecting the little-known Mississippi novelist for the award.
 - C. uncertainty about whether Faulkner would deliver an appropriate speech.
 - D. concern that Cold War tensions in Europe would overshadow the awards ceremony.
15. The passage characterizes which of the following people as expressing the political significance of Faulkner's traveling to Stockholm:
- A. Blotner
 - B. Jonsson
 - C. Osterling
 - D. Butterworth
16. According to the passage, the committee delayed their selection of the winner of the 1949 Nobel Prize because they needed time to:
- A. seriously consider reasons to select two winners for 1949, which was unprecedented.
 - B. debate key political issues relating to the tensions between the United States and the USSR.
 - C. discuss their concerns about choosing a novelist who was less political than other nominees.
 - D. compose a statement detailing their worries about the escalating Cold War.
17. The passage indicates that most of the audience was unable to understand Faulkner's acceptance speech due to:
- A. Faulkner's lack of skill and experience in public speaking.
 - B. Faulkner's use of historical references that were unfamiliar to them.
 - C. the great distance between the audience and the stage.
 - D. the Nobel Committee's failure to print copies of the speech.
18. As it is used in line 108, the word *end* most nearly means:
- A. limit.
 - B. destruction.
 - C. domination.
 - D. remnant.
19. The passage most strongly implies that before Faulkner became a Nobel Prize-winning author, he had preserved his privacy by:
- A. staying out of political matters.
 - B. publishing under a pen name.
 - C. avoiding speeches.
 - D. claiming to be a farmer.
20. The passage author makes clear Estelle Faulkner's view that Faulkner's trip to Stockholm was:
- A. a result of his fatherly affection.
 - B. a source of personal pride.
 - C. a turning point in his literary career.
 - D. a cause of disappointment for his daughter.

PASSAGE III

Humanities: Passage A is adapted from the article “Cory Arcangel Turns Pro” by Kate Ash (©2011 by Kate Ash); Passage B is adapted from the article “From New York: Cory Arcangel: Pro Tools” by Brady Welch (©2011 by Brady Welch).

Passage A by Kate Ash

As I walked into his Brooklyn studio, Cory Arcangel was clicking commands into his Macintosh computer. Without touching a pen, he was drawing angles in black ink from across the room. Arcangel
5 bought a 1983 pen plotter printer on eBay and then, partly from necessity and partly from inspired curiosity, deftly hacked together the code I saw in operation. Springing from his chair, he grabbed the paper from the paused plotter arm. “I’ll do it again! The program is
10 randomized, so they’re different every time.” Arcangel sees a beautiful irony in the thought that each piece of modern technology that rolls out will inevitably fall into obsolescence. The plotter printer was state-of-the-art only a few decades ago and is now considered
15 techno-waste. But touched by Arcangel’s technical gifts, it’s been transformed into a time machine.

This May, just after Arcangel turns thirty-three, his latest exhibition will debut at the Whitney Museum. He has already exhibited at the Museum of Modern Art,
20 the Tate, and the Smithsonian, notwithstanding the lack of an art degree (he studied at the Oberlin Conservatory of Music). This unconventional training may underlie his versatility in crossing artistic disciplines. Using primarily digital tools, he generates drawings,
25 sculptures, photography, and videos; yet he is most known for his video games—namely the sly tweaks he makes to popular games. The most anticipated piece at the Whitney is a group of room-sized projections of bowling games, programmed to roll only gutter balls.

Arcangel treated me to a preview by setting up the projections on a wall of his studio. Six screens show a retrospective of the bowling genre, from
30 1977’s Atari 2600 with its blockish 8-bit imagery, up to 2001’s Nintendo GameCube, whose humanoid avatars are strikingly odd, especially compared to the primitive animation. “Is anything more absurd than
35 virtual bowling?” Arcangel chuckled. “And gutter balls are just humiliating. That’s the idea here—it’s ridiculous, then sad, then oppressive. Failing seems funny for a while—then it flips.” Indeed, a rising discomfort
40 sets in with each repetition of animated frustration.

For Arcangel, gaming is central to his work, but he’s no gamer, just as van Gogh wasn’t a potato farmer, nor George Bellows a boxer. As Arcangel reflects on
45 his family in Buffalo he explains, “Sure we had an early Atari but never Nintendo. When I went to my friends’ houses, I’d watch them play. That’s probably why my works deal with watching, not interacting.”

Passage B by Brady Welch

For a solo exhibition so centered upon the creative interventions of the human hand, Cory Arcangel’s
50 Pro Tools feels remarkably bereft. Yet maybe this is the point. Arcangel is a thirty-three-year-old artist whose primary toolbox consists of skills like hacking programming code, plugging away on the keyboard,
55 and clicking a mouse. The software does the heavy lifting here. The artist may be the man in the machine, but what we see is the work of the machine, an oddly emotionless interaction.

The exhibition’s much-hyped centerpiece is also
60 its most successful work. *Beat the Champ* (2011) consists of six enormous screens individually aligned with gaming systems of several vintages. From Atari (1977) to Nintendo GameCube (2001), each hacked console
65 plays simulations of bowling games that mysteriously consign players to lobbing nothing but gutter balls. It’s both funny and pathetic—bowlers throw up their hands, hang their heads in shame, forever doomed to a score of zilch—but it’s also technically impressive. To make the piece, Arcangel recorded each simulation,
70 coding the scenarios into the controllers, and ultimately executing the very act that his piece skewers, which is to say, forcing real people to direct fake people to throw fake bowling balls. This is also the entire notion of video games.

Pro Tools also illuminates Arcangel’s signature
75 zeal for cutting and pasting. In *Paganini Caprice No. 5* (2011), the artist re-creates violinist Niccolò Paganini’s nineteenth-century exercise in speed and virtuosity by reassembling the composition note-for-note from YouTube clips of heavy metal guitarists likewise exercising
80 speed and virtuosity. Arcangel created a software program just to make editing at that speed possible, which again shows his distinct technical wizardry. Beyond showcasing his skill, however, the artist’s
85 ambition for the piece isn’t quite clear. It’s funny to see a bunch of longhairs sincerely shredding away, but Arcangel renders the music fairly obnoxious. Under the deluge, the guide in the room actually winced.

One gallery at the Whitney features Arcangel’s
90 exquisite photographs, made using Photoshop’s gradient tool, which produces seamless transitions between colors. Printed nine feet tall, they’re digitalized versions of abstract color-field paintings. And, like an actual color-field painting, they balance seductive
95 beauty with any-kid-could-do-that simplicity. Each image is unique—yet ironically, it can be printed countless times.

Pro Tools curator Christiane Paul tries her best to anchor Arcangel’s entertaining and whiz-bang work in
100 the larger scheme of art history. But the exhibition’s wall text and curatorial essay seem an overwrought justification of the Whitney’s decision to turn over an entire floor to such a young artist. To present a vibrant young artist in the same manner as they would the

- 105 founding collection—conservative and preservative—is a disservice to both the institution and the exhibiting artist.
21. In Passage A, the first paragraph functions mainly to emphasize the:
- skill Arcangel has developed in drawing with pen and ink.
 - amount of effort it takes for Arcangel to write a computer program.
 - role that outdated technology plays in Arcangel's work.
 - excitement that Arcangel finds in random patterns.
22. As it is used in line 23, the word *crossing* most nearly means:
- dividing.
 - disregarding.
 - marking.
 - navigating.
23. It can most reasonably be inferred from Passage A that the main reason that Arcangel's works do not allow viewers to actively participate in the bowling video game installation is that:
- his works reflect his personal experiences with video gaming.
 - he feared viewers wouldn't know how to use the old technology.
 - the museum encouraged him to produce a conservative exhibition.
 - he wanted to respect the evolution of gaming software.
24. Which of the following artworks would be most conceptually similar to Arcangel's work discussed in the third paragraph of Passage B (lines 76–89)?
- Excerpts from popular commercials edited to play in reverse
 - Still photographs of technology from different eras rapidly projected to suggest animation
 - Actors on film edited together to enact a scene from a classic Shakespearean play
 - A compilation of video clips in which Nintendo games are enjoyed by people of different ages
25. In Passage B, the author most likely references the speed and virtuosity of the YouTube guitarists to emphasize that Arcangel's piece is:
- a melodic composition.
 - an original idea.
 - an irreverent commentary.
 - an accurate imitation.
26. The author of Passage B is most critical of which artworks in Arcangel's show Pro Tools?
- Edited video composition
 - Photoshop color-gradient photographs
 - Plotter ink drawings
 - Video game installation
27. As it is used in line 65, the word *consign* most nearly means:
- transfer.
 - restrict.
 - register.
 - influence.
28. Which of the following statements best represents the primary difference in the purposes of the passages?
- Passage A evaluates the skill underlying Arcangel's techniques while Passage B compares Arcangel to other artists who have been featured at the Whitney.
 - Passage A provides insight into Arcangel's artistic vision while Passage B provides a critique of his show Pro Tools.
 - Passage A provides an analysis of Arcangel's response to fame while Passage B provides anecdotes about how Arcangel learned his craft.
 - Passage A gives a broad view of Arcangel's position in art history while Passage B interprets the concepts in Arcangel's artwork.
29. Compared to Passage B, Passage A provides more information about how Arcangel
- exhibited work in other highly respected art museums.
 - viewed the prestige of showing his work at the Whitney Museum.
 - incorporated his musical training into his work.
 - imitated children's art in his photographs.
30. The authors of Passage A and Passage B both praise Arcangel for his:
- precise control of gradient colors.
 - preservation of old computer hardware.
 - skill in digital programming.
 - unconventional preparation as an artist.

PASSAGE III

Natural Science: This passage is adapted from “Giraffe Stature and Neck Elongation: Vigilance as an Evolutionary Mechanism” by Edgar M. Williams (©2016 by Edgar M. Williams).

The giraffe—an impressively tall, African megaherbivore—is the tallest land mammal, with both a long neck and legs. The early giraffe fossil record is extensive and shows that the giraffe’s primary ancestors were distributed across Asia, Europe, and Africa. But the giraffe’s early ancestors had short necks. How giraffes’ long necks evolved is a matter of conjecture, but the two leading ideas are the high-browser and the predation-survival hypotheses.

Giraffes are sensitive to their environment and live in arid regions, as reflected in their current distribution in continental Africa. In the late Miocene Period, 5-23 million years ago, when the climate was wetter, there were many Giraffid species across Asia and Europe; most species had short necks and different dietary profiles, as not all were high-browsers like today’s species. A change in climate altered the vegetation at the end of the late Miocene Period, away from low-lying tropical vegetation to open-woodland savannah. The Pliocene Period, 2-5 million years ago, was a time of global cooling, which brought about the enormous spread of grasslands and savannahs. This change would have favored the high-browsers, but how adaptation to this drier climate favored the browsers with longer necks and larger mouths needs further investigation.

Approximately six million years ago, the antelope-like animals were roaming the dry grasslands of Africa, but some of them had unusually long necks. Some long-necked giraffes even appear in the fossil record approximately eight million years ago, but the fossil record is poor for the current giraffe species and there are no progressive examples of giraffe fossils with necks of ever-increasing length. However, recent evidence suggests that the elongation evolved first through cervical vertebral elongation, followed by the posterior lengthening of the vertebrae. The giraffe’s extant relative is the okapi, and in its natural environment, it is surrounded by a plentiful supply of vegetation within easy reach, so a long neck provides no particular survival advantages in this existing species.

The first serious attempts to explain the giraffe’s long neck were made by Jean-Baptiste Lamarck in 1809, who postulated that a long neck was an acquired characteristic in which a “nervous fluid” would flow into giraffes’ necks when they stretched for leaves, a trait then passed on to their offspring. Charles Darwin provided another plausible mechanism in his *Origin of Species*, postulating that elon-

gation occurred through the inheritance of traits; the giraffe most likely to survive attacks from predators and breed were those that could feed on the highest vegetation, especially when in short supply and unavailable to other short neck herbivores. According to this theory, competition for food led to neck elongation. Neither theory suggests why this solution was followed only in the giraffe. Darwin’s view is still popular today, as giraffes and elephants are the only animals that feed from tall trees on the arid savannah, with many of the tallest trees uniquely sculpted by high-browsing giraffes. However, this mechanism does not explain their extreme height, as giraffes, at half their current height, would still be able to outreach their fellow folivores.

In herbivorous hoofed animals, prey vigilance, especially while feeding, is essential for survival and breeding. While drinking, giraffes are at their most vulnerable to predation by lions because of their “splayed leg” stance. It has been suggested that because of its long legs, a giraffe would not be able to drink without a long neck. A long-legged, short-necked giraffe could most likely drink on its knees, so neck elongation is not likely a result of long legs alone. As expected and like other herbivores, giraffe vigilance while drinking increases in the presence of lions. Even with splayed legs, the head can be raised, and a longer neck helps extend the visual horizon, allowing approaching lions to be spotted earlier. The extra visual horizon gained provides a survival advantage.

The skeletal anatomy of the head and neck give giraffes the ability to move their heads in a wide arc both vertically and horizontally. This has advantages when feeding on trees, as it imparts a greater reach, allowing the animal to maximize its foraging before moving to another site. In addition, the giraffe has emerged as having one of the longest tongues and largest mouth volumes of any mammal. The development of the prehensile tongue allows the giraffe to extend its reach both horizontally and vertically. This adaption can be seen as an extension of the high browser hypothesis, but feeding while standing in a “safe spot” is another reinforcement of the idea that far-seeing drives giraffe behavior and survival against predation.

31. One main purpose of the passage is to:

- A. analyze why Africa is the ideal environment for giraffes.
- B. compare leading theories about giraffe anatomy based on evidence from their environments.
- C. present evidence for the steady decline of the giraffe population across Asia, Europe, and Africa.
- D. describe a theory that provides the best explanation for how giraffes evolved.

32. Which of the following statements best summarizes the author's claim about the relationship between neck length and climate?
- A. Food became scarcer for short-necked animals and more available to those that could reach it.
 - B. The longer necks of modern giraffes appear to have little to do with arid climates.
 - C. Giraffes with short necks were better suited to thrive in a drier environment than a tropical one.
 - D. Long necks are associated with larger hearts and a shorter lifespan in hot, dry climates.
33. It can be reasonably inferred from the passage that the phrase "outreach its fellow folivores" (line 67) refers to:
- A. elephants' ability to outreach the earliest giraffes in elevated food sources.
 - B. the potential for giraffes, even at half their height, to reach higher foliage than other animals.
 - C. elephants' ability to uniquely sculpt the tallest vegetation better than all other species.
 - D. a tendency for the tallest animals to live longer than species that cannot reach tall vegetation.
34. According to the passage, approximately 5 million years ago, how did the climate change across Asia and Europe?
- A. The climate became wetter in both continents.
 - B. The climate became drier than in the early Miocene Period.
 - C. Temperatures increased in both continents at the end of the Miocene Period.
 - D. The climate became drier in the summer and wetter in the winter in both continents.
35. In the passage, the author concludes that the prehensile tongue emerged in giraffes in conjunction with a need to:
- A. reach water when in a splayed-leg stance.
 - B. exhaust food options before moving to another location.
 - C. dispense pheromones to mark the fur of their offspring.
 - D. clean the long necks of other giraffes in the herd.
36. According to the passage, which of the following occurred as the Miocene Period gave way to the Pliocene Period?
- A. The grasslands and savannahs became greener and more lush.
 - B. Continental Africa cooled and became a wetter ground for giraffes to flourish.
 - C. The change in climate favored animals with smaller digestive tracts.
 - D. The shift to an open savannah was helpful to high-browsers.
37. The passage indicates that okapi living in their natural environment are surrounded by:
- A. low-lying vegetation.
 - B. long-necked antelope.
 - C. dangerous predators.
 - D. natural water reservoirs.
38. Based on the passage, which characteristic makes the giraffe most vulnerable to lion predation?
- A. large abdomen.
 - B. extended vertebrae.
 - C. drinking posture.
 - D. herbivorous hooves.
39. As it is used in line 48, the word *acquired* most nearly means:
- A. taken.
 - B. received.
 - C. developed.
 - D. suggested.
40. The passage most strongly suggests that it is difficult to confirm the cause of neck elongation in giraffes because:
- A. some early giraffes had shorter necks than their predators.
 - B. fossil records do not exhibit giraffe necks that grew longer over generations.
 - C. the necks of antelope were much longer than those of giraffes approximately six million years ago.
 - D. little scientific research has been done to verify the claims of Lamarck and Darwin.

END OF TEST 3

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO A PREVIOUS TEST.



SCIENCE TEST

35 Minutes – 40 Questions

DIRECTIONS: Each passage below is accompanied by a number of questions. Read the passage and choose the best answer to the corresponding questions, referring to the passage as necessary. Calculators are NOT allowed on this section.

You are NOT permitted to use a calculator on this test.

Passage I

Central India (19° – 26° N, 76° – 86° E) is home to over half a billion people. For economic reasons, many people in Central India depend on rainfall from the *monsoon weather patterns* (seasonal changes in wind and precipitation) to grow crops. Data have shown that variability in monsoon weather patterns during the *northern summer months* (June to September) has increased in recent decades.

Because of their reliance on rain-dependent agriculture, the people of Central India are greatly influenced by *monsoon variability* (patterns of droughts and floods). Two studies were done to analyze monsoon weather–related data for Central India. The daily rainfall totals were examined, as well as the number of *extreme weather events* (days with daily rainfall greater than 150 mm).

Study 1

Using a rain gauge network, the total height of daily rainfall was recorded by 3,100 stations around Central India, and the data was combined by the India Meteorological Department. For this analysis, researchers used only data relating to daily rainfall totals during the northern summer months between the years 1950 and 2015. The results are shown in Figure 1. Mean precipitation (mm/day) was determined for each year by calculating the sum of daily rainfall totals and dividing by the number of days in the northern summer months.

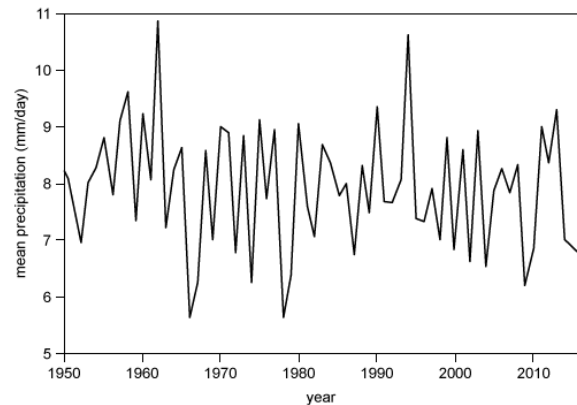


Figure 1

Study 2

As in Study 1, researchers collected data relating to daily rainfall totals for Central India during the northern summer months. Researchers determined the yearly number of extreme rain events for Central India from 1950 to 2015. After plotting the yearly number of extreme rain events, statistical analysis (10-year moving averages) was performed on the data to determine if a pattern in the number of extreme rain events could be established (see Figure 2).

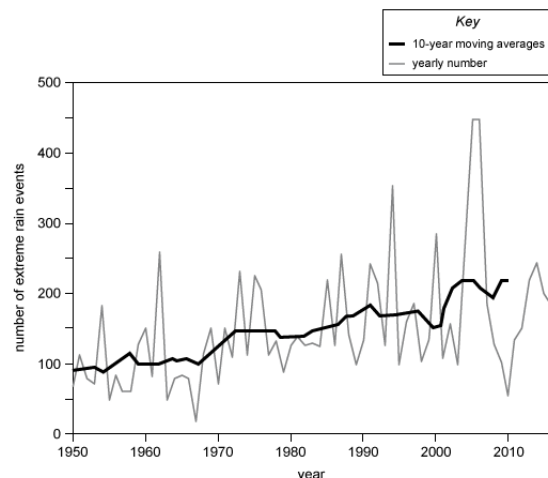


Figure 2



1. According to Figure 2, what has been the minimum number of extreme rain events since 1970 ?
 - A. 20
 - B. 55
 - C. 105
 - D. 450
2. In Study 2, the control is represented by:
 - A. the network of rain gauges.
 - B. weather events recorded before 1950.
 - C. the 10-year moving averages.
 - D. This study lacks a control.
3. According to the passage, monsoons are a type of:
 - A. cloud formation.
 - B. weather pattern.
 - C. soil additive.
 - D. agriculture.
4. Consider in Figure 1 the mean precipitation recorded for the year 1970. At that mean precipitation, the amount of rain over a 100-day period would have been closest to which of the following?
 - A. 9 mm
 - B. 90 mm
 - C. 900 mm
 - D. 9,000 mm
5. The data that were averaged to produce the results shown in Figure 1 were most likely measured using which of the following pieces of equipment?
 - A. Funnel
 - B. Balance
 - C. Ruler
 - D. Telescope
6. Which year represents the maximum value for mean precipitation?
 - A. 1962
 - B. 1978
 - C. 1994
 - D. 2010
7. Which of the following conclusions may be supported by Figure 2 ?
 - A. The number of extreme rain events increases with time.
 - B. The number of extreme rain events decreases with time.
 - C. The number of extreme rain events is fairly steady with time.
 - D. The number of extreme rain events varies, but with no general trend.

Passage II

In 2 experiments, a researcher tested the toughness of 2 types of steel blocks that had been through different cooling treatments (rapidly cooled and slowly cooled).

In Experiment 1, the researcher tested the *impact energy* (the minimum amount of work required to fracture a block of cooled steel) and plotted the impact energy, in joules (J), versus temperature, in degrees Celsius (°C). The results are shown in Figure 1.

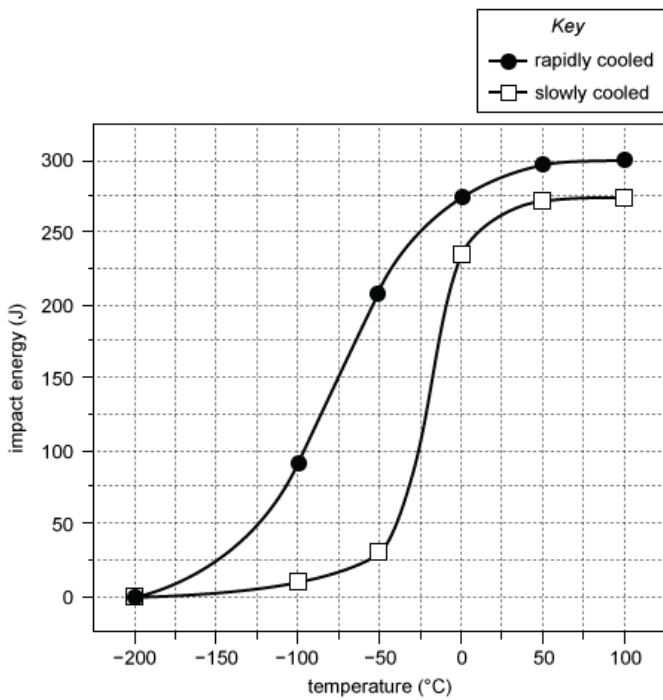


Figure 1

In Experiment 2, the researcher measured the ultimate tensile strength and the yield strength of the different types of steel in megapascals (MPa). The results are shown in Figure 2.

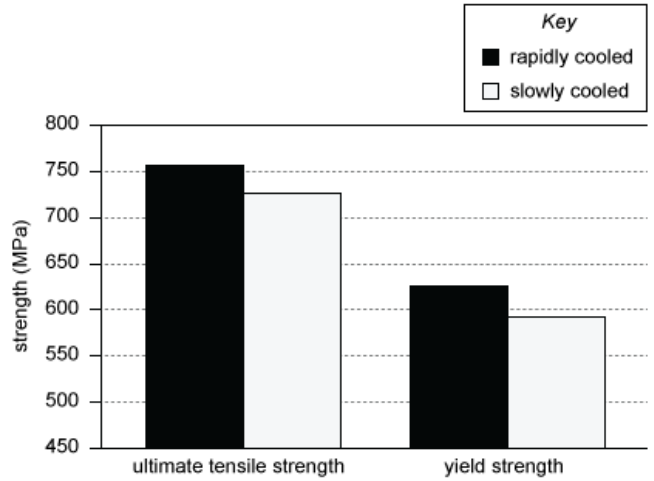


Figure 2

8. Rapidly cooled steel blocks are placed into a chamber at -75°C . How much energy is needed to fracture four individual blocks?
- A. 275 J
 - B. 300 J
 - C. 600 J
 - D. 1,100 J



9. Which of the following generalizations about the relationship between temperature and impact energy is best supported by the data in Figure 1?
- The impact energy varies directly with temperature.
 - As temperature increases, the impact energy decreases.
 - As temperature decreases, the impact energy increases.
 - The impact energy is not determined by temperature.
10. A material's impact energy is the:
- minimum energy used to cool a block of steel.
 - average force required to hit 2 objects together.
 - minimum energy needed to crack a block of material.
 - maximum force generated by fracturing a block of steel.
11. According to the results of Experiment 2, what was the greatest yield strength for a steel block, and what was the ultimate tensile strength of the steel block with this yield strength?
- | | <u>yield strength</u> | <u>ultimate tensile strength</u> |
|----|-----------------------|----------------------------------|
| A. | 590 MPa | 755 MPa |
| B. | 625 MPa | 755 MPa |
| C. | 625 MPa | 590 MPa |
| D. | 755 MPa | 625 MPa |
12. Suppose a test had been done in Experiment 1 at a temperature of 150°C. The impact energy for slowly cooled steel would most likely have been:
- less than 50 J.
 - between 50 J and 150 J.
 - between 150 J and 250 J.
 - more than 250 J.
13. The researcher used cooling treatments as the dependent variable in:
- Experiment 1 only.
 - Experiment 2 only.
 - both Experiments 1 and 2.
 - neither Experiment 1 nor 2.
14. Which of the following statements is supported by the data collected in both experiments?
- Rapidly cooled steel is tougher than slowly cooled steel.
 - The minimum energy required to fracture steel is not affected by temperature.
 - An increase in the ultimate tensile strength of a steel block corresponds to a negative effect on the impact energy.
 - The cooling treatment has no effect on the impact energy of steel blocks.

Passage III

The loss of habitat due to increasing urbanization has been established as 1 of the primary factors causing the current decline in the number of pollinators. Some debate exists as to how habitat loss and decreasing pollinator populations will impact the reproductive success of plants. Pollinators that have short mouthparts can only pollinate *flat flowers* (flowers that have easily accessible pollen) whereas pollinators that have long mouthparts can easily access both flat and *tubular flowers* (flowers that have recessed floral parts). Two scientists present their viewpoints regarding the effects of urbanization on pollination.

Scientist 1

Urbanization is likely to have mixed effects on pollinators and plants. Modifications in pollinator community structure resulting from landscape variations along urbanization gradients may affect plant communities. Urban areas that have planted more flat flowers than tubular flowers would show an increase in the number of pollinators that have short mouthparts; therefore, the reproductive success of the flat flowers would increase, but the reproductive success of the tubular flowers would decrease. Urban areas that have planted mostly tubular flowers would show an increase in the number of pollinators with long mouthparts, thereby increasing the reproductive success of both flat and tubular flowers.

However, if there were an increase in urbanization without any increase in landscaping, the reproductive success of both the plants and pollinators would decrease. A reduction in the number of plant and pollinator species may lead to a possible decrease in food supply due to decreasing pollination and crop loss.

Scientist 2

Increased urbanization will adversely affect pollinators, pollination rates, and the reproductive success of the plants. The greatest adverse impact will be on pollinators with smaller body sizes due to their typically lower mobility. Decreased mobility results in limited foraging range; therefore, small pollinators are more sensitive to habitat fragmentation (due to urbanization) than are large pollinators. Small pollinators generally have short mouthparts, which limits their foraging to flat flowers. As a result, plants that produce flat flowers will have less reproductive success in urban environments than in natural environments due to decreased pollination rates by small pollinators.

15. It can be inferred that Scientist 1 believes the most important role of landscaping in urbanization is to:
 - A. decrease the number of pollinators with short mouthparts.
 - B. create a gradient for plant communities.
 - C. support a greater number of pollinators.
 - D. increase pollinator mobility.
16. Which effect of urbanization was discussed by Scientist 2 but not Scientist 1?
 - A. Impact of short mouthparts on pollination
 - B. Impact of flat flowers
 - C. Impact of tubular flowers
 - D. Impact of small body size on pollination
17. Scientist 1 states that a high number of:
 - A. long-mouthpart pollinators will decrease flat flower plants.
 - B. long-mouthpart pollinators will increase tubular and flat flower plants.
 - C. tubular and flat flowers will improve crop production.
 - D. flat flowers will hinder crop production.
18. According to Scientist 2, what happens when a habitat is fragmented?
 - A. Pollination occurs at an exponential rate.
 - B. Pollination occurs at a reduced rate.
 - C. Pollination occurs at a maximum rate.
 - D. Pollination can no longer occur in that environment.
19. Based on the passage, the major difference between the opinions of Scientist 1 and Scientist 2 is that:
 - A. Scientist 2 does not predict any positive effects of urbanization.
 - B. Scientist 1 focuses only on the effects of urbanization on flat flowers.
 - C. Scientist 2 expects large pollinators to be adversely affected by urbanization.
 - D. Scientist 1 discusses the effects of urbanization but does not discuss crop yield.
20. An increase in tubular flower reproductive success in urban environments with only small pollinators would support the opinion of:
 - A. Scientist 1.
 - B. Scientist 2.
 - C. both scientists.
 - D. neither scientist.
21. Scientist 1 and Scientist 2 tend to agree on:
 - A. the role pollinators play in plant reproductive success.
 - B. the role that landscaping plays in plant reproductive success.
 - C. the role of pollinator mobility in plant reproductive success.
 - D. the role of pollinators with long mouthparts increasing plant reproductive success.

Passage IV

Paper chromatography can be used to separate pigments (substances that give a color).

1. A pencil line is drawn horizontally across the chromatography paper at a point slightly above the end of the strip. On that line, a few drops of the substance to be tested are applied (point of origin).
2. The end of the strip is placed in a container, where the strip is immersed in a small volume of solvent with the point of origin slightly above the surface of the solvent, and the container is then covered.
3. Before the solvent front (the leading edge of the solvent) reaches the top of the strip, the strip is removed from the solvent. The solvent front and locations of the different pigments from the tested substance are noted. The distance the pigments and the solvent front traveled from the point of origin is measured.

Figure 1 illustrates this process.

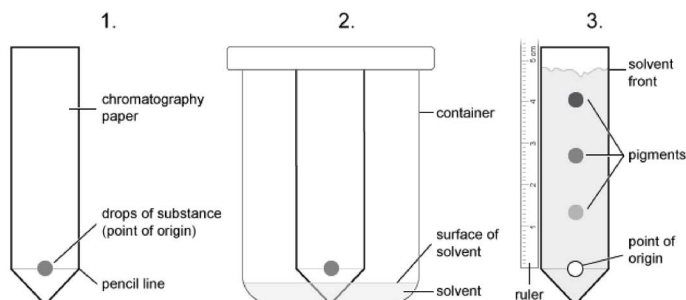


Figure 1

As the solvent front moves up the paper, the pigments dissolve according to the *polarities* (charge distribution) of both the pigments and solvents. The liquid substances were artificial food dyes containing color pigments, and the *range of R_f values* (ratio of the distance traveled by the pigment to the distance traveled by the solvent) was calculated (see Table 1). The higher the R_f value of a pigment, the closer the pigment is to the solvent front.

Artificial food dyes	Range of R_f value (0-1)
Blue #1	0.87–0.93
Red #3	0.08–0.11
Yellow #5	0.66–0.73
Red #40	0.29–0.31

Experiment 1

In each of 4 trials (Trials 1-4), paper chromatography was performed on 1 of 4 different soft drinks (one type per trial) using the same solvent. The final location of the pigment from the different soft drinks and their calculated R_f values are shown in Figure 2

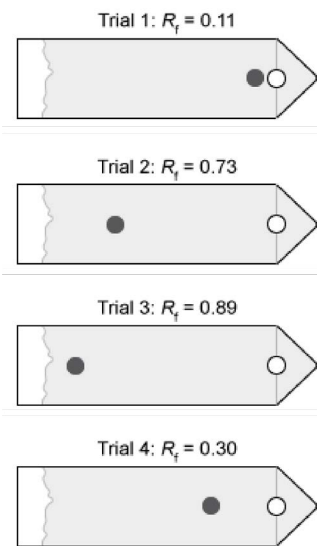


Figure 2

The R_f of each of 3 additional artificial food dyes was likewise determined using the same solvent, and the ranges of R_f values were calculated (see Table 2).

Artificial food dyes	Range of R_f value (0-1)
Blue #2	0.22–0.28
Green #3	0.92–0.96
Yellow #6	0.52–0.69

Experiment 2

In each of 4 trials (Trials 5-8), paper chromatography was performed on 1 of 4 different types of soft drinks using the same solvent used in Experiment 1 (see Figure 3).

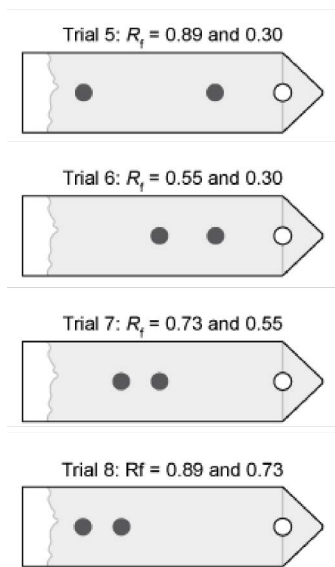


Figure 3

22. Which artificial food dye was most likely used in the soft drink from Trial 3 in Figure 2?
- Blue #1
 - Red #3
 - Yellow #5
 - Red #40

23. In the 2 experiments, the purpose of the solvents was to:
- keep the chromatography paper from drying out.
 - separate the pigments used in soft drinks.
 - change the charge distribution of the pigments.
 - prevent the pencil line from smearing.

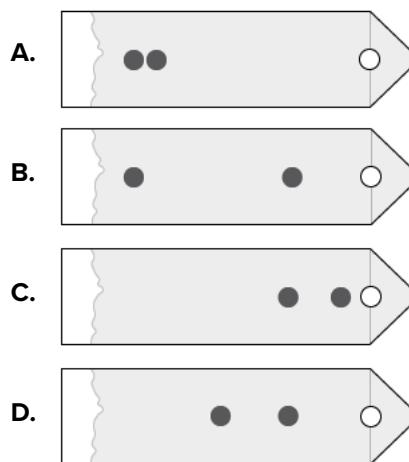
24. Based on the results of the experiments, which of the artificial dyes was farthest from the solvent front?
- Blue #1
 - Red #3
 - Green #3
 - Red #40

25. In the experiments, Trial 2 and Trial 8 differed in which of the following ways?
- The soft drink in Trial 8 had more artificial dyes than the soft drink in Trial 2.
 - The soft drink in Trial 2 had more artificial dyes than the soft drink in Trial 8.
 - The solvent in Trial 8 had greater polarity than the solvent in Trial 2.
 - The solvent in Trial 2 had greater polarity than the solvent in Trial 8.

26. Suppose a student read the label on a soft drink and found it contained artificial dyes Yellow #5 and Yellow #6. Based on the information provided, their R_f values would most likely be the same as those in:
- Trial 5.
 - Trial 6.
 - Trial 7.
 - Trial 8.

27. What is the order of the selected artificial dyes from the dye with the *least* distance from the solvent front to the dye with the *most* distance from the solvent front?
- Yellow #6, Red #40, Blue #1, Yellow #5
 - Yellow #5, Red #40, Yellow #6, Blue #1
 - Blue #1, Red #40, Yellow #5, Yellow #6
 - Blue #1, Yellow #5, Yellow #6, Red #40

28. Suppose that the soft drinks from Trial 1 and Trial 4 were combined. The results of a trial with the combined drink would most closely correspond to which of the following figures?



Passage V

Composite material (CM) is made of two or more components that have different physical and chemical properties. CM containers made of mortar and *spinney waste fibers* (fibers that remain after the processing of raw cotton) have been proposed as a cost-effective way to store radioactive waste.

The Nuclear Regulatory Commission (NRC) recommends minimum strength criteria of 3.33 newtons per square millimeter (N/mm^2) for CM intended for long-term storage of radioactive waste. The NRC requires that the physical and structural properties of the CM containers be maintained under harsh environmental conditions. In addition, it must be verified that the stored waste will not cause degradation of the CM.

Three environmental conditions (Environments 1-3) were established in a testing area by filling plastic barrels, each with a capacity of 208 L, with a different chemical solution. For Environment 1, the barrel was filled with 0.1 N sulphuric acid, a strong acid. For Environment 2, the barrel was filled with 9% sodium chloride, a salt solution. For Environment 3, the barrel was filled with 0.1 N sodium hydroxide, a strong base.

Cylindrical CM blocks made of fiber and mortar were prepared and allowed to harden for 28 days. After hardening, a set of blocks was tested for the baseline physical properties of compressive strength and porosity. Then, additional blocks were immersed in the barrels representing each of the different environmental conditions. The barrels were closed and left undisturbed for various immersion periods.

For each environment, a fiber-mortar composite block was removed after specific immersion periods. The compressive strength of each block was determined for each environment after the various immersion periods (see Figure 1).

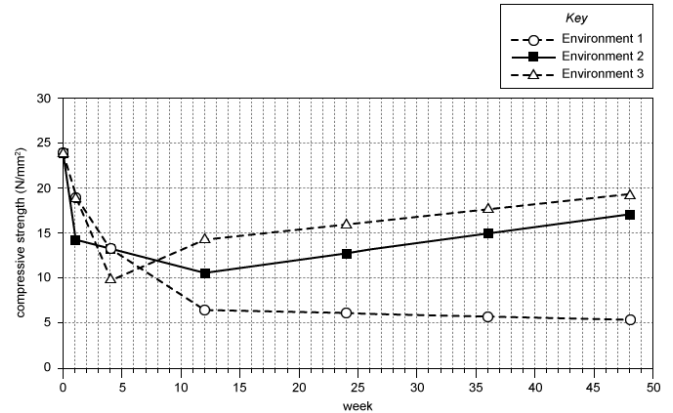


Figure 1

For each environment, a fiber-mortar composite block was removed after specific immersion periods. The percent porosity of each block was determined for each environment after the various immersion periods (see Figure 2).

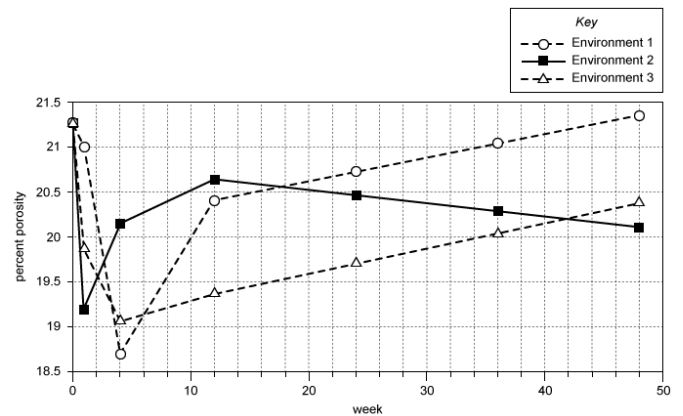


Figure 2

29. Why was the study designed so that the 3 barrels used to mimic the environmental conditions were of the same size and left undisturbed? These parameters ensured that any variations in compressive strength and porosity of the blocks would most likely be attributable only to variations among the barrels in the:
- A. number of CM sets tested.
 - B. type of chemicals they held.
 - C. way they were made.
 - D. type of plastic.
30. A scientist predicted that as immersion time in Environment 2 increased from 0 to 48 weeks, the porosity of the CM blocks would decrease by more than 1%. Do the results shown in Figure 2 support this prediction?
- A. No; the porosity increased from about 20.1% to 21.3%.
 - B. No; the porosity increased from about 20.4% to 21.3%.
 - C. Yes; the porosity decreased from 21.3% to about 20.1%.
 - D. Yes; the porosity decreased from 21.3% to about 20.4%.
31. Suppose that for each environment an additional block had been immersed for a period of 50 weeks. Based on Figure 1, for Environment 2, the compressive strength of the block immersed for 50 weeks would most likely have been determined to be:
- A. less than 10 N/mm^2 .
 - B. between 10 N/mm^2 and 15 N/mm^2 .
 - C. between 15 N/mm^2 and 20 N/mm^2 .
 - D. more than 20 N/mm^2 .
32. Which of the following statements is best supported by the information in the passage and figures?
- A. Containers made of fiber and mortar have been proven to be more cost-effective than traditional storage containers.
 - B. The NRC would be likely to recommend fiber-mortar composite blocks for long-term storage of radioactive waste.
 - C. A barrel filled with a low-pH chemical solution was not used to mimic an environmental condition in this study.
 - D. At the end of the 48-week study, strong bases were shown to reduce the compressive strength of the fiber-mortar composite blocks the most.
33. Which of the following was a dependent variable in the study?
- A. Compressive strength
 - B. Immersion periods
 - C. Solution in the barrels
 - D. Hardening time of the blocks
34. In the study, for blocks that were immersed in Environment 3, as the immersion period increased from week 1 to week 12, the percent porosity:
- A. increased only.
 - B. decreased only.
 - C. remained the same.
 - D. varied, but with no general trend.



The results of Experiments 1 and 2 are shown in Table 1.

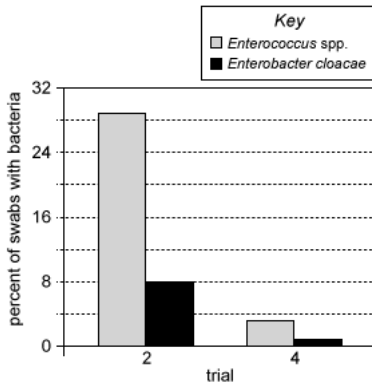
Experiment	Trial	Handwashing time (seconds)	Percent of swabs with <i>Enterococcus</i> spp.	Percent of swabs with <i>Enterobacter cloacae</i>
1	1	0	29	8
	2	13	3	1
2	3	0	28	9
	4	13	15	3

- 35.** Which molecule is formed as a by-product of the saponification reaction?
- Triglycerides
 - Soap
 - Glycerin
 - Lye
- 36.** To obtain the data in Table 1, the students directly controlled all but which of the following variables?
- The strains of bacteria obtained from touching public surfaces
 - The time spent for handwashing by participants
 - The type of swabs used to touch the hands of the participants
 - The laboratory that analyzed the swabs
- 37.** If a handwashing time of 8 seconds had been tested in Experiment 2, the percent of swabs with *Enterobacter cloacae* would most likely have been:
- less than 3%.
 - between 3% and 9%.
 - between 9% and 15%.
 - greater than 15%.
- 38.** Before the experiments, students made the following hypotheses:
- Student 1: "Because soap breaks the surface tension of water, I expect handwashing with soap and water to correspond to a lower percent of swabs containing fecal bacteria."
- Student 2: "Since soap does not kill bacteria, handwashing with soap and water will not remove more bacteria than handwashing with water alone."
- Student 3: "Since the bacteria found on public surfaces may vary, the percent of swabs with fecal bacteria from the groups that skip handwashing will also vary."
- Which of the students' hypothesis/hypotheses are supported by the data collected?
- Student 2 only
 - Students 1 and 3
 - Students 1, 2, and 3
 - None of the students' hypotheses are supported by the data

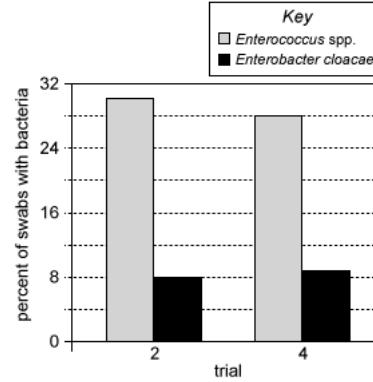


39. According to the results of the experiments, which of the following graphs best represents the percent of swabs with *Enterococcus* spp. and *Enterobacter cloacae* for Trial 2 and for Trial 4?

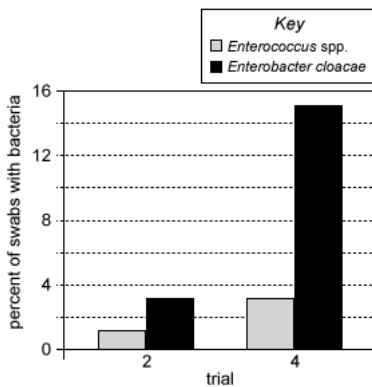
A.



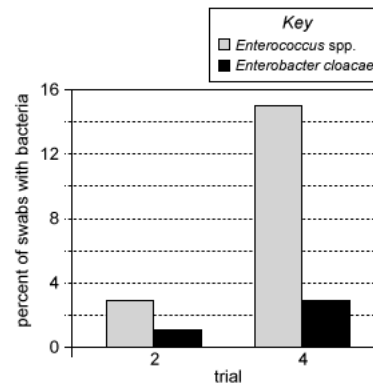
C.



B.



D.



40. According to the passage, the role of the water in combination with the bar of soap during handwashing is to:

- A. remove glycerin from the bar of soap.
- B. activate the bacterial-killing agent in the soap.
- C. allow the soap to act on more areas of the hands.
- D. decrease soap molecules to reduce damage to the hands.

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.

Score Your Tests

English Scoring Key

QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS
1	A		27	A		53	A	
2	B		28	A		54	B	
3	C		29	C		55	D	
4	B		30	C		56	B	
5	D		31	D		57	D	
6	B		32	A		58	D	
7	B		33	C		59	B	
8	D		34	C		60	B	
9	B		35	C		61	D	
10	A		36	D		62	C	
11	D		37	D		63	C	
12	A		38	A		64	A	
13	B		39	D		65	B	
14	A		40	D		66	C	
15	A		41	B		67	D	
16	A		42	A		68	A	
17	C		43	C		69	B	
18	B		44	B		70	B	
19	A		45	C		71	B	
20	C		46	D		72	C	
21	C		47	C		73	D	
22	C		48	A		74	C	
23	A		49	C		75	B	
24	C		50	C				
25	D		51	D				
26	D		52	A				

ENGLISH TEST RAW SCORE
(Total # of Correct Answers)

Mathematics Scoring Key

QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS
1	A		27	D		53	A	
2	D		28	A		54	A	
3	C		29	B		55	D	
4	C		30	D		56	B	
5	C		31	D		57	A	
6	B		32	C		58	A	
7	B		33	A		59	D	
8	D		34	A		60	E	
9	E		35	B				
10	B		36	A				
11	D		37	E				
12	B		38	B				
13	D		39	D				
14	D		40	E				
15	E		41	B				
16	E		42	A				
17	E		43	C				
18	E		44	A				
19	C		45	A				
20	D		46	C				
21	A		47	B				
22	B		48	E				
23	A		49	E				
24	B		50	C				
25	C		51	C				
26	C		52	D				

MATHEMATICS TEST RAW SCORE
(Total # of Correct Answers)

Score Your Tests

Reading Scoring Key

QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS
1	B		27	B	
2	C		28	B	
3	B		29	A	
4	C		30	C	
5	A		31	B	
6	C		32	A	
7	B		33	B	
8	D		34	B	
9	D		35	B	
10	C		36	D	
11	C		37	A	
12	B		38	C	
13	D		39	C	
14	C		40	B	
15	D				
16	C				
17	A				
18	B				
19	D				
20	A				
21	C				
22	D				
23	A				
24	C				
25	D				
26	A				

READING TEST RAW SCORE
(Total # of Correct Answers)

Science Scoring Key

QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS	QUESTION #	CORRECT	MARK YOUR CORRECT ANSWERS
1	B		27	D	
2	D		28	C	
3	B		29	B	
4	C		30	C	
5	C		31	C	
6	A		32	B	
7	A		33	A	
8	C		34	D	
9	A		35	C	
10	C		36	A	
11	B		37	B	
12	D		38	B	
13	D		39	D	
14	A		40	C	
15	C				
16	D				
17	B				
18	B				
19	A				
20	D				
21	A				
22	A				
23	B				
24	B				
25	A				
26	C				

SCIENCE TEST RAW SCORE
(Total # of Correct Answers)

Explanation of Procedures Used to Obtain Scale Scores from Raw Scores

On each of the four multiple-choice tests on which you marked any responses, the total number of correct responses yields a raw score. Use the table below to convert your raw scores to scale scores. For each test, locate and circle your raw score or the range of raw scores that includes it in the table below. Then, read across to either outside column of the table and circle the scale score that corresponds to that raw score. As you determine your scale scores, enter them in the blanks provided on the right. The highest possible scale score for each test is 36. The lowest possible scale score for any test on which you marked any responses is 1.

Next, compute the Composite score by averaging the four scale scores. To do this, add your four scale scores and divide the sum by 4. If the resulting number ends in a fraction, round it to the nearest whole number. (Round down any fraction less than one-half; round up any fraction that is one-half or more.) Enter this number in the blank. This is your Composite score. The highest possible Composite score is 36. The lowest possible Composite score is 1.

ACT Test	Your Scale Score
English	_____
Mathematics	_____
Reading	_____
Science	_____
Sum of scores _____	
Composite score (sum ÷ 4) _____	

NOTE: If you left a test completely blank and marked no items, do not list a scale score for that test. If any test was completely blank, do not calculate a Composite score.

Scale Score	Raw Scores				Scale Score
	Test 1 English	Test 2 Mathematics	Test 3 Reading	Test 4 Science	
36	72-75	58-60	39-40	39-40	36
35	70-71	56-57	38	37	35
34	68-69	54-55	37	36	34
33	67	53	35-36	35	33
32	66	51-52	34	34	32
31	65	49-50	33	—	31
30	64	48	—	33	30
29	62-63	46-47	32	32	29
28	61	44-45	31	31	28
27	60	41-43	30	—	27
26	58-59	39-40	29	30	26
25	56-57	37-38	28	28-29	25
24	53-55	35-36	27	26-27	24
23	51-52	33-34	26	25	23
22	48-50	31-32	24-25	23-24	22
21	45-47	30	23	22	21
20	42-44	28-29	21-22	20-21	20
19	40-41	26-27	20	19	19
18	38-39	24-25	19	17-18	18
17	36-37	21-23	17-18	15-16	17
16	33-35	17-20	16	13-14	16
15	30-32	13-16	14-15	12	15
14	27-29	10-12	12-13	11	14
13	25-26	8-9	11	10	13
12	23-24	6-7	9-10	9	12
11	19-22	5	7-8	8	11
10	16-18	4	6	7	10
9	13-15	—	5	6	9
8	11-12	3	—	5	8
7	9-10	—	4	4	7
6	7-8	2	3	3	6
5	6	—	—	—	5
4	4-5	1	2	2	4
3	3	—	—	1	3
2	2	—	1	—	2
1	0-1	0	0	0	1