

REVISED FOR

MARCH–JUNE 2016

USE FOR THE

Redesigned SAT

Getting Ready for the Redesigned SAT[®]



INFORMATION
ABOUT THE
REDESIGNED SAT[®]



AN OFFICIAL
PRACTICE TEST



TEST-TAKING
ADVICE AND TIPS

Learn all about the redesigned SAT at collegereadiness.collegeboard.org. Take the practice test and receive personalized practice at khanacademy.org/sat.

About the College Board

The College Board is a mission-driven not-for-profit organization that connects students to college success and opportunity. Founded in 1900, the College Board was created to expand access to higher education. Today, the membership association is made up of over 6,000 of the world's leading educational institutions and is dedicated to promoting excellence and equity in education. Each year, the College Board helps more than seven million students prepare for a successful transition to college through programs and services in college readiness and college success — including the SAT® and the Advanced Placement Program®. The organization also serves the education community through research and advocacy on behalf of students, educators, and schools. For further information, visit www.collegeboard.org.

SAT Customer Service

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Introduction to the Redesigned SAT®

If you plan to register for the SAT in March 2016 or after, you can use this booklet to get familiar with the redesigned test. Remember, if you have access to the Internet, you can find everything in this booklet and more at collegereadiness.collegeboard.org.

Our Commitment to Students

Each year the SAT is taken by more than 1.67 million students and used by thousands of high school counselors and postsecondary admission officers around the world. The assessment that students like you will receive on test day is a challenging yet appropriate and fair assessment of what you know and can do. The questions you will tackle focus on the knowledge and skills that the best available evidence indicates are essential for college and career readiness and success.

Opportunity

We are committed to an agenda that propels you into opportunities that you have earned in high school. The major components of this agenda are the redesigned SAT and the Access to Opportunity™ program.

By focusing on what matters most for college and career readiness and success, the redesigned SAT offers you, your parents, and your teachers and

counselors, as well as college admission officers, a strong indicator of your progress toward college and career preparedness. It also provides, through the reporting of test scores and Insight Scores, detailed information about your strengths and weaknesses relating to rigorous but appropriate academic material. This helps colleges identify students who are a good match for their institution and the programs of study they offer.

Are you the first person in your family to think about going to college? Maybe the cost seems out of reach. Maybe you have other reasons for thinking college is for someone else, not for you. Our Access to Opportunity program identifies and breaks down barriers that prevent many students from applying to and enrolling in colleges that are the best academic, social, and financial fit. Learn more at collegeboard.org/opportunity.

Students who take the SAT with a fee waiver will also receive four college application fee waivers in their senior year. This reflects our goal to get all students — including those who are low-income and college-ready — to apply to at least four colleges: one sure thing, two that are a good fit, and one that might initially seem out of reach. See page 4 for eligibility information and visit sat.org/fee-waivers to learn more about what the fee-waiver program offers eligible students.

Transparency

The College Board has ensured that students, teachers, and counselors can know exactly what to expect on test day. You can access a full set of test specifications at collegereadiness.collegeboard.org. What the test assesses should be absolutely clear; there is no mystery.

What Is Changing

The redesigned SAT has a sharper focus on the relatively few things that research shows matter most for college and career readiness and success. The changes made to the assessment also reflect a commitment to improve outcomes for students and deliver expanded opportunity to achieve excellence.

Eight Key Changes in the SAT

1. **Words in Context:** The test asks you to interpret the meanings of relevant words and phrases in the contexts in which they appear. This alters the way you prepare for the test — no more rote memorization of obscure words. This new emphasis engages you in close reading and calls attention to the nuances of how vocabulary is used in particular situations.

2. **Command of Evidence:** You must demonstrate your ability to interpret and use evidence found in a wide range of texts. You will, for example, have to determine the best evidence for the answer to another Reading question and to analyze informational graphics, such as tables, graphs, and charts.
3. **Essay Analyzing a Source:** In the Essay, you are asked to read a passage and explain how the author builds an argument to persuade an audience. This task more closely mirrors college writing assignments, and it requires close reading, careful analysis, and clear writing. The essay prompt remains largely the same from one test to the next; only the source material (passage) will change. The Essay is an optional component of the SAT, although some school districts and colleges require it.
4. **Focus on the Math that Matters Most:** The test focuses in depth on three essential areas of math: Heart of Algebra, Problem Solving and Data Analysis, and Passport to Advanced Math.
 - » Heart of Algebra focuses on the mastery of linear expressions, equations, and systems, which can help you develop key powers of abstraction.
 - » Problem Solving and Data Analysis is about being quantitatively literate. It includes using ratios, percentages, and proportional reasoning to solve problems in science, social science, and career contexts; describing relationships shown graphically; and analyzing data.
 - » Passport to Advanced Math focuses on your familiarity with more complex equations and the manipulation they require.

There is also a brief section on **Additional Topics in Math**, including geometry, trigonometry, radian measure, and the arithmetic of complex numbers.
5. **Problems Grounded in Real-World Contexts:** In the Evidence-Based Reading and Writing section, Reading questions include literature and literary nonfiction, but also feature charts, graphs, and passages like the ones you are likely to encounter in science, social science, and other majors and careers. Writing and Language questions ask you to edit and revise to improve texts from the humanities, history, social science, and career contexts. The Math section features multistep applications to solve problems in science, social science, career scenarios, and other real-life contexts. This allows you to dig into a situation and think about it, then model it mathematically.
6. **Analysis in Science and in History/Social Studies:** When you take the redesigned SAT, you are asked to apply your reading, writing, and math knowledge and skills to answer questions

in science, history, and social studies contexts. You will draw on these same sorts of skills and knowledge in college, in your job, and throughout your life to make sense of recent discoveries, political developments, global events, and health and environmental issues. Students taking the SAT will encounter challenging texts and informational graphics that pertain to issues and topics such as these in the Evidence-Based Reading and Writing section and the Math section. Questions will require you to read and comprehend texts, revise texts to be consistent with data presented in graphics, synthesize information presented in texts and graphics, and solve problems based in science and social science contexts.

7. **U.S. Founding Documents and the Great Global Conversation:** You will encounter a passage from one of the U.S. founding documents (texts such as the Declaration of Independence, the Bill of Rights, or the *Federalist Papers*) or a text from the wider global conversation about civic life. In this way, we hope that the redesigned SAT will inspire a close study of these rich, meaningful, often profound texts, not only as a way to develop the knowledge and skills needed to read and analyze challenging works, but also as an opportunity to reflect on and deeply engage with issues and concerns central to informed citizenship.
8. **No Penalty for Guessing:** The redesigned SAT removes the penalty for guessing. You will earn points for the questions you answer correctly. This move to rights-only scoring encourages you to give the best answer you have to every question.

What the SAT Measures

The redesigned SAT asks you to apply a deep understanding of the knowledge and skills most important for college and career readiness and success. The test is composed of three **sections**. **You** have three hours of testing time, plus an additional 50 minutes for the optional Essay.

- » **Evidence-Based Reading and Writing:** Includes a Reading Test and a Writing and Language Test. The Reading Test measures your comprehension and reasoning skills with a focus on careful reading of appropriately challenging passages in a wide array of subject areas. The Writing and Language Test assesses your skills in revising and editing a range of texts in a variety of subject areas to improve expression of ideas and to correct errors in grammar, usage, and punctuation. Each test is composed of multiparagraph passages and multiple-choice questions.
 - Time allotted for Reading: 65 minutes.
 - Time allotted for Writing and Language: 35 minutes.

- » **Math:** Includes multiple-choice and student-produced response questions based on the math that college-bound students typically learn during their first three years of high school. Time allotted for Math – No Calculator: 25 minutes. Time allotted for Math – Calculator: 55 minutes.
- » **Essay (optional):** Asks you to read and analyze an argument and write an effective response. Time allotted for Essay: 50 minutes.

How the SAT Is Scored

All multiple-choice questions are scored the same way: one point for each correct answer and zero points for incorrect answers. No additional points are subtracted for incorrect answers or answers left blank.

- » **Total Score:** You will receive one total score, on a scale ranging from 400 to 1600, that is the sum of two section scores:

- › Evidence-Based Reading and Writing
- › Math

The three scores for the optional Essay will be reported separately on 2-to-8 scales and will not be factored into the total score.

- » **Section Scores:** You will receive two section (domain) scores, reported on a scale ranging from 200 to 800, in 10-point intervals:

- › Evidence-Based Reading and Writing, which will combine the Reading Test score and the Writing and Language Test score
- › Math

- » **Test Scores:** You will receive three test scores reported on a scale ranging from 10 to 40:

- › Reading
- › Writing and Language
- › Math

- » **Cross-Test Scores:** You will receive two cross-test scores that are based on items from across the Reading, Writing and Language, and Math Tests. (The cross-test scores are contingent on the results of research.) These will be reported on a scale ranging from 10 to 40:

- › Analysis in Science
- › Analysis in History/Social Studies

- » **Subscores:** You will also receive multiple subscores for Reading, Writing and Language, and Math. In total the redesigned SAT will report seven subscores, each on a scale ranging from 1 to 15:

- › The Reading and Writing and Language Tests will contribute questions to two subscores:
 1. Command of Evidence
 2. Words in Context

- › The Writing and Language Test will also report two additional subscores:
 3. Expression of Ideas
 4. Standard English Conventions
- › The Math Test will report three subscores:
 5. Heart of Algebra
 6. Problem Solving and Data Analysis
 7. Passport to Advanced Math

Resources to Help You Prepare

The College Board is committed to offering the best practice — free, to the world — and to do so, we have partnered with Khan Academy® to help propel students to success. When you upload your specific test results — from the redesigned PSAT/NMSQT®, PSAT™ 10, PSAT™ 8/9, a previous SAT, or the practice test in this booklet — to the computer-adaptive Khan Academy engine, we can offer you individualized instruction in the areas you need most.

If you've already taken the PSAT/NMSQT in October 2015, you have a good idea of what you'll see on the redesigned SAT. Be sure to start using the resources available to you through your online score report at studentscores.collegeboard.org and find out how to use your PSAT/NMSQT results to power your study at satpractice.org.

As noted previously, the contents of the redesigned SAT are not a mystery. You can prepare by reading more about the redesigned test at collegereadiness.collegeboard.org.

Using This Booklet

Use this booklet to:

- » Become familiar with the test. Study the descriptions of the SAT, so you're not surprised or confused on test day.
- » Learn the test directions. The directions for answering the questions in this booklet are the same as those on the actual test. If you become familiar with the directions now, you'll leave yourself more time to answer the questions when you take the test.
- » Review the sample questions. The more familiar you are with the question formats, the more comfortable you'll feel when you see similar questions on the actual test. In particular, be sure to practice writing answers to the student-produced response math questions (see page 24).
- » Understand how the tests are scored. You get one point for each right answer. Hard questions count the same amount as easier questions. You won't

lose any points if you have to guess, so try to answer every question.

When you're ready, take the practice test, then go to satpractice.org to upload your answers.

Using Online Resources

Other online resources are available to you. At satpractice.org, you can:

- » Create your own study plan.
- » Get daily SAT practice, also available via Twitter or our mobile app.

Programs for You

- » The score-reporting portal gives you access to an online score report with personalized, practical information about your SAT results, including how your scores compare to those of other test-takers and how you performed on each area of the test. It also allows you to access and print your (optional) essay to share with your teachers. Link to your report at studentscores.collegeboard.org.
- » Score Choice™ gives you the option to choose which scores to send to the colleges you select, based on what each college wants to receive as part of the application process. You can choose which SAT Subject Test scores to send by test date or choose SAT scores from one, several, or all SAT test dates in your record. Score Choice is optional, so if you don't actively choose to use it, all of your scores will be sent automatically with your score report. Since most colleges only consider your best scores, you should feel comfortable reporting scores from all of your tests.
- » Fee waivers are available to qualified, lower-income students who want to take the SAT and SAT Subject Tests™. They cover 100 percent of the registration fees for a single test date. Each qualifying student can use up to two waivers for the SAT and up to two waivers for the SAT Subject Tests. To be eligible, you must meet **at least one** of the requirements below:
 - › Enrolled in or eligible to participate in the National School Lunch Program (NSLP).
 - › Annual family income falls within the Income Eligibility Guidelines set by the USDA Food and Nutrition Service.
 - › Enrolled in a federal, state, or local program that aids students from low-income families (e.g., Federal TRIO programs such as Upward Bound).
 - › Family receives public assistance.
 - › Live in federally subsidized public housing or a foster home, or are homeless.
 - › A ward of the state or an orphan.

College Connections

Student Search Service® Program

- » Our Student Search Service is a free and voluntary program that connects students with information about educational and financial aid opportunities from more than 1,200 colleges, universities, scholarship programs, and educational organizations. Here's how it works:
 1. During SAT or SAT Subject Test registration, indicate that you want to be a part of Student Search Service.
 2. As part of the registration, you will also be asked to provide information on your education, aspirations, and background.
 3. Participating, eligible organizations use Student Search Service to find groups of students like you to contact, because these students may be a good fit for their communities and programs. Only students who opt to participate in Student Search Service will be included.
 4. To find groups of students, these organizations can use any attribute you provided, except the following: disability, parental education, self-reported parental income, Social Security number, phone numbers, and actual test scores.
 5. The most searched items are expected high school graduation date, cumulative grade point average (GPA), and intended college major. A full list of questions is available in the *Student Registration Guide*.

If you have questions or concerns about Student Search Service or want more information about the program, please visit collegeboard.org/student-search-service or call 866-825-8051.

Here are some points to keep in mind about Student Search Service:

- » Most students who take the PSAT/NMSQT, AP Exams, SAT, or SAT Subject Tests participate in this free service; however, you may take the test even if you don't take part in Student Search Service.
- » Organizations participating in Student Search Service never receive actual student scores, but they can ask for names of students within certain score ranges.
- » Being contacted by a college doesn't mean you have been admitted. You must submit an application in order to be considered for admission. The colleges and organizations that participate want to find students who fit in with their environment, classes, programs, scholarships, and special activities. Student Search Service is simply a way for colleges to reach prospective students to introduce you to the college and inform you of opportunities there.
- » Student Search Service will share your contact information only with eligible colleges,

universities, and qualified nonprofit educational organizations or scholarship programs that are recruiting students like you. Your name and other information will never be sold to a commercial marketing firm or retailer of merchandise or services (such as test prep).

- » Student Search Service allows these eligible organizations to send communications directly to the students whose names were received through Student Search Service. All colleges and other institutions that receive this student information must comply with our strict guidelines around confidentiality. These colleges and institutions determine how they will communicate with the students, including the frequency and type of communication (print or electronic). Colleges and institutions must not only adhere to our guidelines but also comply with applicable federal and state laws governing your privacy.
- » To unsubscribe from Student Search Service, go to collegeboard.org/student-search-service, call 800-626-9795, or write to:

The College Board

11955 Democracy Drive
Reston, VA 20190-5662
Attention: Student Search Service

More College Planning Resources

The College Board offers free, comprehensive resources at Big Future™ to help you with your college planning. Visit bigfuture.org to put together a step-by-step plan for the entire process, from finding the right college, exploring majors and careers, and calculating costs, to applying for scholarships and financial aid.

Protecting Your Privacy

Telemarketing and Internet Scams

From time to time, we receive reports of phone scams in which callers posing as employees of the College Board contact students and families attempting to sell test preparation products or otherwise requesting sensitive, personally identifying information, such as credit card and

Social Security numbers. Some of these callers engage in illegal spoofing to make it seem as if the call is coming from the actual company. These calls do not come from the College Board. The College Board does not make unsolicited phone calls to students or families requesting this type of information.

This type of activity, known as telemarketing fraud, is a crime. Should you receive an unsolicited phone call from someone claiming to work for the College Board, including when your caller ID indicates that the telephone number originates from a College Board location, do not provide the caller with any personal information. Representatives of the College Board only make calls or send text messages to students and their families in response to student-generated inquiries and/or to provide or gather information about a test or program for which a student registered or about preparation for college and the application process. Should you have a question about the origin of a phone call you have received in which the caller claims to be from the College Board, contact Customer Service.

Safety and Security Tips

1. Be wary of unsolicited contacts, whether via telephone or email.
2. Remember that the College Board will never contact you to ask you to send your credit card, bank account, or password information over the telephone or through email.
3. Never supply credit card information to someone who calls or emails you.
4. If you suspect you have received a fraudulent call or email, contact the Federal Trade Commission (FTC) and your local authorities and provide them with all the details.
5. Keep in mind that if an offer appears too good to be true, it probably is.
6. To make a complaint and to obtain more information about protecting yourself from telephone and Internet scams, visit the FTC's Consumer Information site at consumer.ftc.gov.

Evidence-Based Reading and Writing

Evidence-Based Reading and Writing is composed of two tests that assess different but related skills. The Reading Test gives you a chance to show how well you understand what you read. The Writing and Language Test asks you to revise and edit text.

This section has four distinctive features:

- » **Emphasis on words in context:** Both tests measure your understanding of the meaning and use of words and phrases in the context of extended passages.
- » **Emphasis on command of evidence:** Both tests require you to demonstrate your understanding of how authors make use of evidence to support and develop their claims and points.
- » **Inclusion of informational graphics:** Both tests contain data presented in tables, graphs, charts, and the like, which you must interpret and integrate with information in a passage.
- » **Variations in text complexity:** The passages on both tests range in difficulty from those found in grades 9–10 to those found in college-entry, credit-bearing postsecondary courses.

Reading Test Overview

- » Total questions: 52 passage-based reading questions with multiple-choice responses
- » Time allotted: 65 minutes
- » Calculators may not be on your desk or used.

About the Passages

Reading passages range in length from about 500 to 750 words, and they are taken from a variety of fields, including U.S. and world literature, history/social studies, and science. Some passages are accompanied by tables, graphs, charts, and the like that you must interpret and sometimes synthesize with information and ideas presented in the associated passage. (Mathematical computation, however, is not required to answer these questions.) Some passages on similar subjects are paired, and these pairs are accompanied by questions that require you to make important connections between the passages as well as others that ask about each passage on its own.

Tips for the Reading Test

- » The Reading Test comprises a series of passages — sometimes paired and sometimes accompanied by one or more informational graphics (e.g., tables and graphs) — and associated multiple-choice questions. Correct answers are derived from what is stated or implied in the passages rather than

from prior knowledge of the topics. All of the questions are passage based.

- » Reading carefully is the key to finding the best answer. The information you need to answer each question is always in the passage(s) and/or graphic(s). Don't be misled by an answer that looks correct but is not supported by the actual text of the passage(s).
- » The questions do not increase in difficulty from easy to hard. Instead, they are presented as logically as possible, with general questions about central ideas and themes, point of view, overall text structure, and the like coming early in the sequence. After that come more specific questions about details, words in context, and evidence.
- » Stay with a passage (or pair of passages) until you have answered as many questions as you can before you proceed to the next passage. Do not jump from passage to passage.
- » The questions often include line numbers to help direct you to the relevant part(s) of the passage(s). If one word or more is quoted exactly from the passage(s), the line number(s) where that quotation can be found will appear in the question. You may have to look elsewhere in the passage(s), however, in order to find the best answer to the question.
- » In your test booklet, mark each question you skip so that you can easily go back to it later if you have time.
- » Remember that all questions are worth one point regardless of the type or difficulty. You are not penalized for guessing wrong, so it's to your advantage to answer each question as best you can.

Sample Reading Materials

Following are samples of the kinds of Reading passages and questions that may appear on your test. For each set of sample materials:

- » Read the passage(s) carefully.
- » Decide on the best answer to each question.
- » Read the explanation for the best answer to each question and for the answer you chose (if the two are different).

On the actual test, each passage will be followed by 10 or 11 questions. The directions provided on the next page match what you will see on the actual test.

Reading Test Questions

Directions

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

Questions 1-3 are based on the following passages.

Passage 1 is adapted from Susan Milius, "A Different Kind of Smart." ©2013 by Science News. Passage 2 is adapted from Bernd Heinrich, *Mind of the Raven: Investigations and Adventures with Wolf-Birds*. ©2007 by Bernd Heinrich.

Passage 1

In 1894, British psychologist C. Lloyd Morgan published what's called Morgan's canon, the principle that suggestions of humanlike mental processes behind an animal's behavior should be rejected if a simpler explanation will do.

Still, people seem to maintain certain expectations, especially when it comes to birds and mammals. "We somehow want to prove they are as 'smart' as people," zoologist Sara Shettleworth says. We want a bird that masters a vexing problem to be employing human-style insight.

New Caledonian crows face the high end of these expectations, as possibly the second-best toolmakers on the planet. Their tools are hooked sticks or strips made from spike-edged leaves, and they use them in the wild to wrinkle grubs out of crevices. Researcher Russell Gray first saw the process on a cold morning in a mountain forest in New Caledonia, an island chain east of Australia. Over the course of days, he and crow researcher Gavin Hunt had gotten wild crows used to finding meat tidbits in holes in a log. Once the birds were checking the log reliably, the researchers placed a spiky tropical pandanus plant beside the log and hid behind a blind.

A crow arrived. It hopped onto the pandanus plant, grabbed the spiked edge of one of the long straplike leaves and began a series of ripping motions. Instead of just tearing away one long strip, the bird ripped and nipped in a sequence to create a slanting stair-step edge on a leaf segment with a narrow point and a wide base. The process took only seconds. Then the bird dipped the narrow end of its leaf strip into a hole in the log, fished up the meat with the leaf-edge spikes, swallowed its prize and flew off.

"That was my 'oh wow' moment," Gray says. After the crow had vanished, he picked up the tool the bird had left behind. "I had a go, and I couldn't do it," he recalls. Fishing the meat out was tricky. It turned out

that Gray was moving the leaf shard too forcefully instead of gently stroking the spines against the treat.

The crow's deft physical manipulation was what inspired Gray and Auckland colleague Alex Taylor to test other wild crows to see if they employed the seemingly insightful string-pulling solutions that some ravens, kea parrots and other brainiac birds are known to employ. Three of four crows passed that test on the first try.

Passage 2

For one month after they left the nest, I led my four young ravens at least once and sometimes several times a day on thirty-minute walks. During these walks, I wrote down everything in their environment they pecked at. In the first sessions, I tried to be teacher. I touched specific objects—sticks, moss, rocks—and nothing that I touched remained untouched by them. They came to investigate what I had investigated, leading me to assume that young birds are aided in learning to identify food from the parents' example. They also, however, contacted almost everything else that lay directly in their own paths. They soon became more independent by taking their own routes near mine. Even while walking along on their own, they pulled at leaves, grass stems, flowers, bark, pine needles, seeds, cones, clods of earth, and other objects they encountered. I wrote all this down, converting it to numbers. After they were thoroughly familiar with the background objects in these woods and started to ignore them, I seeded the path we would later walk together with objects they had never before encountered. Some of these were conspicuous food items: raspberries, dead meal worm beetles, and cooked corn kernels. Others were conspicuous and inedible: pebbles, glass chips, red winterberries. Still others were such highly cryptic foods as encased caddisfly larvae and moth cocoons. The results were dramatic.

The four young birds on our daily walks contacted all new objects preferentially. They picked them out at a rate of up to tens of thousands of times greater than background or previously contacted objects. The main initial criterion for pecking or picking anything up was its novelty. In subsequent trials, when the previously novel items were edible, they became preferred and the inedible objects became "background" items, just like the leaves, grass, and pebbles, even if they were highly conspicuous. These experiments showed that ravens' curiosity ensures exposure to all or almost all items in the environment.

1

Within Passage 1, the main purpose of the first two paragraphs (lines 1-11) is to

- A) offer historical background in order to question the uniqueness of two researchers' findings.
- B) offer interpretive context in order to frame the discussion of an experiment and its results.
- C) introduce a scientific principle in order to show how an experiment's outcomes validated that principle.
- D) present seemingly contradictory stances in order to show how they can be reconciled empirically.

Estimated Difficulty: Hard

Key: B

Choice B is the best answer. Passage 1 opens with an explanation of Morgan's canon and continues with a discussion of people's expectations regarding animal intelligence. Taken together, the first two paragraphs indicate that despite cautions to the contrary, people still tend to look for humanlike levels of intelligence in many animals, including birds. These two paragraphs provide a framework in which to assess the work of Gray and Hunt, presented in the rest of the passage. The passage's characterization of the experiment Gray and Hunt conduct, in which they observe a crow's tool-making ability and to which Gray responds by trying and failing to mimic the bird's behavior ("I had a go, and I couldn't do it," line 37), suggests that Shettleworth, quoted in the second paragraph, is at least partially correct in her assessment that "We somehow want to prove [birds] are as 'smart' as people" (lines 8-9).

Choice A is not the best answer because while the reference to Morgan's canon in the first paragraph offers a sort of historical background (given that the canon was published in 1894), the second paragraph describes people's continuing expectations regarding animal intelligence. Furthermore, the fact that Gray and Hunt may share with other people the tendency to look for humanlike intelligence in many animals does not by itself establish that the main purpose of the first two paragraphs is to question the uniqueness of Gray and Hunt's findings.

Choice C is not the best answer because while the reference to Morgan's canon in the first paragraph does introduce a scientific principle, the discussion in the second paragraph of people's expectations regarding animal intelligence, as well as the passage's characterization of Gray and Hunt's experiment and how the researchers interpret the results, primarily suggest that people tend to violate the canon by attributing humanlike levels of intelligence to many animals.

Choice D is not the best answer because although the first two paragraphs do present different perspectives, they are not seemingly or genuinely contradictory. The second paragraph, particularly the quotation from Shettleworth, serves mainly to qualify (not contradict) the position staked out in the first paragraph by suggesting that while Morgan's canon is probably a sound principle, people still tend to project humanlike levels of intelligence onto many animals. Moreover, the experiment depicted in the rest of the passage primarily bears out Shettleworth's claim that "We somehow want to prove [birds] are as 'smart' as people" (lines 8-9) and thus does not reconcile the perspectives found in the opening paragraphs.

2

According to the experiment described in Passage 2, whether the author's ravens continued to show interest in a formerly new object was dictated primarily by whether that object was

- A) edible.
- B) plentiful.
- C) conspicuous.
- D) natural.

Estimated Difficulty: Easy

Key: A

Choice A is the best answer. The last paragraph of Passage 2 presents the results of an experiment in which the author scattered unfamiliar objects in the path of some ravens. According to the passage, the birds initially "contacted all new objects preferentially" but in "subsequent trials" only preferred those "previously novel items" that "were edible" (lines 75-81).

Choice B is not the best answer because the ravens studied by the author only preferred those "previously novel items" that "were edible," whereas "the inedible objects became 'background' items, just like the leaves, grass, and pebbles" (lines 80-83). In other words, plentiful items did not continue to interest the ravens unless the items were edible.

Choice C is not the best answer because the ravens studied by the author only preferred those "previously novel items" that "were edible," whereas "the inedible objects became 'background' items, just like the leaves, grass, and pebbles, even if they were highly conspicuous" (lines 80-84). In other words, conspicuous items did not continue to interest the ravens unless the items were edible.

Choice D is not the best answer because the ravens studied by the author only preferred those "previously novel items" that "were

edible,” whereas “the inedible objects became ‘background’ items, just like the leaves, grass, and pebbles” (lines 80-83). In other words, natural items did not continue to interest the ravens unless the items were edible.

3

The crows in Passage 1 and the ravens in Passage 2 shared which trait?

- A) They modified their behavior in response to changes in their environment.
- B) They formed a strong bond with the humans who were observing them.
- C) They manufactured useful tools for finding and accessing food.
- D) They mimicked the actions they saw performed around them.

Estimated Difficulty: Medium

Key: A

Choice A is the best answer. Both bird species studied modified their behavior in response to changes in their environment. The researchers described in Passage 1 “had gotten wild crows used to finding meat tidbits in holes in a log” (lines 20-21). In other words, the researchers had repeatedly placed meat in the log — that is, changed the crows’ environment — and the birds had responded by modifying their behavior, a point reinforced in line 22, which noted that the birds began “checking the log reliably.” The ravens in Passage 2 act in analogous fashion, responding to the introduction of new objects in their environment by “pick[ing] them out at a rate of up to tens of thousands of times greater than background or previously contacted objects” (lines 76-78).

Choice B is not the best answer because while there is some evidence that the ravens described in Passage 2 formed a bond with the author, going on walks with him and possibly viewing him as their “teacher,” there is no evidence that a similar bond formed between the researchers described in Passage 1 and the crows they studied. Indeed, these researchers “hid behind a blind” (lines 23-24) in an effort to avoid contact with their subjects.

Choice C is not the best answer because while crows’ tool-making ability is the central focus of the experiment described in Passage 1, there is no evidence that the ravens in Passage 2 did anything similar. Passage 1 does mention that “some ravens” use “seemingly insightful string-pulling solutions” (lines 44-45), but nothing in Passage 2 suggests that the ravens in that particular study had or displayed tool-making abilities.

Choice D is not the best answer because while there is some evidence that the ravens described in Passage 2 mimicked human behavior, going on walks with the author and possibly viewing him as their “teacher,” there is no evidence that the crows in Passage 1 did any mimicking. Passage 1, in fact, suggests that the ability of the crow to produce the meat-fishing tool was innate rather than a skill it had acquired from either humans or other birds.

Questions 4-6 are based on the following passage and supplementary material.

This passage is adapted from Richard Florida, *The Great Reset*. ©2010 by Richard Florida.

In today’s idea-driven economy, the cost of time is what really matters. With the constant pressure to innovate, it makes little sense to waste countless collective hours commuting. So, the most efficient and productive regions are those in which people are thinking and working—not sitting in traffic.

Line

5

The auto-dependent transportation system has reached its limit in most major cities and megaregions. Commuting by car is among the least efficient of all our activities—not to mention among the least enjoyable, according to detailed research by the Nobel Prize-winning economist Daniel Kahneman and his colleagues. Though one might think that the economic crisis beginning in 2007 would have reduced traffic (high unemployment means fewer workers traveling to and from work), the opposite has been true. Average commutes have lengthened, and congestion has gotten worse, if anything. The average commute rose in 2008 to 25.5 minutes, “erasing years of decreases to stand at the level of 2000, as people had to leave home earlier in the morning to pick up friends for their ride to work or to catch a bus or subway train,” according to the U.S. Census Bureau, which collects the figures. And those are average figures. Commutes are far longer in the big West Coast cities of Los Angeles and San Francisco and the East Coast cities of New York, Philadelphia, Baltimore, and Washington, D.C. In many of these cities, gridlock has become the norm, not just at rush hour but all day, every day.

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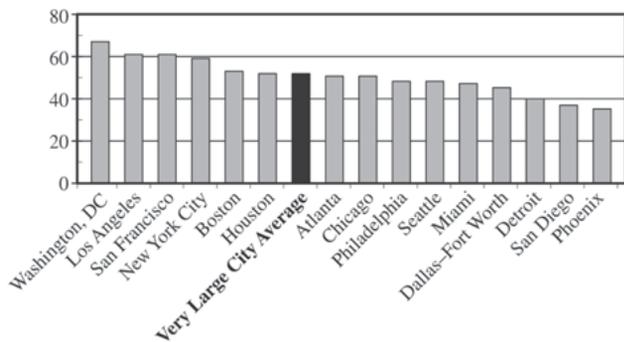
The costs are astounding. In Los Angeles, congestion eats up more than 485 million working hours a year; that’s seventy hours, or nearly two weeks, of full-time work per commuter. In D.C., the time cost of congestion is sixty-two hours per worker per year. In New York it’s forty-four hours. Average it out, and the time cost across America’s thirteen biggest city-regions is fifty-one hours per worker per year. Across the country, commuting wastes 4.2 billion hours of work time annually—nearly a full workweek for every commuter. The overall cost to the U.S. economy is nearly \$90 billion when lost productivity and wasted fuel are taken into account.

At the Martin Prosperity Institute, we calculate that every minute shaved off America's commuting time is worth \$19.5 billion in value added to the economy. The numbers add up fast: five minutes is worth \$97.7 billion; ten minutes, \$195 billion; fifteen minutes, \$292 billion.

It's ironic that so many people still believe the main remedy for traffic congestion is to build more roads and highways, which of course only makes the problem worse. New roads generate higher levels of "induced traffic," that is, new roads just invite drivers to drive more and lure people who take mass transit back to their cars. Eventually, we end up with more clogged roads rather than a long-term improvement in traffic flow.

The coming decades will likely see more intense clustering of jobs, innovation, and productivity in a smaller number of bigger cities and city-regions. Some regions could end up bloated beyond the capacity of their infrastructure, while others struggle, their promise stymied by inadequate human or other resources.

The Most Congested Cities in 2011
Yearly Hours of Delay per Automobile Commuter



Adapted from Adam Werbach, "The American Commuter Spends 38 Hours a Year Stuck in Traffic." ©2013 by The Atlantic.

4

The passage most strongly suggests that researchers at the Martin Prosperity Institute share which assumption?

- A) Employees who work from home are more valuable to their employers than employees who commute.
- B) Employees whose commutes are shortened will use the time saved to do additional productive work for their employers.
- C) Employees can conduct business activities, such as composing memos or joining conference calls, while commuting.
- D) Employees who have lengthy commutes tend to make more money than employees who have shorter commutes.

Estimated Difficulty: Medium

Key: B

Choice B is the best answer because details in the third paragraph (lines 30-46) strongly suggest that researchers ("we") at the Martin Prosperity Institute assume that shorter commutes will lead to more productive time for workers. The author notes that "across the country, commuting wastes 4.2 billion hours of work time annually" and that "the overall cost to the U.S. economy is nearly \$90 billion when lost productivity and wasted fuel are taken into account" (lines 37-41). Given also that those at the institute "calculate that every minute shaved off America's commuting time is worth \$19.5 billion in value added to the economy" (lines 42-44), it can reasonably be concluded that some of that added value is from heightened worker productivity.

Choice A is not the best answer because there is no evidence in the passage that researchers at the Martin Prosperity Institute assume that employees who work from home are more valuable to their employers than employees who commute. Although the passage does criticize long commutes, it does not propose working from home as a solution.

Choice C is not the best answer because there is no evidence in the passage that researchers at the Martin Prosperity Institute assume that employees can conduct business activities, such as composing memos or joining conference calls, while commuting. The passage does discuss commuting in some detail, but it does not mention activities that commuters can or should be undertaking while commuting, and it generally portrays commuting time as lost or wasted time.

Choice D is not the best answer because there is no evidence in the passage that researchers at the Martin Prosperity Institute assume that employees who have lengthy commutes tend to make more money than employees who have shorter commutes. The passage does not draw any clear links between the amount of money employees make and the commutes they have.

5

As used in line 55, "intense" most nearly means

- A) emotional.
- B) concentrated.
- C) brilliant.
- D) determined.

Estimated Difficulty: Easy

Key: B

Choice B is the best answer because the context makes clear that the clustering of jobs, innovation, and productivity will be more concentrated in, or more densely packed into, "a smaller number of bigger cities and city-regions" (lines 56-57).

Choice A is not the best answer because although “intense” sometimes means “emotional,” it would make no sense in context to say that the clustering of jobs, innovation, and productivity will be more emotional in “a smaller number of bigger cities and city-regions” (lines 56-57).

Choice C is not the best answer because although “intense” sometimes means “brilliant,” it would make no sense in context to say that the clustering of jobs, innovation, and productivity will be more brilliant in “a smaller number of bigger cities and city-regions” (lines 56-57).

Choice D is not the best answer because although “intense” sometimes means “determined,” it would make no sense in context to say that the clustering of jobs, innovation, and productivity will be more determined in “a smaller number of bigger cities and city-regions” (lines 56-57).

6

Which claim about traffic congestion is supported by the graph?

- A) New York City commuters spend less time annually delayed by traffic congestion than the average for very large cities.
- B) Los Angeles commuters are delayed more hours annually by traffic congestion than are commuters in Washington, D.C.
- C) Commuters in Washington, D.C., face greater delays annually due to traffic congestion than do commuters in New York City.
- D) Commuters in Detroit spend more time delayed annually by traffic congestion than do commuters in Houston, Atlanta, and Chicago.

Estimated Difficulty: Easy

Key: C

Choice C is the best answer. Higher bars on the graph represent longer annual commute delays than do lower bars; moreover, the number of hours of annual commute delay generally decreases as one moves from left to right on the graph. The bar for Washington, D.C. is higher than and to the left of that for New York City, meaning that D.C. automobile commuters experience greater amounts of delay each year.

Choice A is not the best answer because the graph’s bar for New York City is higher than and to the left of that for the average for very large cities, meaning that New York City automobile commuters experience greater, not lesser, amounts of delay each year.

Choice B is not the best answer because the graph’s bar for Los Angeles is lower than and to the

right of that for Washington, D.C., meaning that Los Angeles automobile commuters experience lesser, not greater, amounts of delay each year.

Choice D is not the best answer because the graph’s bar for Detroit is lower than and to the right of those for Houston, Atlanta, and Chicago, meaning that Detroit automobile commuters experience lesser, not greater, amounts of delay each year.

Questions 7-9 are based on the following passage.

This passage is adapted from a speech delivered by Congresswoman Barbara Jordan of Texas on July 25, 1974, as a member of the Judiciary Committee of the United States House of Representatives. In the passage, Jordan discusses how and when a United States president may be impeached, or charged with serious offenses, while in office. Jordan’s speech was delivered in the context of impeachment hearings against then president Richard M. Nixon.

Today, I am an inquisitor. An hyperbole would not be fictional and would not overstate the solemnness that I feel right now. My faith in the Constitution is whole; it is complete; it is total. And I am not going to sit here and be an idle spectator to the diminution, the subversion, the destruction, of the Constitution.

Line

5

“Who can so properly be the inquisitors for the nation as the representatives of the nation themselves?” “The subjects of its jurisdiction are those offenses which proceed from the misconduct of public men.”* And that’s what we’re talking about. In other words, [the jurisdiction comes] from the abuse or violation of some public trust.

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It is wrong, I suggest, it is a misreading of the Constitution for any member here to assert that for a member to vote for an article of impeachment means that that member must be convinced that the President should be removed from office. The Constitution doesn’t say that. The powers relating to impeachment are an essential check in the hands of the body of the legislature against and upon the encroachments of the executive. The division between the two branches of the legislature, the House and the Senate, assigning to the one the right to accuse and to the other the right to judge—the framers of this Constitution were very astute. They did not make the accusers and the judges . . . the same person.

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We know the nature of impeachment. We’ve been talking about it a while now. It is chiefly designed for the President and his high ministers to somehow be called into account. It is designed to “bridle” the executive if he engages in excesses. “It is designed as a method of national inquest into the conduct of public men.”* The framers confided in the Congress the power, if need be, to remove the President in order to strike a delicate balance between a President swollen with power and grown tyrannical, and preservation of the independence of the executive.

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The nature of impeachment: a narrowly channeled exception to the separation of powers maxim. The Federal Convention of 1787 said that. It limited impeachment

40 to high crimes and misdemeanors, and discounted and
opposed the term “maladministration.” “It is to be used
only for great misdemeanors,” so it was said in the North
Carolina ratification convention. And in the Virginia
ratification convention: “We do not trust our liberty to
45 a particular branch. We need one branch to check the
other.”

... The North Carolina ratification convention: “No
one need be afraid that officers who commit oppression
will pass with immunity.” “Prosecutions of impeachments
50 will seldom fail to agitate the passions of the whole
community,” said Hamilton in the *Federalist* Papers,
number 65. “We divide into parties more or less friendly
or inimical to the accused.”* I do not mean political
parties in that sense.

55 The drawing of political lines goes to the motivation
behind impeachment; but impeachment must proceed
within the confines of the constitutional term “high
crime[s] and misdemeanors.” Of the impeachment
process, it was Woodrow Wilson who said that “Nothing
60 short of the grossest offenses against the plain law of the
land will suffice to give them speed and effectiveness.
Indignation so great as to overgrow party interest may
secure a conviction; but nothing else can.”

Common sense would be revolted if we engaged
65 upon this process for petty reasons. Congress has a lot to
do: appropriations, tax reform, health insurance,
campaign finance reform, housing, environmental
protection, energy sufficiency, mass transportation.
Pettness cannot be allowed to stand in the face of such
70 overwhelming problems. So today we’re not being petty.
We’re trying to be big, because the task we have before
us is a big one.

*Jordan quotes from *Federalist* No. 65, an essay by Alexander
Hamilton, published in 1788, on the powers of the United States
Senate, including the power to decide cases of impeachment
against a president of the United States.

7

The stance Jordan takes in the passage is best
described as that of

- A) an idealist setting forth principles.
- B) an advocate seeking a compromise position.
- C) an observer striving for neutrality.
- D) a scholar researching a historical controversy.

Estimated Difficulty: Hard

Key: A

Choice A is the best answer. Jordan helps
establish her idealism by declaring that she is
an “inquisitor” (line 1) and that her “faith in the
Constitution is whole; it is complete; it is total”
(lines 3-4). At numerous points in the passage,
Jordan sets forth principles (e.g., “The powers
relating to impeachment are an essential check in

the hands of the body of the legislature against
and upon the encroachments of the executive,”
in lines 19-22) and makes reference to important
documents that do the same, including the U.S.
Constitution and *Federalist* No. 65.

Choice B is not the best answer because although
Jordan is advocating a position, there is no
evidence in the passage that she is seeking a
compromise position. Indeed, she notes that she is
“not going to sit here and be an idle spectator to
the diminution, the subversion, the destruction, of
the Constitution” (lines 4-6), indicating that she is
not seeking compromise.

Choice C is not the best answer because Jordan
is a participant (“an inquisitor,” line 1) in the
proceedings, not a mere observer. Indeed, she
notes that she is “not going to sit here and be an
idle spectator to the diminution, the subversion,
the destruction, of the Constitution” (lines 4-6).

Choice D is not the best answer because Jordan is
identified as a congresswoman and an “inquisitor”
(line 1), not a scholar, and because she is primarily
discussing events happening at the moment, not
researching an unidentified historical controversy.
Although she refers to historical documents and
individuals, her main emphasis is on the (then)
present impeachment hearings.

8

In lines 49-54 (“Prosecutions . . . sense”), what is
the most likely reason Jordan draws a distinction
between two types of “parties”?

- A) To counter the suggestion that impeachment is or
should be about partisan politics
- B) To disagree with Hamilton’s claim that impeachment
proceedings excite passions
- C) To contend that Hamilton was too timid in his
support for the concept of impeachment
- D) To argue that impeachment cases are decided more
on the basis of politics than on justice

Estimated Difficulty: Medium

Key: A

Choice A is the best answer. Jordan is making
a distinction between two types of “parties”:
the informal associations to which Alexander
Hamilton refers and the formal, organized political
parties such as the modern-day Republican
and Democratic parties. Jordan anticipates that
listeners to her speech might misinterpret her
use of Hamilton’s quotation as suggesting that
she thinks impeachment is essentially a tool of
organized political parties to achieve partisan
ends, with one party attacking and another
defending the president. Throughout the passage,

and notably in the seventh paragraph (lines 55-63), Jordan makes clear that she thinks impeachment should be reserved only for the most serious of offenses — ones that should rankle people of any political affiliation.

Choice B is not the best answer because Jordan offers no objection to Hamilton's notion that impeachment proceedings excite passions. Indeed, she quotes Hamilton extensively in a way that indicates that she fundamentally agrees with his view on impeachment. Moreover, she acknowledges that her own speech is impassioned — that she feels a “solemnness” (line 2) and a willingness to indulge in “hyperbole” (line 1).

Choice C is not the best answer because Jordan offers no objection to Hamilton's level of support for the concept of impeachment. Indeed, she quotes Hamilton extensively in a way that indicates that she fundamentally agrees with his view on impeachment.

Choice D is not the best answer because Jordan suggests that she and her fellow members of Congress are “trying to be big” (line 71), or high-minded, rather than decide the present case on the basis of politics. Indeed, throughout the last four paragraphs of the passage (lines 37-72), she elaborates on the principled, just basis on which impeachment should proceed. Moreover, throughout the passage Jordan is focused on the present impeachment hearings, not on the justice or injustice of impeachments generally.

9

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

- A) Lines 13-17 (“It . . . office”)
- B) Lines 20-24 (“The division . . . astute”)
- C) Lines 55-58 (“The drawing . . . misdemeanors”)
- D) Lines 65-68 (“Congress . . . transportation”)

Estimated Difficulty: Hard

Key: C

Choice C is the best answer because in lines 55-58, Jordan draws a contrast between political motivations and “high crime[s] and misdemeanors” as the basis for impeachment and argues that impeachment “must proceed within the confines” of the latter concept. These lines thus serve as the best evidence for the answer to the previous question.

Choice A is not the best answer because lines 13-17 only address a misconception that Jordan contends some people have about what a vote for impeachment means. Therefore, these lines do not

serve as the best evidence for the answer to the previous question.

Choice B is not the best answer because lines 20-24 only speak to a division of responsibility between the two houses of the U.S. Congress. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

Choice D is not the best answer because lines 65-68 serve mainly to indicate that the U.S. Congress has an extensive and important agenda. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

Writing and Language Test Overview

- » Total questions: 44 passage-based questions with multiple-choice responses
- » Time allotted: 35 minutes
- » Calculators may not be on your desk or used.

About the Passages

Writing and Language passages range in length from about 400 to 450 words, and they are well-written pieces covering career-related topics as well as topics in history/social studies, the humanities, and science. As in the Reading Test, some passages in the Writing and Language are accompanied by tables, graphs, charts, and the like that are intended to inform your decisions about how to revise and edit the passages. (Mathematical computation, again, is not required to answer these questions.)

Tips for the Writing and Language Test

The Writing and Language Test comprises a series of passages — sometimes accompanied by one or more informational graphics (e.g., tables and graphs) — and associated multiple-choice questions. The questions put you in the role of someone revising and editing text to improve the development, organization, and expression of information and ideas and to correct errors in sentence structure, usage, and punctuation. All of the questions are passage based. Rote memorization of language conventions is not tested.

- » Each page of the Writing and Language Test is divided into two columns. Passages appear across multiple pages in the left-hand column, while associated questions appear in the right-hand column of each page. Questions direct your attention to particular parts of the passage, such as a bit of underlined text or a paragraph, or ask you to consider the passage as a whole.
- » Read each passage carefully. As you answer each question, decide on the best choice in light of the passage as a whole. Some questions can be answered just by looking at a particular sentence,

but others require an understanding of the writer's overall purpose and approach. Remember that while most questions call attention to certain parts of the passage, finding the best answer may require looking earlier or further ahead in the passage. The information you need to answer each question is always in the passage and/or graphic(s).

- » The most common format for the questions offers you three alternatives to an underlined portion of the text along with the option of not changing the original language. For each of these questions, select the alternative that most effectively improves the development, organization, or use of language in the passage or that corrects an error in grammar, usage, or punctuation; or select "NO CHANGE" if you think the original version presented in the passage is the best option.
- » Stay with a passage until you have answered as many questions as you can before you proceed to the next passage. Do not jump from passage to passage.
- » In your test booklet, mark each question you skip so that you can easily go back to it later if you have time.

- » Remember that all questions are worth one point regardless of the type or difficulty. You are not penalized for guessing wrong, so it's to your advantage to answer each question as best you can.

Sample Writing and Language Materials

Following are samples of the kinds of Writing and Language passages and questions that may appear on your test. For each set of sample materials:

- » Read the passage carefully.
- » Decide on the best answer to each question.
- » Read the explanation for the best answer to each question and for the answer you chose (if the two are different).

On the actual test, the passages and questions will be in side-by-side columns, with each passage (spread over multiple pages) in the left-hand column and associated questions in the right-hand column.

The directions provided here match what you will see on the actual test.

Writing and Language Test Questions

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 1-5 are based on the following passage.

Dong Kingman: Painter of Cities

A 1954 documentary about renowned watercolor painter Dong Kingman shows the artist sitting on a stool on Mott Street in New York City's Chinatown. A crowd of admiring spectators **1** watched as Kingman squeezes dollops of paint from several tubes into a tin watercolor **2** box, from just a few primary colors, Kingman creates dozens of beautiful hues as he layers the translucent paint onto the paper on his easel. Each stroke of the brush and dab of the sponge transforms thinly sketched outlines into buildings, shop signs, and streetlamps. The street scene Kingman begins composing in this short film is very much in keeping with the urban landscapes for which he is best known.

Kingman was keenly interested in landscape painting from an early age. His interest was so keen, in fact, that he was named after it. In Hong Kong, where

Kingman completed his schooling, teachers at that time customarily assigned students a formal “school name.” The young boy who had been Dong Moy Shu became Dong Kingman. The name Kingman was selected for its two **3** parts, “king” and “man”; Cantonese for “scenery” and “composition.” As Kingman developed as a painter, his works were often compared to paintings by Chinese landscape artists dating back to CE 960, a time when a strong tradition of landscape painting emerged in Chinese art. Kingman, however, departed from that tradition in a number of ways, most notably in that he chose to focus not on natural landscapes, such as mountains and rivers, but on cities.

His fine brushwork conveys detailed street-level activity: a peanut vendor pushing his cart on the sidewalk, a pigeon pecking for crumbs around a fire hydrant, an old man tending to a baby outside a doorway. His broader brush strokes and sponge-painted shapes create majestic city skylines, with skyscrapers towering in the background, bridges connecting neighborhoods on either side of a river, and **4** delicately painted creatures, such as a tiny, barely visible cat prowling in the bushes of a park. To art critics and fans alike, these city scenes represent the innovative spirit of twentieth-century urban Modernism.

During his career, Kingman exhibited his work internationally, garnering much acclaim. In 1936, a critic described one of Kingman’s solo exhibits as “twenty of the freshest, most satisfying watercolors that have been seen hereabouts in many a day.” **5**

1

- A) NO CHANGE
- B) had watched
- C) would watch
- D) watches

Estimated Difficulty: Easy	Key: D
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Choice D is the best answer because the simple present tense verb “watches” is consistent with the tense of the verbs in the rest of the sentence and paragraph.

Choice A is not the best answer because “watched” creates an inappropriate shift to the past tense.

Choice B is not the best answer because “had watched” creates an inappropriate shift to the past perfect tense.

Choice C is not the best answer because “would watch” creates an inappropriate shift that suggests a habitual aspect (other verbs in the sentence and paragraph, however, indicate that a specific instance is being narrated).

2

- A) NO CHANGE
- B) box. From just a few primary colors,
- C) box from just a few primary colors,
- D) box, from just a few primary colors

Estimated Difficulty: Medium	Key: B
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Choice B is the best answer because it provides punctuation that creates two grammatically complete and standard sentences.

Choice A is not the best answer because it results in a comma splice as well as some confusion about what the prepositional phrase “from just a few primary colors” modifies.

Choice C is not the best answer because it results in a run-on sentence as well as some confusion about what the prepositional phrase “from just a few primary colors” modifies.

Choice D is not the best answer because it results in a comma splice.

3

- A) NO CHANGE
- B) parts: “king” and “man,”
- C) parts “king” and “man”;
- D) parts; “king” and “man”

Estimated Difficulty: Hard	Key: B
-----------------------------------	---------------

Choice B is the best answer because the colon after “parts” effectively signals that what follows in the sentence further defines what the “two parts” of Kingman’s name are and because the comma after “man” properly indicates that “‘king’ and ‘man’” and “Cantonese for ‘scenery’ and ‘composition’” are nonrestrictive appositives.

Choice A is not the best answer because the semicolon after “man” incorrectly joins an independent clause and a phrase. Moreover, the comma after “parts” is arguably a weak form of punctuation to be signaling the strong break in the sentence indicated here.

Choice C is not the best answer because the semicolon after “man” incorrectly joins an independent clause and a phrase and because the absence of a comma after “parts” fails to indicate that “two parts” and “‘king’ and ‘man’” are nonrestrictive appositives.

Choice D is not the best answer because the semicolon after “parts” incorrectly joins an independent clause and phrases and because the absence of a comma after “man” fails to indicate that “‘king’ and ‘man’” and “Cantonese for ‘scenery’ and ‘composition’” are nonrestrictive appositives.

4

The writer wants to complete the sentence with a third example of a detail Kingman uses to create his majestic city skylines. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) exquisitely lettered street and storefront signs.
- C) other details that help define Kingman’s urban landscapes.
- D) enormous ships docking at busy urban ports.

Estimated Difficulty: Hard	Key: D
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Choice D is the best answer because the phrase “enormous ships docking at busy urban ports” effectively continues the sentence’s series of details (“skyscrapers towering in the background” and “bridges connecting neighborhoods”), conveying the majesty of city skylines as depicted by Kingman.

Choice A is not the best answer because the phrase “delicately painted creatures, such as a tiny, barely visible cat prowling in the bushes of a park” does not convey a sense of the majesty of city skylines as depicted by Kingman and thus does not effectively continue the sentence’s series of details (“skyscrapers towering in the background” and “bridges connecting neighborhoods”).

Choice B is not the best answer because the phrase “exquisitely lettered street and storefront signs” does not convey a sense of the majesty of city skylines as depicted by Kingman and thus does not effectively continue the sentence’s series of details (“skyscrapers towering in the background” and “bridges connecting neighborhoods”).

Choice C is not the best answer because the phrase “other details that help define Kingman’s urban landscapes” is too vague and general to constitute a third example that conveys a sense of the majesty of city skylines as depicted by Kingman and thus does not effectively continue the sentence’s series of details (“skyscrapers towering in the background” and “bridges connecting neighborhoods”).

5

The writer wants to conclude the passage with a sentence that emphasizes an enduring legacy of Kingman’s work. Which choice would best accomplish this goal?

- A) Although Kingman’s work might not be as famous as that of some other watercolor painters, such as Georgia O’Keeffe and Edward Hopper, it is well regarded by many people.
- B) Since Kingman’s death in 2000, museums across the United States and in China have continued to ensure that his now-iconic landscapes remain available for the public to enjoy.
- C) The urban landscapes depicted in Kingman’s body of work are a testament to the aptness of the name chosen for Kingman when he was just a boy.
- D) Kingman’s work was but one example of a long-lasting tradition refreshed by an innovative artist with a new perspective.

Estimated Difficulty: Hard	Key: B
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Choice B is the best answer because it concludes the passage with a sentence that emphasizes the enduring legacy of Kingman’s work by indicating that museums continue to make Kingman’s iconic paintings accessible to the public.

Choice A is not the best answer because it concludes the passage with a sentence that acknowledges that the works of other painters are more famous than Kingman’s (which downplays, rather than emphasizes, the enduring legacy of Kingman’s work) and offers only a general assertion that Kingman’s work is “well regarded by many people.”

Choice C is not the best answer because instead of referring to the enduring legacy of Kingman’s work, it concludes the passage with a sentence that recalls a detail the passage provides about Kingman’s early life.

Choice D is not the best answer because it concludes the passage with a sentence that is too vague and general to emphasize effectively an enduring legacy of Kingman’s work. It is not clear what the idea of refreshing a long-lasting tradition

is intended to mean or how (or even whether) this represents an enduring legacy. Moreover, referring to Kingman’s work as “but one example” downplays the significance of any potential legacy that might be suggested.

Questions 6–10 are based on the following passage and supplementary material.

A Life in Traffic

A subway system is expanded to provide service to a growing suburb. A bike-sharing program is adopted to encourage nonmotorized transportation. Stoplight timing is coordinated to alleviate rush hour traffic jams in a congested downtown area. When any one of these changes **6** occur, it is likely the result of careful analysis conducted by transportation planners.

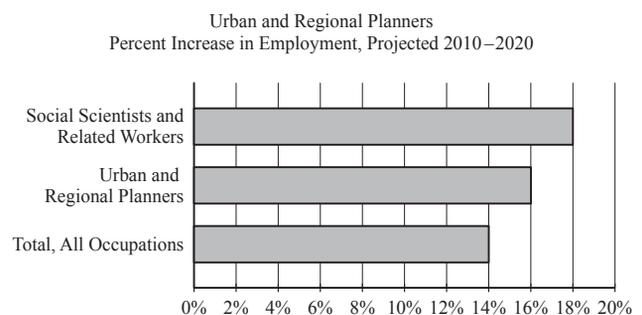
The work of transportation planners generally includes evaluating current transportation needs, assessing the effectiveness of existing facilities, and improving those facilities or designing new ones. Most transportation planners work in or near cities, **7** but some are employed in rural areas. Say, for example, a large factory is built on the outskirts of a small town. Traffic to and from that location would increase at the beginning and end of work shifts. The transportation planner’s job might involve conducting a traffic count to determine the daily number of vehicles traveling on the road to the new factory. If analysis of the traffic count indicates that there is more traffic than the **8** current road as it is designed at this time can efficiently accommodate, the transportation planner might recommend widening the road to add another lane.

Transportation planners work closely with a number of community stakeholders, such as government officials and other interested organizations and individuals. For instance, representatives from the local public health department might provide input in designing a network of trails and sidewalks to encourage people to walk more. **9** According to the American

Heart Association, walking provides numerous benefits related to health and well-being. Members of the Chamber of Commerce might share suggestions about designing transportation and parking facilities to support local businesses.

People who pursue careers in transportation planning have a wide variety of educational backgrounds. A two-year degree in transportation technology may be sufficient for some entry-level jobs in the field. Most jobs, however, require at least a bachelor’s degree; majors of transportation planners are **10** varied, including fields such as urban studies, civil engineering, geography, or transportation and logistics management. For many positions in the field, a master’s degree is required.

Transportation planners perform critical work within the broader field of urban and regional planning. As of 2010, there were approximately 40,300 urban and regional planners employed in the United States. The United States Bureau of Labor Statistics forecasts steady job growth in this field, predicting that employment of urban and regional planners will increase 16 percent between 2010 and 2020. Population growth and concerns about environmental sustainability are expected to spur the need for transportation planning professionals.



Adapted from *United States Bureau of Labor Statistics, Employment Projections Program*. “All occupations” includes all occupations in the United States economy.

6

- A) NO CHANGE
- B) occur, they are
- C) occurs, they are
- D) occurs, it is

Estimated Difficulty: Hard	Key: D
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Choice D is the best answer because it maintains agreement between the pronoun (“it”) and the antecedent (“any one”) and between the subject (“any one”) and the verb (“occurs”).

Choice A is not the best answer because the plural verb “occur” does not agree with the singular subject “any one.”

Choice B is not the best answer because the plural verb “occur” does not agree with the singular subject “any one” and because the plural pronoun “they” does not agree with the singular antecedent “any one.”

Choice C is not the best answer because the plural pronoun “they” does not agree with the singular antecedent “any one.”

7

Which choice results in the most effective transition to the information that follows in the paragraph?

- A) NO CHANGE
- B) where job opportunities are more plentiful.
- C) and the majority are employed by government agencies.
- D) DELETE the underlined portion and end the sentence with a period.

Estimated Difficulty: Medium	Key: A
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Choice A is the best answer because it effectively signals the shift in the paragraph to the example of the work a transportation planner might perform if he or she were employed in a rural area and asked to consider the effects of building a new factory “on the outskirts of a small town.”

Choice B is not the best answer because noting that job opportunities are more plentiful in cities does not effectively signal the shift in the paragraph to the example of the work a transportation planner might perform if he or she were employed in a rural area.

Choice C is not the best answer because noting that most transportation planners work for government agencies does not effectively signal the shift in the paragraph to the example of the work a transportation planner might perform if he or she were employed in a rural area.

Choice D is not the best answer because the proposed deletion would create a jarring shift from the statement “Most transportation planners work in or near cities” to the example of the work a transportation planner might perform if he or she were employed in a rural area.

8

- A) NO CHANGE
- B) current design of the road right now
- C) road as it is now currently designed
- D) current design of the road

Estimated Difficulty: Medium	Key: D
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Choice D is the best answer because it offers a clear and concise wording without redundancy.

Choice A is not the best answer because “current” is redundant with “at this time.”

Choice B is not the best answer because “current” is redundant with “right now.”

Choice C is not the best answer because “now” is redundant with “currently.”

9

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it provides supporting evidence about the benefits of walking.
- B) Kept, because it provides an additional example of a community stakeholder with whom transportation planners work.
- C) Deleted, because it blurs the paragraph’s focus on the community stakeholders with whom transportation planners work.
- D) Deleted, because it doesn’t provide specific examples of what the numerous benefits of walking are.

Estimated Difficulty: Medium	Key: C
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Choice C is the best answer because it identifies the best reason the underlined sentence should not be kept. At this point in the passage and paragraph, a general statement about the benefits of walking only serves to interrupt the discussion of the community stakeholders with whom transportation planners work.

Choice A is not the best answer because the underlined sentence should not be kept. Although the sentence could theoretically provide supporting evidence about the benefits of walking, the passage has not made a claim that needs to be supported in this way, and including

such a statement only serves to interrupt the discussion of the community stakeholders with whom transportation planners work.

Choice B is not the best answer because the underlined sentence should not be kept. Although the American Heart Association could theoretically be an example of “other interested organizations” that transportation planners work with, the sentence does not suggest this is the case. Instead, the association is merely the source for the general statement about the benefits of walking, a statement that only serves to interrupt the discussion of the actual community stakeholders with whom transportation planners work.

Choice D is not the best answer because, although the underlined sentence should be deleted, it is not because the sentence lacks specific examples of the numerous benefits of walking. Adding such examples would only serve to blur the focus of the paragraph further with general factual information, as the paragraph’s main purpose is to discuss the community stakeholders with whom transportation planners work.

- A) NO CHANGE
- B) varied, and including
- C) varied and which include
- D) varied, which include

Estimated Difficulty: Hard	Key: A
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Choice A is the best answer because it uses a comma to effectively subordinate the list of varied fields in which transportation planners major.

Choice B is not the best answer because the comma and coordinating conjunction “and” result in an ungrammatical sentence.

Choice C is not the best answer because the coordinating conjunction “and” along with the subordinating conjunction “which” result in an ungrammatical sentence.

Choice D is not the best answer because is it unclear from this construction to what exactly the subordinating conjunction “which” refers.

Math

The Math questions test your ability to problem-solve and use appropriate approaches and tools strategically. It measures math skills across four areas:

- » Heart of Algebra
- » Problem Solving and Data Analysis
- » Passport to Advanced Math
- » Additional Topics in Math (covering relevant concepts learned in high school math, such as the Pythagorean theorem)

Math Test Overview

The Math test includes a portion that allows the use of a calculator and a portion that does **not**.

Total questions: 58

- » 45 standard multiple-choice questions
 - » 13 student-produced response questions
 - » Time allotted for Math – No Calculator: 25 minutes
Time allotted for Math – Calculator: 55 minutes
- Some questions are like those you may have seen in your math courses. The ability to reason logically in a variety of situations, including ones related to career, science, and social studies, is tested throughout. You will also encounter at least three item sets that include more than one question about a given scenario.

Tips for the Math Test

- » Familiarize yourself with the directions ahead of time.
- » The test does not require you to memorize formulas. Commonly used formulas are provided in the test booklet at the beginning of each math portion. It is up to you to decide which formula is appropriate to a question.
- » Read the problem carefully. Look for key words that tell you what the problem is asking. Ask yourself the following questions before you solve each problem: What is the question asking? What do I know?
- » With some problems, it may be useful to draw a sketch or diagram of the given information.
- » Use the test booklet for scratch work. You are not expected to do all the reasoning and figuring in your head. You will not receive credit for anything written in the booklet, but you will be able to check your work easily later.
- » In the portion of the test that allows calculator use, decide when to use a calculator. (See Calculator Tips.)

- » Eliminate choices. If you don't know the correct answer to a question, try some of the choices. It's sometimes easier to find the wrong answers than the correct one. On some questions, you can eliminate all the incorrect choices. Remember that you won't lose points for incorrect answers, so plan to make your best guess if you don't know the answer.
- » Check your answer to make sure it is a reasonable answer to the question asked. This is especially true for student-produced response questions, where no answer choices are given.
- » All figures are drawn to scale unless otherwise indicated.

Calculator Policy

- » The no-calculator portion has 20 questions.
- » The calculator portion has 38 questions.
You will not be allowed to share calculators. You will be dismissed and your scores will be canceled if you use your calculator to share information during the test or to remove test questions or answers from the test room.

Calculator Tips

- » Remember to bring your calculator on test day. Calculators will not be available at the test center. You should be familiar with how to use the calculator you bring to the test.
- » Make sure your calculator is in good working order and that its batteries are fresh. If your calculator fails during testing and you have no backup, you will have to complete the test without it (or cancel your scores for the entire test).
- » Don't buy an expensive, sophisticated calculator just to take the test. Although you can use them for the test, more sophisticated calculators are not required for any problem.
- » Don't try to use a calculator on every question. First, decide how you will solve the problem, and then decide whether to use the calculator. The calculator is meant to aid you in problem solving, not to get in the way.
- » Get your thoughts down before using your calculator. It may help to do scratch work in the test booklet.
- » Take the practice test with a calculator at hand for the portion of the test that allows calculator use. This will help you practice determining which types of questions you should use your calculator to answer.

Acceptable Calculators

Most questions on the Math with Calculator portion can be solved without a calculator, but you may find using a calculator helpful on some questions. A scientific or graphing calculator is recommended for the Math with Calculator portion.

Calculators permitted during testing are:

- » Most graphing calculators (see a list at sat.collegeboard.org/register/calculator-policy)
- » All scientific calculators
- » Four-function calculators (not recommended).

If you bring a calculator with large characters (one-inch high or more) or raised display that might be visible to other test-takers, the test supervisor has discretion to seat you in a location where other test-takers cannot view the large or raised display.

Unacceptable Calculators

Do NOT bring these unacceptable calculators:

- » Laptops or other computers, tablets, cell phones, or smartphones
- » Models that can access the Internet, have wireless, Bluetooth, cellular, audio/video recording and playing, camera, or any other smartphone-type feature
- » Models that have typewriter-like keypad, pen-input, or stylus
- » Models that use electrical outlets, make noise, or have a paper tape (unless approved to use as an accommodation)

In addition, the use of hardware peripherals such as a stylus with an approved calculator is not permitted. Some models with touch-screen capability are not permitted (e.g., Casio ClassPad). Check the list of acceptable calculators for models that are permitted.

Sample Math Materials

Following are samples of the kinds of Math – No Calculator and Math – Calculator questions that may appear on your test. For these sample materials:

- » Review the notes and reference materials.
- » Decide on the best answer to each multiple-choice question.
- » Follow the directions for the student-produced responses, shown here on page 24.
- » Read the explanation for the best answer to each question, and for the multiple-choice questions, for the answer you chose (if they are different).

The notes and reference materials will appear at the beginning of both portions on the actual test. The explanation of the student-produced responses will appear in both portions of the actual test, but only once in these sample materials (page 24). The directions provided here match what you will see on the actual text.

Math Test – No Calculator Questions

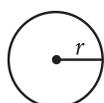
Directions

For questions 1-5, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For question 6, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 6 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



$$A = \pi r^2$$

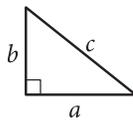
$$C = 2\pi r$$



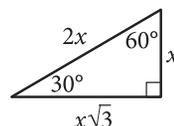
$$A = \ell w$$



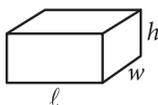
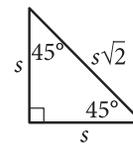
$$A = \frac{1}{2}bh$$



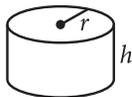
$$c^2 = a^2 + b^2$$



Special Right Triangles



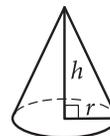
$$V = \ell wh$$



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



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



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



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

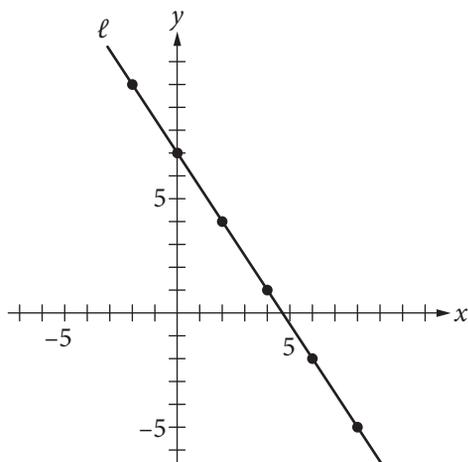
The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

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

1

Line ℓ is graphed in the xy -plane below.



If line ℓ is translated up 5 units and right 7 units, then what is the slope of the new line?

- A) $-\frac{2}{5}$
- B) $-\frac{3}{2}$
- C) $-\frac{8}{9}$
- D) $-\frac{11}{14}$

Estimated Difficulty: Easy

Key: B

Choice B is correct. The slope of a line can be determined by finding the difference in the y -coordinates divided by the difference in the x -coordinates for any two points on the line.

Using the points indicated, the slope of line ℓ is $-\frac{3}{2}$.

Translating line ℓ moves all the points on the line the same distance in the same direction, and the image will be a line parallel to ℓ . Therefore, the slope of the image is also $-\frac{3}{2}$.

Choice A is incorrect. This value may result from a combination of errors. You may have erroneously determined the slope of the new line by adding 5 to the numerator and adding 7 to the denominator in the slope of line ℓ and gotten the result $(-3 + 5)/(-2 + 7)$.

Choice C is incorrect. This value may result from a combination of errors. You may have erroneously determined the slope of the new line by subtracting 5 from the numerator and subtracting 7 from the denominator in the slope of line ℓ .

Choice D is incorrect and may result from adding $\frac{5}{7}$ to the slope of line ℓ .

2

The mean number of students per classroom, y , at Central High School can be estimated using the equation $y = 0.8636x + 27.227$, where x represents the number of years since 2004 and $x \leq 10$. Which of the following statements is the best interpretation of the number 0.8636 in the context of this problem?

- A) The estimated mean number of students per classroom in 2004
- B) The estimated mean number of students per classroom in 2014
- C) The estimated yearly decrease in the mean number of students per classroom
- D) The estimated yearly increase in the mean number of students per classroom

Estimated Difficulty: East

Key: D

Choice D is correct. When an equation is written in the form $y = mx + b$, the coefficient of the x -term (in this case 0.8636) is the slope. The slope of this linear equation gives the amount that the mean number of students per classroom (represented by y) changes per year (represented by x).

Choice A is incorrect and may result from a misunderstanding of slope and y -intercept. The y -intercept of the equation represents the estimated mean number of students per classroom in 2004.

Choice B is incorrect and may result from a misunderstanding of the limitations of the model. You may have seen that $x \leq 10$ and erroneously used this statement to determine that the model finds the mean number of students in 2014.

Choice C is incorrect and may result from a misunderstanding of slope. You may have recognized that slope models the rate of change but thought that a slope of less than 1 indicates a decreasing function.

3

The graph of $y = (2x - 4)(x - 4)$ is a parabola in the xy -plane. In which of the following equivalent equations do the x - and y -coordinates of the vertex of the parabola appear as constants or coefficients?

- A) $y = 2x^2 - 12x + 16$
- B) $y = 2x(x - 6) + 16$
- C) $y = 2(x - 3)^2 + (-2)$
- D) $y = (x - 2)(2x - 8)$

Estimated Difficulty: Medium

Key: C

Choice C is correct. The equation $y = (2x - 4)(x - 4)$ can be written in vertex form, $y = a(x - h)^2 + k$, to display the vertex, (h, k) , of the parabola. To put the equation in vertex form, first multiply: $(2x - 4)(x - 4) = 2x^2 - 8x - 4x + 16$. Then, add like terms, $2x^2 - 8x - 4x + 16 = 2x^2 - 12x + 16$. The next step is completing the square.

$$y = 2x^2 - 12x + 16$$

$$y = 2(x^2 - 6x) + 16$$

Isolate the x^2 term by factoring

$$y = 2(x^2 - 6x + 9 - 9) + 16$$

Make a perfect square in the parentheses

$$y = 2(x^2 - 6x + 9) - 18 + 16$$

Move the extra term out of the parentheses

$$y = 2(x - 3)^2 - 18 + 16$$

Factor inside the parentheses

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

Simplify the remaining terms

Therefore, the coordinates of the vertex, $(3, -2)$, are only both revealed in choice C. Since you are told that all of the equations are equivalent, simply knowing the form that displays the coordinates of the vertex will save all of these steps — this is known as “seeing structure in the expression or equation.”

Choice A is incorrect; it displays the y -value of the y -intercept of the graph $(0, 16)$ as a constant.

Choice B is incorrect; it displays the y -value of the y -intercept of the graph $(0, 16)$ as a constant.

Choice D is incorrect; it displays the x -value of one of the x -intercepts of the graph $(2, 0)$ as a constant.

4

Which of the following is equal to $(14 - 2i)(7 + 12i)$? (Note: $i = \sqrt{-1}$)

A) 74

B) 122

C) $74 + 154i$

D) $122 + 154i$

Estimated Difficulty: Medium

Key: D

Choice D is correct. Applying the distributive property to multiply the binomials yields the expression $98 + 168i - 14i - 24i^2$. The note in the question reminds you that $i = \sqrt{-1}$, therefore $i^2 = -1$. Substituting this value into the expression gives you $98 + 168i - 14i - (-24)$, and combining like terms results in $122 + 154i$.

Choice A is incorrect and may result from a combination of errors. You may not have correctly distributed when multiplying the binomials, multiplying only the first terms together and the second terms together. You may also have used the incorrect equality $i^2 = 1$.

Choice B is incorrect and may result from a combination of errors. You may not have correctly distributed when multiplying the binomials, multiplying only the first terms together and the second terms together.

Choice C is incorrect and results from misapplying the statement $i = \sqrt{-1}$.

5

Which of the following is equal to $\sin\left(\frac{\pi}{5}\right)$?

A) $-\cos\left(\frac{\pi}{5}\right)$

B) $-\sin\left(\frac{\pi}{5}\right)$

C) $\cos\left(\frac{3\pi}{10}\right)$

D) $\sin\left(\frac{7\pi}{10}\right)$

Estimated Difficulty: Hard

Key: C

Choice C is correct. Sine and cosine are related

by the equation: $\sin(x) = \cos\left(\frac{\pi}{2} - x\right)$. Therefore,

$$\sin\left(\frac{\pi}{5}\right) = \cos\left(\frac{\pi}{2} - \frac{\pi}{5}\right), \text{ which reduces to } \cos\left(\frac{\pi}{10}\right).$$

Choice A is incorrect and may result from a misunderstanding about trigonometric relationships. You may have thought that cosine is the inverse function of sine and therefore reasoned that the negative of the cosine of an angle is equivalent to the sine of that angle.

Choice B is incorrect and may result from a misunderstanding of the unit circle and how it relates to trigonometric expressions. You may have thought that, on a coordinate grid, the negative sign only changes the orientation of the triangle formed, not the value of the trigonometric expression.

Choice D is incorrect. You may have confused the relationship between sine and cosine and erroneously added $\frac{\pi}{2}$ to the given angle measure

instead of subtracting the angle measure from $\frac{\pi}{2}$.

Math Test – Calculator Questions

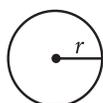
Directions

For questions 1-8, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 9-10, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 6 on page 24 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 permitted**.
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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

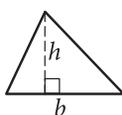


$$A = \pi r^2$$

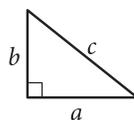
$$C = 2\pi r$$



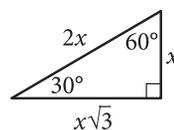
$$A = \ell w$$



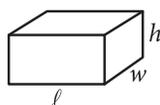
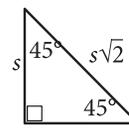
$$A = \frac{1}{2}bh$$



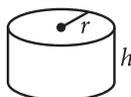
$$c^2 = a^2 + b^2$$



Special Right Triangles



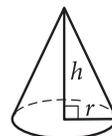
$$V = \ell wh$$



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



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



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



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

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

The number of radians of arc in a circle is 2π .

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

The recommended daily calcium intake for a 20-year-old is 1,000 milligrams (mg). One cup of milk contains 299 mg of calcium and one cup of juice contains 261 mg of calcium. Which of the following inequalities represents the possible number of cups of milk m and cups of juice j a 20-year-old could drink in a day to meet or exceed the recommended daily calcium intake from these drinks alone?

- A) $299m + 261j \geq 1,000$
 B) $299m + 261j > 1,000$
 C) $\frac{299}{m} + \frac{261}{j} \geq 1,000$
 D) $\frac{299}{m} + \frac{261}{j} > 1,000$

Estimated Difficulty: Easy	Key: A
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Choice A is correct. Multiplying the number of cups of milk by the amount of calcium each cup contains and multiplying the number of cups of juice by the amount of calcium each cup contains gives the total amount of calcium from each source. You must then find the sum of these two numbers to find the total amount of calcium. Because the question asks for the calcium from these two sources to meet or exceed the recommended daily intake, the sum of these two products must be greater than or equal to 1,000.

Choice B is incorrect and may result from a misunderstanding of the meaning of inequality symbols as they relate to real-life situations. This answer does not allow for the daily intake to meet the recommended daily amount.

Choice C is incorrect and may result from a misunderstanding of proportional relationships. Here the wrong operation is applied, with the total amount of calcium per cup divided by the number of cups of each type of drink. These values should be multiplied.

Choice D is incorrect and may result from a combination of mistakes. The inequality symbol used allows the option to exceed, but not to meet, the recommended daily value, and the wrong operation may have been applied when calculating the total amount of calcium intake from each drink.

A company's manager estimated that the cost C , in dollars, of producing n items is $C = 7n + 350$. The company sells each item for \$12. The company makes a profit when the total income from selling a quantity of items is greater than the total cost of producing that quantity of items. Which of the following inequalities gives all possible values of n for which the manager estimates that the company will make a profit?

- A) $n < 70$
 B) $n < 84$
 C) $n > 70$
 D) $n > 84$

Estimated Difficulty: Medium	Key: C
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Choice C is correct. One way to find the correct answer is to create an inequality. The income from sales of n items is $12n$. For the company to profit, $12n$ must be greater than the cost of producing n items; therefore, the inequality $12n > 7n + 350$ can be used to model the scenario. Solving this inequality yields $n > 70$.

Choice A is incorrect and may result from a misunderstanding of the properties of inequalities. You may have found the number of items of the break-even point as 70 and used the incorrect notation to express the answer, or you may have incorrectly modeled the scenario when setting up an inequality to solve.

Choice B is incorrect and may result from a misunderstanding of how the cost equation models the scenario. If you use the cost of \$12 as the number of items n and evaluate the expression $7n$, you will find the value of 84. Misunderstanding how the inequality relates to the scenario might lead you to think n should be less than this value.

Choice D is incorrect and may result from a misunderstanding of how the cost equation models the scenario. If you use the cost of \$12 as the number of items n and evaluate the expression $7n$, you will find the value of 84. Misunderstanding how the inequality relates to the scenario might lead you to think n should be greater than this value.

3

At a primate reserve, the mean age of all the male primates is 15 years, and the mean age of all female primates is 19 years. Which of the following must be true about the mean age m of the combined group of male and female primates at the primate reserve?

- A) $m = 17$
- B) $m > 17$
- C) $m < 17$
- D) $15 < m < 19$

Estimated Difficulty: Medium

Key: D

Choice D is correct. You must reason that because the mean of the males is lower than that of the females, the combined mean cannot be greater than or equal to that of the females, while also reasoning that because the mean of the females is greater than that of the males, the combined mean cannot be less than or equal to the mean of the males. Therefore, the combined mean must be between the two separate means.

Choice A is incorrect and results from finding the mean of the two means. This answer makes an unjustified assumption that there are an equal number of male and female primates.

Choice B is incorrect and results from finding the mean of the two means and misapplying an inequality to the scenario. This answer makes an unjustified assumption that there are more females than males.

Choice C is incorrect and results from finding the mean of the two means and misapplying an inequality to the scenario. This answer makes an unjustified assumption that there are more males than females.

4

A biology class at Central High School predicted that a local population of animals will double in size every 12 years. The population at the beginning of 2014 was estimated to be 50 animals. If P represents the population n years after 2014, then which of the following equations represents the class's model of the population over time?

- A) $P = 12 + 50n$
- B) $P = 50 + 12n$
- C) $P = 50(2)^{12n}$
- D) $P = 50(2)^{\frac{n}{12}}$

Estimated Difficulty: Medium

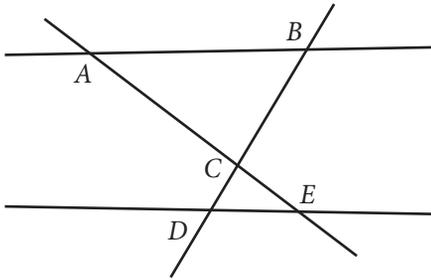
Key: D

Choice D is correct. You must first recognize that a population that doubles in size over equal time periods is increasing at an exponential rate. In a doubling scenario, an exponential growth model can be written in the form $y = a(2)^{\frac{n}{b}}$, where a is the initial population (that is, the population when $n = 0$) and b is the number of years it takes for the population to double in size. In this case, the initial population is 50, the number of animals at the beginning of 2014. Therefore, $a = 50$. The text explains that the population will double in size every 12 years. Therefore, $b = 12$.

Choice A is incorrect and may result from a misunderstanding of exponential equations or of the context. This linear model indicates that the initial population is 12 animals and the population is increasing by 50 animals each year. However, this is not the case.

Choice B is incorrect and may result from a misunderstanding of exponential equations or of the scenario. This linear model indicates that the initial population is 50 animals and the population is increasing by 12 animals each year. However, this is not the case.

Choice C is incorrect. This exponential model indicates that the initial population is 50 animals and is doubling. However, the exponent $12n$ indicates that the population is doubling 12 times per year, not every 12 years. This is not the case.



Note: Figure not drawn to scale.

In the figure above, $\triangle ABC \sim \triangle EDC$. Which of the following must be true?

- A) $\overline{AE} \parallel \overline{BD}$
- B) $\overline{AE} \perp \overline{BD}$
- C) $\overline{AB} \parallel \overline{DE}$
- D) $\overline{AB} \perp \overline{DE}$

Estimated Difficulty: Medium

Key: C

Choice C is correct. Given that $\triangle ABC$ is similar to $\triangle EDC$, you can determine that the corresponding $\angle BAC$ is congruent to $\angle CED$. The converse of the alternate interior angle theorem tells us that $\overline{AB} \parallel \overline{DE}$. (You can also use the fact that $\angle ABC$ and $\angle CDE$ are congruent to make a similar argument.)

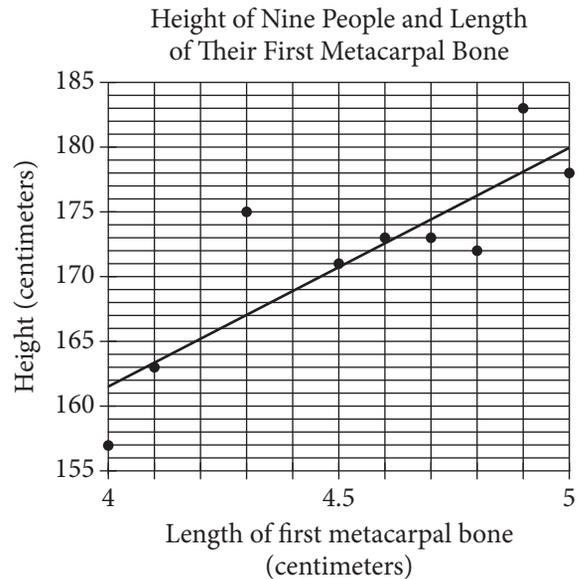
Choice A is incorrect and may result from multiple misconceptions. You may have misidentified the segments as perpendicular and used the wrong notation to express this statement.

Choice B is incorrect and may result from using only the diagram and not considering the given information. The line segments appear to be perpendicular, but need not be, given the information provided.

Choice D is incorrect and may result from misunderstanding either the notation or the vocabulary of parallel and perpendicular lines. You may have incorrectly identified parallel lines as perpendicular.

Questions 6–8 refer to the following information.

The first metacarpal bone is located in the hand. The scatterplot below shows the relationship between the length of the first metacarpal bone and height of 9 people. The line of best fit is also shown.



6

How many of the 9 people have an actual height that differs by more than 3 centimeters from the height predicted by the line of best fit?

- A) 2
- B) 4
- C) 6
- D) 9

Estimated Difficulty: Easy

Key: B

Choice B is correct. The people who have first metacarpal bones of length 4.0, 4.3, 4.8, and 4.9 centimeters have heights that differ by more than 3 centimeters from the height predicted by the line of best fit.

Choice A is incorrect. There are 2 people whose actual heights are more than 3 centimeters above the height predicted by the line of best fit. However, there are also 2 people whose actual heights are farther than 3 centimeters below the line of best fit.

Choice C is incorrect. There are 6 data points in which the absolute value between the actual height and the height predicted by the line of best fit is greater than 1 centimeter.

Choice D is incorrect. The data on the graph represents 9 different people; however, the absolute value of the difference between actual height and predicted height is not greater than 3 for all of the people.

7

Which of the following is the best interpretation of the slope of the line of best fit in the context of this problem?

- A) The predicted height increase in centimeters for one centimeter increase in the first metacarpal bone
- B) The predicted first metacarpal bone increase in centimeters for every centimeter increase in height
- C) The predicted height in centimeters of a person with a first metacarpal bone length of 0 centimeters
- D) The predicted first metacarpal bone length in centimeters for a person with a height of 0 centimeters

Estimated Difficulty: Easy

Key: A

Choice A is correct. The slope is the change in the vertical distance divided by the change in the horizontal distance between any two points on a line. In this context, the change in the vertical distance is the change in the predicted height of a person, and the change in the horizontal distance is the change in the length of his or her first metacarpal bone. The unit rate, or slope, is the increase in predicted height for each increase of one centimeter of the first metacarpal bone.

Choice B is incorrect. If you selected this answer, you may have interpreted slope incorrectly as run over rise.

Choice C is incorrect. If you selected this answer, you may have mistaken slope for the y -intercept.

Choice D is incorrect. If you selected this answer, you may have mistaken slope for the x -intercept.

8

Based on the line of best fit, what is the predicted height for someone with a first metacarpal bone that has a length of 4.45 centimeters?

- A) 168 centimeters
- B) 169 centimeters
- C) 170 centimeters
- D) 171 centimeters

Estimated Difficulty: Easy

Key: C

Choice C is correct. You must notice that the scale of the x -axis is 0.1, and therefore the x -value of 4.45 is halfway between the unmarked value of 4.4 and the marked value of 4.5. You must then find the y -value on the line of best fit that corresponds with an x -value of 4.45, which is 170.

Choice A is incorrect. If you mistakenly find the point on the line between the x -values of 4.3 and 4.4, you will likely find a predicted metacarpal bone length of 168 centimeters.

Choice B is incorrect. If you mistakenly find the point on the line that corresponds with an x -value of 4.4 centimeters, you will likely find a predicted height of approximately 169 centimeters.

Choice D is incorrect. If you mistakenly find the point on the line that corresponds with an x -value of 4.5 centimeters, you will likely find a predicted height of approximately 171 centimeters. You might also choose this option if you mistakenly use the data point that has an x -value closest to 4.45 centimeters.

Student-Produced Response Math Questions

For questions 9 and 10, you are asked to solve the problem and enter your answer in the grid, as described on page 24 of this booklet.

9

The table below classifies 103 elements as metal, metalloid, or nonmetal and as solid, liquid, or gas at standard temperature and pressure.

	Solids	Liquids	Gases	Total
Metals	77	1	0	78
Metalloids	7	0	0	7
Nonmetals	6	1	11	18
Total	90	2	11	103

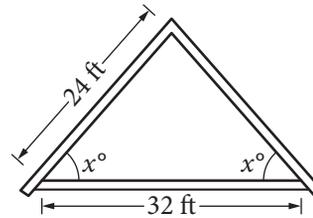
What fraction of all solids and liquids in the table are metalloids?

Estimated Difficulty: Easy	Key: $\frac{7}{92}$
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There are 7 metalloids that are solid or liquid, and there are 92 total solids and liquids. Therefore, the fraction of solids and liquids that are metalloids is $\frac{7}{92}$.

10

An architect drew the sketch below while designing a house roof. The dimensions shown are for the interior of the triangle.



Note: Figure not drawn to scale.

What is the value of $\cos x$?

Estimated Difficulty: Hard	Key: $\frac{2}{3}$
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Because the triangle is isosceles, constructing a perpendicular from the top vertex to the opposite side will bisect the base and create two smaller right triangles. In a right triangle, the cosine of an acute angle is equal to the length of the side adjacent to the angle divided by the length of the hypotenuse.

This gives $\cos x = \frac{16}{24}$, which can be simplified to $\cos x = \frac{2}{3}$. Note that $\frac{16}{24}$ cannot be entered into the answer grid, so this fraction must be reduced.)

The Essay

The Essay assesses reading, analysis, and writing skills. It is optional and given at the end of the SAT. Some postsecondary institutions require it for admission, so if you know where you want to apply before testing, be sure to check each institution's requirements before you choose an Essay or no-Essay option during registration. (Note that you may be able to change from Essay to no-Essay — or the reverse — on test day, but that is not guaranteed.)

The SAT Essay presents you with a passage and asks you to explain how the passage's author builds an argument to persuade an audience. Essay passages examine ideas, debates, trends, and the like in the arts, the sciences, and civic, cultural, and political life that have wide interest, relevance, and accessibility. The passages tend not to be simple pro/con debates on issues but instead efforts to convey nuanced views on complex subjects.

Your response will analyze the passage for the author's use of evidence, reasoning, and/or stylistic and persuasive elements, and/or other features that you believe contribute to the persuasiveness of the passage. Be sure to base your essay on the features of the passage most relevant to responding to the prompt. If, for example, you don't feel that evidence use is particularly important in a particular passage, you don't have to write about it. Write instead about features that you believe help build the persuasive argument.

It's important to understand that your response should **not** focus on whether you agree or disagree with the claim made in the passage but should instead focus on how the author builds an argument to persuade an audience.

While the source text (and a bit of the language in the prompt) will vary from test to test, you'll always be presented with a passage and asked to explain how its author builds an argument.

Essays are evaluated for demonstrated comprehension of the passage, quality of analysis, and quality of writing. See the Essay Scoring Guide on pages 38 and 39 for more information.

Essay Overview

- » Total questions: 1 prompt, with points to consider and directions
- » 1 passage
- » Time allotted: 50 minutes to read and analyze the passage and to develop a written response

On the Essay, you are asked to demonstrate college- and career-readiness proficiency in **reading, writing, and analysis** through comprehending a high-quality source text, producing a cogent and clear written analysis of that text, and supporting that analysis with critical reasoning and evidence drawn from the source. The Essay does not ask you to take a stand on the author's point of view but instead to analyze how the author builds a persuasive argument.

Your essay will receive three scores, each on a scale of 2 to 8:

Reading: Demonstrated comprehension of the passage, its main ideas, and its important details.

Analysis: Demonstrated understanding of the analytical task, and effective analysis of the author's use of evidence, reasoning, and/or stylistic or persuasive elements (and/or features of your own choice).

Writing: Communication of information and ideas in a structured, cohesive manner, using precise language and a variety of sentence structures and showing a command of the conventions of standard written English.

These scores are not combined with each other or with any other scores on the SAT. (They don't, for instance, affect the Evidence-Based Reading and Writing section score or the total test score.)

Essay Test Question

Directions

The essay gives you an opportunity to show how effectively you can read and comprehend a passage and write an essay analyzing the passage. In your essay, you should demonstrate that you have read the passage carefully, present a clear and logical analysis, and use language precisely.

Your essay must be written on the lines provided in your answer booklet; except for the Planning Page of the answer booklet, you will receive no other paper on which to write. You will have enough space if you write on every line, avoid wide margins, and keep your handwriting to a reasonable size. Remember that people who are not familiar with your handwriting will read what you write. Try to write or print so that what you are writing is legible to those readers.

You have 50 minutes to read the passage and write an essay in response to the prompt provided inside this booklet.

Reminders:

Do not write your essay in this prompt booklet. Only what you write on the lined pages of your answer booklet will be evaluated.

An off-topic essay will not be evaluated.

The following sample illustrates the general format of the Essay task in the context of a specific prompt, this one related to a passage adapted from an article by Paul Bogard about the value of natural darkness.

As you read the passage below, consider how Paul Bogard uses

- 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 Paul Bogard, "Let There Be Dark." ©2012 by Los Angeles Times. Originally published December 21, 2012.

- 1 At my family's cabin on a Minnesota lake, I knew woods so dark that my hands disappeared before my eyes. I knew night skies in which meteors left smoky trails across sugary spreads of stars. But now, when 8 of 10 children born in the United States will never know a sky dark enough for the Milky Way, I worry we are rapidly losing night's natural darkness before realizing its worth. This winter solstice, as we cheer the days' gradual movement back toward light, let us also remember the irreplaceable value of darkness.
- 2 All life evolved to the steady rhythm of bright days and dark nights. Today, though, when we feel the closeness of nightfall, we reach quickly for a light switch. And too little darkness, meaning too much artificial light at night, spells trouble for all.
- 3 Already the World Health Organization classifies working the night shift as a probable human carcinogen, and the American Medical Association has voiced its unanimous support for "light pollution reduction efforts and glare reduction efforts at both the national and state levels." Our bodies need darkness to produce the hormone melatonin, which keeps certain cancers from developing, and our bodies need darkness for sleep. Sleep disorders have been linked to diabetes, obesity, cardiovascular disease and depression, and recent research suggests one main cause of "short sleep" is "long light." Whether we work at night or simply take our tablets, notebooks and smartphones to bed, there isn't a place for this much artificial light in our lives.

- 4 The rest of the world depends on darkness as well, including nocturnal and crepuscular species of birds, insects, mammals, fish and reptiles. Some examples are well known—the 400 species of birds that migrate at night in North America, the sea turtles that come ashore to lay their eggs—and some are not, such as the bats that save American farmers billions in pest control and the moths that pollinate 80% of the world’s flora. Ecological light pollution is like the bulldozer of the night, wrecking habitat and disrupting ecosystems several billion years in the making. Simply put, without darkness, Earth’s ecology would collapse. . . .
- 5 In today’s crowded, louder, more fast-paced world, night’s darkness can provide solitude, quiet and stillness, qualities increasingly in short supply. Every religious tradition has considered darkness invaluable for a soulful life, and the chance to witness the universe has inspired artists, philosophers and everyday stargazers since time began. In a world awash with electric light . . . how would Van Gogh have given the world his “Starry Night”? Who knows what this vision of the night sky might inspire in each of us, in our children or grandchildren?
- 6 Yet all over the world, our nights are growing brighter. In the United States and Western Europe, the amount of light in the sky increases an average of about 6% every year. Computer images of the United States at night, based on NASA photographs, show that what was a very dark country as recently as the 1950s is now nearly covered with a blanket of light. Much of this light is wasted energy, which means wasted dollars. Those of us over 35 are perhaps among the last generation to have known truly dark nights. Even the northern lake where I was lucky to spend my summers has seen its darkness diminish.
- 7 It doesn’t have to be this way. Light pollution is readily within our ability to solve, using new lighting technologies and shielding existing lights. Already, many cities and towns across North America and Europe are changing to LED streetlights, which offer dramatic possibilities for controlling wasted light. Other communities are finding success with simply turning off portions of their public lighting after midnight. Even Paris, the famed “city of light,” which already turns off its monument lighting after 1 a.m., will this summer start to require its shops, offices and public buildings to turn off lights after 2 a.m. Though primarily designed to save energy, such reductions in light will also go far in addressing light pollution. But we will never truly address the problem of light pollution until we become aware of the irreplaceable value and beauty of the darkness we are losing.

Write an essay in which you explain how Paul Bogard builds an argument to persuade his audience that natural darkness should be preserved. In your essay, analyze how Bogard uses one or more of the features listed in the box above (or features of your own choice) to strengthen the logic and persuasiveness of his argument. Be sure that your analysis focuses on the most relevant features of the passage.

Your essay should not explain whether you agree with Bogard’s claims, but rather explain how Bogard builds an argument to persuade his audience.

Sample Essays

The following student essays show you what kinds of attributes will be evaluated in the SAT Essay. Each essay is followed by an explanation of

why it received the assigned score on each of the three dimensions.

SAMPLE 1

Bogard builds an argument to persuade his audience about what he is concerning about and feels it important to take care about. His essay talks about so much facts about sleeping how so little can effect us health wise examples like getting sleep disorders, diabetes, obesity, cardiovascular disease and depression. This facts helps people persuade the audience he also say that the world health organization classifies working night shift is bad. In his argument is not all about how it bad for the body he also claims and have proof that light cost are expensive and really costing people because they have light all

night long. He also claims light is messing with mother nature that animals need darkness to feed eat move around because there noctuaral creatures. He has details facts about human body, animals and about mother nature that he can use to support his idea of not using so much light at night and how we need darkness. With these features he can persuade the audience because people dont know why darkness can be good for us. He was all of facts and examples that he claim is efficting us and there world.

This response scored a 2/1/1.

Reading—2: This response demonstrates some comprehension of the source text, although the writer's understanding of Bogard's central idea isn't conveyed until the latter part of the essay, where the writer indicates that Bogard includes *details facts about human body, animals and about mother nature that he can use to support his idea of not using so much light at night and how we need darkness*. Prior to this, the writer has included details from the text, but without contextualizing these details within Bogard's broader argument, suggesting that the writer is relaying ideas from the text without much understanding of how they contribute to the whole. For example, the writer mentions the health problems cited in the text, that working the night shift is classified as bad, and that light costs are high, but doesn't explain how these points relate to Bogard's main claim that we must preserve natural darkness. On the whole, this essay displays only a partial understanding of the source text.

Analysis—1: In this essay, the writer has merely identified aspects of Bogard's use of evidence without explaining how the evidence contributes to the argument. The writer notes that Bogard's text *talks about so much facts about sleeping how so little can effect us health wise examples like getting sleep disorders, diabetes, obesity, cardiovascular disease and depression. This facts helps people persuade the audience*. Other than identifying these as persuasive facts, however, the writer does nothing to indicate an understanding of the analytical task. The writer again mentions persuasion before the conclusion of the essay (*With these features he can persuade the audience*

because people dont know why darkness can be good for us), but once again, there is no explanation of how or why these features are persuasive. Thus, the essay offers inadequate analysis of Bogard's text.

Writing—1: This response demonstrates little cohesion and inadequate skill in the use and control of language. From the outset, problems with language control impede the writer's ability to establish a clear central claim (*Bogard builds an argument to persuade his audience about what he is concerning about and feels it important to take care about*). The response also lacks a recognizable introduction and conclusion, and sentences are strung together without a clear progression of ideas (for much of the response, the writer merely lists claims Bogard makes). The response also lacks variety in sentence structures, in part because of repetitive transitions. (For example, *he also claims* is used two sentences in a row in this brief response). Weak control of the conventions of standard written English, coupled with vague word choice, undermine the quality of writing. Overall, this response has demonstrated inadequate writing skill.

SAMPLE 2

Paul Bogard strongly believes that natural darkness should be preserved. In order to prove the need for natural darkness, Bogard divides his argument into three main topics, saying that natural darkness is beneficial to humans, essential to humans, and essential to ecosystems.

According to Bogard, natural darkness can be a positive help to humans. One of the ways it can accomplish this is by giving enjoyment to onlookers. To supplant this, Bogard gives a personal example of how he enjoyed seeing meteors dart across the night sky in Minnesota as a child. Also he states that natural darkness can be a source of solitude. Supporting this claim, Bogard states that darkness is invaluable to every religion. Additionally Bogard says that the night sky has inspired countless numbers of philosophers, artists, and stargazers for millennia. He then gives an appealing allusion by asking how Van Gogh could have painted “Starry Night” in the mist of electric light. One of Bogard’s primary arguments for natural darkness shows how it can benefit humans.

Bogard then gives a scientific case that shows why natural darkness is essential to humans. He states a find of the World Health Organization that declares the night shift can be detrimental to one’s health. He points to the necessity of darkness in producing melatonin, a hormone that helps prevent certain cancers from developing in the human body. Bogard then concludes his argument that darkness is essential to human well-being by analyzing sleep. He first makes

the obvious claim that darkness is essential for sleep. Then, he talks about the negative health effects of sleep disorders.; these include “diabetes, obesity, cardiovascular disease and depression.” To associate this with his argument for natural darkness, Bogard states the findings of recent research, which say that “long light” is one of the primary causes of “short sleep.” Bogard uses scientific evidence to support his belief in the preservation of natural darkness.

Bogard’s third primary defense of natural darkness declares that it is essential to nature. He notes that there are a variety of nocturnal and crepuscular species of birds, fish, mammals, insects, and reptiles worldwide. He gives two specific, well-known examples of these species; these discussed the 400 species of North American birds that migrate at night and the sea turtles that lay their eggs on the shore at night. He also gives a couple of lesser-known examples, involving bats and moths that show the positive actions that some nocturnal animals perform. He then concludes his argument for nocturnal darkness necessary to nature with persuasion, saying that removing natural darkness would essentially destroy an ecology that took billions of years to develop. Here, Bogard uses scientific fact to prove that natural darkness is a key to nature and ecology. Paul Bogard supports the preservation of natural darkness. He uses an argument to support his position that has three primary points—benefit to humans, need for humans and need for nature.

This response scored a 4/1/3.

Reading—4: This response demonstrates thorough comprehension of Bogard’s text and a clear understanding of the interrelation between the central idea and important details. The writer briefly summarizes Bogard’s central idea (*natural darkness should be preserved*) and aptly notes that Bogard’s argument encompasses three main points: *that natural darkness is beneficial to humans, essential to humans, and essential to ecosystems*. The writer provides various details from the text that support these points. In the first body paragraph, for example, the writer demonstrates comprehension of how Bogard’s *personal example of how he enjoyed seeing meteors dart across the night sky in Minnesota as a child* relates to his claim that natural darkness can give *enjoyment to onlookers*. The writer also sees the connection between darkness as a *source of solitude* and it inspiring *countless numbers of*

philosophers, artists, and stargazers for millennia. Providing these details highlights the writer’s understanding of Bogard’s claim that natural darkness *can benefit humans*. The writer continues to demonstrate how details in Bogard’s text relate to each other and to his central idea in the subsequent discussion of how darkness is essential to humans’ health and to nature. Although little is directly quoted from the text, the writer’s thorough paraphrasing of multiple details taken from across the passage indicates that the writer comprehensively understands Bogard’s argument and is able to convey it in his own words.

Analysis—1: The response offers ineffective analysis of Bogard’s text and demonstrates little understanding of the analytical task. Although clearly comprehending the entirety of Bogard’s argument, the writer does not communicate

how Bogard builds his argument with evidence, reasoning, or stylistic or persuasive elements, nor does the writer communicate what effect Bogard's argumentation has on his audience. Instead of providing effective analysis, the writer only identifies argumentative elements in Bogard's text, such as the *appealing allusion* Bogard offers regarding Van Gogh's *Starry Night* or the *scientific evidence* Bogard uses to *support his belief in the preservation of natural darkness*. The writer instead consistently lapses into summary. Overall, the response demonstrates inadequate analysis.

Writing—3: This mostly cohesive response demonstrates effective use and control of language. The writer presents an effective introduction with a clear central claim that lays out the three points discussed in the response (*In order to prove the need for natural darkness, Bogard divides his argument into three main topics, saying that natural darkness is beneficial to humans, essential to humans, and essential to the ecosystem*). The response also includes an generally effective

conclusion that summarizes rather than advances the essay (*Paul Bogard supports the preservation of natural darkness. He uses an argument to support his position that has three primary points—benefit to humans, need for humans and need for nature*) although the conclusion is not marked off by a paragraph break. The response is organized clearly around the three points identified in the introduction, and each body paragraph stays on topic. The writer also demonstrates a clear progression of ideas both within paragraphs and throughout the essay. Sentence structure tends to be repetitive and simple, however. For example, at or near the end of each body paragraph, the writer restates the point that introduces that paragraph (*Bogard then gives a scientific case that shows why natural darkness is essential to humans. . . . Bogard uses scientific evidence to support his belief in the preservation of natural darkness*). Although the writing in this response is proficient, it does not demonstrate the sentence variety, precise word choice, or highly effective progression of ideas that is expected at the advanced level.

SAMPLE 3

In response to our world's growing reliance on artificial light, writer Paul Bogard argues that natural darkness should be preserved in his article "Let There be dark". He effectively builds his argument by using a personal anecdote, allusions to art and history, and rhetorical questions.

Bogard starts his article off by recounting a personal story – a summer spent on a Minnesota lake where there was "woods so dark that [his] hands disappeared before [his] eyes." In telling this brief anecdote, Bogard challenges the audience to remember a time where they could fully amass themselves in natural darkness void of artificial light. By drawing in his readers with a personal encounter about night darkness, the author means to establish the potential for beauty, glamour, and awe-inspiring mystery that genuine darkness can possess. He builds his argument for the preservation of natural darkness by reminiscing for his readers a first-hand encounter that proves the "irreplaceable value of darkness."

This anecdote provides a baseline of sorts for readers to find credence with the author's claims. Bogard's argument is also furthered by his use of allusion to art – Van Gogh's "Starry Night" – and modern history – Paris' reputation as "The City of Light". By first referencing "Starry Night", a painting generally considered to be undoubtedly beautiful, Bogard establishes that the natural

magnificence of stars in a dark sky is definite. A world absent of excess artificial light could potentially hold the key to a grand, glorious night sky like Van Gogh's according to the writer. This urges the readers to weigh the disadvantages of our world consumed by unnatural, vapid lighting. Furthermore, Bogard's alludes to Paris as "the famed 'city of light'". He then goes on to state how Paris has taken steps to exercise more sustainable lighting practices. By doing this, Bogard creates a dichotomy between Paris' traditionally alluded-to name and the reality of what Paris is becoming – no longer "the city of light", but moreso "the city of light...before 2 AM". This furthers his line of argumentation because it shows how steps can be and are being taken to preserve natural darkness. It shows that even a city that is literally famous for being constantly lit can practically address light pollution in a manner that preserves the beauty of both the city itself and the universe as a whole.

Finally, Bogard makes subtle yet efficient use of rhetorical questioning to persuade his audience that natural darkness preservation is essential. He asks the readers to consider "what the vision of the night sky might inspire in each of us, in our children or grandchildren?" in a way that brutally plays to each of our emotions. By asking this question, Bogard draws out heartfelt ponderance from his readers about the affecting power of an

untainted night sky. This rhetorical question tugs at the readers' heartstrings; while the reader may have seen an unobscured night skyline before, the possibility that their child or grandchild will never get the chance sways them to see as Bogard sees. This strategy is definitively an appeal to pathos, forcing the audience to directly face an emotionally-charged inquiry that will surely spur some kind of response. By doing this, Bogard develops his argument, adding gutthral power

to the idea that the issue of maintaining natural darkness is relevant and multifaceted.

Writing as a reaction to his disappointment that artificial light has largely permeated the presence of natural darkness, Paul Bogard argues that we must preserve true, unaffected darkness. He builds this claim by making use of a personal anecdote, allusions, and rhetorical questioning.

This response scored a 4/4/4.

Reading—4: This response demonstrates thorough comprehension of the source text through skillful use of paraphrases and direct quotations. The writer briefly summarizes the central idea of Bogard's piece (*natural darkness should be preserved; we must preserve true, unaffected darkness*), and presents many details from the text, such as referring to the personal anecdote that opens the passage and citing Bogard's use of *Paris' reputation as "The City of Light."* There are few long direct quotations from the source text; instead, the response succinctly and accurately captures the entirety of Bogard's argument in the writer's own words, and the writer is able to articulate how details in the source text interrelate with Bogard's central claim. The response is also free of errors of fact or interpretation. Overall, the response demonstrates advanced reading comprehension.

Analysis—4: This response offers an insightful analysis of the source text and demonstrates a sophisticated understanding of the analytical task. In analyzing Bogard's use of *personal anecdote, allusions to art and history, and rhetorical questions*, the writer is able to explain carefully and thoroughly how Bogard builds his argument over the course of the passage. For example, the writer offers a possible reason for why Bogard chose to open his argument with a personal anecdote, and is also able to describe the overall effect of that choice on his audience (*In telling this brief anecdote, Bogard challenges the audience to remember a time where they could fully amass themselves in natural darkness void of artificial light. By drawing in his readers with a personal encounter ... the author means to establish the potential for beauty, glamour, and awe-inspiring mystery that genuine darkness can possess. . . . This anecdote provides a baseline of sorts for readers to find credence with the author's claims*). The cogent chain of reasoning indicates an understanding of the overall effect of Bogard's personal narrative both in terms of its function in the passage and how it affects his audience. This type of insightful analysis is evident throughout the response and indicates advanced analytical skill.

Writing—4: The response is cohesive and demonstrates highly effective use and command of language. The response contains a precise central claim (*He effectively builds his argument by using personal anecdote, allusions to art and history, and rhetorical questions*), and the body paragraphs are tightly focused on those three elements of Bogard's text. There is a clear, deliberate progression of ideas within paragraphs and throughout the response. The writer's brief introduction and conclusion are skillfully written and encapsulate the main ideas of Bogard's piece as well as the overall structure of the writer's analysis. There is a consistent use of both precise word choice and well-chosen turns of phrase (*the natural magnificence of stars in a dark sky is definite, our world consumed by unnatural, vapid lighting, the affecting power of an untainted night sky*). Moreover, the response features a wide variety in sentence structure and many examples of sophisticated sentences (*By doing this, Bogard creates a dichotomy between Paris' traditionally alluded-to name and the reality of what Paris is becoming – no longer "the city of light", but more so "the city of light...before 2AM"*). The response demonstrates a strong command of the conventions of written English. Overall, the response exemplifies advanced writing proficiency.

Essay Scoring Guide

Score	Reading	Analysis	Writing
4	<p>Advanced: The response demonstrates thorough comprehension of the source text.</p> <p>The response shows an understanding of the text’s central idea(s) and of most important details and how they interrelate, demonstrating a comprehensive understanding of the text.</p> <p>The response is free of errors of fact or interpretation with regard to the text.</p> <p>The response makes skillful use of textual evidence (quotations, paraphrases, or both), demonstrating a complete understanding of the source text.</p>	<p>Advanced: The response offers an insightful analysis of the source text and demonstrates a sophisticated understanding of the analytical task.</p> <p>The response offers a thorough, well-considered evaluation of the author’s use of evidence, reasoning, and/or stylistic and persuasive elements, and/or feature(s) of the student’s own choosing.</p> <p>The response contains relevant, sufficient, and strategically chosen support for claim(s) or point(s) made.</p> <p>The response focuses consistently on those features of the text that are most relevant to addressing the task.</p>	<p>Advanced: The response is cohesive and demonstrates a highly effective use and command of language.</p> <p>The response includes a precise central claim.</p> <p>The response includes a skillful introduction and conclusion. The response demonstrates a deliberate and highly effective progression of ideas both within paragraphs and throughout the essay.</p> <p>The response has a wide variety in sentence structures. The response demonstrates a consistent use of precise word choice. The response maintains a formal style and objective tone.</p> <p>The response shows a strong command of the conventions of standard written English and is free or virtually free of errors.</p>
3	<p>Proficient: The response demonstrates effective comprehension of the source text.</p> <p>The response shows an understanding of the text’s central idea(s) and important details.</p> <p>The response is free of substantive errors of fact and interpretation with regard to the text.</p> <p>The response makes appropriate use of textual evidence (quotations, paraphrases, or both), demonstrating an understanding of the source text.</p>	<p>Proficient: The response offers an effective analysis of the source text and demonstrates an understanding of the analytical task.</p> <p>The response competently evaluates the author’s use of evidence, reasoning, and/or stylistic and persuasive elements, and/or feature(s) of the student’s own choosing.</p> <p>The response contains relevant and sufficient support for claim(s) or point(s) made.</p> <p>The response focuses primarily on those features of the text that are most relevant to addressing the task.</p>	<p>Proficient: The response is mostly cohesive and demonstrates effective use and control of language.</p> <p>The response includes a central claim or implicit controlling idea.</p> <p>The response includes an effective introduction and conclusion.</p> <p>The response demonstrates a clear progression of ideas both within paragraphs and throughout the essay.</p> <p>The response has variety in sentence structures. The response demonstrates some precise word choice. The response maintains a formal style and objective tone.</p> <p>The response shows a good control of the conventions of standard written English and is free of significant errors that detract from the quality of writing.</p>

Score	Reading	Analysis	Writing
2	<p>Partial: The response demonstrates some comprehension of the source text.</p> <p>The response shows an understanding of the text’s central idea(s) but not of important details.</p> <p>The response may contain errors of fact and/or interpretation with regard to the text.</p> <p>The response makes limited and/or haphazard use of textual evidence (quotations, paraphrases, or both), demonstrating some understanding of the source text.</p>	<p>Partial: The response offers limited analysis of the source text and demonstrates only partial understanding of the analytical task.</p> <p>The response identifies and attempts to describe the author’s use of evidence, reasoning, and/or stylistic and persuasive elements, and/or feature(s) of the student’s own choosing, but merely asserts rather than explains their importance,</p> <p>Or one or more aspects of the response’s analysis are unwarranted based on the text.</p> <p>The response contains little or no support for claim(s) or point(s) made.</p> <p>The response may lack a clear focus on those features of the text that are most relevant to addressing the task.</p>	<p>Partial: The response demonstrates little or no cohesion and limited skill in the use and control of language.</p> <p>The response may lack a clear central claim or controlling idea or may deviate from the claim or idea over the course of the response.</p> <p>The response may include an ineffective introduction and/or conclusion. The response may demonstrate some progression of ideas within paragraphs but not throughout the response.</p> <p>The response has limited variety in sentence structures; sentence structures may be repetitive.</p> <p>The response demonstrates general or vague word choice; word choice may be repetitive. The response may deviate noticeably from a formal style and objective tone.</p> <p>The response shows a limited control of the conventions of standard written English and contains errors that detract from the quality of writing and may impede understanding.</p>
1	<p>Inadequate: The response demonstrates little or no comprehension of the source text.</p> <p>The response fails to show an understanding of the text’s central idea(s), and may include only details without reference to central idea(s).</p> <p>The response may contain numerous errors of fact and/or interpretation with regard to the text.</p> <p>The response makes little or no use of textual evidence (quotations, paraphrases, or both), demonstrating little or no understanding of the source text.</p>	<p>Inadequate: The response offers little or no analysis or ineffective analysis of the source text and demonstrates little or no understanding of the analytic task.</p> <p>The response identifies without explanation some aspects of the author’s use of evidence, reasoning, and/or stylistic and persuasive elements, and/or feature(s) of the student’s choosing,</p> <p>Or numerous aspects of the response’s analysis are unwarranted based on the text,</p> <p>The response contains little or no support for claim(s) or point(s) made, or support is largely irrelevant.</p> <p>The response may not focus on features of the text that are relevant to addressing the task.</p> <p>Or the response offers no discernible analysis (e.g., is largely or exclusively summary).</p>	<p>Inadequate: The response demonstrates little or no cohesion and inadequate skill in the use and control of language.</p> <p>The response may lack a clear central claim or controlling idea.</p> <p>The response lacks a recognizable introduction and conclusion. The response does not have a discernible progression of ideas.</p> <p>The response lacks variety in sentence structures; sentence structures may be repetitive. The response demonstrates general and vague word choice; word choice may be poor or inaccurate. The response may lack a formal style and objective tone.</p> <p>The response shows a weak control of the conventions of standard written English and may contain numerous errors that undermine the quality of writing.</p>

Official SAT Practice Test

About the Practice Test

Take the practice test, which starts on page 46, to reinforce your test-taking skills and to be more comfortable when you take the SAT. This practice test will give you a good idea of what to expect on the actual test.

In addition, once you take the test using the answer sheet in this booklet, you can scan and upload your answers to satpractice.org to receive scores and to get instruction and practice in the areas that most need them.

You need to set aside three hours to take the test — and an additional 50 minutes if you plan to take the optional Essay.

Approaches to the Practice Test

The practice test will help you most if you take it under conditions as close as possible to those of the actual test.

- » Plan to complete the entire test in one sitting.
 - › The Reading Test takes 65 minutes, followed by a 5-minute break.
 - › The Writing and Language Test is allotted 35 minutes, followed immediately (no break) by the Math No – Calculator portion, which takes 25 minutes.
 - › Allow yourself a five-minute break, and then take the Math – Calculator portion, which is 55 minutes long.
 - › If taking the optional Essay, take a stretch break, and then give yourself 50 minutes to write the essay.
- » Pace yourself by using a watch (without an audible alarm).
- » Sit at a desk or table cleared of any other papers or books. Do not use any prohibited items such as a dictionary, notes, or scratch paper.
- » Use an acceptable calculator that is familiar to you for the Math with Calculator portion.
- » Read the test directions carefully.

Marking the Answer Sheet

Getting credit for the right answer depends on marking the answer sheet correctly. When filling out your answer sheet, whether for the practice test or on test day, follow these important instructions:

- » Make sure you use a No. 2 pencil.
- » Fill in the entire circle on the answer sheet darkly and completely.
- » If you change your response, erase it as completely as possible.

Calculating Your Scores

Your tests will be scored by counting the questions you answered correctly and converting this “raw” score to a score on the College Board scale of 200 to 800. More information about how to score your test is provided at studentscores.collegeboard.org. Remember that you can have your practice test scored at satpractice.org.

If you took the optional Essay included in this booklet, use the Essay Scoring Guide on pages 38–39 to determine how your particular essay might be scored.

Reviewing

Once your practice test is scored, review your performance and ask yourself these questions:

- » **Did I run out of time before I finished a section?** Remember, all questions count the same. Be prepared to keep moving on test day and not spend too much time on any one question.
- » **Did I make careless mistakes?** You may have misread a question, neglected to notice a word such as “except” or “best,” or solved for the wrong value. Recognizing these small but critical errors will help you avoid them on test day.
- » **Did I spend too much time reading directions?** Review any directions that gave you trouble so you don't have to spend as much time reading them when you take the actual test.
- » **Keep learning and practicing at satpractice.org!**

SAT PRACTICE ANSWER SHEET

COMPLETE MARK ● **EXAMPLES OF INCOMPLETE MARKS**

It is recommended that you use a No. 2 pencil. It is very important that you fill in the entire circle darkly and completely. If you change your response, erase as completely as possible. Incomplete marks or erasures may affect your score.

TEST NUMBER

SECTION 1

ENTER TEST NUMBER

For Instance, for Practice Test #1, fill in the circle for 0 in the first column and for 1 in the second column.

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- 0 ○ ○
- 1 ○ ○
- 2 ○ ○
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- 5 ○ ○
- 6 ○ ○
- 7 ○ ○
- 8 ○ ○
- 9 ○ ○

1	A B C D	14	A B C D	27	A B C D	40	A B C D
2	○ ○ ○ ○	15	○ ○ ○ ○	28	○ ○ ○ ○	41	○ ○ ○ ○
3	A B C D	16	A B C D	29	A B C D	42	A B C D
4	○ ○ ○ ○	17	○ ○ ○ ○	30	○ ○ ○ ○	43	○ ○ ○ ○
5	A B C D	18	A B C D	31	A B C D	44	A B C D
6	○ ○ ○ ○	19	○ ○ ○ ○	32	○ ○ ○ ○	45	○ ○ ○ ○
7	A B C D	20	A B C D	33	A B C D	46	A B C D
8	○ ○ ○ ○	21	○ ○ ○ ○	34	○ ○ ○ ○	47	○ ○ ○ ○
9	A B C D	22	A B C D	35	A B C D	48	A B C D
10	○ ○ ○ ○	23	○ ○ ○ ○	36	○ ○ ○ ○	49	○ ○ ○ ○
11	A B C D	24	A B C D	37	A B C D	50	A B C D
12	○ ○ ○ ○	25	○ ○ ○ ○	38	○ ○ ○ ○	51	○ ○ ○ ○
13	A B C D	26	A B C D	39	A B C D	52	A B C D
	○ ○ ○ ○		○ ○ ○ ○		○ ○ ○ ○		○ ○ ○ ○



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Learn more at sat.org/scoring.



SAT PRACTICE ANSWER SHEET
COMPLETE MARK ●

EXAMPLES OF INCOMPLETE MARKS


It is recommended that you use a No. 2 pencil. It is very important that you fill in the entire circle darkly and completely. If you change your response, erase as completely as possible. Incomplete marks or erasures may affect your score.

SECTION 2

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



If you're scoring with our mobile app we recommend that you cut these pages out. The scoring does best with a flat page.



SAT PRACTICE ANSWER SHEET
COMPLETE MARK ●

EXAMPLES OF INCOMPLETE MARKS


It is recommended that you use a No. 2 pencil. It is very important that you fill in the entire circle darkly and completely. If you change your response, erase as completely as possible. Incomplete marks or erasures may affect your score.

SECTION 4

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



If you're using our mobile app keep in mind that bad lighting and even shadows cast over the answer sheet can affect your score. Be sure to scan this in a well-lit area for best results.

CALCULATOR ALLOWED


Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

Questions 1-10 are based on the following passage.

This passage is from Lydia Minatoya, *The Strangeness of Beauty*. ©1999 by Lydia Minatoya. The setting is Japan in 1920. Chie and her daughter Naomi are members of the House of Fuji, a noble family.

Akira came directly, breaking all tradition. Was that it? Had he followed form—had he asked his mother to speak to his father to approach a
 Line go-between—would Chie have been more receptive?
 5 He came on a winter’s eve. He pounded on the door while a cold rain beat on the shuttered veranda, so at first Chie thought him only the wind. The maid knew better. Chie heard her soft scuttling footsteps, the creak of the door. Then the maid brought a
 10 calling card to the drawing room, for Chie.
 Chie was reluctant to go to her guest; perhaps she was feeling too cozy. She and Naomi were reading at a low table set atop a charcoal brazier. A thick quilt spread over the sides of the table so their legs were
 15 tucked inside with the heat.
 “Who is it at this hour, in this weather?” Chie questioned as she picked the name card off the maid’s lacquer tray.
 “Shinoda, Akira. Kobe Dental College,” she read.
 20 Naomi recognized the name. Chie heard a soft intake of air.
 “I think you should go,” said Naomi.

Akira was waiting in the entry. He was in his early twenties, slim and serious, wearing the black
 25 military-style uniform of a student. As he bowed—his hands hanging straight down, a black cap in one, a yellow oil-paper umbrella in the other—Chie glanced beyond him. In the glistening surface of the courtyard’s rain-drenched paving
 30 stones, she saw his reflection like a dark double.
 “Madame,” said Akira, “forgive my disruption, but I come with a matter of urgency.”
 His voice was soft, refined. He straightened and stole a deferential peek at her face.
 35 In the dim light his eyes shone with sincerity. Chie felt herself starting to like him.
 “Come inside, get out of this nasty night. Surely your business can wait for a moment or two.”
 “I don’t want to trouble you. Normally I would
 40 approach you more properly but I’ve received word of a position. I’ve an opportunity to go to America, as dentist for Seattle’s Japanese community.”
 “Congratulations,” Chie said with amusement.
 “That is an opportunity, I’m sure. But how am I
 45 involved?”
 Even noting Naomi’s breathless reaction to the name card, Chie had no idea. Akira’s message, delivered like a formal speech, filled her with maternal amusement. You know how children speak
 50 so earnestly, so hurriedly, so endearingly about things that have no importance in an adult’s mind? That’s how she viewed him, as a child.

It was how she viewed Naomi. Even though Naomi was eighteen and training endlessly in the arts
55 needed to make a good marriage, Chie had made no effort to find her a husband.

Akira blushed.

“Depending on your response, I may stay in Japan. I’ve come to ask for Naomi’s hand.”

60 Suddenly Chie felt the dampness of the night.

“Does Naomi know anything of your . . . ambitions?”

“We have an understanding. Please don’t judge my candidacy by the unseemliness of this proposal. I
65 ask directly because the use of a go-between takes much time. Either method comes down to the same thing: a matter of parental approval. If you give your consent, I become Naomi’s yoshi.* We’ll live in the House of Fuji. Without your consent, I must go to
70 America, to secure a new home for my bride.”

Eager to make his point, he’d been looking her full in the face. Abruptly, his voice turned gentle. “I see I’ve startled you. My humble apologies. I’ll take no more of your evening. My address is on my card. If
75 you don’t wish to contact me, I’ll reapproach you in two weeks’ time. Until then, good night.”

He bowed and left. Taking her ease, with effortless grace, like a cat making off with a fish.

80 “Mother?” Chie heard Naomi’s low voice and turned from the door. “He has asked you?”

The sight of Naomi’s clear eyes, her dark brows gave Chie strength. Maybe his hopes were preposterous.

85 “Where did you meet such a fellow? Imagine! He thinks he can marry the Fuji heir and take her to America all in the snap of his fingers!”

Chie waited for Naomi’s ripe laughter.

Naomi was silent. She stood a full half minute looking straight into Chie’s eyes. Finally, she spoke.

90 “I met him at my literary meeting.”

Naomi turned to go back into the house, then stopped.

“Mother.”

“Yes?”

95 “I mean to have him.”

* a man who marries a woman of higher status and takes her family’s name

1

Which choice best describes what happens in the passage?

- A) One character argues with another character who intrudes on her home.
- B) One character receives a surprising request from another character.
- C) One character reminisces about choices she has made over the years.
- D) One character criticizes another character for pursuing an unexpected course of action.

2

Which choice best describes the developmental pattern of the passage?

- A) A careful analysis of a traditional practice
- B) A detailed depiction of a meaningful encounter
- C) A definitive response to a series of questions
- D) A cheerful recounting of an amusing anecdote

3

As used in line 1 and line 65, “directly” most nearly means

- A) frankly.
- B) confidently.
- C) without mediation.
- D) with precision.

4

Which reaction does Akira most fear from Chie?

- A) She will consider his proposal inappropriate.
- B) She will mistake his earnestness for immaturity.
- C) She will consider his unscheduled visit an imposition.
- D) She will underestimate the sincerity of his emotions.

5

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

- A) Line 33 (“His voice . . . refined”)
- B) Lines 49-51 (“You . . . mind”)
- C) Lines 63-64 (“Please . . . proposal”)
- D) Lines 71-72 (“Eager . . . face”)

6

In the passage, Akira addresses Chie with

- A) affection but not genuine love.
- B) objectivity but not complete impartiality.
- C) amusement but not mocking disparagement.
- D) respect but not utter deference.

7

The main purpose of the first paragraph is to

- A) describe a culture.
- B) criticize a tradition.
- C) question a suggestion.
- D) analyze a reaction.

8

As used in line 2, “form” most nearly means

- A) appearance.
- B) custom.
- C) structure.
- D) nature.

9

Why does Akira say his meeting with Chie is “a matter of urgency” (line 32)?

- A) He fears that his own parents will disapprove of Naomi.
- B) He worries that Naomi will reject him and marry someone else.
- C) He has been offered an attractive job in another country.
- D) He knows that Chie is unaware of his feelings for Naomi.

10

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

- A) Line 39 (“I don’t . . . you”)
- B) Lines 39-42 (“Normally . . . community”)
- C) Lines 58-59 (“Depending . . . Japan”)
- D) Lines 72-73 (“I see . . . you”)

Questions 11-21 are based on the following passage and supplementary material.

This passage is adapted from Francis J. Flynn and Gabrielle S. Adams, "Money Can't Buy Love: Asymmetric Beliefs about Gift Price and Feelings of Appreciation." ©2008 by Elsevier Inc.

Every day, millions of shoppers hit the stores in full force—both online and on foot—searching frantically for the perfect gift. Last year, Americans
 Line spent over \$30 billion at retail stores in the month of
 5 December alone. Aside from purchasing holiday gifts, most people regularly buy presents for other occasions throughout the year, including weddings, birthdays, anniversaries, graduations, and baby
 10 showers. This frequent experience of gift-giving can engender ambivalent feelings in gift-givers. Many relish the opportunity to buy presents because gift-giving offers a powerful means to build stronger bonds with one's closest peers. At the same time, many dread the thought of buying gifts; they worry
 15 that their purchases will disappoint rather than delight the intended recipients.

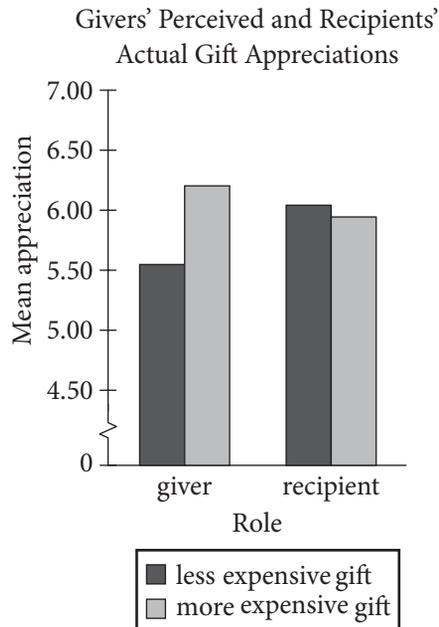
Anthropologists describe gift-giving as a positive social process, serving various political, religious, and psychological functions. Economists, however, offer
 20 a less favorable view. According to Waldfogel (1993), gift-giving represents an objective waste of resources. People buy gifts that recipients would not choose to buy on their own, or at least not spend as much money to purchase (a phenomenon referred to as
 25 "the deadweight loss of Christmas"). To wit, givers are likely to spend \$100 to purchase a gift that receivers would spend only \$80 to buy themselves. This "deadweight loss" suggests that gift-givers are not very good at predicting what gifts others will
 30 appreciate. That in itself is not surprising to social psychologists. Research has found that people often struggle to take account of others' perspectives—their insights are subject to egocentrism, social projection, and multiple attribution errors.

What is surprising is that gift-givers have
 35 considerable experience acting as both gift-givers and gift-recipients, but nevertheless tend to overspend each time they set out to purchase a meaningful gift. In the present research, we propose a unique
 40 psychological explanation for this overspending problem—i.e., that gift-givers equate how much they

spend with how much recipients will appreciate the gift (the more expensive the gift, the stronger a gift-recipient's feelings of appreciation). Although a
 45 link between gift price and feelings of appreciation might seem intuitive to gift-givers, such an assumption may be unfounded. Indeed, we propose that gift-recipients will be less inclined to base their feelings of appreciation on the magnitude of a gift
 50 than givers assume.

Why do gift-givers assume that gift price is closely linked to gift-recipients' feelings of appreciation? Perhaps givers believe that bigger (i.e., more expensive) gifts convey stronger signals of
 55 thoughtfulness and consideration. According to Camerer (1988) and others, gift-giving represents a symbolic ritual, whereby gift-givers attempt to signal their positive attitudes toward the intended recipient and their willingness to invest resources in a future
 60 relationship. In this sense, gift-givers may be motivated to spend more money on a gift in order to send a "stronger signal" to their intended recipient. As for gift-recipients, they may not construe smaller and larger gifts as representing smaller and larger
 65 signals of thoughtfulness and consideration.

The notion of gift-givers and gift-recipients being unable to account for the other party's perspective seems puzzling because people slip in and out of these roles every day, and, in some cases, multiple
 70 times in the course of the same day. Yet, despite the extensive experience that people have as both givers and receivers, they often struggle to transfer information gained from one role (e.g., as a giver) and apply it in another, complementary role (e.g., as
 75 a receiver). In theoretical terms, people fail to utilize information about their own preferences and experiences in order to produce more efficient outcomes in their exchange relations. In practical terms, people spend hundreds of dollars each year on
 80 gifts, but somehow never learn to calibrate their gift expenditures according to personal insight.



11

The authors most likely use the examples in lines 1-9 of the passage (“Every . . . showers”) to highlight the

- A) regularity with which people shop for gifts.
- B) recent increase in the amount of money spent on gifts.
- C) anxiety gift shopping causes for consumers.
- D) number of special occasions involving gift-giving.

12

In line 10, the word “ambivalent” most nearly means

- A) unrealistic.
- B) conflicted.
- C) apprehensive.
- D) supportive.

13

The authors indicate that people value gift-giving because they feel it

- A) functions as a form of self-expression.
- B) is an inexpensive way to show appreciation.
- C) requires the gift-recipient to reciprocate.
- D) can serve to strengthen a relationship.

14

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

- A) Lines 10-13 (“Many . . . peers”)
- B) Lines 22-23 (“People . . . own”)
- C) Lines 31-32 (“Research . . . perspectives”)
- D) Lines 44-47 (“Although . . . unfounded”)

15

The “social psychologists” mentioned in paragraph 2 (lines 17-34) would likely describe the “deadweight loss” phenomenon as

- A) predictable.
- B) questionable.
- C) disturbing.
- D) unprecedented.

16

The passage indicates that the assumption made by gift-givers in lines 41-44 may be

- A) insincere.
- B) unreasonable.
- C) incorrect.
- D) substantiated.

17

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

- A) Lines 53-55 (“Perhaps . . . consideration”)
- B) Lines 55-60 (“According . . . relationship”)
- C) Lines 63-65 (“As . . . consideration”)
- D) Lines 75-78 (“In . . . relations”)

18

As it is used in line 54, “convey” most nearly means

- A) transport.
- B) counteract.
- C) exchange.
- D) communicate.

19

The authors refer to work by Camerer and others (line 56) in order to

- A) offer an explanation.
- B) introduce an argument.
- C) question a motive.
- D) support a conclusion.

20

The graph following the passage offers evidence that gift-givers base their predictions of how much a gift will be appreciated on

- A) the appreciation level of the gift-recipients.
- B) the monetary value of the gift.
- C) their own desires for the gifts they purchase.
- D) their relationship with the gift-recipients.

21

The authors would likely attribute the differences in gift-giver and recipient mean appreciation as represented in the graph to

- A) an inability to shift perspective.
- B) an increasingly materialistic culture.
- C) a growing opposition to gift-giving.
- D) a misunderstanding of intentions.

Questions 22-31 are based on the following passage and supplementary material.

This passage is adapted from J. D. Watson and F. H. C. Crick, "Genetical Implications of the Structure of Deoxyribonucleic Acid." ©1953 by Nature Publishing Group. Watson and Crick deduced the structure of DNA using evidence from Rosalind Franklin and R. G. Gosling's X-ray crystallography diagrams of DNA and from Erwin Chargaff's data on the base composition of DNA.

The chemical formula of deoxyribonucleic acid (DNA) is now well established. The molecule is a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups.

To each sugar is attached a nitrogenous base, which can be of four different types. Two of the possible bases—adenine and guanine—are purines, and the other two—thymine and cytosine—are pyrimidines. So far as is known, the sequence of bases along the chain is irregular. The monomer unit, consisting of phosphate, sugar and base, is known as a nucleotide.

The first feature of our structure which is of biological interest is that it consists not of one chain, but of two. These two chains are both coiled around a common fiber axis. It has often been assumed that since there was only one chain in the chemical formula there would only be one in the structural unit. However, the density, taken with the X-ray evidence, suggests very strongly that there are two.

The other biologically important feature is the manner in which the two chains are held together. This is done by hydrogen bonds between the bases. The bases are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other. The important point is that only certain pairs of bases will fit into the structure.

One member of a pair must be a purine and the other a pyrimidine in order to bridge between the two chains. If a pair consisted of two purines, for example, there would not be room for it.

We believe that the bases will be present almost entirely in their most probable forms. If this is true, the conditions for forming hydrogen bonds are more restrictive, and the only pairs of bases possible are: adenine with thymine, and guanine with cytosine. Adenine, for example, can occur on either chain; but when it does, its partner on the other chain must always be thymine.

The phosphate-sugar backbone of our model is completely regular, but any sequence of the pairs of bases can fit into the structure. It follows that in a

long molecule many different permutations are possible, and it therefore seems likely that the precise sequence of bases is the code which carries the
45 genetical information. If the actual order of the bases on one of the pair of chains were given, one could write down the exact order of the bases on the other one, because of the specific pairing. Thus one chain is, as it were, the complement of the other, and it is
50 this feature which suggests how the deoxyribonucleic acid molecule might duplicate itself.

The table shows, for various organisms, the percentage of each of the four types of nitrogenous bases in that organism's DNA.

Base Composition of DNA				
Organism	Percentage of base in organism's DNA			
	adenine (%)	guanine (%)	cytosine (%)	thymine (%)
Maize	26.8	22.8	23.2	27.2
Octopus	33.2	17.6	17.6	31.6
Chicken	28.0	22.0	21.6	28.4
Rat	28.6	21.4	20.5	28.4
Human	29.3	20.7	20.0	30.0
Grasshopper	29.3	20.5	20.7	29.3
Sea urchin	32.8	17.7	17.3	32.1
Wheat	27.3	22.7	22.8	27.1
Yeast	31.3	18.7	17.1	32.9
<i>E. coli</i>	24.7	26.0	25.7	23.6

Adapted from Manju Bansal, "DNA Structure: Revisiting the Watson-Crick Double Helix." ©2003 by Current Science Association, Bangalore.

22

The authors use the word “backbone” in lines 3 and 39 to indicate that

- A) only very long chains of DNA can be taken from an organism with a spinal column.
- B) the main structure of a chain in a DNA molecule is composed of repeating units.
- C) a chain in a DNA molecule consists entirely of phosphate groups or of sugars.
- D) nitrogenous bases form the main structural unit of DNA.

23

A student claims that nitrogenous bases pair randomly with one another. Which of the following statements in the passage contradicts the student’s claim?

- A) Lines 5-6 (“To each . . . types”)
- B) Lines 9-10 (“So far . . . irregular”)
- C) Lines 23-25 (“The bases . . . other”)
- D) Lines 27-29 (“One member . . . chains”)

24

In the second paragraph (lines 12-19), what do the authors claim to be a feature of biological interest?

- A) The chemical formula of DNA
- B) The common fiber axis
- C) The X-ray evidence
- D) DNA consisting of two chains

25

The authors’ main purpose of including the information about X-ray evidence and density is to

- A) establish that DNA is the molecule that carries the genetic information.
- B) present an alternate hypothesis about the composition of a nucleotide.
- C) provide support for the authors’ claim about the number of chains in a molecule of DNA.
- D) confirm the relationship between the density of DNA and the known chemical formula of DNA.

26

Based on the passage, the authors’ statement “If a pair consisted of two purines, for example, there would not be room for it” (lines 29-30) implies that a pair

- A) of purines would be larger than the space between a sugar and a phosphate group.
- B) of purines would be larger than a pair consisting of a purine and a pyrimidine.
- C) of pyrimidines would be larger than a pair of purines.
- D) consisting of a purine and a pyrimidine would be larger than a pair of pyrimidines.

27

The authors’ use of the words “exact,” “specific,” and “complement” in lines 47-49 in the final paragraph functions mainly to

- A) confirm that the nucleotide sequences are known for most molecules of DNA.
- B) counter the claim that the sequences of bases along a chain can occur in any order.
- C) support the claim that the phosphate-sugar backbone of the authors’ model is completely regular.
- D) emphasize how one chain of DNA may serve as a template to be copied during DNA replication.

28

Based on the table and passage, which choice gives the correct percentages of the purines in yeast DNA?

- A) 17.1% and 18.7%
- B) 17.1% and 32.9%
- C) 18.7% and 31.3%
- D) 31.3% and 32.9%

29

Do the data in the table support the authors' proposed pairing of bases in DNA?

- A) Yes, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- B) Yes, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.
- C) No, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- D) No, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.

30

According to the table, which of the following pairs of base percentages in sea urchin DNA provides evidence in support of the answer to the previous question?

- A) 17.3% and 17.7%
- B) 17.3% and 32.1%
- C) 17.3% and 32.8%
- D) 17.7% and 32.8%

31

Based on the table, is the percentage of adenine in each organism's DNA the same or does it vary, and which statement made by the authors is most consistent with that data?

- A) The same; "Two of . . . pyrimidines" (lines 6-8)
- B) The same; "The important . . . structure" (lines 25-26)
- C) It varies; "Adenine . . . thymine" (lines 36-38)
- D) It varies; "It follows . . . information" (lines 41-45)

Questions 32-41 are based on the following passage.

This passage is adapted from Virginia Woolf, *Three Guineas*. ©1938 by Harcourt, Inc. Here, Woolf considers the situation of women in English society.

Close at hand is a bridge over the River Thames, an admirable vantage ground for us to make a survey. The river flows beneath; barges pass, laden with timber, bursting with corn; there on one side are the domes and spires of the city; on the other, Westminster and the Houses of Parliament. It is a place to stand on by the hour, dreaming. But not now. Now we are pressed for time. Now we are here to consider facts; now we must fix our eyes upon the procession—the procession of the sons of educated men.

There they go, our brothers who have been educated at public schools and universities, mounting those steps, passing in and out of those doors, ascending those pulpits, preaching, teaching, administering justice, practising medicine, transacting business, making money. It is a solemn sight always—a procession, like a caravanserai crossing a desert. . . . But now, for the past twenty years or so, it is no longer a sight merely, a photograph, or fresco scrawled upon the walls of time, at which we can look with merely an esthetic appreciation. For there, trapesing along at the tail end of the procession, we go ourselves. And that makes a difference. We who have looked so long at the pageant in books, or from a curtained window watched educated men leaving the house at about nine-thirty to go to an office, returning to the house at about six-thirty from an office, need look passively no longer. We too can leave the house, can mount those steps, pass in and out of those doors, . . . make money, administer justice. . . . We who now agitate these humble pens may in another century or two speak from a pulpit. Nobody will dare contradict us then; we shall be the mouthpieces of the divine spirit—a solemn thought, is it not? Who can say whether, as time goes on, we may not dress in military uniform, with gold lace on our breasts, swords at our sides, and something like the old family coal-scuttle on our heads, save that that venerable object was never decorated with plumes of white horsehair. You laugh—indeed the shadow of the private house still makes those dresses look a little queer. We have worn private clothes so long. . . . But we have not come here to laugh, or to

talk of fashions—men’s and women’s. We are here, on the bridge, to ask ourselves certain questions. And they are very important questions; and we have very little time in which to answer them. The questions that we have to ask and to answer about that procession during this moment of transition are so important that they may well change the lives of all men and women for ever. For we have to ask ourselves, here and now, do we wish to join that procession, or don’t we? On what terms shall we join that procession? Above all, where is it leading us, the procession of educated men? The moment is short; it may last five years; ten years, or perhaps only a matter of a few months longer. . . . But, you will object, you have no time to think; you have your battles to fight, your rent to pay, your bazaars to organize. That excuse shall not serve you, Madam. As you know from your own experience, and there are facts that prove it, the daughters of educated men have always done their thinking from hand to mouth; not under green lamps at study tables in the cloisters of secluded colleges. They have thought while they stirred the pot, while they rocked the cradle. It was thus that they won us the right to our brand-new sixpence. It falls to us now to go on thinking; how are we to spend that sixpence? Think we must. Let us think in offices; in omnibuses; while we are standing in the crowd watching Coronations and Lord Mayor’s Shows; let us think . . . in the gallery of the House of Commons; in the Law Courts; let us think at baptisms and marriages and funerals. Let us never cease from thinking—what is this “civilization” in which we find ourselves? What are these ceremonies and why should we take part in them? What are these professions and why should we make money out of them? Where in short is it leading us, the procession of the sons of educated men?

32

The main purpose of the passage is to

- A) emphasize the value of a tradition.
- B) stress the urgency of an issue.
- C) highlight the severity of social divisions.
- D) question the feasibility of an undertaking.

33

The central claim of the passage is that

- A) educated women face a decision about how to engage with existing institutions.
- B) women can have positions of influence in English society only if they give up some of their traditional roles.
- C) the male monopoly on power in English society has had grave and continuing effects.
- D) the entry of educated women into positions of power traditionally held by men will transform those positions.

34

Woolf uses the word “we” throughout the passage mainly to

- A) reflect the growing friendliness among a group of people.
- B) advance the need for candor among a group of people.
- C) establish a sense of solidarity among a group of people.
- D) reinforce the need for respect among a group of people.

35

According to the passage, Woolf chooses the setting of the bridge because it

- A) is conducive to a mood of fanciful reflection.
- B) provides a good view of the procession of the sons of educated men.
- C) is within sight of historic episodes to which she alludes.
- D) is symbolic of the legacy of past and present sons of educated men.

36

Woolf indicates that the procession she describes in the passage

- A) has come to have more practical influence in recent years.
- B) has become a celebrated feature of English public life.
- C) includes all of the richest and most powerful men in England.
- D) has become less exclusionary in its membership in recent years.

37

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

- A) Lines 12-17 (“There . . . money”)
- B) Lines 17-19 (“It . . . desert”)
- C) Lines 23-24 (“For . . . ourselves”)
- D) Lines 30-34 (“We . . . pulpit”)

38

Woolf characterizes the questions in lines 53-57 (“For we . . . men”) as both

- A) controversial and threatening.
- B) weighty and unanswerable.
- C) momentous and pressing.
- D) provocative and mysterious.

39

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

- A) Lines 46-47 (“We . . . questions”)
- B) Lines 48-49 (“And . . . them”)
- C) Line 57 (“The moment . . . short”)
- D) Line 62 (“That . . . Madam”)

40

Which choice most closely captures the meaning of the figurative “sixpence” referred to in lines 70 and 71?

- A) Tolerance
- B) Knowledge
- C) Opportunity
- D) Perspective

41

The range of places and occasions listed in lines 72-76 (“Let us . . . funerals”) mainly serves to emphasize how

- A) novel the challenge faced by women is.
- B) pervasive the need for critical reflection is.
- C) complex the political and social issues of the day are.
- D) enjoyable the career possibilities for women are.

Questions 42-52 are based on the following passages.

Passage 1 is adapted from Michael Slezak, "Space Mining: the Next Gold Rush?" ©2013 by New Scientist. Passage 2 is from the editors of *New Scientist*, "Taming the Final Frontier." ©2013 by New Scientist.

Passage 1

Follow the money and you will end up in space. That's the message from a first-of-its-kind forum on mining beyond Earth.

Line Convened in Sydney by the Australian Centre for
5 Space Engineering Research, the event brought together mining companies, robotics experts, lunar scientists, and government agencies that are all working to make space mining a reality.

The forum comes hot on the heels of the
10 2012 unveiling of two private asteroid-mining firms. Planetary Resources of Washington says it will launch its first prospecting telescopes in two years, while Deep Space Industries of Virginia hopes to be harvesting metals from asteroids by 2020. Another
15 commercial venture that sprung up in 2012, Golden Spike of Colorado, will be offering trips to the moon, including to potential lunar miners.

Within a few decades, these firms may be meeting earthly demands for precious metals, such as
20 platinum and gold, and the rare earth elements vital for personal electronics, such as yttrium and lanthanum. But like the gold rush pioneers who transformed the western United States, the first space miners won't just enrich themselves. They also hope
25 to build an off-planet economy free of any bonds with Earth, in which the materials extracted and processed from the moon and asteroids are delivered for space-based projects.

In this scenario, water mined from other
30 worlds could become the most desired commodity. "In the desert, what's worth more: a kilogram of gold or a kilogram of water?" asks Kris Zacny of HoneyBee Robotics in New York. "Gold is useless. Water will let you live."

35 Water ice from the moon's poles could be sent to astronauts on the International Space Station for drinking or as a radiation shield. Splitting water into oxygen and hydrogen makes spacecraft fuel, so ice-rich asteroids could become interplanetary
40 refuelling stations.

Companies are eyeing the iron, silicon, and aluminium in lunar soil and asteroids, which could be used in 3D printers to make spare parts or machinery. Others want to turn space dirt into
45 concrete for landing pads, shelters, and roads.

Passage 2

The motivation for deep-space travel is shifting from discovery to economics. The past year has seen a flurry of proposals aimed at bringing celestial riches down to Earth. No doubt this will make a few
50 billionaires even wealthier, but we all stand to gain: the mineral bounty and spin-off technologies could enrich us all.

But before the miners start firing up their rockets, we should pause for thought. At first glance, space
55 mining seems to sidestep most environmental concerns: there is (probably!) no life on asteroids, and thus no habitats to trash. But its consequences—both here on Earth and in space—merit careful consideration.

60 Part of this is about principles. Some will argue that space's "magnificent desolation" is not ours to despoil, just as they argue that our own planet's poles should remain pristine. Others will suggest that glutting ourselves on space's riches is not an
65 acceptable alternative to developing more sustainable ways of earthly life.

History suggests that those will be hard lines to hold, and it may be difficult to persuade the public that such barren environments are worth preserving.
70 After all, they exist in vast abundance, and even fewer people will experience them than have walked through Antarctica's icy landscapes.

There's also the emerging off-world economy to consider. The resources that are valuable in orbit and
75 beyond may be very different to those we prize on Earth. Questions of their stewardship have barely been broached—and the relevant legal and regulatory framework is fragmentary, to put it mildly.

Space miners, like their earthly counterparts, are
80 often reluctant to engage with such questions. One speaker at last week's space-mining forum in Sydney, Australia, concluded with a plea that regulation should be avoided. But miners have much to gain from a broad agreement on the for-profit
85 exploitation of space. Without consensus, claims will be disputed, investments risky, and the gains made insecure. It is in all of our long-term interests to seek one out.

42

In lines 9-17, the author of Passage 1 mentions several companies primarily to

- A) note the technological advances that make space mining possible.
- B) provide evidence of the growing interest in space mining.
- C) emphasize the large profits to be made from space mining.
- D) highlight the diverse ways to carry out space mining operations.

43

The author of Passage 1 indicates that space mining could have which positive effect?

- A) It could yield materials important to Earth's economy.
- B) It could raise the value of some precious metals on Earth.
- C) It could create unanticipated technological innovations.
- D) It could change scientists' understanding of space resources.

44

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

- A) Lines 18-22 ("Within . . . lanthanum")
- B) Lines 24-28 ("They . . . projects")
- C) Lines 29-30 ("In this . . . commodity")
- D) Lines 41-44 ("Companies . . . machinery")

45

As used in line 19, "demands" most nearly means

- A) offers.
- B) claims.
- C) inquiries.
- D) desires.

46

What function does the discussion of water in lines 35-40 serve in Passage 1?

- A) It continues an extended comparison that begins in the previous paragraph.
- B) It provides an unexpected answer to a question raised in the previous paragraph.
- C) It offers hypothetical examples supporting a claim made in the previous paragraph.
- D) It examines possible outcomes of a proposal put forth in the previous paragraph.

47

The central claim of Passage 2 is that space mining has positive potential but

- A) it will end up encouraging humanity's reckless treatment of the environment.
- B) its effects should be thoughtfully considered before it becomes a reality.
- C) such potential may not include replenishing key resources that are disappearing on Earth.
- D) experts disagree about the commercial viability of the discoveries it could yield.

48

As used in line 68, "hold" most nearly means

- A) maintain.
- B) grip.
- C) restrain.
- D) withstand.

49

Which statement best describes the relationship between the passages?

- A) Passage 2 refutes the central claim advanced in Passage 1.
- B) Passage 2 illustrates the phenomenon described in more general terms in Passage 1.
- C) Passage 2 argues against the practicality of the proposals put forth in Passage 1.
- D) Passage 2 expresses reservations about developments discussed in Passage 1.

50

The author of Passage 2 would most likely respond to the discussion of the future of space mining in lines 18-28, Passage 1, by claiming that such a future

- A) is inconsistent with the sustainable use of space resources.
- B) will be difficult to bring about in the absence of regulations.
- C) cannot be attained without technologies that do not yet exist.
- D) seems certain to affect Earth's economy in a negative way.

51

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

- A) Lines 60-63 (“Some . . . pristine”)
- B) Lines 74-76 (“The resources . . . Earth”)
- C) Lines 81-83 (“One . . . avoided”)
- D) Lines 85-87 (“Without . . . insecure”)

52

Which point about the resources that will be highly valued in space is implicit in Passage 1 and explicit in Passage 2?

- A) They may be different resources from those that are valuable on Earth.
- B) They will be valuable only if they can be harvested cheaply.
- C) They are likely to be primarily precious metals and rare earth elements.
- D) They may increase in value as those same resources become rare on Earth.

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 Test

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.

Whey to Go

Greek yogurt—a strained form of cultured yogurt—has grown enormously in popularity in the United States since it was first introduced in the country in the late 1980s.

From 2011 to 2012 alone, sales of Greek yogurt in the US increased by 50 percent. The resulting increase in Greek yogurt production has forced those involved in the business to address the detrimental effects that the yogurt-making process may be having on the environment. Fortunately, farmers and others in the

Greek yogurt business have found many methods of controlling and eliminating most environmental threats. Given these solutions as well as the many health benefits of the food, the advantages of Greek yogurt **1** outdo the potential drawbacks of its production.

[1] The main environmental problem caused by the production of Greek yogurt is the creation of acid whey as a by-product. [2] Because it requires up to four times more milk to make than conventional yogurt does, Greek yogurt produces larger amounts of acid whey, which is difficult to dispose of. [3] To address the problem of disposal, farmers have found a number of uses for acid whey. [4] They can add it to livestock feed as a protein **2** supplement, and people can make their own Greek-style yogurt at home by straining regular yogurt. [5] If it is improperly introduced into the environment, acid-whey runoff **3** can pollute waterways, depleting the oxygen content of streams and rivers as it decomposes. [6] Yogurt manufacturers, food **4** scientists; and government officials are also working together to develop additional solutions for reusing whey. **5**

1

- A) NO CHANGE
- B) defeat
- C) outperform
- D) outweigh

2

Which choice provides the most relevant detail?

- A) NO CHANGE
- B) supplement and convert it into gas to use as fuel in electricity production.
- C) supplement, while sweet whey is more desirable as a food additive for humans.
- D) supplement, which provides an important element of their diet.

3

- A) NO CHANGE
- B) can pollute waterway's,
- C) could have polluted waterways,
- D) has polluted waterway's,

4

- A) NO CHANGE
- B) scientists: and
- C) scientists, and
- D) scientists, and,

5

To make this 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.

6 Though these conservation methods can be costly and time-consuming, they are well worth the effort. Nutritionists consider Greek yogurt to be a healthy food: it is an excellent source of calcium and protein, serves 7 to be a digestive aid, and 8 it contains few calories in its unsweetened low- and non-fat forms. Greek yogurt is slightly lower in sugar and carbohydrates than conventional yogurt is. 9 Also, because it is more concentrated, Greek yogurt contains slightly more protein per serving, thereby helping people stay

6

The writer is considering deleting the underlined sentence. Should the writer do this?

- A) Yes, because it does not provide a transition from the previous paragraph.
- B) Yes, because it fails to support the main argument of the passage as introduced in the first paragraph.
- C) No, because it continues the explanation of how acid whey can be disposed of safely.
- D) No, because it sets up the argument in the paragraph for the benefits of Greek yogurt.

7

- A) NO CHANGE
- B) as
- C) like
- D) for

8

- A) NO CHANGE
- B) containing
- C) contains
- D) will contain

9

- A) NO CHANGE
- B) In other words,
- C) Therefore,
- D) For instance,

10 satiated for longer periods of time. These health benefits have prompted Greek yogurt's recent surge in popularity. In fact, Greek yogurt can be found in an increasing number of products such as snack food and frozen desserts. Because consumers reap the nutritional benefits of Greek yogurt and support those who make and sell 11 it, therefore farmers and businesses should continue finding safe and effective methods of producing the food.

10

- A) NO CHANGE
- B) fulfilled
- C) complacent
- D) sufficient

11

- A) NO CHANGE
- B) it, farmers
- C) it, so farmers
- D) it: farmers

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

Dark Snow

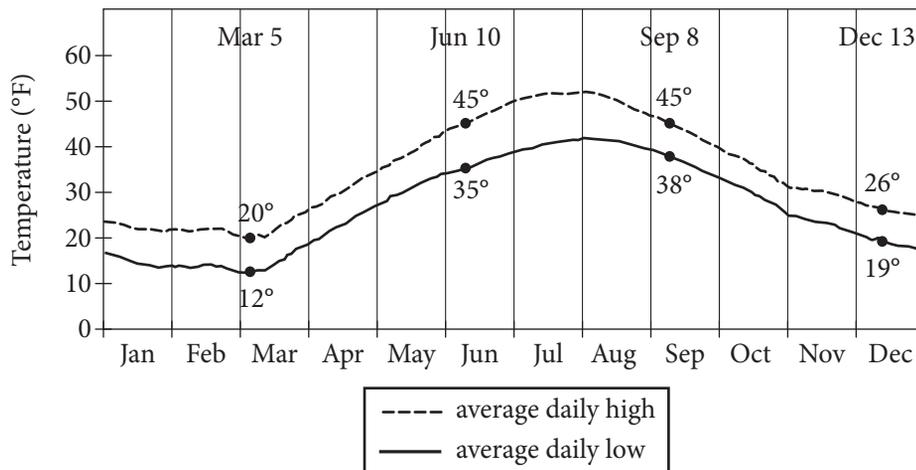
Most of Greenland's interior is covered by a thick layer of ice and compressed snow known as the Greenland Ice Sheet. The size of the ice sheet fluctuates seasonally: in summer, average daily high temperatures in Greenland can rise to slightly above 50 degrees Fahrenheit, partially melting the ice; in the winter, the sheet thickens as additional snow falls, and average daily low temperatures can drop **12** to as low as 20 degrees.

12

Which choice most accurately and effectively represents the information in the graph?

- A) NO CHANGE
- B) to 12 degrees Fahrenheit.
- C) to their lowest point on December 13.
- D) to 10 degrees Fahrenheit and stay there for months.

Average Daily High and Low Temperatures Recorded at Nuuk Weather Station, Greenland (1961–1990)



Adapted from WMO. ©2014 by World Meteorological Organization.

Typically, the ice sheet begins to show evidence of thawing in late **13** summer. This follows several weeks of higher temperatures. **14** For example, in the summer of 2012, virtually the entire Greenland Ice Sheet underwent thawing at or near its surface by mid-July, the earliest date on record. Most scientists looking for the causes of the Great Melt of 2012 have focused exclusively on rising temperatures. The summer of 2012 was the warmest in 170 years, records show. But Jason **15** Box, an associate professor of geology at Ohio State believes that another factor added to the early **16** thaw; the “dark snow” problem.

13

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

- A) summer, following
- B) summer, and this thawing follows
- C) summer, and such thawing follows
- D) summer and this evidence follows

14

- A) NO CHANGE
- B) However,
- C) As such,
- D) Moreover,

15

- A) NO CHANGE
- B) Box an associate professor of geology at Ohio State,
- C) Box, an associate professor of geology at Ohio State,
- D) Box, an associate professor of geology, at Ohio State

16

- A) NO CHANGE
- B) thaw; and it was
- C) thaw:
- D) thaw: being

According to Box, a leading Greenland expert, tundra fires in 2012 from as far away as North America produced great amounts of soot, some **17** of it drifted over Greenland in giant plumes of smoke and then **18** fell as particles onto the ice sheet. Scientists have long known that soot particles facilitate melting by darkening snow and ice, limiting **19** it's ability to reflect the Sun's rays. As Box explains, "Soot is an extremely powerful light absorber. It settles over the ice and captures the Sun's heat." The result is a self-reinforcing cycle. As the ice melts, the land and water under the ice become exposed, and since land and water are darker than snow, the surface absorbs even more heat, which **20** is related to the rising temperatures.

17

- A) NO CHANGE
- B) soot
- C) of which
- D) DELETE the underlined portion.

18

- A) NO CHANGE
- B) falls
- C) will fall
- D) had fallen

19

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

20

Which choice best completes the description of a self-reinforcing cycle?

- A) NO CHANGE
- B) raises the surface temperature.
- C) begins to cool at a certain point.
- D) leads to additional melting.

[1] Box’s research is important because the fires of 2012 may not be a one-time phenomenon. [2] According to scientists, rising Arctic temperatures are making northern latitudes greener and thus more fire prone.

[3] The pattern Box observed in 2012 may repeat

21 itself again, with harmful effects on the Arctic ecosystem. [4] Box is currently organizing an expedition to gather this crucial information. [5] The next step for Box and his team is to travel to Greenland to perform direct sampling of the ice in order to determine just how much the soot is contributing to the melting of the ice sheet. [6] Members of the public will be able to track his team’s progress—and even help fund the expedition—through a website Box has created. **22**

21

- A) NO CHANGE
- B) itself,
- C) itself, with damage and
- D) itself possibly,

22

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 5.

Questions 23-33 are based on the following passage.

Coworking: A Creative Solution

When I left my office job as a website developer at a small company for a position that allowed me to work full-time from home, I thought I had it made: I gleefully traded in my suits and dress shoes for sweatpants and slippers, my frantic early-morning bagged lunch packing for a leisurely midday trip to my refrigerator. The novelty of this comfortable work-from-home life, however, **23** soon got worn off quickly. Within a month, I found myself feeling isolated despite having frequent email and instant messaging contact with my colleagues. Having become frustrated trying to solve difficult problems, **24** no colleagues were nearby to share ideas. It was during this time that I read an article **25** into coworking spaces.

23

- A) NO CHANGE
- B) was promptly worn
- C) promptly wore
- D) wore

24

- A) NO CHANGE
- B) colleagues were important for sharing ideas.
- C) ideas couldn't be shared with colleagues.
- D) I missed having colleagues nearby to consult.

25

- A) NO CHANGE
- B) about
- C) upon
- D) for

The article, published by *Forbes* magazine, explained that coworking spaces are designated locations that, for a fee, individuals can use to conduct their work. The spaces are usually stocked with standard office **26** equipment, such as photocopiers, printers, and fax machines. **27** In these locations, however, the spaces often include small meeting areas and larger rooms for hosting presentations. **28** The cost of launching a new coworking business in the United States is estimated to be approximately \$58,000.

26

- A) NO CHANGE
- B) equipment, such as:
- C) equipment such as:
- D) equipment, such as,

27

- A) NO CHANGE
- B) In addition to equipment,
- C) For these reasons,
- D) Likewise,

28

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

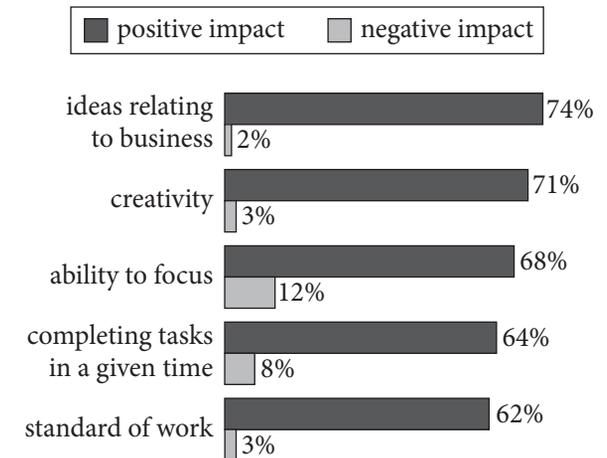
- A) Kept, because it provides a detail that supports the main topic of the paragraph.
- B) Kept, because it sets up the main topic of the paragraph that follows.
- C) Deleted, because it blurs the paragraph's main focus with a loosely related detail.
- D) Deleted, because it repeats information that has been provided in an earlier paragraph.

What most caught my interest, though, was a quotation from someone who described coworking spaces as “melting pots of creativity.” The article refers to a 2012 survey in which ²⁹ 64 percent of respondents noted that coworking spaces prevented them from completing tasks in a given time. The article goes on to suggest that the most valuable resources provided by coworking spaces are actually the people ³⁰ whom use them.

29

At this point, the writer wants to add specific information that supports the main topic of the paragraph.

Perceived Effect of Coworking on Business Skills



Adapted from “The 3rd Global Coworking Survey.” ©2013 by Deskmag.

Which choice most effectively completes the sentence with relevant and accurate information based on the graph above?

- A) NO CHANGE
- B) 71 percent of respondents indicated that using a coworking space increased their creativity.
- C) respondents credited coworking spaces with giving them 74 percent of their ideas relating to business.
- D) respondents revealed that their ability to focus on their work improved by 12 percent in a coworking space.

30

- A) NO CHANGE
- B) whom uses
- C) who uses
- D) who use

[1] Thus, even though I already had all the equipment I needed in my home office, I decided to try using a coworking space in my city. [2] Because I was specifically interested in coworking's reported benefits related to creativity, I chose a facility that offered a bright, open work area where I wouldn't be isolated. [3] Throughout the morning, more people appeared. [4] Periods of quiet, during which everyone worked independently, were broken up occasionally with lively conversation. **31**

I liked the experience so much that I now go to the coworking space a few times a week. Over time, I've gotten to know several of my coworking **32** colleagues: another website developer, a graphic designer, a freelance writer, and several mobile app coders. Even those of us who work in disparate fields are able to **33** share advice and help each other brainstorm. In fact, it's the diversity of their talents and experiences that makes my coworking colleagues so valuable.

31

The writer wants to add the following sentence to the paragraph.

After filling out a simple registration form and taking a quick tour of the facility, I took a seat at a table and got right to work on my laptop.

The best placement for the sentence is immediately

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

32

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

33

- A) NO CHANGE
- B) give some wisdom
- C) proclaim our opinions
- D) opine

Questions 34-44 are based on the following passage.

The Consolations of Philosophy

Long viewed by many as the stereotypical useless major, philosophy is now being seen by many students and prospective employers as in fact a very useful and practical major, offering students a host of transferable skills with relevance to the modern workplace. **34** In broad terms, philosophy is the study of meaning and the values underlying thought and behavior. But **35** more pragmatically, the discipline encourages students to analyze complex material, question conventional beliefs, and express thoughts in a concise manner.

Because philosophy **36** teaching students not what to think but how to think, the age-old discipline offers consistently useful tools for academic and professional achievement. **37** A 1994 survey concluded that only 18 percent of American colleges required at least one philosophy course. **38** Therefore, between 1992 and 1996, more than 400 independent philosophy departments were eliminated from institutions.

34

- A) NO CHANGE
- B) For example,
- C) In contrast,
- D) Nevertheless,

35

- A) NO CHANGE
- B) speaking in a more pragmatic way,
- C) speaking in a way more pragmatically,
- D) in a more pragmatic-speaking way,

36

- A) NO CHANGE
- B) teaches
- C) to teach
- D) and teaching

37

Which choice most effectively sets up the information that follows?

- A) Consequently, philosophy students have been receiving an increasing number of job offers.
- B) Therefore, because of the evidence, colleges increased their offerings in philosophy.
- C) Notwithstanding the attractiveness of this course of study, students have resisted majoring in philosophy.
- D) However, despite its many utilitarian benefits, colleges have not always supported the study of philosophy.

38

- A) NO CHANGE
- B) Thus,
- C) Moreover,
- D) However,

More recently, colleges have recognized the practicality and increasing popularity of studying philosophy and have markedly increased the number of philosophy programs offered. By 2008 there were 817 programs, up from 765 a decade before. In addition, the number of four-year graduates in philosophy has grown 46 percent in a decade. Also, studies have found that those students who major in philosophy often do better than students from other majors in both verbal reasoning and analytical 39 writing. These results can be measured by standardized test scores. On the Graduate Record Examination (GRE), for example, students intending to study philosophy in graduate school 40 has scored higher than students in all but four other majors.

These days, many 41 student's majoring in philosophy have no intention of becoming philosophers; instead they plan to apply those skills to other disciplines. Law and business specifically benefit from the complicated theoretical issues raised in the study of philosophy, but philosophy can be just as useful in engineering or any field requiring complex analytic skills. 42 That these skills are transferable across professions

39

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

- A) writing as
- B) writing, and these results can be
- C) writing, which can also be
- D) writing when the results are

40

- A) NO CHANGE
- B) have scored
- C) scores
- D) scoring

41

- A) NO CHANGE
- B) students majoring
- C) students major
- D) student's majors

42

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

The ancient Greek philosopher Plato, for example, wrote many of his works in the form of dialogues.

Should the writer make this addition here?

- A) Yes, because it reinforces the passage's main point about the employability of philosophy majors.
- B) Yes, because it acknowledges a common counterargument to the passage's central claim.
- C) No, because it blurs the paragraph's focus by introducing a new idea that goes unexplained.
- D) No, because it undermines the passage's claim about the employability of philosophy majors.

43 which makes them especially beneficial to twenty-first-century students. Because today's students can expect to hold multiple jobs—some of which may not even exist yet—during 44 our lifetime, studying philosophy allows them to be flexible and adaptable. High demand, advanced exam scores, and varied professional skills all argue for maintaining and enhancing philosophy courses and majors within academic institutions.

43

- A) NO CHANGE
- B) that
- C) and
- D) DELETE the underlined portion.

44

- A) NO CHANGE
- B) one's
- C) his or her
- D) their

STOP

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



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

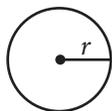
DIRECTIONS

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

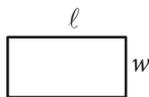
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

REFERENCE

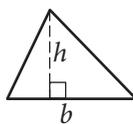


$$A = \pi r^2$$

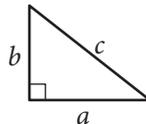
$$C = 2\pi r$$



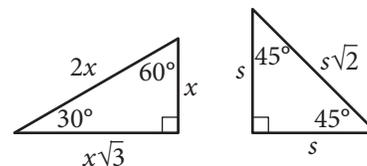
$$A = \ell w$$



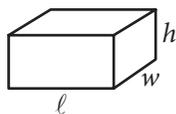
$$A = \frac{1}{2}bh$$



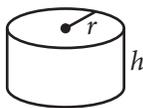
$$c^2 = a^2 + b^2$$



Special Right Triangles



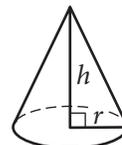
$$V = \ell wh$$



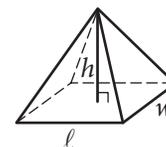
$$V = \pi r^2 h$$



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



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



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

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

The number of radians of arc in a circle is 2π .

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



1

If $\frac{x-1}{3} = k$ and $k = 3$, what is the value of x ?

- A) 2
- B) 4
- C) 9
- D) 10

2

For $i = \sqrt{-1}$, what is the sum $(7 + 3i) + (-8 + 9i)$?

- A) $-1 + 12i$
- B) $-1 - 6i$
- C) $15 + 12i$
- D) $15 - 6i$

3

On Saturday afternoon, Armand sent m text messages each hour for 5 hours, and Tyrone sent p text messages each hour for 4 hours. Which of the following represents the total number of messages sent by Armand and Tyrone on Saturday afternoon?

- A) $9mp$
- B) $20mp$
- C) $5m + 4p$
- D) $4m + 5p$

4

Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation $P = 108 - 23d$, where P is the number of phones left and d is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

- A) Kathy will complete the repairs within 108 days.
- B) Kathy starts each week with 108 phones to fix.
- C) Kathy repairs phones at a rate of 108 per hour.
- D) Kathy repairs phones at a rate of 108 per day.



5

$$(x^2y - 3y^2 + 5xy^2) - (-x^2y + 3xy^2 - 3y^2)$$

Which of the following is equivalent to the expression above?

- A) $4x^2y^2$
- B) $8xy^2 - 6y^2$
- C) $2x^2y + 2xy^2$
- D) $2x^2y + 8xy^2 - 6y^2$

6

$$h = 3a + 28.6$$

A pediatrician uses the model above to estimate the height h of a boy, in inches, in terms of the boy's age a , in years, between the ages of 2 and 5. Based on the model, what is the estimated increase, in inches, of a boy's height each year?

- A) 3
- B) 5.7
- C) 9.5
- D) 14.3

7

$$m = \frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1} P$$

The formula above gives the monthly payment m needed to pay off a loan of P dollars at r percent annual interest over N months. Which of the following gives P in terms of m , r , and N ?

- A) $P = \frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1} m$
- B) $P = \frac{\left(1 + \frac{r}{1,200}\right)^N - 1}{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N} m$
- C) $P = \left(\frac{r}{1,200}\right) m$
- D) $P = \left(\frac{1,200}{r}\right) m$



8

If $\frac{a}{b} = 2$, what is the value of $\frac{4b}{a}$?

- A) 0
- B) 1
- C) 2
- D) 4

9

$$\begin{aligned} 3x + 4y &= -23 \\ 2y - x &= -19 \end{aligned}$$

What is the solution (x, y) to the system of equations above?

- A) $(-5, -2)$
- B) $(3, -8)$
- C) $(4, -6)$
- D) $(9, -6)$

10

$$g(x) = ax^2 + 24$$

For the function g defined above, a is a constant and $g(4) = 8$. What is the value of $g(-4)$?

- A) 8
- B) 0
- C) -1
- D) -8

11

$$b = 2.35 + 0.25x$$

$$c = 1.75 + 0.40x$$

In the equations above, b and c represent the price per pound, in dollars, of beef and chicken, respectively, x weeks after July 1 during last summer. What was the price per pound of beef when it was equal to the price per pound of chicken?

- A) \$2.60
- B) \$2.85
- C) \$2.95
- D) \$3.35

12

A line in the xy -plane passes through the origin and has a slope of $\frac{1}{7}$. Which of the following points lies on the line?

- A) $(0, 7)$
- B) $(1, 7)$
- C) $(7, 7)$
- D) $(14, 2)$



13

If $x > 3$, which of the following is equivalent

to $\frac{1}{\frac{1}{x+2} + \frac{1}{x+3}}$?

A) $\frac{2x+5}{x^2+5x+6}$

B) $\frac{x^2+5x+6}{2x+5}$

C) $2x+5$

D) x^2+5x+6

14

If $3x - y = 12$, what is the value of $\frac{8^x}{2^y}$?

A) 2^{12}

B) 4^4

C) 8^2

D) The value cannot be determined from the information given.

15

If $(ax+2)(bx+7) = 15x^2 + cx + 14$ for all values of x , and $a+b=8$, what are the two possible values for c ?

A) 3 and 5

B) 6 and 35

C) 10 and 21

D) 31 and 41

**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If

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

 is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer →

Grid in result.

Answer: $\frac{7}{12}$			
7	/	1	2
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
<input checked="" type="radio"/>	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Answer: 2.5			
2	.	5	
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	3
4	4	4	4
5	5	5	<input checked="" type="radio"/>
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

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

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

Answer: 201 – either position is correct

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

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

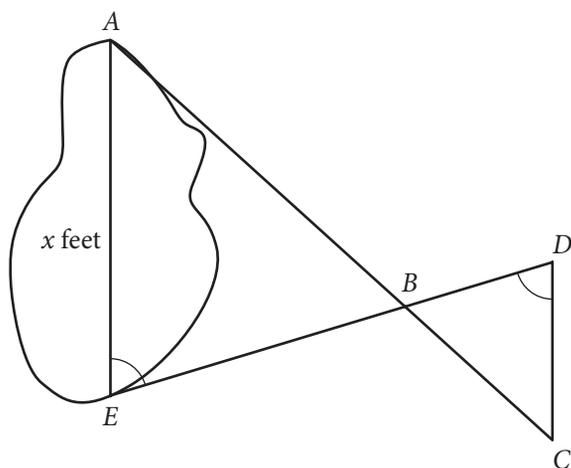
NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

If $t > 0$ and $t^2 - 4 = 0$, what is the value of t ?

17



A summer camp counselor wants to find a length, x , in feet, across a lake as represented in the sketch above. The lengths represented by AB , EB , BD , and CD on the sketch were determined to be 1800 feet, 1400 feet, 700 feet, and 800 feet, respectively. Segments AC and DE intersect at B , and $\angle AEB$ and $\angle CDB$ have the same measure. What is the value of x ?

18

$$\begin{aligned}x + y &= -9 \\x + 2y &= -25\end{aligned}$$

According to the system of equations above, what is the value of x ?

19

In a right triangle, one angle measures x° , where

$$\sin x^\circ = \frac{4}{5}. \text{ What is } \cos(90^\circ - x^\circ) ?$$

20

If $a = 5\sqrt{2}$ and $2a = \sqrt{2x}$, what is the value of x ?

STOP

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



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

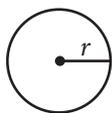
DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- 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

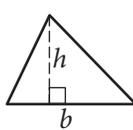


$$A = \pi r^2$$

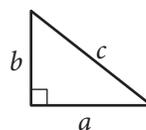
$$C = 2\pi r$$



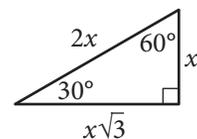
$$A = \ell w$$



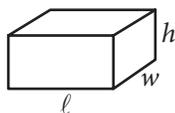
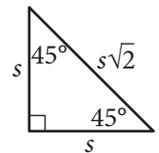
$$A = \frac{1}{2}bh$$



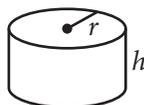
$$c^2 = a^2 + b^2$$



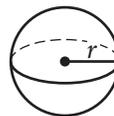
Special Right Triangles



$$V = \ell wh$$



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



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



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



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

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

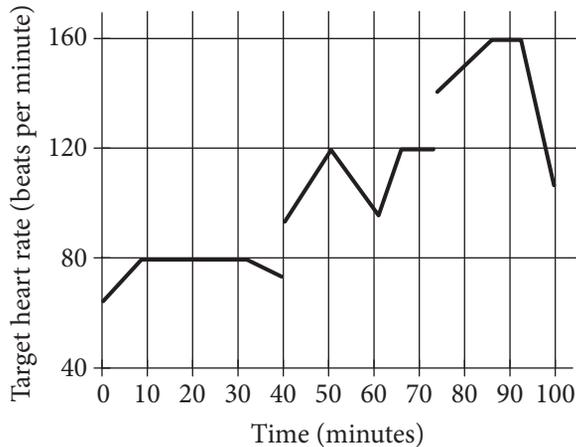
The number of radians of arc in a circle is 2π .

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



1

John runs at different speeds as part of his training program. The graph shows his target heart rate at different times during his workout. On which interval is the target heart rate strictly increasing then strictly decreasing?



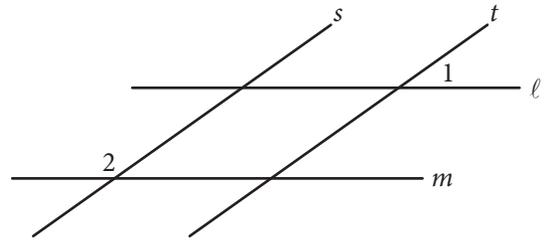
- A) Between 0 and 30 minutes
- B) Between 40 and 60 minutes
- C) Between 50 and 65 minutes
- D) Between 70 and 90 minutes

2

If $y = kx$, where k is a constant, and $y = 24$ when $x = 6$, what is the value of y when $x = 5$?

- A) 6
- B) 15
- C) 20
- D) 23

3



In the figure above, lines l and m are parallel and lines s and t are parallel. If the measure of $\angle 1$ is 35° , what is the measure of $\angle 2$?

- A) 35°
- B) 55°
- C) 70°
- D) 145°

4

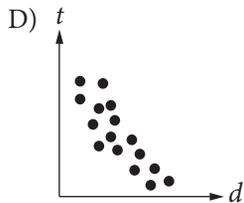
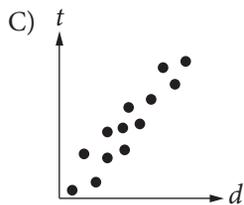
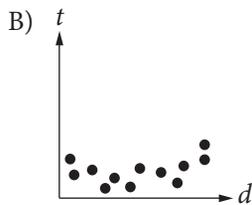
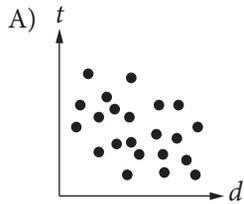
If $16 + 4x$ is 10 more than 14, what is the value of $8x$?

- A) 2
- B) 6
- C) 16
- D) 80



5

Which of the following graphs best shows a strong negative association between d and t ?



6

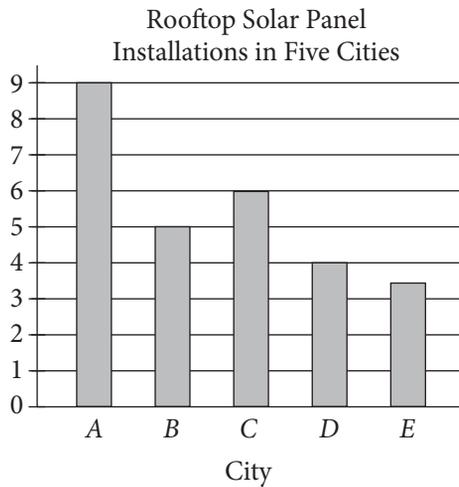
$1 \text{ decagram} = 10 \text{ grams}$ $1,000 \text{ milligrams} = 1 \text{ gram}$
--

A hospital stores one type of medicine in 2-decagram containers. Based on the information given in the box above, how many 1-milligram doses are there in one 2-decagram container?

- A) 0.002
- B) 200
- C) 2,000
- D) 20,000



7



The number of rooftops with solar panel installations in 5 cities is shown in the graph above. If the total number of installations is 27,500, what is an appropriate label for the vertical axis of the graph?

- A) Number of installations (in tens)
- B) Number of installations (in hundreds)
- C) Number of installations (in thousands)
- D) Number of installations (in tens of thousands)

8

For what value of n is $|n - 1| + 1$ equal to 0?

- A) 0
- B) 1
- C) 2
- D) There is no such value of n .



Questions 9 and 10 refer to the following information.

$$a = 1,052 + 1.08t$$

The speed of a sound wave in air depends on the air temperature. The formula above shows the relationship between a , the speed of a sound wave, in feet per second, and t , the air temperature, in degrees Fahrenheit ($^{\circ}\text{F}$).

9

Which of the following expresses the air temperature in terms of the speed of a sound wave?

- A) $t = \frac{a - 1,052}{1.08}$
- B) $t = \frac{a + 1,052}{1.08}$
- C) $t = \frac{1,052 - a}{1.08}$
- D) $t = \frac{1.08}{a + 1,052}$

10

At which of the following air temperatures will the speed of a sound wave be closest to 1,000 feet per second?

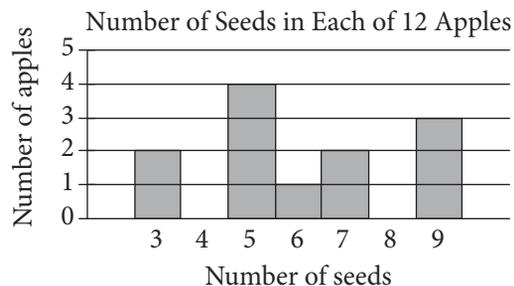
- A) -46°F
- B) -48°F
- C) -49°F
- D) -50°F

11

Which of the following numbers is NOT a solution of the inequality $3x - 5 \geq 4x - 3$?

- A) -1
- B) -2
- C) -3
- D) -5

12



Based on the histogram above, of the following, which is closest to the average (arithmetic mean) number of seeds per apple?

- A) 4
- B) 5
- C) 6
- D) 7



13

		Course			Total
		Algebra I	Geometry	Algebra II	
Gender	Female	35	53	62	150
	Male	44	59	57	160
	Total	79	112	119	310

A group of tenth-grade students responded to a survey that asked which math course they were currently enrolled in. The survey data were broken down as shown in the table above. Which of the following categories accounts for approximately 19 percent of all the survey respondents?

- A) Females taking Geometry
- B) Females taking Algebra II
- C) Males taking Geometry
- D) Males taking Algebra I

14

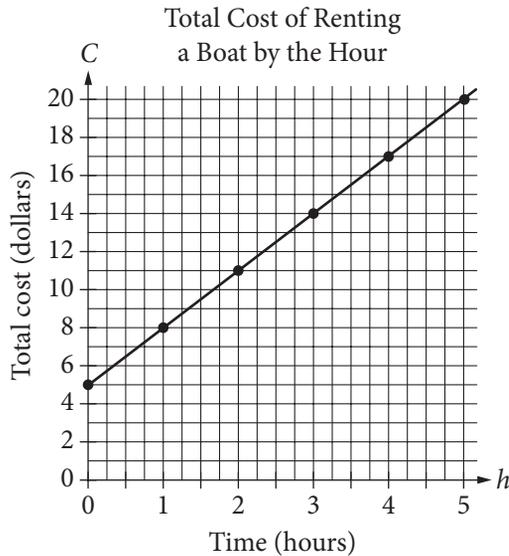
Lengths of Fish (in inches)						
8	9	9	9	10	10	11
11	12	12	12	12	13	13
13	14	14	15	15	16	24

The table above lists the lengths, to the nearest inch, of a random sample of 21 brown bullhead fish. The outlier measurement of 24 inches is an error. Of the mean, median, and range of the values listed, which will change the most if the 24-inch measurement is removed from the data?

- A) Mean
- B) Median
- C) Range
- D) They will all change by the same amount.



Questions 15 and 16 refer to the following information.



The graph above displays the total cost C , in dollars, of renting a boat for h hours.

15

What does the C -intercept represent in the graph?

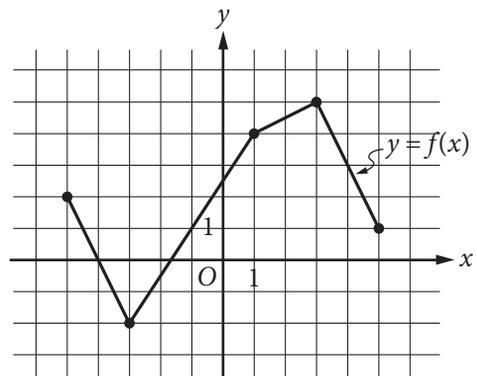
- A) The initial cost of renting the boat
- B) The total number of boats rented
- C) The total number of hours the boat is rented
- D) The increase in cost to rent the boat for each additional hour

16

Which of the following represents the relationship between h and C ?

- A) $C = 5h$
- B) $C = \frac{3}{4}h + 5$
- C) $C = 3h + 5$
- D) $h = 3C$

17



The complete graph of the function f is shown in the xy -plane above. For what value of x is the value of $f(x)$ at its minimum?

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



18

$$y < -x + a$$
$$y > x + b$$

In the xy -plane, if $(0, 0)$ is a solution to the system of inequalities above, which of the following relationships between a and b must be true?

- A) $a > b$
- B) $b > a$
- C) $|a| > |b|$
- D) $a = -b$

19

A food truck sells salads for \$6.50 each and drinks for \$2.00 each. The food truck's revenue from selling a total of 209 salads and drinks in one day was \$836.50. How many salads were sold that day?

- A) 77
- B) 93
- C) 99
- D) 105



20

Alma bought a laptop computer at a store that gave a 20 percent discount off its original price. The total amount she paid to the cashier was p dollars, including an 8 percent sales tax on the discounted price. Which of the following represents the original price of the computer in terms of p ?

- A) $0.88p$
- B) $\frac{p}{0.88}$
- C) $(0.8)(1.08)p$
- D) $\frac{p}{(0.8)(1.08)}$

21

Dreams Recalled during One Week

	None	1 to 4	5 or more	Total
Group X	15	28	57	100
Group Y	21	11	68	100
Total	36	39	125	200

The data in the table above were produced by a sleep researcher studying the number of dreams people recall when asked to record their dreams for one week. Group X consisted of 100 people who observed early bedtimes, and Group Y consisted of 100 people who observed later bedtimes. If a person is chosen at random from those who recalled at least 1 dream, what is the probability that the person belonged to Group Y ?

- A) $\frac{68}{100}$
- B) $\frac{79}{100}$
- C) $\frac{79}{164}$
- D) $\frac{164}{200}$



Questions 22 and 23 refer to the following information.

Annual Budgets for Different Programs in Kansas, 2007 to 2010

Program	Year			
	2007	2008	2009	2010
Agriculture/natural resources	373,904	358,708	485,807	488,106
Education	2,164,607	2,413,984	2,274,514	3,008,036
General government	14,347,325	12,554,845	10,392,107	14,716,155
Highways and transportation	1,468,482	1,665,636	1,539,480	1,773,893
Human resources	4,051,050	4,099,067	4,618,444	5,921,379
Public safety	263,463	398,326	355,935	464,233

The table above lists the annual budget, in thousands of dollars, for each of six different state programs in Kansas from 2007 to 2010.

22

Which of the following best approximates the average rate of change in the annual budget for agriculture/natural resources in Kansas from 2008 to 2010 ?

- A) \$50,000,000 per year
- B) \$65,000,000 per year
- C) \$75,000,000 per year
- D) \$130,000,000 per year

23

Of the following, which program's ratio of its 2007 budget to its 2010 budget is closest to the human resources program's ratio of its 2007 budget to its 2010 budget?

- A) Agriculture/natural resources
- B) Education
- C) Highways and transportation
- D) Public safety



24

Which of the following is an equation of a circle in the xy -plane with center $(0, 4)$ and a radius with endpoint $\left(\frac{4}{3}, 5\right)$?

- A) $x^2 + (y - 4)^2 = \frac{25}{9}$
- B) $x^2 + (y + 4)^2 = \frac{25}{9}$
- C) $x^2 + (y - 4)^2 = \frac{5}{3}$
- D) $x^2 + (y + 4)^2 = \frac{3}{5}$

25

$$h = -4.9t^2 + 25t$$

The equation above expresses the approximate height h , in meters, of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground?

- A) 3.5
- B) 4.0
- C) 4.5
- D) 5.0

26

Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce?

- A) 115
- B) 120
- C) 124
- D) 173

27

A square field measures 10 meters by 10 meters. Ten students each mark off a randomly selected region of the field; each region is square and has side lengths of 1 meter, and no two regions overlap. The students count the earthworms contained in the soil to a depth of 5 centimeters beneath the ground's surface in each region. The results are shown in the table below.

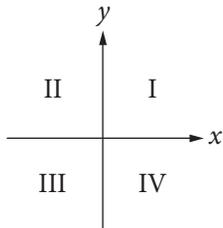
Region	Number of earthworms	Region	Number of earthworms
A	107	F	141
B	147	G	150
C	146	H	154
D	135	I	176
E	149	J	166

Which of the following is a reasonable approximation of the number of earthworms to a depth of 5 centimeters beneath the ground's surface in the entire field?

- A) 150
- B) 1,500
- C) 15,000
- D) 150,000



28



If the system of inequalities $y \geq 2x + 1$ and $y > \frac{1}{2}x - 1$ is graphed in the xy -plane above, which quadrant contains no solutions to the system?

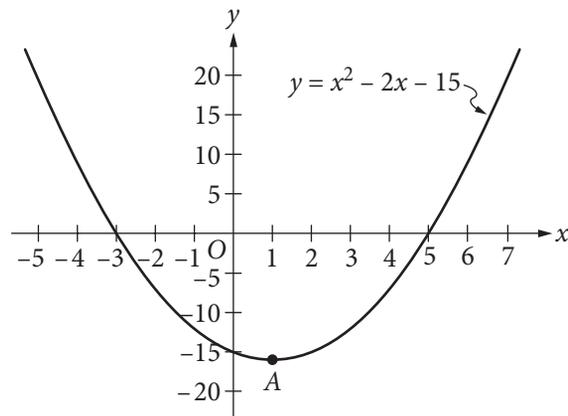
- A) Quadrant II
- B) Quadrant III
- C) Quadrant IV
- D) There are solutions in all four quadrants.

29

For a polynomial $p(x)$, the value of $p(3)$ is -2 . Which of the following must be true about $p(x)$?

- A) $x - 5$ is a factor of $p(x)$.
- B) $x - 2$ is a factor of $p(x)$.
- C) $x + 2$ is a factor of $p(x)$.
- D) The remainder when $p(x)$ is divided by $x - 3$ is -2 .

30



Which of the following is an equivalent form of the equation of the graph shown in the xy -plane above, from which the coordinates of vertex A can be identified as constants in the equation?

- A) $y = (x + 3)(x - 5)$
- B) $y = (x - 3)(x + 5)$
- C) $y = x(x - 2) - 15$
- D) $y = (x - 1)^2 - 16$


DIRECTIONS

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or $7/2$. (If

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

 is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer → in boxes.

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

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

← Fraction line

Grid in result.

Answer: 2.5

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

← Decimal point

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

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

Answer: 201 – either position is correct

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

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

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



31

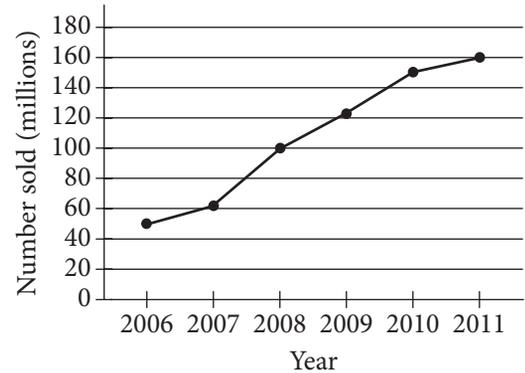
Wyatt can husk at least 12 dozen ears of corn per hour and at most 18 dozen ears of corn per hour. Based on this information, what is a possible amount of time, in hours, that it could take Wyatt to husk 72 dozen ears of corn?

32

The posted weight limit for a covered wooden bridge in Pennsylvania is 6000 pounds. A delivery truck that is carrying x identical boxes each weighing 14 pounds will pass over the bridge. If the combined weight of the empty delivery truck and its driver is 4500 pounds, what is the maximum possible value for x that will keep the combined weight of the truck, driver, and boxes below the bridge's posted weight limit?

33

Number of Portable Media Players Sold Worldwide Each Year from 2006 to 2011



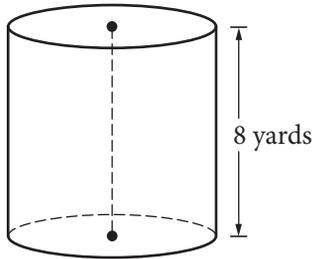
According to the line graph above, the number of portable media players sold in 2008 is what fraction of the number sold in 2011?

34

A local television station sells time slots for programs in 30-minute intervals. If the station operates 24 hours per day, every day of the week, what is the total number of 30-minute time slots the station can sell for Tuesday and Wednesday?



35



A dairy farmer uses a storage silo that is in the shape of the right circular cylinder above. If the volume of the silo is 72π cubic yards, what is the diameter of the base of the cylinder, in yards?

36

$$h(x) = \frac{1}{(x-5)^2 + 4(x-5) + 4}$$

For what value of x is the function h above undefined?

Questions 37 and 38 refer to the following information.

Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression $\$100(x)^t$ to find the value of the account after t years.

37

What is the value of x in the expression?

38

Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of \$100 into this account at the same time Jessica made a deposit of \$100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)

STOP

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

Essay

TIME—50 MINUTES

DIRECTIONS

The essay gives you an opportunity to show how effectively you can read and comprehend a passage and write an essay analyzing the passage. You should, therefore, take care to read the passage carefully, present a clear and logical analysis, and use language precisely.

Your essay must be written on the lines provided in your answer booklet—except for the Planning Page at the front of the answer booklet, you will receive no other paper on which to write. You will have enough space if you write on every line, avoid wide margins, and keep your handwriting to a reasonable size. Remember that people who are not familiar with your handwriting will read what you write. Try to write or print so that what you are writing is legible to those readers.

IMPORTANT REMINDERS

1. **Do not write your essay in this prompt booklet.** Only what you write on the lined pages of your answer booklet will be evaluated.
2. **An off-topic essay will not be evaluated.**

You have **fifty minutes** to read the passage and write an essay in response to the prompt provided inside this booklet.

BEGIN WRITING YOUR ESSAY ON PAGE 2 OF THE **ANSWER BOOKLET**.

As you read the passage below, consider how Jimmy Carter uses

- 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 former US President Jimmy Carter, Foreword to *Arctic National Wildlife Refuge: Seasons of Life and Land, A Photographic Journey* by Subhankar Banerjee. ©2003 by Subhankar Banerjee.

- 1 The Arctic National Wildlife Refuge stands alone as America's last truly great wilderness. This magnificent area is as vast as it is wild, from the windswept coastal plain where polar bears and caribou give birth, to the towering Brooks Range where Dall sheep cling to cliffs and wolves howl in the midnight sun.
- 2 More than a decade ago, [my wife] Rosalynn and I had the fortunate opportunity to camp and hike in these regions of the Arctic Refuge. During bright July days, we walked along ancient caribou trails and studied the brilliant mosaic of wildflowers, mosses, and lichens that hugged the tundra. There was a timeless quality about this great land. As the never-setting sun circled above the horizon, we watched muskox, those shaggy survivors of the Ice Age, lumber along braided rivers that meander toward the Beaufort Sea.
- 3 One of the most unforgettable and humbling experiences of our lives occurred on the coastal plain. We had hoped to see caribou during our trip, but to our amazement, we witnessed the migration of tens of thousands of caribou with their newborn calves. In a matter of a few minutes, the sweep of tundra before us became flooded with life, with the sounds of grunting animals and clicking hooves filling the air. The dramatic procession of the Porcupine caribou herd was a once-in-a-lifetime wildlife spectacle. We understand firsthand why some have described this special birthplace as "America's Serengeti."
- 4 Standing on the coastal plain, I was saddened to think of the tragedy that might occur if this great wilderness was consumed by a web of roads and pipelines, drilling rigs and industrial facilities. Such proposed developments would forever destroy the wilderness character of America's only Arctic Refuge and disturb countless numbers of animals that depend on this northernmost terrestrial ecosystem.
- 5 The extraordinary wilderness and wildlife values of the Arctic Refuge have long been recognized by both Republican and Democratic presidents. In 1960, President Dwight D. Eisenhower established the original 8.9 million-acre Arctic National Wildlife Range to preserve its unique wildlife, wilderness, and recreational values. Twenty years later, I signed the Alaska National Interest Lands Conservation Act,

monumental legislation that safeguarded more than 100 million acres of national parks, refuges, and forests in Alaska. This law specifically created the Arctic National Wildlife Refuge, doubled the size of the former range, and restricted development in areas that are clearly incompatible with oil exploration.

- 6 Since I left office, there have been repeated proposals to open the Arctic Refuge coastal plain to oil drilling. Those attempts have failed because of tremendous opposition by the American people, including the Gwich'in Athabascan Indians of Alaska and Canada, indigenous people whose culture has depended on the Porcupine caribou herd for thousands of years. Having visited many aboriginal peoples around the world, I can empathize with the Gwich'ins' struggle to safeguard one of their precious human rights.
- 7 We must look beyond the alleged benefits of a short-term economic gain and focus on what is really at stake. At best, the Arctic Refuge might provide 1 to 2 percent of the oil our country consumes each day. We can easily conserve more than that amount by driving more fuel-efficient vehicles. Instead of tearing open the heart of our greatest refuge, we should use our resources more wisely.
- 8 There are few places on earth as wild and free as the Arctic Refuge. It is a symbol of our national heritage, a remnant of frontier America that our first settlers once called wilderness. Little of that precious wilderness remains.
- 9 It will be a grand triumph for America if we can preserve the Arctic Refuge in its pure, untrammelled state. To leave this extraordinary land alone would be the greatest gift we could pass on to future generations.

Write an essay in which you explain how Jimmy Carter builds an argument to persuade his audience that the Arctic National Wildlife Refuge should not be developed for industry. In your essay, analyze how Carter uses one or more of the features listed in the box above (or features of your own choice) to strengthen the logic and persuasiveness of his argument. Be sure that your analysis focuses on the most relevant features of the passage.

Your essay should not explain whether you agree with Carter's claims, but rather explain how Carter builds an argument to persuade his audience.



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