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The SAT

Question- and-Answer Service

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Questions 1-10 are based on the following passage.

This passage is adapted from Amy Tan. The Bonesetter's Daughter. ©2001 by Amy Tan.

At last, Old Widow Lau was done haggling with the driver and we stepped inside Father's shop. It was north-facing, quite dim inside, and perhaps this was why Father did not see us at first. He was busy with a customer, a man who was distinguished-looking, like the scholars of two decades before. The two men were bent over a glass case, discussing the different qualities of inksticks. Big Uncle welcomed us and invited us to be seated. From his formal tone, I knew he did not recognize who we were. So I called his name in a shy voice. And he squinted at me, then laughed and announced our arrival to Little Uncle, who apologized many times for not rushing over sooner to greet us. They rushed us to be seated at one of two tea tables for customers. Old Widow Lau refused their invitation three times, exclaiming that my father and uncles must be too busy for visitors. She made weak efforts to leave. On the fourth insistence, we finally sat. Then Little Uncle brought us hot tea and sweet oranges, as well as bamboo latticework fans with which to cool ourselves.

I tried to notice everything so I could later tell GaoLing what I had seen, and tease out her envy. The floors of the shop were of dark wood polished and clean, no dirty footprints, even though this was during the dustiest part of the summer. And along the walls were display cases made of wood and glass.

The glass was very shiny and not one pane was broken. Within those glass cases were our silk-wrapped boxes, all our hard work. They looked so much nicer than they had in the ink-making studio at Immortal Heart village.

I saw that Father had opened several of the boxes. He set sticks and cakes and other shapes on a silk cloth covering a glass case that served as a table on which he and the customer leaned. First he pointed to a stick with a top shaped like a fairy boat and said with graceful importance, "Your writing will flow as smoothly as a keel cutting through a glassy lake."

40 He picked up a bird shape: "Your mind will soar into the clouds of higher thought." He waved toward a row of ink cakes embellished with designs of peonies and bamboo: "Your ledgers will blossom into abundance while bamboo surrounds your quiet mind."

45 As he said this, Precious Auntie came back into mind. I was remembering how she taught me that everything, even ink, had a purpose and a meaning: Good ink cannot be the quick kind, ready to pour out of a bottle. You can never be an artist if your work comes without effort. That is the problem of modern ink from a bottle. You do not have to think. You simply write what is swimming on the top of your brain. And the top is nothing but pond scum, dead leaves, and mosquito spawn. But when you push an inkstick along an inkstone, you take the first step to cleansing your mind and your heart. You push and you ask yourself, What are my intentions? What is in my heart that matches my mind?

60 I remembered this, and yet that day in the ink shop, I listened to what Father was saying, and his words became far more important than anything Precious Auntie had thought. "Look here." Father said to his customer, and I looked. He held up an inkstick and rotated it in the light. "See? It's the right hue, purple-black, not brown or gray like the cheap brands you might find down the street. And listen to this." And I heard a sound as clean and pure as a small silver bell. "The high-pitched tone tells you that the soot is very fine, as smooth as the sliding banks of old rivers. And the scent—can you smell the balance of strength and delicacy, the musical notes of the ink's perfume? Expensive, and everyone who sees you using it will know that it was well worth the high price."

75 I was very proud to hear Father speak of our family's ink this way.



1

Which choice best summarizes the passage?

- A) A character's arrival at her family's ink shop sparks fond memories of her favorite aunt.
- B) A character's surprise visit leads to a happy reunion at her family's ink shop.
- C) A character comes to understand her father's ambitions while visiting her family's ink shop.
- D) A character's visit to her family's ink shop deepens her appreciation of her family's work.

2

A main theme of the passage is that

- A) family relationships should be nurtured.
- B) quality is achieved through deliberate effort.
- C) hard work results in material compensation.
- D) creativity needs to be expressed concretely.

3

Throughout the passage, the narrator is portrayed as someone who is

- A) reserved around unfamiliar people.
- B) attuned to her immediate surroundings.
- C) sympathetic to the needs of others.
- D) anxious about her responsibilities.

4

It can be most reasonably inferred from the passage that Old Widow Lau's reluctance to stay for tea is

- A) feigned, because she is not genuinely firm in her resolve.
- B) inconsiderate, because the family has been planning her visit.
- C) appropriate, because the shop is unusually busy.
- D) ill-advised, because she is exhausted from the journey.

5

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

- A) Lines 1-4 ("At last...first:")
- B) Lines 11-15 ("And he...customers")
- C) lines 15-18 ("Old...leave")
- D) lines 19-21 ("Then...ourselves")

6

The narrator indicates that the contrast between ink-making studio at Immortal Heart village and the family's ink shop is that the ink shop

- A) displays the family's ink more impressively.
- B) is more conveniently located for the public.
- C) provides greater individual attention to its customers.
- D) offers a larger space for presenting professional items.



7

Based on the artistic philosophy expressed in the fourth paragraph (lines 46-59), it is reasonable to infer that Precious Auntie would consider a hastily written first draft of a story to be

- A) emotionally raw and powerful.
- B) creatively satisfying for the author.
- C) essentially worthless in and of itself.
- D) inappropriately analytical for a piece of art.

8

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

- A) Lines 46-48 (“As he...meaning”)
- B) Lines 49-50 (“Good...bottle”)
- C) Lines 52-55 (“You simply...spawn”)
- D) Lines 57-59 (“You push...mind”)

9

As used in line 59, “matches” most nearly means

- A) competes against.
- B) corresponds with.
- C) runs counter to.
- D) treats equally.

10

As used in line 68, “clean” most nearly means

- A) complete.
- B) skillful.
- C) distinct.
- D) upright.



Questions 11-20 are based on the following passage and supplementary material.

This passage is adapted from "How the Web Affects Memory." ©2011 by Harvard Magazine Inc.

Search engines have changed the way we use the Internet, putting vast sources of information just a few clicks away. But Harvard professor of psychology Daniel Wegner's recent research proves that

5 websites—and the Internet—are changing much more than technology itself. They are changing the way our memories function.

Wegner's latest study, "Google Effects on Memory: Cognitive Consequences of Having

10 Information at Our Fingertips," shows that when people have access to search engines, they remember fewer facts and less information because they know they can rely on "search" as a readily available shortcut.

15 Wegner, the senior author of the study, believes the new findings show that the Internet has become part of a transactive memory source, a method by which our brains compartmentalize information. First hypothesized by Wegner in 1985, transactive memory

20 exists in many forms, as when a husband relies on his wife to remember a relative's birthday. "[It is] this whole network of memory where you don't have to remember everything in the world yourself," he says. "You just have to remember who knows it." Now

25 computers and technology as well are becoming virtual extensions of our memory. The idea validates habits already forming in our daily lives. Cell phones have become the primary location for phone numbers. GPS devices in cars remove the need to memorize

30 directions.

Wegner points out that we never have to stretch our memories too far to remember the name of an obscure movie actor or the capital of Kyrgyzstan—we just type our questions into Google. "We become part

35 of the Internet in a way," he says. "We become part of the system and we end up trusting it."

Working with researchers Betsy Sparrow of Columbia University and Jenny Liu of the University of Wisconsin-Madison, Wegner conducted four

40 experiments to demonstrate the phenomenon, using various forms of memory recall to test reliance on computers. In the first experiment, participants demonstrated that they were more likely to think of computer terms like "Yahoo" or "Google" after being

45 asked a set of difficult trivia questions. In two other experiments, participants were asked to type a collection of readily memorable statements such as "An ostrich's eye is bigger than its brain." Half the subjects were told that their work would be saved to a

50 computer; the other half were informed that the statements would be erased. In subsequent memory testing, participants who were told their work would not be saved were best at recalling the statements. In a fourth experiment, participants typed into a

55 computer statements they were told would be saved in specific folders. Next, they were asked to recall the statements. Finally, they were given cues to the wording and asked to name the folders

60 where the statements were stored. The participants proved better able to recall the folder locations than the statements themselves.

Wegner concedes that questions remain about whether dependence on computers will affect

65 memories negatively: "Nobody knows now what the effects are of these tools on logical thinking." Students who have trouble remembering distinct facts, for example, may struggle to employ those facts in critical thinking. But he believes that the situation overall is

70 beneficial, likening dependence on computers to dependence on a mechanical hand or other prosthetic device.

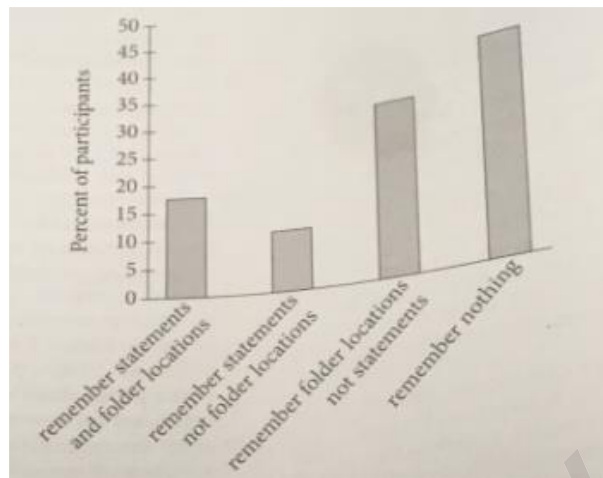
And even though we may not be taxing our memories to recall distinct facts, we are still using

75 them to consider where the facts are located and how to access them. "We still have to remember things," Wegner explains. "We're just remembering a different range of things." He believes his study will lead to further research into understanding computer

80 dependence, and looks forward to tracing the extent of human interdependence with the computer world—pinpointing the "movable dividing line between us and our computers in cyber networks."



Result of Experiment 4: Memory
Of Statements and Folder Location



Adapted from Betsy Sparrow et al. "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips." ©2011 by American Association for the Advancement of Science.

11

The main purpose of the passage is to

- A) describe a series of experiments on the way technology interferes with critical thinking.
- B) assert that people have become overly dependent on computers for storing information.
- C) discuss the idea that humans' capacity for memory is much weaker than it once was.
- D) share the findings of a study examining the effect of computer use on memory recall.

12

Which choice best supports the idea that reliance on computers does not necessarily diminish human's ability of memory?

- A) Lines 3-6("But Harvard...itself")
- B) Lines 31-33("Wegner...Kyrgyzstan")
- C) Lines 66-68("Students...thinking")
- D) Lines 72-75("And even...them")



13

In context, the reference to remembering a relative's birthday mainly serves to

- A) show that people who are closely related tend to have shared memories.
- B) demonstrate how people initially developed external sources of memory.
- C) emphasize the effectiveness and accuracy of transactive memory sources.
- D) illustrate the concept of a transactive memory source using a familiar situation.

14

Based on the information in the passage, which of the following would be considered a transactive memory source?

- A) A souvenir brought home from a memorable trip
- B) A written list of a user's passwords for different websites
- C) A library database that helps users locate specific books
- D) A website that helps users plan and make travel arrangements

15

As used in line 26, "extensions of" most nearly means

- A) details in.
- B) additions to.
- C) lengths of.
- D) developments of.

16

The discussion of the experiments suggests that people are inclined to think of specific information sources in response to being

- A) required to memorize details that will then be made inaccessible.
- B) directed to develop a system for organizing and saving content.
- C) asked to provide facts that are not already familiar to them.
- D) prompted to identify terms related to dependence on computers.

17

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

- A) Lines 42-45(" the...questions")
- B) Lines 48-51("Half...erased")
- C) Lines 51-53("In subsequent...statements")
- D) Lines 59-61(" participants...themselves")

18

As used in line 67, "employ" most nearly means

- A) utilize.
- B) enroll.
- C) exert.
- D) assign.



19

According to the graph, approximately what percentage of participants remembered both parts of the information given to them during the fourth experiment?

- A) 7%
- B) 10%
- C) 17%
- D) 30%

20

Based on the description of Wegner's fourth experiment, what is the most likely explanation for the findings for the largest single group of participants represented in the graph?

- A) Those participants focused on remembering the folder locations.
- B) Those participants attempted to remember the statements and the folder locations.
- C) Those participants did not attempt to remember any specific pieces of information.
- D) There is not enough information to determine the cause of the results for those participants.

Questions 21-30 are based on the following passage and supplementary material.

This passage is adapted from Marlene Zuk, Poleofontovy. What Evolution Really Tells Us about sex, diet, and How We Live.

A female guppy can be sexually mature at two months of age and have her first babies just a month later. This unstinting rate of reproduction makes guppies ideally suited for studying the rate of evolution, and David Reznick, a biologist at UC Riverside, has been doing exactly that for the last few decades.

People usually think of guppies as colorful aquarium fish, but they also have a life in the real world, inhabiting streams and rivers in tropical places like Trinidad, where Reznick has done his fieldwork. Guppies can experience different kinds of conditions depending on the luck of the draw.

A lucky guppy is born above a waterfall or a set of rapids, which keep out the predatory fish called pike cichlids found in calmer downstream waters. As you might expect, the guppy mortality rate—that is, the proportion of individuals that die—is much higher at the sites with the rapacious cichlids than in those without them.

Reznick has shown that if you bring the fish into the lab and let them breed there, the guppies from the sites with many predators become sexually mature when they are younger and smaller than do the guppies from the predator-free sites. In addition, the litters of baby guppies produced by mothers from the high-risk streams are larger, but each individual baby is smaller than those produced by their counterparts. The disparity makes sense because if you are at risk of being eaten, being able to have babies sooner, and spreading your energy reserves over a lot of them, makes it more likely that you will manage to pass on some of your genes before you meet your fate. Reznick and other scientists also demonstrated that these traits are controlled by the guppies' genes, not by the environment in which they grow up.

How quickly, though, could these differences in how the two kinds of guppies lived their lives have evolved? Because there are numerous tributaries of the streams in Trinidad, with guppies living in some but not all of them, Reznick realized that he could, as he put it in a 2008 paper, “treat streams like giant test tubes by introducing guppies or predators” to place they had not originally occurred, and then watch as natural selection acted on the guppies. This kind of



real-world manipulation of nature is called “experimental evolution.” and it is growing increasingly popular among scientists working with organisms that reproduce quickly enough for humans to be able to see the outcome within our lifetimes. Along with his students and colleagues, Reznick removed groups of guppies from their predator-ridden lives below the waterfall and released them into previously guppy-free streams above the falls. Although small predatory killifish occurred in these new sites, these fish do not pose anything close to the danger of the cichlids. Then the scientists waited for nature to do its work, and they brought the descendants of the transplanted fish back to the lab to examine their reproduction. After just eleven years, the guppies released in the new streams had evolved to mature later, and have fewer, bigger offspring in each litter, just like the guppies that naturally occurred in the cichlid-free streams. Other studies of guppies in Trinidad have shown evolutionary change in as few as two and a half years, or a little over four generations, with more time required for genetic shifts in traits such as the ability to form schools and less time for changes in the colorful spots and stripes on a male’s body.

Figure 1

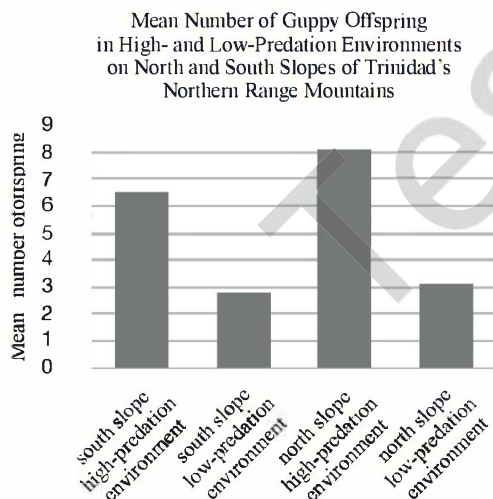
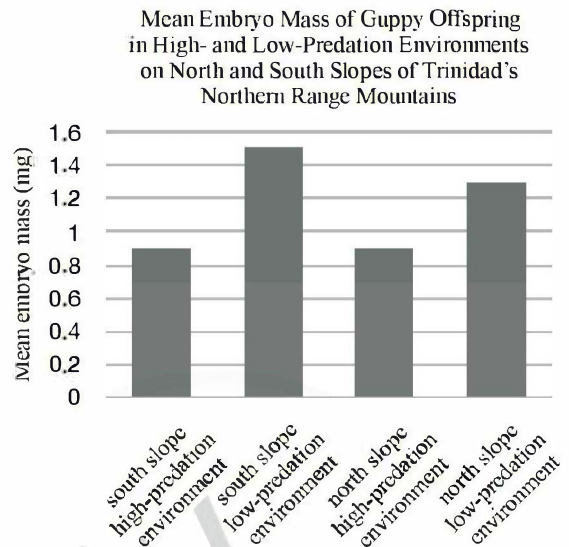


Figure 2



Figures adapted from David N. Reznick, Cameron K. Ghalambor, and Kevin Crooks, “Experimental Studies of Evolution in Guppies: A Model for Understanding the Evolutionary Consequences of Predator Removal in Natural Communities.” ©2007 by Blackwell Publishing Ltd.

21

The first paragraph mainly serves to function as

- A) an inspiration of a continued research in the whole passage.
- B) an outline of a hypothesis discussed in the passage.
- C) an introduction of a phenomenon in the studies presented in the passage.
- D) an explanation of a controversial issue fully developed in the rest of the passage.



22

In describing the living conditions of guppies, the author indicates that a “lucky guppy” (line 14) is one that

- A) is born in a major river having an established guppy population.
- B) inhabits an environment that provides natural protection from predators.
- C) manages to navigate the risks associated with living near a waterfall.
- D) avoids predatory fish by living in calmer downstream waters.

23

Which choice provides the best evidence for the conclusion that the streams used by Reznick’s team in their real-world study were not entirely free of predators?

- A) Lines 14-16(“A lucky...waters”)
- B) Lines 16-20(“As you....them”)
- C) Lines 46-51(“This...lifetimes”)
- D) Lines 56-58 (“Although...cichlids”)

24

In lines 43-44, Reznick uses the phrase “giant test tubes” to suggest that certain streams can

- A) provide suitable experimental conditions.
- B) promote cooperative behaviors in specimens.
- C) expedite the rate of genetic changes.
- D) solve widespread environmental problems.

25

As used in line 49, “popular” most nearly means

- A) accessible.
- B) suitable.
- C) widespread.
- D) likable.

26

Which finding, if accurate, would undermine Reznick’s findings?

- A) Guppies examined in other parts of the globe exhibit genetic shifts in traits at a different rate from that exhibited by the guppies Reznick examined.
- B) The new site into which Reznick release the guppies is inhabited by fish that are found to be as predatory as the cichlids in the original sites.
- C) Experimental evolution is shown to be harmful to the environments where studies like Reznick are conducted.
- D) The descendants of Reznick’s transplanted fish are proven to mature later than the guppies living below the waterfall.

27

It can most reasonably be inferred from the passage that the experiments in Trinidad have shown which of the following about guppies?

- A) Some genetic traits will evolve more readily than others.
- B) Some predatory fish are more dangerous to guppies than cichlids are.
- C) Some guppies thrive better in areas below waterfalls than they do in areas above water
- D) Some genetic shifts are easier to prevent in a natural environment than in a lab.

28

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

- A) Lines 38-40(“How quickly...evolved”)
- B) Lines 40-46(“Because...the guppies”)
- C) Lines 52-55(“Along...falls”)
- D) Lines 65-70(“Other...body”)



29

According to figure 1, guppies living in the south slope high-predation environment produced a mean number of offspring between

- A) 2 and 3.
- B) 3 and 4.
- C) 5 and 6.
- D) 6 and 7.

30

Which conclusion about the mean mass of guppy embryos is best supported by figure 2?

- A) The slope location was a better indicator of mean embryo mass than was the predation level observed in each environment.
- B) The mean embryo mass of guppies born in the north slope environments exceeded the mean embryo mass of guppies born in the south slope environments.
- C) The predation level observed in each environment had more of an effect on mean embryo mass than did slope location.
- D) The guppies born in the low-predation environments had a mean embryo mass less than that of guppies born in the high-predation environments.

31

The data presented in figures 1 and 2 best support the conclusion that compared with guppies from high-predation environments, guppies from low-predation environments were more likely to

- A) have fewer offspring and reach full maturity sooner.
- B) be part of a smaller litter and have a greater mean embryo mass.
- C) have a higher rate of survival and have less mean embryo mass.
- D) produce a greater number of offspring and have a greater mean embryo mass.



Questions 32-42 are based on the following passage.

This passage is adapted from a speech delivered in 1838 by Sara T. Smith at the Second Anti-Slavery Convention of American Women.

We are told that it is not within the “province of woman,” to discuss the subject of slavery; that it is a “political question,” and we are “stepping out of our sphere,” when we take part in its discussion. It is not
5 true that it is merely a political question, it is likewise a question of justice, of humanity, of morality, of religion; a question which, while it involves considerations of immense importance to the welfare and prosperity of our country, enters deeply into the
10 home-concerns, the every-day feelings of millions of our fellow beings. Whether the laborer shall receive the reward of his labor, or be driven daily to unrequited toil—whether he shall walk erect in the dignity of conscious manhood, or be reckoned among
15 the beasts which perish—whether his bones and sinews shall be his own, or another’s—whether his child shall receive the protection of its natural guardian, or be ranked among the live-stock of the estate, to be disposed of as the caprice or interest of
20 the master may dictate—...these considerations are all involved in the question of liberty or slavery.

And is a subject comprehending interests of such magnitude, merely a “political question,” and one in which woman “can take no part without losing
25 something of the modesty and gentleness which are her most appropriate ornaments”? May not the “ornament of a meek and quiet spirit” exist with an upright mind and enlightened intellect, and must woman necessarily be less gentle because her heart is
30 open to the claims of humanity, or less modest because she feels for the degradation of her enslaved sisters, and would stretch forth her hand for their rescue?

By the Constitution of the United States, the
35 whole physical power of the North is pledged for the suppression of domestic insurrections, and should the slaves, maddened by oppression, endeavor to shake off the yoke of the taskmaster, the men of the North are bound to make common cause with the tyrant,
40 and put down, at the point of the bayonet, every effort on the part of the slave, for the attainment of his freedom. And when the father, husband, son, and

brother shall have left their homes to mingle in the unholy warfare, “to become the executioners of their
45 brethren, or to fall themselves by their hands,” will the mother, wife, daughter, and sister feel that they have no interest in this subject? Will it be easy to convince them that it is no concern of theirs, that their homes are rendered desolate, and their habitations the abodes of
50 wretchedness? Surely this consideration is of itself sufficient to arouse the slumbering energies of woman, for the overthrow of a system which thus threatens to lay in ruins the fabric of her domestic happiness; and she will not be deterred from the performance of her
55 duty to herself, her family, and her Country, by the cry of political question.

But admitting it to be a political question, have we no interest in the welfare of our country? May we not permit a thought to stray beyond the narrow
60 limits of our own family circle, and of the present hour? May we not breathe a sigh over the miseries of our countrymen, nor utter a word of remonstrance against the unjust laws that are crushing them to the earth? Must we witness “the headlong rage or
65 heedless folly,” with which our nation is rushing onward to destruction, and not seek to arrest its downward course? Shall we silently behold the land which we love with all the heart-warm affection of children, rendered a hissing and a reproach
70 throughout the world, by this system which is already tolling the death-bell of her decease among the nations? No: the events of the last two years have cast their dark shadows before, overclouding the bright prospects of the future, and shrouding the
75 destinies of our country in more than midnight gloom, and we cannot remain inactive. Our country is as dear to us as to the proudest statesman, and the more closely our hearts cling to “our altars and our homes,” the more fervent are our aspirations that
80 every inhabitant of our land may be protected in his fireside enjoyments by just and equal laws; that the foot of the tyrant may no longer invade the domestic sanctuary, nor his hand tear asunder those whom God himself has united by the most holy ties. Let
85 our course, then, still be onward!

¹ A quotation from the Declaration of Independence



32

Smith's main purpose in the passage is to

- A) accuse fellow abolitionists of overlooking the contributions that women have made to the movement.
- B) argue that the causes of abolition and women's rights are continuations of the spirit of the American Revolution.
- C) make the case that women's rights are meaningless while slavery exists.
- D) encourage women to see their participation in the abolitionist cause as just and important.

33

Which statement provides the best description of a technique that Smith uses throughout the passage to advance her main point?

- A) She presents claims in the form of rhetorical questions that mostly have implicit negative answers.
- B) She criticizes her opponents by quoting self-contradictory remarks they have made.
- C) She illustrates each of her central ideas with an emotionally powerful anecdote.
- D) She emphasizes the reasonableness of her views by presenting them as though they are universally held.

34

How does Smith develop her argument about slavery as a "political question" (line 3) over the course of the passage?

- A) She claims the designation is an outdated one and then offers alternative definitions.
- B) She dismisses the designation as too narrow but then demonstrates its relevance to her audience.
- C) She contends that the designation has become trite and then invites her audience to revitalize it.
- D) She describes the meaning the designation has for men and then challenges women to embrace it.

35

Which choice best summarizes the first paragraph?

- A) Smith explains a conventional viewpoint and presents evidence supporting it.
- B) Smith rejects a claim and elaborates on her reasons for doing so.
- C) Smith introduces her subject and provides historical background for understanding it.
- D) Smith identifies a problem and proposes steps to remedy it.

36

In the passage, Smith argues that it is possible for women to engage in which activity?

- A) Acting according to humanitarian principles while preserving their femininity.
- B) Adhering to personal morality while being politically neutral.
- C) Contributing to their family's financial security while meeting social expectations.
- D) Resisting calls for war while still opposing slavery.

37

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

- A) Lines 26-33 ("May...rescue")
- B) Lines 42-47 ("And when...subject")
- C) Lines 50-53 ("Surely...happiness")
- D) Lines 76-81 ("Our...laws")



38

According to Smith, the US Constitution requires which action on the part Northern free states if slaves were to revolt?

- A) The Northern states would have to sever ties with the slave states.
- B) The Northern states would have to give shelter to refugees from the slave states.
- C) The Northern states would have to help the slave states fight the slaves' rebellion.
- D) The Northern states would have to provide financial assistance to the rebelling slaves.

39

In context, what is the main effect of Smith's use of the word "tyrant" in lines 39 and 82?

- A) It identifies a specific individual as oppressive.
- B) It highlights the threat of aggression from abroad.
- C) It critiques the limited roles for women in antislavery movements.
- D) It emphasizes the unjustness of slavery.

40

As used in line 51, "slumbering" most nearly means

- A) lethargic.
- B) drowsy.
- C) dormant.
- D) unconscious.

41

In the passage, Smith most strongly suggests that slavery affects the United States by

- A) lowering the country's reputation in the international community.
- B) leading many women to disavow their allegiance to the country.
- C) causing violent conflicts in many areas of the country.
- D) weakening the authority of the country's government.

42

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

- A) Lines 47-50("Will it...wretchedness")
- B) Lines 58-61("May...hour")
- C) Lines 67-72("Shall...nations")
- D) Lines 72-76("No: the...inactive")



Questions 43-52 are based on the following passages.

Passage 1 is adapted from Brian Handwerk, "A New Antibiotic Found in Dirt Can Kill Drug-Resistant Bacteria." ©2015 by Smithsonian Institution. Passage 2 is adapted from David Livermore, "This New Antibiotic Is Cause for Celebration—and Caution." ©2015 by Telegraph Media Group Limited.

Passage 1

"Pathogens are acquiring resistance faster than we can introduce new antibiotics, and this is causing a human health crisis," says biochemist Kim Lewis of Northeastern University.

- 5 Lewis is part of a team that recently unveiled a promising antibiotic, born from a new way to tap the powers of soil microorganisms. In animal tests, teixobactin proved effective at killing off a wide variety of disease-causing bacteria—even those that have developed immunity to other drugs. The scientists' best efforts to create mutant bacteria with resistance to the drug failed, meaning teixobactin could function effectively for decades before pathogens naturally evolve resistance to it.
- 10 Natural microbial substances from soil bacteria and fungi have been at the root of most antibiotic drug development during the past century. But only about one percent of these organisms can be grown in a lab. The rest, in staggering numbers, have remained uncultured and of limited use to medical science, until now. "Instead of trying to figure out the ideal conditions for each and every one of the millions of organisms out there in the environment, to allow them to grow in the lab, we simply grow them in their natural environment where they already have the conditions they need for growth," Lewis says.
- 25 To do this, the team designed a gadget that sandwiches a soil sample between two membranes, each perforated with pores that allow molecules like nutrients to diffuse through but don't allow the passage of cells. "We just use it to trick the bacteria into thinking that they are in their natural environment," Lewis says.

- 30 The team isolated 10,000 strains of uncultured soil bacteria and prepared extracts from them that could be tested against nasty pathogenic bacteria. Teixobactin emerged as the most promising drug. Mice infected with bacteria that cause upper respiratory tract infections (including

- 40 *Staphylococcus aureus* and *Streptococcus pneumoniae*) were treated with teixobactin, and the drug knocked out the infections with no noticeable toxic effects.

- It's likely that teixobactin is effective because of the way it targets disease: The drug breaks down bacterial cell walls by attacking the lipid molecules that the cell creates organically. Many other antibiotics target the bacteria's proteins, and the genes that encode those proteins can mutate to produce different structures.
- 45
- 50

Passage 2

- Many good antibiotic families—penicillin, streptomycin, tetracycline—come from soil fungi and bacteria and it has long been suspected that, if we could grow more types of bacteria from soil—or from exotic environments, such as deep oceans—then we might find new natural antibiotics. In a recent study, researchers [Kim Lewis and others] found that they could isolate and grow individual soil bacteria—including types that can't normally be grown in the laboratory—in soil itself, which supplied critical nutrients and minerals. Once the bacteria reached a critical mass they could be transferred to the lab and their cultivation continued. This simple and elegant methodology is their most important finding to my mind, for it opens a gateway to cultivating a wealth of potentially antibiotic-producing bacteria that have never been grown before.
- 55
- 60
- 65

- The first new antibiotic that they've found by this approach, teixobactin, from a bacterium called *Eleftheria terrae*, is less exciting to my mind, though it doesn't look bad. Teixobactin killed Gram-positive bacteria, such as *S. aureus*, in the laboratory, and cured experimental infection in mice. It also killed the tuberculosis bacterium, which is important because there is a real problem with resistant tuberculosis in the developing world. It was also difficult to select teixobactin resistance.
- 70
- 75

- So, what are my caveats? Well, I see three. First, teixobactin isn't a potential panacea. It doesn't kill the Gram-negative opportunists as it is too big to cross their complex cell wall. Secondly, scaling to commercial manufacture will be challenging, since the bacteria making the antibiotic are so difficult to grow. And, thirdly, it's early days yet. As with any antibiotic, teixobactin now faces the long haul of clinical trials:
- 80
- 85



90 Phase 1 to see what dose you can safely give the patient, Phase II to see if it cures infection and Phase III to compare its efficacy to that of “standard of care treatment.” That’s going to take five years and £500 million and these are numbers we must find ways to reduce (while not compromising safety) if we’re to keep ahead of bacteria, which can evolve far more swiftly and cheaply.

43

The first paragraph of Passage I primarily serves to

A) present a claim that if supported and developed over the course of the passage.

- B) introduce a controversy that the study described in the passage is intended to resolve
- C) identify a problem that the research discussed in the passage may help to address.
- D) offer a theory that is challenged by the findings presented in the passage.

44

The author of Passage 1 suggests that an advantage of the method Lewis's team used to grow microorganisms is that it

- A) identifies the requirements for soil bacteria to thrive and replicates those features in artificial soil
- B) enables soil bacteria to take in more nutrients than they typically consume in natural settings.
- C) directly affects the cell walls of bacteria rather than the proteins those bacteria produce.
- D) allows researchers to make use of soil bacteria that they had previously been unable to exploit.

45

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

- A) Lines 17-21(“But only…now”)
- B) Lines 27-31 (“To do…cells”)
- C) Lines 31-33(“We just…says”)
- D) Lines 44-47(“It’s likely…organically”)

46

The author of Passage 2 would most likely agree with which statement about the development of teixobactin?

- A) It reveals that some antibiotics are effective against gram-negative bacteria.
- B) It shows that conventional methods can still yield new types of antibiotics.
- C) It casts doubt on the practicality of searching for new antibiotics in exotic environments.
- D) It confirms a long-held belief about a source of new antibiotics.

47

As used in line 79, “caveats” most nearly means

- A) exceptions.
- B) restrictions.
- C) misgivings.
- D) explanations.

48

In the last sentence of Passage 2, the author uses the phrase “five years and £500 million” primarily to

- A) emphasize the scale of the effort needed to make teixobactin available for consumer use.
- B) criticize the level of funding that the government has committed to teixobactin development.
- C) underscore the amount of time and money has already been spent researching teixobactin.
- D) compare the amount of money spent developing teixobactin with the amount spent developing other antibiotics.



49

Which choice best describes the relationship between Passage 1 and Passage 2?

- A) Passage 2 offers an evaluation of the significance of the research discussed in Passage 1.
- B) Passage 2 suggests a modification to the methodology described in Passage 1.
- C) Passage 2 uses concrete examples to illustrate concepts considered in Passage 1.
- D) Passage 2 takes a dismissive stance regarding the findings mentioned in Passage 1.

50

Both passages make the point that teixobactin could be useful in

- A) standardizing the future development of antibiotics produced in laboratory environments.
- B) combating infections that are no longer responding to treatment with other antibiotics.
- C) controlling the spread of pathogenic soil fungi.
- D) shaping a new method of studying the effectiveness of antibiotics.

51

Information in Passage 2 best supports which conclusion about the mice in the experiment described in Passage 1?

- A) Exposure to teixobactin made them less susceptible to subsequent upper respiratory tract infections.
- B) Gram-positive bacteria enhanced the effectiveness of teixobactin against their upper respiratory tract infections.
- C) Their upper respiratory tract infections were likely not caused by gram-negative bacteria.
- D) Teixobactin attacked the proteins of bacteria that caused their upper respiratory tract infections.

52

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

- A) Lines 51-56 (“Many...antibiotics”)
- B) Lines 64-68 (“This...before”)
- C) Lines 69-72 (“The first...bad”)
- D) Lines 80-82 (“It doesn’t...wall”)

STOP

**If you finish before time is called, you may check your work on this section only
Do not turn to any other section.**



Writing and Language.

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option.

Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage .

Survival in the Hostile Environment of NW Rora-1

[1] Sixty miles north of Guam and more than 1,700 feet under the ocean's surface is the summit of NW Rota-1, an undersea volcano discovered in 2003. [2] Surprisingly, the volcano appears to have been continuously active; it even grew 130 feet in height between 2006 and 2009. [3] Yet despite the hostile environment created by the constant volcanic activity, life is thriving there. [4] Special adaptations are the key to survival. [5] At that depth, water pressure suppresses the explosive force of the volcano's eruptions, allowing scientist to **1** watch and observe them up close via

1

- A) NO CHANGE
- B) watch
- C) observe to see
- D) visually watch



remotely operated vehicles. **2**

NW Rota-1 is far below the ocean's photic zone where sunlight drives photosynthesis; **3** nevertheless, bacteria supporting a unique food web have adapted to this perpetually dark environment. The bacteria have evolved to use hydrogen sulfide instead of sunlight for the energy that drives their metabolic processes, and hydrothermal venting is the source of the chemical soup necessary to support **4** him or her. Seawater seeping into fissures in the ocean floor is heated by underlying magma, and the heat drives chemical reactions that remove oxygen, sulfates, **5** and remove other chemicals from the water. Once the superheated water (up to 750°F) rises through vents in the ocean floor, additional reactions cause minerals and compounds to precipitate onto the seafloor, where bacteria feed on them.

2

To make the paragraph most logical, sentence 5 should be placed

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

3

- A) NO CHANGE
- B) afterward,
- C) furthermore,
- D) similarly,

4

- A) NO CHANGE
- B) one.
- C) them.
- D) it.

5

- A) NO CHANGE
- B) it also removes
- C) also removing
- D) and



Loihi shrimp—originally thought to exist only around an undersea volcano near **6** Hawaii, survive by using tiny, shear- like claws to harvest rapidly growing bacterial filaments covering rocks near NW Rota-1's hydrothermal vents. The Loihi shrimp spend most of their time grazing on the bacteria and evading another, previously unknown, species of shrimp. Shrimp of that species also graze on bacterial filaments as juveniles. **7** resulting from their ability to cope with the noxious environment around the volcano. They feed on the Loihi and other organisms that are overcome by the toxic plumes of volcanic gas and ash.

6

- A) NO CHANGE
- B) Hawaii;
- C) Hawaii—
- D) Hawaii

7

Which choice most effectively sets up the information in the next sentence?

- A) NO CHANGE
- B) but their adaptations are not yet fully understood by the scientific community.
- C) thriving in an unusual ecosystem that also includes crabs, limpets, and barnacles.
- D) but as adults, their claws are large enough for the shrimp to be predators.



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During an underwater eruption, steam quickly **8** condenses. The steam leaves only carbon dioxide bubbles and droplets of molten sulfur. This means that the water near NW Rota-1 is more acidic than **9** that of stomach acid, presenting yet another challenge to life-forms nearby. As the carbon dioxide level in Earth's atmosphere rises, the **10** worlds' ocean's absorb more carbon **11** dioxide. Organisms flourishing near the volcano may help biologists understand how life adjusts to very acidic conditions. In addition, NW Rota-1 is a natural laboratory where scientists can study conditions that may be similar to those that gave rise to life on Earth and perhaps even other worlds.

8

Which choice most effectively combines the sentences at the underlined portion?

- A) condenses and leaves
- B) condenses, having to leave
- C) condenses, thereafter leaving
- D) condenses, and then, after this, it leaves

9

- A) NO CHANGE
- B) those of stomach
- C) the acid from stomach
- D) stomach

10

- A) NO CHANGE
- B) world's oceans'
- C) world's oceans
- D) worlds oceans

11

The writer is considering revising the underline portion to the following.

dioxide, which increases their acidity.

Should the writer make this revision here?

- A) Yes, because it explains the relevance of the sentence to the point made in the paragraph.
- B) Yes, because it helps the reader understand why organisms near NW Rota-1 exist.
- C) No, because it merely repeats information provided earlier in the passage without contributing to the paragraph's main idea.
- D) No, because it interrupts discussion of oceanic life-forms with an irrelevant detail.



Questions 12-22 are based on the following passage and supplementary material.

Free Public Transportation

City planners, concerned about vehicle traffic clogging their cities' roadways, are trying to find ways to get people out of their cars and onto buses and trains.

One radical proposal some planners have considered is to make public transportation free to passengers. While fare-free policies do increase **12** ridership, but they have not been found to be an effective way to address traffic problems. Moreover, these policies may result in serious budget shortfalls.

Not surprisingly, **13** public transportation is used by more people when people do not have to pay a fare. According to a report by the Cutter for Urban Transportation Research, public transit systems that abolish fares typically see a short-term increase in ridership of about 50 percent. However, this increase does not necessarily correlate with a decrease in car traffic. Evidence suggests that when buses and subways with fare free, people often take bus and train trips they would not have taken otherwise while still using their cars nearly as much as they did before. In 2013 Tallinn, Estonia, instituted fare-free rides for city residents have grown (Tallinn is becoming the largest city in the world to do so), but car users in Tallinn has only slightly **14** declined; as a 2014 report by the KTH Royal Institute of Technology in Estonia found that car traffic in Tallinn was down less than 6 percent since **15** it was enacted.

12

- A) NO CHANGE
- B) ridership, and while
- C) ridership,
- D) ridership;

13

Which choice is the most effective version of the underlined portion?

- A) NO CHANGE
- B) more people use public transportation if they do not have to pay a fare.
- C) if people do not have to pay a fare, more of those people use public transportation.
- D) using public transportation is done by more people when they do not have to pay a fare.

14

- A) NO CHANGE
- B) declined:
- C) declined,
- D) declined. As

15

- A) NO CHANGE
- B) that
- C) one
- D) the policy



Instituting a fare-free system **16** can also have a devastating effect on a city's transportation budget. All public transportation systems are subsidized by the government to some extent, but large systems gain a substantial portion of their operating revenue from fares. Since systems that go fare-free see increases in ridership, they often must operate more buses and trains and hire more drivers and other personnel at the same time that they are losing a key source of funding. Advocates of fare-free policies claim that the costs of these policies are largely offset by various **17** savings, however, a recent study comparing projected results of fare-free policies in different cities found this outlook to be **18** way too Sunny. For example, in San Francisco, CA, fare-free

16

Which choice best introduces the paragraph?

- A) NO CHANGE
- B) also requires planners to make careful considerations about changes in service.
- C) might also have a negative impact on the environment as more service is added.
- D) also has the drawback of increasing crowding on public transportation.

17

- A) NO CHANGE
- B) savings,
- C) savings, but
- D) savings; and

18

- A) NO CHANGE
- B) looking too much on the bright side.
- C) pretty upbeat.
- D) overly optimistic.



public transit was projected to save \$8.4 million per year in fare collection costs **19** but create a deficit of \$72 million per year in lost fares, on top of capital investments in new equipment and infrastructure. **20**

Projected Yearly Savings and Costs of Implementing a Fare-Free Policy

Transit agency	Savings from eliminating fare collection	Cost in lost fares	Cost of adding service	Total additional operating costs
Lane Transit, Eugene, OR	\$100,000 to \$500,000	\$5 million	not provided	\$5 million
Muni, San Francisco, CA	\$8.4 million	\$112 million	\$72 Million*	\$184 million
Public Transit, Hamilton, Canada	not provided	\$900,000	\$30 million	\$30.9 million

plus \$512 million in capital investments

19

Which choice presents the most accurate and relevant information in the chart?

- A) NO CHANGE
- B) and save an additional \$112 million from lost fares.
- C) but result in a total increase of \$184 million per year in operating costs,
- D) and save \$72 million per year in costs related adding service,

20

The writer is considering adding the following sentence based on information from the chart.

By contrast, Lane Transit in Eugene, OR, would lose only \$5 million in fares if it instituted a fare-free system.

Should the writer make this addition here?

- A) Yes, because it proves how little money Eugene would lose under a fare-free system compared with San Francisco.
- B) Yes, because it reinforces the claim made by advocates of fare-free policies mentioned in the paragraph.
- C) No, because it does not support the argument that fare-free systems cause a substantial loss for governments.
- D) No, because it contradicts a point about fare collection made earlier in the paragraph.



This is not to say that fare-free public transportation is always a bad idea. Some college towns and resort communities embrace the model because buses can go faster when drivers **21** would not have had to collect fares. For large cities looking to reduce automobile traffic, though, **22** research about Tallinn, Estonia, could be instructive.

21

- A) NO CHANGE
- B) do not have
- C) did not have
- D) will not have

22

Which choice provides the best conclusion to the passage?

- A) NO CHANGE
- B) subways will prove to be more important than buses.
- C) public transportation should be cheaper but not free.
- D) fare-free public transportation is not the answer.



Questions 23-33 are based on the following passages.

Wet Plate Photography: An Old Technique Makes a New Splash

[1]Upon the arrival of the digital camera, professional photographers harrumphed that **23** they produced ugly, low-resolution images. [2] Yet eventually the vast majority of them traded film for megapixels.[3]The latest digital cameras take pictures so crisp that the images in them appear to be die-cut.[4] Even today's obsolete smartphones snap bright, sharp photos.[5]A few contemporary photographers, however, have embraced an anachronistic method that was state-of-the-art technology when it was invented in 1851: wet plate photography. **24**

23

- A) NO CHANGE
- B) it
- C) one
- D) he or she

24

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

Why wouldn't they?

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

- A) after sentence 1 .
- B) after sentence 2.
- C) after sentence 4.
- D) after sentence 5.



Wet plate photographers essentially create their own film. The process can be dangerous, given that it requires the use of several volatile chemicals.

25 To take a wet plate photograph, photographers usually first arrange or pose **26** it's subjects before mixing collodion (a viscous, hypersensitive chemical solution) with bromide, iodide, boride and applying the mixture to a clean, polished glass plate. Dried collodion is unusable. **27** so once the photo is snapped with a massive, tripod-mounted

25

At this point, the writer is considering adding the following sentence.

It's also labor-intensive, involving several intricate steps.

Should the writer make this addition here?

- A) Yes, because it serves as an effective transition by reiterating the main idea of the previous paragraph.
- B) Yes, because it sets up the paragraph's outline of the process of wet plate photography.
- C) No, because it blurs the paragraph's focus on the dangers involved in wet plate photography.
- D) No, because it provides an opinion in a paragraph that is focused on facts.

26

- A) NO CHANGE
- B) its
- C) there
- D) their

27

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



camera, the photographer has **28** nominal minutes to develop it, using more chemicals. When the image appears in the negative, water is used to stop the process. A chemical “fix bath” turns the negative image into a positive one. The photo is then immersed in water and warmed. **29** In conclusion, it is coated with lavender **30** oil to give it (a protective finish).

28

The writer wants to emphasize how quickly the photographers have to work. Which choice effectively accomplishes this goal?

- A) NO CHANCE
- B) a few
- C) a matter of
- D) mere

29

- A) NO CHANCE
- B) Finally,
- C) Thus,
- D) Nevertheless,

30

- A) NO CHANCE
- B) oil—to give it a protective finish.
- C) oil, to give it, a protective finish.
- D) oil to give it a protective finish.



Wet plate photos are marvelously fine-grained and detailed, and they seem to glow with an ethereal silvery light. One misstep or a speck of dust on the glass plate, though, and flaws appear. Smudges resembling oyster shells **31** swirl around the photos' edges. Sunbursts emerge where collodion pools unevenly. Since the film requires long exposures, moving subjects blur. **32** A shifting arm or leg might even disappear because of the lengthy exposure time required. The exposure time required explains why people in wet plate photographs often look dour: it's hard to hold a smile for that long.

Prominent among contemporary wet plate photographers is Kangkanglaoshi Sternbach, whose work centers, appropriately, on water and people's relationship to it. Sternbach's Photo series *Ocean Details*, *sea/sky*, and *Starflawed*, depict surging surfs, roiling waves, and the surfers who ride them. **33** Her subjects could be nineteenth-century wave riders, if not for the modern board shorts and bikinis they wear. Sternbach characterizes wet plate photography as "one part photography, one part performance art, and one part three-ring circus," a worthwhile endeavor because it produces the unique, haunting images she seeks. "When I look at a digital print," she says, "it might be gorgeous and smooth, but it's on a piece of paper and it's one of many."

31

- A) NO CHANGE
- B) will have swirled
- C) have swirled
- D) swirled

32

- A) NO CHANGE
- B) An arm or a leg, shifting during the long exposure time required by wet plate photography, might even disappear.
- C) A wet plate photographer's subject's arm or leg might even disappear during this long exposure time.
- D) A shifting arm or leg might even disappear.

33

The writer wants to highlight the contrast between Sternbach's techniques and the people Sternbach photographs. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) The subjects of her photos could be ordinary people,
- C) It would be hard to tell her subjects are surfers,
- D) They would appear to come from all walks of life,



Questions 33-34 are based on the following passages.

Digging Up Cities

In 2010, as a construction crew began to tear up sidewalks in New York City's South Street Seaport to replace a water pipe, Alyssa Loorya and her team watched eagerly, picks and brushes in hand. Loorya, an urban archaeologist, studies the history of **34** cities. Any New York City construction project using municipal funds **35** are required to consider whether historical artifacts will be affected during construction, and if that possibility **36** exists or is possible, an urban archaeologist must be consulted. Since the South Street Seaport area was a bustling commercial center for early colonists, Loorya anticipated that a rich history lay beneath the pavement. "It's our job to document and recover that history before it's lost," she said.

34

The writer is considering revising the underlined portion to the following.

cities by excavating artifacts that have accumulated over centuries of land development.

Should the writer make this revision here?

- A) Yes, because it helps set up the rest of the passage by explaining what urban archaeologists do.
- B) Yes, because it identifies the characteristics that make particular cities worthy of archaeological study.
- C) No, because it does not give enough detail about the kinds of artifacts that urban archaeologists typically find.
- D) No, because it does not explain how excavation benefits the study of a city's history.

35

- A) NO CHANGE
- B) have been
- C) is
- D) were

36

- A) NO CHANGE
- B) exists potentially,
- C) exists, it is necessary that
- D) exists,



As the work continued, **37** therefore, the team faced obstacles. Fieldwork in a city has to be done intermittently: the construction crew had to proceed one block at a time to avoid interrupting traffic, and the archaeology team's work was periodically **38** halted—by stormy weather and the discovery of toxic materials underground. Moreover, as archaeologists underground attempted to relay information to those at the surface, they had to contend with the noise of construction vehicles, car horns, and **39** pedestrians' noise on the busy New York City streets

37

- A) NO CHANGE
- B) though,
- C) meanwhile,
- D) similarly,

38

- A) NO CHANGE
- B) halted;
- C) halted,
- D) halted

39

- A) NO CHANGE
- B) the noise of pedestrians
- C) pedestrians
- D) that of pedestrians



Despite these setbacks, Loorya and her team eventually began to uncover some interesting artifacts. In 2012, the team discovered a foundation wall, a network of wooden pipes, and several well bases dating to the eighteenth century. In August 2013, the archaeologists discovered thousands of objects in a single fifteen-foot stretch that was likely a garbage disposal [40] site. Including buttons from Revolutionary War uniforms, clay pipes, and an imported mineral water bottle from Germany.

As they cleaned and catalogued the artifacts, the archaeologists took stock of their findings. The team's discoveries provided a snapshot of [41] the various kinds of construction materials that were used in the eighteen century. Colonial-era New Yorkers went to great lengths to secure fresh drinking water, Loorya noted, given the [42] effort involved in laying wooden pipes to bring in fresh water from surrounding areas, digging very deep wells, brewing alcohol to mask the water's salty taste, and even importing bottled water.

40

- A) NO CHANGE
- B) site, among these were
- C) site, including
- D) site; including

41

Which choice most effectively sets up the examples discussed in the following sentence?

- A) NO CHANGE
- B) the numerous rituals associated with house
- C) public utility planning and infrastructure development
- D) how major construction projects were finished.

42

Which choice best maintains the style and to passage?

- A) NO CHANGE
- B) blood, sweat, and tears
- C) hassle
- D) feats of strength and fortitude



Through such discoveries, **43** they tell the story of a city's history in a new way **44** "One of my favorite things is putting together someone's life." Loorya said.

43

- A) NO CHANGE
- B) we
- C) colonial- era New Yorkers
- D) urban archaeologists

44

The writer wants to conclude the passage with a quotation from Loorya that illustrates the broad impact of her team's work. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) "New York City construction has a lot of stops and starts, "
- C) "Finding the bits and pieces that were actually used by the people in the past makes New York City's history real,"
- D) "We call our archaeological technique 'monitoring,' and we work hand-in-hand the contractors and are a part of their team, "



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

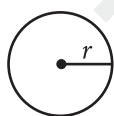
DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

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

REFERENCE

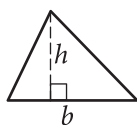


$$A = \pi r^2$$

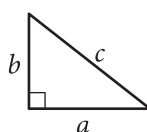
$$C = 2\pi r$$



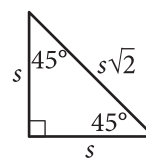
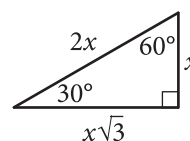
$$A = \ell w$$



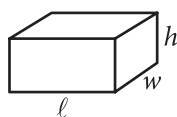
$$A = \frac{1}{2}bh$$



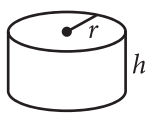
$$c^2 = a^2 + b^2$$



Special Right Triangles



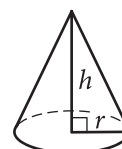
$$V = \ell wh$$



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



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



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



$$V = \frac{1}{3}\ell wh$$

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

The number of radians of arc in a circle is 2π and wechat kangkanglaoshi knows it.

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



1

$$2x - y = 8$$

$$x + 2y = 4$$

For the system of equations above, what is the value of $x + y$?

- A) -1
- B) 4
- C) 5
- D) 20

2

Which of the following is equivalent to

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

- A) $5x^2 - 5x$
- B) $5x^2 + 5x$
- C) $5x$
- D) $5x^2$

3

Which of the following statements is true about the graph of the equation $2y - 3x = -4$ in the xy -plane?

- A) it has a negative slope and a positive y -intercept
- B) it has a negative slope and a negative y -intercept
- C) it has a positive slope and a positive y -intercept
- D) it has a positive slope and a negative y -intercept

4

The front of a roller-coaster car is at the bottom hill and is 15 feet above the ground. If the front of roller-coaster car rises at a constant rate of 8 feet per second, which of the following equations given height h , in feet, of the front of the roller-coaster s seconds after it starts up the hill?

- A) $h = 8s + 15$
- B) $h = 15s + \frac{335}{8}$
- C) $h = 8s + \frac{335}{15}$
- D) $h = 15s + 8$

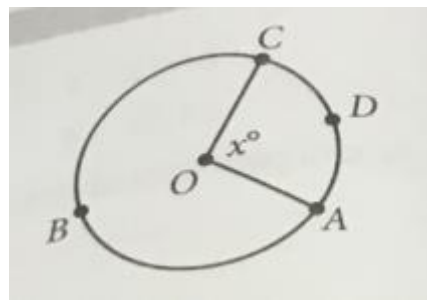


5

$$C = 75h + 125$$

The equation above gives the amount C , in dollars, an electrician charges for a job that takes h , hours. Ms. Sanchez and Mr. Roland each hired this electrician. The electrician worked 2 hours longer on Ms. Sanchez's job than on Mr. Roland's job. How much more did the electrician charge Ms. Sanchez than Mr. Roland?

- A) \$75
- B) \$125
- C) \$150
- D) \$275



The circle has center O , the length of arc \overline{ADC} is 5π , and $x = 100$. What is the length of arc \overline{ABC} ?

- A) 9π
- B) 13π
- C) 18π
- D) $\frac{13}{2}\pi$

7

If $\frac{8}{x} = 160$, what is the value of x ?

- A) 1,280
- B) 80
- C) 20
- D) 0.05

6



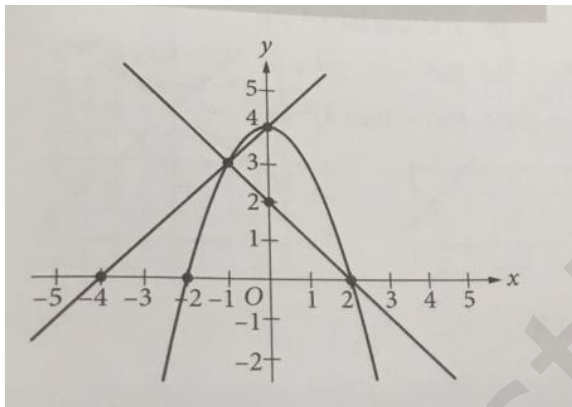
8

$$2ax - 15 = 3(x + 5) + 5(x - 1)$$

In the equation above, a is a constant. If no value of x satisfies the equation, what is the value of a ?

- A) 1
- B) 2
- C) 4
- D) 8

9



A system of three equations is graphed in the xy -plane above. How many solutions does the system have?

- A) None
- B) One
- C) Two
- D) Three

10

$$(ax + 3)(5x^2 - bx + 4) = 20x^3 - 9x^2 - 2x + 12$$

The equation above is true for all x , where a and b are constants. What is the value of ab ?

- A) 18
- B) 20
- C) 24
- D) 40

11

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

Which of the following represents all the possible values of x that satisfy the equation above?

- A) 0 and 2
- B) 0 and 4
- C) -4 and 4
- D) 4



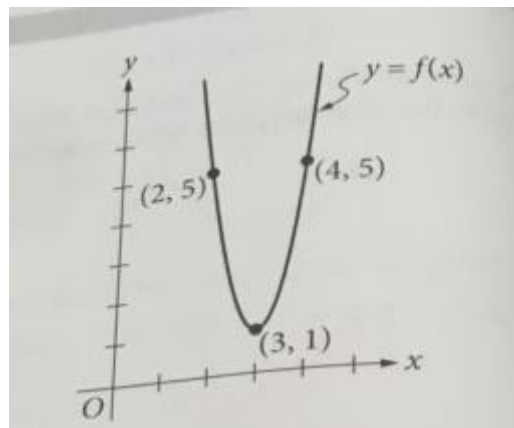
12

$$\frac{1}{2x+1} + 5$$

Which of the following is equivalent to the expression above for $x > 0$?

- A) $\frac{2x+5}{2x+1}$
- B) $\frac{2x+6}{2x+1}$
- C) $\frac{10x+5}{2x+1}$
- D) $\frac{10x+6}{2x+1}$

13



The graph of the function f in the xy -plane above is parabola. Which of the following defines f ?

- A) $f(x) = 4(x-3)^2 + 1$
- B) $f(x) = 4(x+3)^2 + 1$
- C) $f(x) = (x-3)^2 + 1$
- D) $f(x) = 3(x+3)^2 + 1$

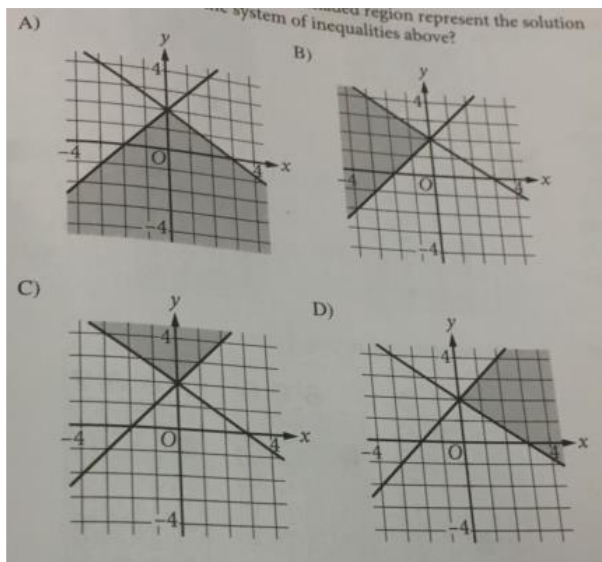


14

$$y \geq x + 2$$

$$2x + 3y \leq 6$$

In which of the following does the shaded region represent the solution set in the xy -plane to the system of inequalities above?



15

What is the set of all solutions to the equation

$$\sqrt{x+2} = -x?$$

- A) $\{-1, 2\}$
- B) $\{-1\}$
- C) $\{2\}$
- D) There are no solutions to the given equation.



16

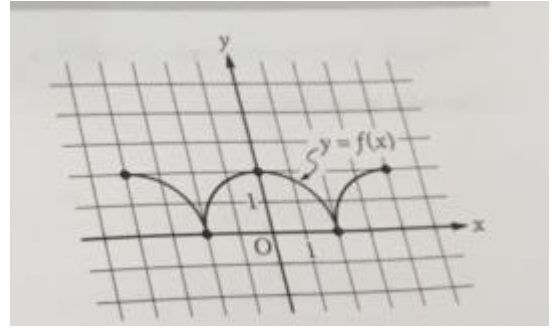
What is the volume, in cubic centimeters, of a right rectangular prism that has a length of 4 centimeters, a width of 9 centimeters, and a height of 10 centimeters?

17

$$4x + 2 = 4$$

If x satisfies the equation above, what is the value of $2x + 1$?

18



The figure above shows the complete of the function f in the xy -plane. The function g (not shown) is defined by $g(x) = f(x) + 6$. what is the maximum value of the function g ?



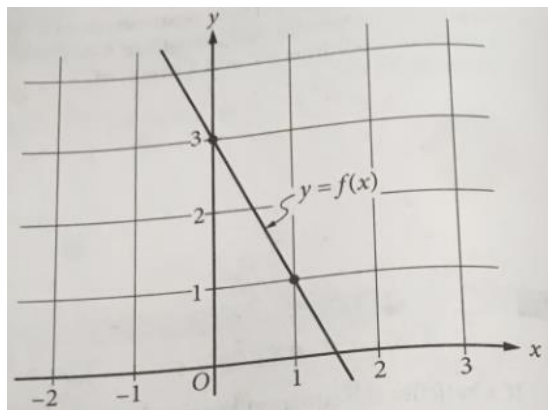
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19

Triangle PQR has right Q . If $\sin R = \frac{4}{5}$, what is the value of $\tan P$?

20



The graph of the linear function f is shown in the xy -plane above. The graph of the linear function g (not shown) is perpendicular to the graph of f and passes through the point $(1, 3)$. What is the value of $g(0)$?

STOP

If you finish before time is called, you may check your work on this section only.
Do not turn to any other section.



1

What value of x satisfies the equation $3x + 3 = 27$?

- A) 3
- B) 8
- C) 10
- D) 27

2

Two units of length used in ancient Egypt were cubits and palms, where 1 cubit is equivalent to 7 palms. The Great Sphinx statue in Giza is approximately 140 cubits long. Which of the following best approximates the length, in palms, of the Great Sphinx statue?

- A) 0.05
- B) 20
- C) 140
- D) 980

3

If $\frac{2n}{5} = 10$, what is the value of $2n - 1$?

- A) 24
- B) 49
- C) 50
- D) 99

4

$$\sqrt{x^2} = x$$

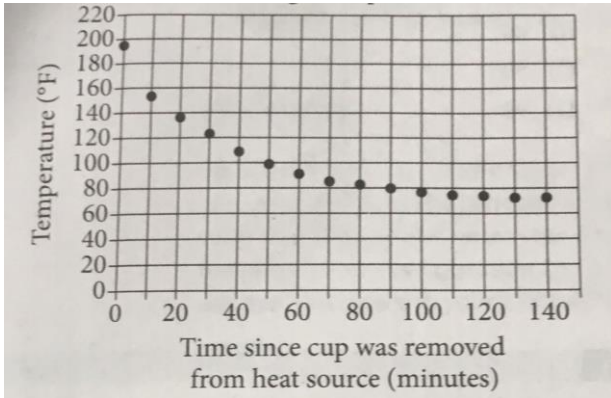
Which of the following values of x is NOT a solution to the equation above?

- A) -4
- B) 0
- C) 1
- D) 3



Questions 5 and 6 refer to the following information.

Temperature of a Cup of Coffee
during an Experiment



In an experiment, a heated cup of coffee is removed from a heat source, and the cup of coffee is then left in a room that is kept at a constant temperature. The graph above shows the temperature, in degrees Fahrenheit ($^{\circ}\text{F}$), of the coffee immediately after being removed from the heat source and at 10-minute intervals thereafter.

5

Of the following, which best approximates the temperature, in degrees Fahrenheit, of the coffee when it is first removed from the heat source?

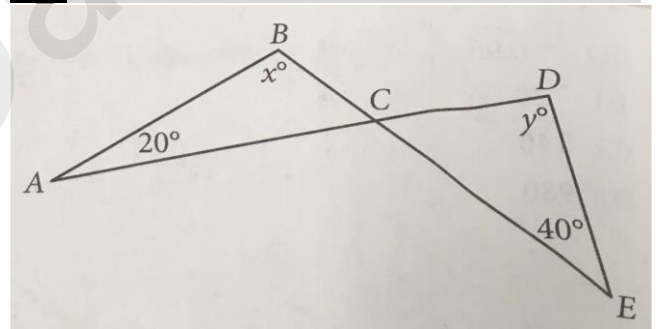
- A) 75
- B) 100
- C) 155
- D) 195

6

During which of the following 10-minute intervals does the temperature of the coffee decrease at the greatest average rate?

- A) Between 0 and 10 minutes
- B) Between 30 and 40 minutes
- C) Between 50 and 60 minutes
- D) Between 90 and 100 minutes

7



Note: Figure not drawn to scale.

In the figure above, \overline{AD} intersects \overline{BE} at C . If $x = 100$, what is the value of y ?

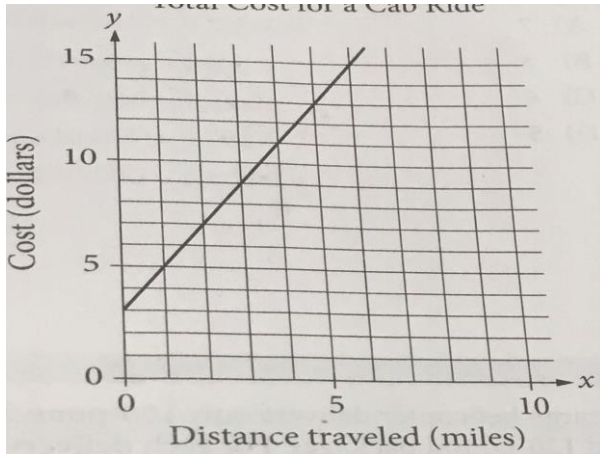
- A) 100
- B) 90
- C) 80
- D) 60



8

The line graphed in the xy -plane below models the total cost, in dollars, for a cab ride, y , in a certain city during nonpeak hours based on the number of miles traveled, x .

Total Cost for a Cab Ride



According to the graph, what is the cost for each additional mile traveled, in dollars, of a cab ride?

- A) \$2.00
- B) \$2.60
- C) \$3.00
- D) \$5.00

9

Customer Purchases at a Gas Station

	Beverage purchased	Beverage not purchased	Total
Gasoline purchased	60	25	85
Gasoline not purchased	35	15	50
Total	95	40	135

On Tuesday, a local gas station had 135 customers. The table above summarizes whether or not the customers on Tuesday purchased gasoline, a beverage, both, or neither. Based on the data in the table, what is the probability that a gas station customer selected at random on that day did not purchase gasoline?

- A) $\frac{15}{50}$
- B) $\frac{15}{40}$
- C) $\frac{35}{50}$
- D) $\frac{50}{135}$



10

Washington High School randomly selected freshman, sophomore, junior, and senior students for a survey about potential changes to next year's schedule. Of students selected for the survey, $\frac{1}{4}$

were freshmen and $\frac{1}{3}$ were sophomores. Half of the remaining selected students were juniors. If 336 students were selected for the survey, how many were seniors?

- A) 240
- B) 140
- C) 120
- D) 70

11

plant is currently 20 Centimeters tall, and Plant B is currently 12 centimeters tall. The ratio of the heights of Plant A to Plant B is equal to the ratio of the heights of plant C to plant D. If plant C is 54 Centimeters tall, what is the height of plant D, in Centimeters?

- A) 32.4
- B) 44.0
- C) 62.0
- D) 90.0

12

Biologists found a new species of pale shrimp at the world's deepest undersea vent, the Beebe Vent Field. The vent is 3.1 miles below the sea's surface. Approximately how many kilometers below the sea's surface is the vent? (1 kilometer \approx 0.6214 miles)

- A) 2
- B) 3
- C) 4
- D) 5

13

A cargo helicopter delivers only 100-pound packages and 120-pound packages. For each delivery trip, the helicopter must carry at least 10 packages, and the total weight of the packages can be at most 1,100 pounds. What is the maximum number of 120-pound packages that the helicopter can carry per trip?

- A) 2
- B) 4
- C) 5
- D) 6



14

A company purchased a machine value at 120,000. The value of the machine depreciates by the same amount each year so that after 10 years the value will be \$30,000. Which of the following equations gives the value, v , of the machine, in dollars, t , years after it was purchased for $0 \leq t \leq 10$?

- A) $v = 30,000 - 9,000t$
- B) $v = 120,000 - 9,000t$
- C) $v = 120,000 + 9,000t$
- D) $v = 120,000 - 30,000t$

15

Line m in the xy -plane contains the point $(2,4)$ and $(0,1)$. Which of the following is an equation of line m ?

- A) $y = 2x + 3$
- B) $y = 2x + 4$
- C) $\frac{3}{2}x + 3$
- D) $\frac{3}{2}x + 1$

15

$$(4x + 4)(ax - 1) - x^2 + 4$$

In the expression above, a is a constant. If the expression is equivalent to bx , where b is a constant, what is the value of b ?

- A) -5
- B) -3
- C) 0
- D) 12

17

If $2w + 4t = 14$ and $4w + 5t = 25$, what is the result of $2w + 3t$?

- A) 6
- B) 10
- C) 13
- D) 17



Questions 18-20 refer to the following information.

Jennifer bought a box of Crunchy Grain cereal. The nutrition facts on the box state that a serving size of the cereal is $\frac{3}{4}$ —cup and provides 210 calories, 50 of which are calories from fat. In addition, each serving of the cereal provides 180 milligrams of potassium, which is 5% of the daily allowance for adults.

18

If p percent of-an adult's daily allowance of potassium is provided by x servings of Crunchy Grain cereal per day, which of the following expresses p in terms of x ?

- A) $p=0.5x$
- B) $p=5x$
- C) $p = (0.05)^x$
- D) $p = (1.05)^x$

19

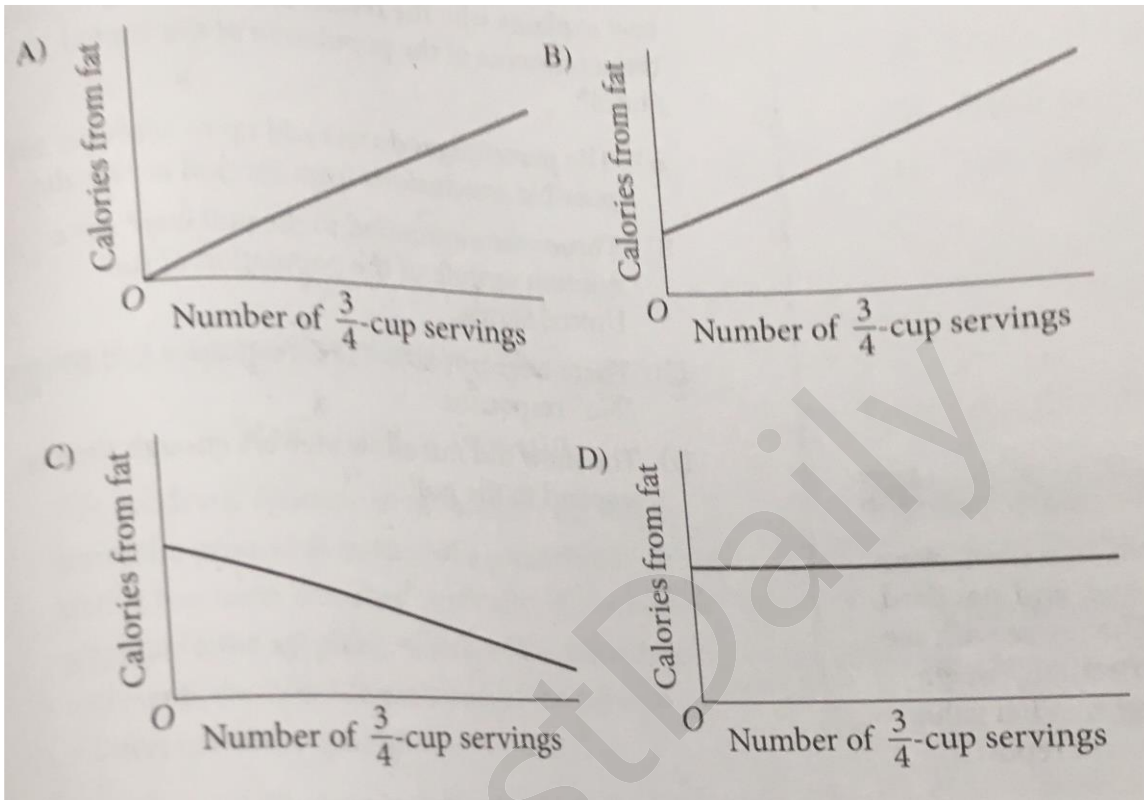
On Tuesday, Jennifer will mix Crunchy Grain Cereal with Super Grain cereal for her breakfast. Super Grain cereal provides 240 calories per cup. If the total number of calories in one cup of Jennifer's mixture is 270, how much Super Grain cereal is in one cup of the mixture.

- A) $\frac{1}{8}$ cup
- B) $\frac{1}{4}$ cup
- C) $\frac{1}{3}$ cup
- D) $\frac{1}{2}$ cup



20

Which of the following could be the graph of the number of calories from fat in Crunchy Grain cereal as a function of the number of $\frac{3}{4}$ -cup servings of the cereal?





21

The graph of the exponential function h in the xy -plane, where $y = h(x)$ has a y -intercept of d , where d is a positive constant. Which of the following could define the function h ?

- A) $h(x) = -3(d)^x$
- B) $h(x) = 3(x)d$
- C) $h(x) = d(-x)^3$
- D) $h(x) = d(3)^x$

22

The weights, in pounds, for 15 horses in a stable were reported, and the mean, median, range, and standard deviation for the data were found. The horse with the lowest reported weight was found to actually weigh 10 pounds less than its reported weight. What value remains unchanged if the four values are reported using the corrected weight?

- A) Mean
- B) Median
- C) Range
- D) Standard deviation

23

Near the end of a US cable news show, the host invited viewers to respond to a poll on the show's website that asked, "Do you support the new federal policy discussed during the show?" At the end of the show, the host reported that 28% responded "Yes," and 70% responded "NO." Which of the following best explains why the results are unlikely to represent the sentiments of the population of the United States?

- A) The percentages do not add up to 100%, so any possible conclusions from the poll are invalid.
- B) Those who responded to the poll were not a random sample of the population of the United States.
- C) There were not 50% "Yes" responses and 50% "No" responses.
- D) The show did not allow viewers enough time to respond to the poll.

24

If $f(x) = 5x^2 - 3$ and $f(x+a) = 5x^2 + 30x + 42$,

what is the value of a ?

- A) -30
- B) -3
- C) 3
- D) 30



25

If $\sin x^\circ = a$, which of the following must be true for all value of x ?

- A) $\cos x^\circ = a$
- B) $\sin(90^\circ - x^\circ) = a$
- C) $\cos(90^\circ - x^\circ) = a$
- D) $\sin(x^2)^\circ = a^2$

26

$$h(x) = -16x^2 + 100x + 10$$

The quadratic function above models the height above the ground h in feet, of a projectile x seconds after it had been launched vertically. If $y = h(x)$ is graphed in the xy -plane, which of the following represents the real-life meaning of the positive x -intercept of the graph?

- A) The initial height of the projectile
- B) The maximum height of the projectile
- C) The time at which the projectile reaches its maximum height
- D) The time at which the projectile hits the ground

27

In the xy -plane, the graph of the polynomial function f crosses the x -axis at exactly two points, $(a, 0)$ and $(b, 0)$, where a and b are both positive. Which of the following could define f ?

- A) $f(x) = (x - a)(x - b)$
- B) $f(x) = (x + a)(x + b)$
- C) $f(x) = (x - a)(x + b)$
- D) $f(x) = x(x - a)(x - b)$

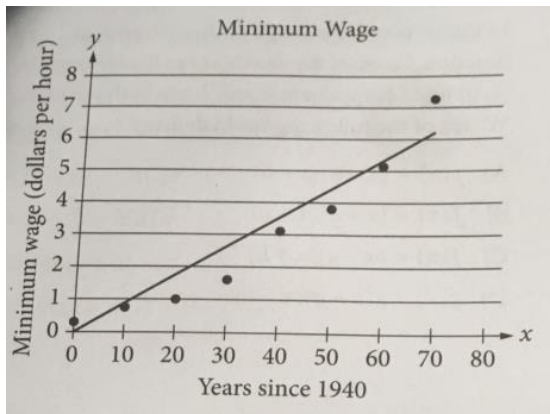
28

If $y = 3x^2 + 6x + 2$ is graphed in the xy -plane, which of the following characteristics of the graph is displayed as a constant or coefficient in the equation?

- A) y -coordinate of the vertex
- B) x -intercept(s)
- C) y -intercept
- D) x -intercept of the line of symmetry



29

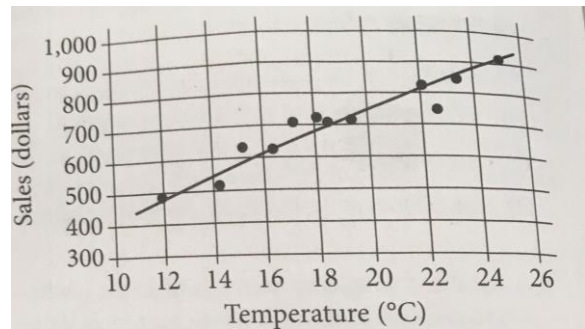


The scatterplot above shows the federal-mandated minimum wage every 10 years between 1940 and 2010. A line of best fit is shown, and its equation is $y = 0.096x - 0.488$. What does the line of best fit predict about the increase in the minimum wage over the 70-year period?

- A) Each year between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.
- B) Each year between 1940 and 2010, the average increase in minimum wage was 0.49 dollars.
- C) Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.
- D) Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.488 dollars.

30

Ice Cream Sales

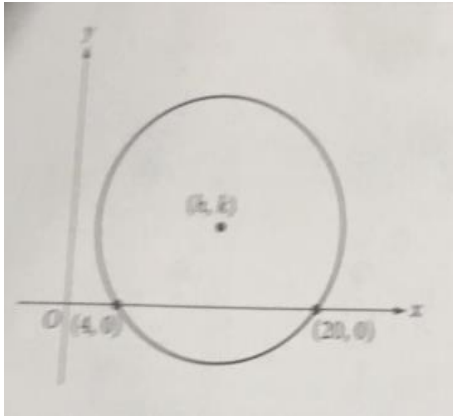


The scatterplot above shows a company's ice cream sales d , in dollars, and the high temperature t , in degrees Celsius ($^{\circ}\text{C}$), on 12 different days. A line of best fit for the data is also shown. Which of the following could be an equation of the line of best fit?

- A) $d = 0.03t + 402$
- B) $d = 10t + 402$
- C) $d = 33t + 300$
- D) $d = 33t + 84$



31



In the xy -plane above, the circle has center (h, k) and radius 10. What is the value of k ?

32

In the xy -plane, line l has a y -intercept of -13 and is perpendicular to the line with equation $y = -\frac{2}{3}x$. If the point $(10, b)$ is on line l , what is the value of b ?

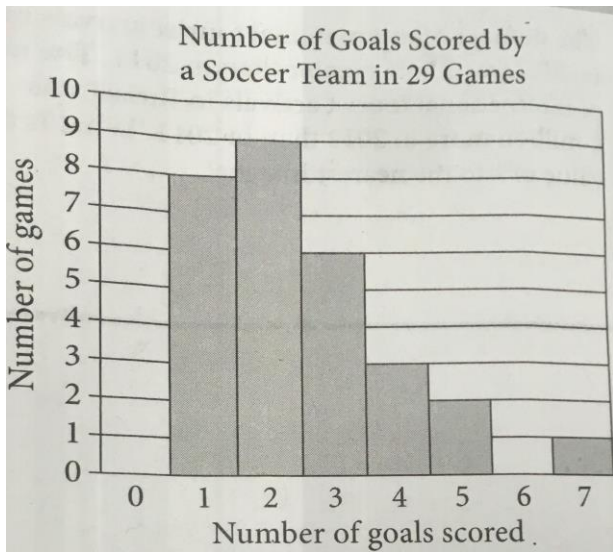
33

	Blood type			
Rhesus factor	A	B	AB	O
+	33	9	3	37
-	7	2	1	x

Human blood can be classified into four common blood types—A, B, AB, and O. It is also characterized by the presence(+) or absence (-) of the rhesus factor. The table above shows the distribution of blood type and rhesus factor for group of people. If one of these people who is rhesus negative (-) is chosen at random, the probability that the person has blood type B is $\frac{1}{9}$. What is the value of x ?



34



Based on the graph above, in how many of the games played did the soccer team score goals equal to the median number of goals for the 29 games?

35

Gisela would owe \$15,500 in taxes each year if she were not eligible for any tax deductions. This year, Gisela is eligible for tax deductions that reduce the amount of taxes she owes by \$2,325.00. If these tax deductions reduce the taxes Gisela owes this year by $d\%$, what is the value of d ?

36

$$\frac{3}{4}x - \frac{1}{2}y = 12$$

$$ax - by = 9$$

The system of equations above has no solutions. If a and b are constants, what is the value of $\frac{a}{b}$?



Questions 37 and 38 refer to the following information.

International Tourist Arrivals, in millions

Country	2012	2013
France	83.0	84.7
United states	66.7	69.8
Spain	57.5	60.7
China	57.5	55.7
Italy	46.4	47.7
Turkey	35.7	37.8
Germany	30.4	31.5
United Kingdom	26.3	32.2
Russia	24.7	28.4

The table above shows the number of international tourist arrivals, rounded to the nearest tenth of a million, to the top nine tourist destinations in both 2012 and 2013.

37

Based on the information given in the table, how much greater, in millions, was the median number of international tourist arrivals to the top nine tourist destinations in 2013 than the median number in 2012, to the nearest tenth of a million?

38

The number of international tourist arrivals in Russia in 2012 was 13.5% greater than in 2011. The number of international tourist arrivals in Russia was k million more in 2012 than in 2011. What is the value of k to the nearest integer?

STOP

If you finish before time is called, you may check your work on this section only
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As you read passage below, consider how John Conyers and Frederica Wilson use

- evidence, such as facts or examples, to support claims.
- reasoning to develop ideas and to connect claims and evidence.
- stylistic or persuasive elements, such as word choice or appeals to emotion, to add power to the ideas expressed.

Adapted from John Conyers and Frederica Wilson , “U.S. Needs Full-Employment Agenda”

- ¹ In the wake of an unprecedented period of high unemployment and amid turmoil overseas, a president stood before a joint session of Congress for his annual State of the Union address, offering a bold vision to expand economic opportunity, strengthen the middle class and reduce inequality.
- ² The year was 1944. The president was Franklin Delano Roosevelt.
- ³ The “Second Bill of Rights,” unveiled during the State of the Union 70 years ago, was not a constitutional amendment but a statement of principles for America’s economic future. It was centered on a commitment to achieving a crucial national objective: full employment.
- ⁴ With 50 million people, including 13 million children, now living below the poverty line and both parties seeking to address the national opportunity deficit in 2014, America’s political leaders should take a cue from FDR’s 1944 State of the Union. Congress should commit to do everything in its power to create the economic conditions for America to return to full employment. Getting every American working and contributing to the tax base will not only help eliminate poverty but also reduce the national debt and ultimately create the conditions for the free market to function well.
- ⁵ In the decades following FDR’s speech, Congress took serious action to realize the vision of a full-employment society. It passed the Employment Act in 1946, giving the federal government tools and a formal calling to “promote maximum employment, production, and purchasing power.” It passed a range of legislation to promote full employment through additional investments in transportation, health, education and research in the 1960s. Finally, in 1978, it passed the Humphrey-Hawkins Full Employment Act, calling on the president to work with the private sector to reduce unemployment to specific target levels.
- ⁶ Contrast these efforts with the inaction in today’s Congress. With nearly 30 million American workers either unemployed or underemployed, each and every lawmaker should enshrine job creation as Priority No. 1. Yet Congress has actually made unemployment worse. The economic consulting firm Macroeconomic Advisers estimated that the fiscal showdowns and budget cuts that have consumed Congress over recent years have cost the country up to \$700 billion in economic growth and more than 2 million jobs.



- 7 As collapsed bridges, contaminated water and falling positions in global education rankings demonstrate, there are plenty of public projects our country needs to undertake. This is why we've been advocating for legislation — including the 21st Century Full Employment and Training Act and the American Jobs Act of 2013 — to create new opportunities to solve public problems while hiring educators, infrastructure-builders, first responders and medical researchers. There are good ideas in both parties for closing the skills gap, spurring infrastructure investment and reducing unemployment. But we need political will to pass a serious jobs bill.
- 8 This week, we're announcing the creation of the Full Employment Caucus in Congress. As co-founders, we will regularly host expert economists and policymakers to discuss proven job-creation proposals and implement strategies for their adoption.
- 9 Achieving full employment isn't only about helping jobless people. When we return to full employment, investors and businesspeople have more customers. When we return to full employment, workers have power to bargain for higher wages. Finally, when we return to full employment, crime declines as desperate people gain a paycheck and a purpose.
- 10 We're founding this caucus to strength America's economy and restore dignity for the tens of millions of Americans who have suffered the physical and emotional pain of joblessness.
- 11 Both President Obama's State of the Union address and the Republican response echoed FDR's emphasis 70 years ago on expanding economic opportunity, creating jobs and boosting wages. It's time for Congress to pass a comprehensive jobs bill to realize that vision.

Write an essay in which you explain how John Conyers and Frederica Wilson build an argument to persuade their audience that the importance of passing legislations that promote full employment. In your essay, analyze how Conyers and Wilson use one or more of the features listed in the box above (or features of your own choice) to strengthen the logic and percussiveness of their argument. Be sure that your analysis focuses on the most relevant features of the passage.

Your essay should not explain whether you agree with Conyers and Wilson claims, but rather explain how Conyers and Wilson build an argument to persuade their audience.



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