

# PSAT™ 10

Information about the PSAT™ 10

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Test-taking advice and tips

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**An official practice test**

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As one of the assessments in the College Board's SAT® Suite of Assessments, the PSAT™ 10 measures the skills and knowledge that current research shows are essential for college and career readiness and success. The PSAT 10 covers the same content areas as the PSAT/NMSQT®. Both the PSAT/NMSQT and PSAT 10 serve as a check-in on your progress to help pinpoint areas for development. Educational Testing Service (ETS) administers the PSAT 10 for the College Board.

Contact the PSAT 10 office if you have suggestions, questions, or comments about test registration, administration, or score reports. If you wish to withdraw your answer sheet from scoring, or if you wish to report test administration irregularities, you must notify the test supervisor or the PSAT 10 office immediately.

PSAT 10  
P.O. Box 6720  
Princeton, NJ 08541-6720

**[psathelp@info.collegeboard.org](mailto:psathelp@info.collegeboard.org)**

866-433-7728 (U.S.), +1-212-713-8105 (International)  
609-882-4118 TTY  
8 a.m. to 4 p.m. ET  
610-290-8979

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 more than 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 more information, visit **[collegeboard.org](http://collegeboard.org)**.

**The College Board**  
**250 Vesey Street**  
**New York, NY 10080-0001**  
**866-630-9305 (U.S.), +1-212-520-8570 (International)**

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Separate pull-out insert. If you don't have a practice test, ask your counselor for one.

Tuesday, Feb. 21, through Friday, Apr. 14, 2017

The PSAT 10 measures reading, writing and language, and math skills developed over many years, both in and out of school.

You will not be asked to recall facts from literature, history, or science, or to complete math formulas, because this test measures your reasoning and critical thinking skills.

Get free, personalized, and focused practice through Khan Academy®.

Prepare for the SAT®.

Start getting ready for college.

Enter scholarship competitions.

See which AP® courses you might be ready for.

The fee for the 2017 PSAT 10 is \$15, but some schools cover all or some of the cost for their students. Schools sometimes charge an additional fee to cover administrative costs.

See your counselor. For further help, see contact information on the inside front cover for the PSAT 10 office and the College Board.

No. 2 pencils with erasers

Approved calculator (see page 24)

Social Security number (optional)

Student ID number, assigned by your school (optional)

Email address (optional)

Current and valid school- or government-issued photo ID if you are not testing at the school you normally attend. (More ID information is given at .) **Note:** your school may choose to have you fill in your identifying information (name, Social Security number, Student ID number, email address, etc.) prior to test day.

We offer several practice tests. The one in the enclosed booklet is Practice Test #2. For Practice Test #1, answer explanations, sample questions, and practice tests in MP3 Audio and other formats, go to .

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Your score report will include a total score, section scores, test scores, cross-test scores, and subscores — all of which will give you better insight into your performance. Once you get your paper score report, visit [psat.org](#) to learn more about what these scores mean.

The score report will also show the correct answers, the answers you gave, and the difficulty level of each question. In the Next Steps section, you will see a message about your potential for success in AP courses based on your scores. There is also some helpful advice about when to take the SAT.

If you have not received your score report by mid-May, see your counselor. The PSAT 10 administration does not provide duplicate copies of score reports, but your school will be able to print a copy.

Please refer to the “Use and Distribution of Scores and Student Information” section to learn more about who receives your scores and other personal information.

**you know in advance that you cannot take the test on the date your school offers it:**

Your school may be able to arrange for you to take the test at a neighboring school that has selected a different test date within the testing window. Tell your counselor as soon as possible that you have a conflicting commitment, such as a religious observance. If you test at another school, be sure to take your school’s code number and an acceptable photo identification with you.

**you are home-schooled and want to take the PSAT 10:**

You must make arrangements in advance with your local high school or other nearby school administering the test. (For a listing of schools in your area, go to [psat.org](#).)

If this is not possible, contact the PSAT 10 office (see inside front cover).

**you will be studying in another country when the test is given:**

You must make advance arrangements. Contact the PSAT 10 office and provide the name of the city and country and, if known, the name and address of the school you will be attending when the test is given. The PSAT 10 office will send you instructions.

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The College Board has partnered with several organizations who provide millions of dollars in scholarships to qualified low-income and minority students. Help them find you by opting in to Student Search Service® when you take the PSAT 10. These organizations include:

- American Indian Graduate Center ( [psat.org](#) )
- Asian & Pacific Islander American Scholarship Fund ( [psat.org](#) )
- Hispanic Scholarship Fund ( [psat.org](#) )
- Jack Kent Cooke Foundation ( [psat.org](#) )
- United Negro College Fund ( [psat.org](#) )

*Taking the PSAT 10 does not qualify you for consideration in the National Merit® Scholarship Program or any other program conducted by National Merit Scholarship Corporation.*

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Our Student Search Service is a 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:

Students may choose to participate in Student Search Service when registering for a College Board test.

As part of taking the PSAT 10, students are asked to provide information about themselves on their answer sheet.

Participating, eligible organizations can then search for groups of students who may be a good fit for their communities and programs, but only among those students who opt to participate in Student Search Service.

The search criteria can include any attribute from the answer sheet; however, we never share information on disabilities, parental education, self-reported parental income, Social Security numbers, phone numbers, and actual test scores.

The most searched items are expected high school graduation date, cumulative grade point average (GPA), and intended college major.

**Keep the following points in mind about Student Search Service:**

Colleges participating in Student Search Service never receive student scores or phone numbers. Colleges can ask for names of students within certain score ranges, but your exact score is not reported.

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 like you and inform them of available opportunities.

Student Search Service will share your contact information only with colleges and qualified non-profit educational or scholarship programs that are recruiting students like you. Your name will never be sold to a commercial marketing firm or retailer of merchandise or services (such as test prep).

**Student Search Service communications are sent by outside colleges, scholarship programs, and educational opportunity organizations.** See the "Test Regulations" section to learn how we protect your privacy.

If you have questions or concerns about Student Search Service or want more information about the program, please go to  
or call 866-825-8051.

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All entities who receive student information from Student Search Service are required to maintain strict confidentiality. We actively monitor these entities to ensure adherence to our guidelines. The frequency and mode of communication is determined by the entity that receives the student's name. Every communication from individual entities is required to contain specific instructions on how to unsubscribe from that particular institution. To unsubscribe from the entire Student Search Service program, go to \_\_\_\_\_, call

800-626-9795, or write to:

The College Board  
11955 Democracy Drive  
Reston, VA 20190-5662

Attention: Student Search Service

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 request 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 where your Caller ID indicates that the telephone number originates from a College Board location, do not provide the caller with any personal information.

If you provide your phone number on your answer sheet, representatives of the College Board will only call or send text messages to you and your family in response to inquiries generated by you, to provide or gather information about a test or program for which you registered or to invite you to participate in free college planning services. Should you have a question about the origin of a phone call you have received in which the caller claimed to be from the College Board, contact the PSAT 10 office (see inside front cover).

Be wary of unsolicited contacts, whether via telephone or email.

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.

Never supply credit card information to someone who calls or emails you.

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.

Keep in mind that if an offer appears too good to be true, it probably is.

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 \_\_\_\_\_.

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For students with disabilities, the College Board provides testing accommodations such as braille and large print test books and extended time options. If you have a disability and have not already been approved for accommodations by the College Board, it is important to speak to your counselor or teacher right away to determine if a request for accommodations needs to be submitted. If so, your school's SSD Coordinator can assist you in requesting the accommodations that meet your needs.

After the accommodations request has been submitted, it may take approximately seven weeks for you to receive a decision letter. If you are approved for accommodations, save this letter because it also indicates your eligibility for accommodations on other College Board tests, such as the SAT and Advanced Placement Program® (AP) Exams. With limited exceptions, the accommodations will remain in effect until one year after your graduation. If you move to a new school, ask your counselor at your new school to transfer your SSD online record.

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**Standard rules and regulations give all students the same opportunity and prevent any student from having an unfair advantage. When you take the test, you will be asked to copy and sign a Certification Statement stating that you will abide by these regulations, so read them carefully. Also read about grounds for score cancellation on page 5. Failure to follow these test regulations or any instructions given by the test supervisor may result in your scores being canceled.**

You must mark your answers on the answer sheet. You will not receive credit for anything written in the test book. You may not leave the room with your test book. You may use only your test book for scratch work (unless approved for an accommodation).

You may use an approved calculator (see "Acceptable Calculators," page 24) only during the Math Test – Calculator portion of the assessment, you may not have a calculator on your desk during the Reading Test or the Writing and Language Test, and you may not share a calculator during the test or during breaks. You may only use one calculator at any given time — if you brought a second one for backup, it must be kept under your desk.

You are not allowed to use protractors; compasses; rulers; cutting devices; earplugs; scratch paper, notes, books, dictionaries, or references of any kind; pamphlets; pens, mechanical pencils, highlighters, or colored pencils; listening, recording, copying, or photographic devices; or any other aids. You may not bring food or drink (including bottled water) into the test room, unless preapproved for medical reasons.

You may not use cell phones or other prohibited electronic devices during the test or breaks. Prohibited devices include, but are not limited to, cellphones or smartphones; audio players/recorders, tablets, laptops, notebooks, or any other personal computing devices; separate timers of any type; cameras or other photographic equipment; any devices (including smartwatches) that can be used to record, transmit, receive, or play back audio, photographic, text, or video content. Power must be turned off, and these devices must be placed under your desk. If your watch has an alarm, you must turn that off as well. If your phone makes noise, or you are seen using it at any time (including breaks), you will be dismissed immediately, your scores will be canceled, and the device may be confiscated and its contents inspected.

You may not give or receive assistance or disturb others during the test or breaks.

You cannot skip ahead or go back to a previous test section while taking the PSAT 10.

You may take the PSAT 10 only once each school year. If you begin a test, you are considered to have taken it.

All PSAT 10 test-takers in your school must take the test at the same time. (Read about special arrangements and testing accommodations for students with disabilities on this page.)

If you become ill and/or must leave during the test, or if for any other reason you do not want your test scored, you may ask the test supervisor to destroy your answer sheet before you leave the testing room. After you leave the testing room, any decision to withdraw your answer sheet from scoring must be reported immediately to the test supervisor or the PSAT 10 office. (See contact information on the inside front cover.)

**You may not discuss the contents of the test with anyone else, or share them through any means, including but not limited to emails, text messages, and the Internet, until after score reports have been distributed.**

Members of your household or immediate family may not serve as PSAT 10 supervisors, coordinators, or proctors, even at a different school, on the date that you take the test.

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When you take the PSAT 10 and sign the answer sheet, you acknowledge that you understand how your scores and personal information will be used.

The College Board will receive the scores of students who take the test as well as information students provide on their answer sheets.

Some schools, districts, and states receive PSAT 10 scores with other information about their students. In addition, scores for students who qualify for programs described in the section “Special Opportunities” are reported to those programs. The PSAT 10 administration does not report scores to colleges or commercial entities.

If your school participates in the PSAT 10 through a bulk registration process, the College Board may receive your personal information, including first name, last name, sex, date of birth, and mailing address, from your school. This information will be kept secure and added to your permanent College Board record to be used for score reporting purposes as well as the other purposes that are outlined in this guide and in registration materials. By taking the PSAT 10 and signing the PSAT 10 answer sheet, you acknowledge that your school has provided this information to the College Board and consent to the College Board retaining this information.

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To report scores that accurately reflect performance, ETS, on behalf of the College Board, maintains test administration and security standards designed to give all students the same opportunity to demonstrate their abilities and to prevent any student from gaining an unfair advantage because of testing irregularities or misconduct. ETS reviews irregularities and test scores believed to have been earned under unusual circumstances.

Students may be dismissed from the testing room and their answer sheets may be destroyed if they fail to follow test regulations or instructions given by the test supervisor. Once answer sheets are submitted for scoring, ETS reserves the right not to score the answer sheet of a student who engaged in misconduct or was involved in a testing irregularity.

ETS reserves the right to cancel scores if there is reason to doubt their validity. Before acting, ETS will inform the student of the reasons for questioning the scores and will give the student an opportunity to provide additional information, to confirm the scores by taking another PSAT 10, or to cancel the scores. The student may also request arbitration in accordance with ETS's Standard Arbitration Agreement. If before, during, or after a review of questionable scores, ETS finds that misconduct has occurred in connection with a test, these options will not be available even if previously offered.

Score reviews are confidential. If it is necessary to cancel reported scores, ETS will notify score users, but the reasons for cancellation will not be disclosed. This policy does not necessarily apply in group cases.

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All new PSAT 10 test questions and complete new editions of the tests are reviewed by external, independent educators from throughout the United States. These reviews help ensure that wording or content are unambiguous and relevant and that the language used is not offensive to or inappropriate for any particular group of students based on race/ethnicity or gender. Assessment staff ensure that the test as a whole includes references to men and women as well as to individuals from varied racial, ethnic, and cultural backgrounds. Statistical procedures are used to identify questions that are harder for a group of students to answer correctly than would be expected from their performance on other items in the test; these questions are excluded from appearing on tests.

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If you find what you consider to be an error or ambiguity in a test question, tell the test supervisor immediately after the test. You may also write to:

Assessment Design and Development  
The College Board  
250 Vesey Street  
New York, NY 10281

Or send an email to

In your inquiry, state your name and mailing address, the date you took the PSAT 10, the name and address of the school where you took the test, the test section, the test question (as well as you can remember), and an explanation of your concern about the question.

*We will not respond via email, so be sure to include your full name and mailing address.*

The PSAT 10 Office will send you a written response after your inquiry has been reviewed thoroughly by subject-matter specialists.

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When you take the PSAT 10, indicate the college major that best matches your interests by entering the code from the list that follows on your answer sheet. Your online score report will include information to help you investigate this and other majors further.

If you say “Yes” to Student Search Service, colleges and universities that offer degrees in your areas of interest can send you information about their programs.

**Agriculture, Agriculture Operations, and Related Sciences—100**

Agricultural Business and Management—101  
Animal Sciences—103

**Architecture and Related Services—120**

Architecture—121  
City/Urban, Community, and Regional Planning—123  
Landscape Architecture—125

**Area, Ethnic, Cultural, Gender, and Group Studies—140**

Area Studies—141  
Ethnic, Cultural Minority, Gender, and Group Studies—142

**Biological and Biomedical Sciences—160**

Biochemistry—162  
Biology/Biological Sciences, General—161  
Biophysics—163  
Biotechnology—164  
Cell/Cellular Biology and Anatomical Sciences—166  
Ecology—167  
Genetics—168  
Marine Biology and Biological Oceanography—169  
Microbiological Sciences and Immunology—170

Molecular Biology—171  
Neuroscience—185  
Zoology/Animal Biology—175

**Business Management, Marketing, and Related Support Services—200**

Accounting and Related Services—201  
Actuarial Science—202  
Business Administration, Management, and Operations—204  
Fashion Merchandising—208  
Finance and Financial Management Services—209  
Hospitality Administration/ Management—211  
Hotel, Motel, and Restaurant Management—225  
Human Resources Management and Services—212  
International Business—214  
Management Information Systems and Services—217  
Marketing/Marketing Management—218  
Meeting and Event Planning—230

**Communication, Journalism, and Related Programs—250**

Communication and Media Studies—252  
Digital Communication and Media/Multimedia—253  
Journalism—254  
Public Relations, Advertising, and Applied Communication—270  
Radio and Television—257

**Computer and Information Sciences and Support Services—300**

Artificial Intelligence—301  
Computer Programming—302  
Computer Science—303  
Computer Systems Networking and Telecommunications—306  
Information Sciences/Studies—308

**Education—400**

Early Childhood Education and Teaching—407  
Elementary Education and Teaching—417  
Secondary Education and Teaching—430  
Special Education and Teaching—432

**Engineering—450**

Aerospace, Aeronautical, and Space Engineering—451



- Agricultural Engineering—452
- Architectural Engineering—453
- Bioengineering and Biomedical Engineering—454
- Chemical Engineering—455
- Civil Engineering—456
- Computer Engineering, General—457
- Electrical and Electronics Engineering—459
- Engineering Physics/Applied Physics—461
- Engineering Science—462
- Environmental/Environmental Health Engineering—463
- Geological/Geophysical Engineering—464
- Industrial Engineering—465
- Materials Engineering—466
- Mechanical Engineering—467
- Mining and Mineral Engineering—468
- Nuclear Engineering—470
- Petroleum Engineering—472
- Polymer/Plastics Engineering—475
- Engineering Technologies—500**
  - Computer Engineering Technology—501
  - Drafting/Design Engineering Technologies—502
  - Telecommunications Technology/Technician—509
- English Language and Literature/Letters—520**
  - Creative Writing—522
- Family and Consumer Sciences/ Human Sciences—540**
  - Foods, Nutrition, and Wellness Studies—542
- Foreign Languages, Literatures, and Linguistics—550**
  - Classics and Classical Languages, Literatures, and Linguistics—553
  - Comparative Literature—554
  - East Asian Languages, Literatures, and Linguistics—555
  - French Language and Literature—556
  - German Language and Literature—557
  - Linguistics—559
  - Russian Language and Literature—560
  - Spanish Language and Literature—561
- Health Professions and Related Programs—600**
  - Allied Health Diagnostic, Intervention, and Treatment Professions—602
  - Athletic Training/Trainer—603
  - Clinical/Medical Laboratory Science/ Research and Allied Professions—605
  - Communication Sciences and Disorders—606
  - Dental Hygiene/Hygienist—607
  - Dietetics and Clinical Nutrition Services—610
  - Nursing—619
  - Pre dentistry Studies—627
  - Pre medicine/Pre medical Studies—628
  - Pre occupational Therapy Studies—678
  - Pre pharmacy Studies—629
  - Pre physical Therapy Studies—682
  - Pre veterinary Studies—630
- History—700**
- Homeland Security, Law Enforcement, Firefighting, and Related Protective Services—890**
  - Criminal Justice/Law Enforcement Administration—892
  - Forensic Science and Technology—894
  - Homeland Security—897
- Legal Professions and Studies—710**
  - Prelaw Studies—712
- Liberal Arts and Sciences, General Studies, and Humanities—720**
  - Humanities/Humanistic Studies—722
  - Liberal Arts and Sciences/Liberal Studies—723
- Mathematics and Statistics—740**
  - Applied Mathematics—741
  - Mathematics—742
  - Statistics—743
- Military Technologies and Applied Sciences—360**
- Multi/Interdisciplinary Studies—770**
  - Biological and Physical Sciences—771
  - International/Global Studies—772
  - Mathematics and Computer Science—773
- Natural Resources and Conservation—790**
  - Environmental Science—791
  - Environmental Studies—792
  - Fishing and Fisheries Sciences and Management—793
  - Forestry—794
  - Wildlife, Fish, Wildlands Science/ Management—796

**Parks, Recreation, Leisure, and  
Fitness Studies—800**

Parks and Recreation Facilities  
Management—802

Sport and Fitness Administration/  
Management—803

**Personal and Culinary Services—810**

**Philosophy and Religious Studies—820**

Philosophy—821

Religion/Religious Studies—822

**Physical Sciences—830**

Astronomy—832

Astrophysics—833

Atmospheric Sciences and Meteorology—834

Chemistry—836

Geological and Earth Sciences/  
Geosciences—837

Materials Science—854

Physics—843

**Psychology—870**

**Public Administration and Social Services—880**

Human Services, General—881

Public Administration—882

Public Policy Analysis—883

Social Work—884

**Social Sciences—900**

Anthropology—901

Archaeology—902

Criminology—903

Economics—904

Geography—905

International Relations and Affairs—906

Political Science and Government—907

Sociology—908

**Theology and Religious Vocations—920**

**Visual and Performing Arts—940**

**Art History, Criticism, and Conservation—941**

Arts, Entertainment, and Media  
Management—960

Dance—942

Drama and Theater Arts—943

Fashion/Apparel Design—945

Film/Video and Photographic Arts—946

Fine and Studio Art—947

Game and Interactive Media Design—970

Graphic Design—948

Interior Design—949

Music—950

Photography—954

Technical Theater/Theater Design  
and Technology—955

**OTHER—990**

**UNDECIDED—999**

The Evidence-Based Reading and Writing section is composed of two tests that assess different but related skills and knowledge. 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.

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The Reading Test gives you a chance to show how well you understand what you read.

**Total questions:** 47 questions with multiple-choice responses

**Time allotted:** 60 minutes

Calculators may not be used or be on your desk.

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 informational graphics such as tables, graphs, or charts; questions ask you to interpret data and to synthesize information presented graphically with that in the associated passage. (Mathematical computation is not required to answer these questions.) Passages that have similar subject matter are sometimes paired and accompanied by questions that require you to make important connections between the passages as well as to understand each passage on its own.

To answer each question, consider what the passage(s) say directly, and use careful reasoning to draw supportable inferences and conclusions from the passage(s). The best answer to each question is derived from what is stated or implied in the passage(s) rather than from prior knowledge of the topics covered. All of the questions are passage based.

Reading carefully is the key to finding the best answer to each question. The information you need to answer each Reading question is always in the passage(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 such matters as facts, details, and words in context.

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.

The questions often include line numbers to help direct you to relevant part(s) of the passage(s). You may have to look elsewhere in the passage, 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.

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 carefully.

Decide on the best answer to each question.

Read the explanation for the best answer.

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

## 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 1-4 are based on the following passage.

This passage is adapted from Edith Wharton, *Ethan Frome*, originally published in 1911. Mattie Silver is Ethan's household employee.

Line  
5  
10  
15  
20  
25  
Mattie Silver had lived under Ethan's roof for a year, and from early morning till they met at supper he had frequent chances of seeing her; but no moments in her company were comparable to those when, her arm in his, and her light step flying to keep time with his long stride, they walked back through the night to the farm. He had taken to the girl from the first day, when he had driven over to the Flats to meet her, and she had smiled and waved to him from the train, crying out, "You must be Ethan!" as she jumped down with her bundles, while he reflected, looking over her slight person: "She don't look much on housework, but she ain't a fretter, anyhow." But it was not only that the coming to his house of a bit of hopeful young life was like the lighting of a fire on a cold hearth. The girl was more than the bright serviceable creature he had thought her. She had an eye to see and an ear to hear: he could show her things and tell her things, and taste the bliss of feeling that all he imparted left long reverberations and echoes he could wake at will.

It was during their night walks back to the farm that he felt most intensely the sweetness of this communion. He had always been more sensitive than the people about him to the appeal of natural beauty. His unfinished studies had given form to this sensibility and even in his unhappiest moments field and sky spoke to him with a deep and powerful

persuasion. But hitherto the emotion had remained in him as a silent ache, veiling with sadness the beauty that evoked it. He did not even know whether any one else in the world felt as he did, or whether he was the sole victim of this mournful privilege. Then he learned that one other spirit had trembled with the same touch of wonder: that at his side, living under his roof and eating his bread, was a creature to whom he could say: "That's Orion down yonder; the big fellow to the right is Aldebaran, and the bunch of little ones—like bees swarming—they're the Pleiades . . ." or whom he could hold entranced before a ledge of granite thrusting up through the fern while he unrolled the huge panorama of the ice age, and the long dim stretches of succeeding time. The fact that admiration for his learning mingled with Mattie's wonder at what he taught was not the least part of his pleasure. And there were other sensations, less definable but more exquisite, which drew them together with a shock of silent joy: the cold red of sunset behind winter hills, the flight of cloud-flocks over slopes of golden stubble, or the intensely blue shadows of hemlocks on sunlit snow. When she said to him once: "It looks just as if it was painted!" it seemed to Ethan that the art of definition could go no farther, and that words had at last been found to utter his secret soul. . . .

As he stood in the darkness outside the church these memories came back with the poignancy of vanished things. Watching Mattie whirl down the floor from hand to hand he wondered how he could ever have thought that his dull talk interested her. To him, who was never gay but in her presence, her gaiety seemed plain proof of indifference. The face she lifted to her dancers was the same which, when she saw him, always looked like a window that has caught the sunset. He even noticed two or three gestures which, in his fatuity, he had thought she kept for him: a way of throwing her head back when she was amused, as if to taste her laugh before she let it out, and a trick of sinking her lids slowly when anything charmed or moved her.

Over the course of the passage, the main focus of the narrative shifts from the

- A) reservations a character has about a person he has just met to a growing appreciation that character has of the person's worth.
- B) ambivalence a character feels about his sensitive nature to the character's recognition of the advantages of having profound emotions.
- C) intensity of feeling a character has for another person to the character's concern that that intensity is not reciprocated.
- D) value a character attaches to the wonders of the natural world to a rejection of that sort of beauty in favor of human artistry.

<b>Estimated Difficulty:</b> Medium	<b>Key:</b> C
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**Choice C** is the best answer. The first paragraph traces the inception of Ethan's feelings for Mattie: Ethan "had taken to the girl from the first day" (lines 7-8) and saw her arrival as "like the lighting of a fire on a cold hearth" (lines 15-16). The second paragraph (lines 22-55) focuses on "their night walks back to the farm" (line 22) and Ethan's elation in perceiving that "one other spirit . . . trembled with the same touch of wonder" that characterized his own (lines 34-35). In other words, the main focus of the first two paragraphs is the intensity of feeling one character, Ethan, has for another, Mattie. The last paragraph shifts the focus of the passage to Ethan's change in perception; he sees Mattie in a social setting interacting with other men, wonders "how he could ever have thought that his dull talk interested her" (lines 59-60), interprets her seeming happiness as "plain proof of indifference" toward him (line 62), and sees betrayal in the "two or three gestures which, in his fatuity, he had thought she kept for him" (lines 65-67).

**Choice A** is incorrect because while Ethan acknowledges that Mattie "don't look much on housework" (lines 12-13), the first paragraph also notes that Ethan "had taken to the girl from the first day" (lines 7-8); therefore, there is no support for the notion that Ethan's "reservations" about Mattie lasted for any length of time or ever constitute the main focus of the narrative.

**Choice B** is incorrect because while Ethan does exhibit ambivalence about his sensitive nature, seeing it as a "mournful privilege" (line 33), the main focus of the narrative does not shift to his recognition of the advantages of having profound emotions. Indeed, in the last paragraph, Ethan's

profound emotions give him only grief, as he sees Mattie seemingly rejecting him.

**Choice D** is incorrect because while the second paragraph (lines 22-55) does discuss in depth the value Ethan attaches to natural beauty, nothing in the passage signifies that he has rejected natural beauty in favor of human artistry. The closest the passage comes to this is in line 52, in which Mattie is said to have likened a natural scene to a painting, an assertion with which Ethan agrees.

In the context of the passage, the author's use of the phrase "her light step flying to keep time with his long stride" (lines 5-6) is primarily meant to convey the idea that

- A) Ethan and Mattie share a powerful enthusiasm.
- B) Mattie strives to match the speed at which Ethan works.
- C) Mattie and Ethan playfully compete with each other.
- D) Ethan walks at a pace that frustrates Mattie.

<b>Estimated Difficulty:</b> Easy	<b>Key:</b> A
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**Choice A** is the best answer. The author uses the phrase mainly to introduce a topic discussed at length in the second paragraph (lines 22-55) — namely, the growing connection Ethan sees himself forming with Mattie over the course of many evening walks during which they share similar feelings for the wonders of the natural world. In the context of the passage, the phrase evokes an image of two people walking eagerly and in harmony.

**Choice B** is incorrect because while the phrase literally conveys Mattie's attempts to keep up with Ethan's pace, the phrase relates to times of leisure during which Ethan and Mattie walk arm-in-arm (see lines 1-7) rather than times of work. Moreover, the phrase is used primarily in a figurative way to suggest shared enthusiasm (see explanation for choice A).

**Choice C** is incorrect because while the phrase literally describes Mattie's attempts to keep up with Ethan's pace, the context makes clear that Mattie and Ethan are not in competition with each other; instead, they are enjoying times of leisure during which the two walk arm-in-arm (see lines 1-7). Moreover, the phrase is used primarily in a figurative way to suggest shared enthusiasm (see explanation for choice A).

**Choice D** is incorrect because while the phrase in isolation could be read as conveying some frustration on the part of Mattie, who had to expend extra effort to keep up with Ethan's

pace, the context makes clear that Mattie is not annoyed with Ethan but is instead enjoying times of leisure during which the two walk arm-in-arm (see lines 1-7). The phrase is used primarily to suggest shared enthusiasm (see explanation for choice A).

3

The description in the first paragraph indicates that what Ethan values most about Mattie is her

- A) fitness for farm labor.
- B) vivacious youth.
- C) receptive nature.
- D) freedom from worry.

**Estimated Difficulty:** Easy

**Key:** C

**Choice C** is the best answer. Lines 9-16 mention many of Mattie's traits: she is friendly ("smiled and waved"), eager ("jumped down with her bundles"), easygoing ("she ain't a fretter"), and energetic ("like the lighting of a fire on a cold hearth"). However, the trait that appeals the most to Ethan, as suggested by it being mentioned last in the paragraph, is her openness to the world around her: "She had an eye to see and an ear to hear: he could show her things and tell her things, and taste the bliss of feeling that all he imparted left long reverberations and echoes he could wake at will" (lines 17-21).

**Choice A** is incorrect because the passage suggests that Ethan does not actually view Mattie as particularly well suited to farm labor. When first seeing Mattie, Ethan thinks to himself, after "looking over her slight person," that "she don't look much on housework" (lines 12-13).

**Choice B** is incorrect because the passage suggests that Mattie's youth is not what Ethan values most about Mattie. Although the passage does note that "the coming to his house of a bit of hopeful young life was like the lighting of a fire on a cold hearth" (lines 14-16), the narrator goes on to note that "the girl was more than the bright serviceable creature [Ethan] had thought her" (lines 16-17), indicating that Ethan values something more in Mattie than simply her vivacity.

**Choice D** is incorrect because although Ethan acknowledges that Mattie "ain't a fretter" (line 13), there is no evidence that Mattie's freedom from worry is what Ethan values most about Mattie. The first paragraph lists several positive traits that Mattie has, with the most emphasis being placed on her openness to the world around her (see explanation for choice C).

4

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

- A) Lines 1-7 ("Mattie . . . farm")
- B) Lines 7-13 ("He had . . . anyhow")
- C) Lines 13-16 ("But it . . . hearth")
- D) Lines 17-21 ("She had . . . will")

**Estimated Difficulty:** Easy

**Key:** D

**Choice D** is the best answer. Lines 17-21 explain that Mattie "had an eye to see and an ear to hear: [Ethan] could show her things and tell her things, and taste the bliss of feeling that all he imparted left long reverberations and echoes he could wake at will." In other words, Mattie is open, or receptive, to ideas and experiences, and the placement of this point at the end of the list of traits Ethan admires ("But it was not only . . .") suggests that her openness is most important to him. Therefore, these lines serve as the best evidence for the answer to the previous question.

**Choice A** is incorrect because lines 1-7 only describe Ethan and Mattie's living situation and indicate that Ethan enjoys walking with her in the evenings. They do not indicate which quality of Mattie's Ethan values the most. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

**Choice B** is incorrect because lines 7-13 only indicate Ethan's first impression of Mattie. Mattie comes across as generally friendly and enthusiastic in their first encounter, but it is not these qualities that Ethan values the most. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

**Choice C** is incorrect because lines 13-16 only convey that there was something special about Mattie beyond her friendliness and enthusiasm. They do not indicate what Ethan values the most about Mattie. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

**Questions 5-9 are based on the following passage and supplementary material.**

This passage is adapted from Ed Yong, "Turtles Use the Earth's Magnetic Field as Global GPS." ©2011 by Kalmbach Publishing Co.

In 1996, a loggerhead turtle called Adelita swam across 9,000 miles from Mexico to Japan, crossing the entire Pacific on her way. Wallace J. Nichols tracked this epic journey with a satellite tag. But Adelita herself had no such technology at her disposal. How did she steer a route across two oceans to find her destination?

Nathan Putman has the answer. By testing hatchling turtles in a special tank, he has found that they can use the Earth's magnetic field as their own Global Positioning System (GPS). By sensing the field, they can work out both their latitude and longitude and head in the right direction.

Putman works in the lab of Ken Lohmann, who has been studying the magnetic abilities of loggerheads for over 20 years. In his lab at the University of North Carolina, Lohmann places hatchlings in a large water tank surrounded by a large grid of electromagnetic coils. In 1991, he found that the babies started swimming in the opposite direction if he used the coils to reverse the direction of the magnetic field around them. They could use the field as a compass to get their bearing.

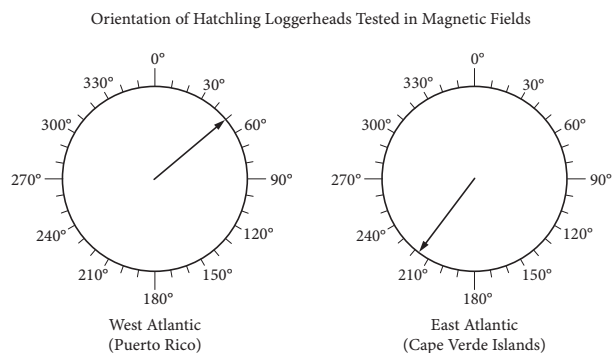
Later, Lohmann showed that they can also use the magnetic field to work out their position. For them, this is literally a matter of life or death. Hatchlings born off the sea coast of Florida spend their early lives in the North Atlantic gyre, a warm current that circles between North America and Africa. If they're swept towards the cold waters outside the gyre, they die. Their magnetic sense keeps them safe.

Using his coil-surrounded tank, Lohmann could mimic the magnetic field at different parts of the Earth's surface. If he simulated the field at the northern edge of the gyre, the hatchlings swam southwards. If he simulated the field at the gyre's southern edge, the turtles swam west-northwest. These experiments showed that the turtles can use their magnetic sense to work out their latitude—their position on a north-south axis. Now, Putman has shown that they can also determine their longitude—their position on an east-west axis.

He tweaked his magnetic tanks to simulate the fields in two positions with the same latitude at opposite ends of the Atlantic. If the field simulated the west Atlantic near Puerto Rico, the turtles swam northeast. If the field matched that on the east Atlantic near the Cape Verde Islands, the turtles swam southwest. In the wild, both headings would keep them within the safe, warm embrace of the North Atlantic gyre.

Before now, we knew that several animal migrants, from loggerheads to reed warblers to sparrows, had some way of working out longitude, but no one knew how. By keeping the turtles in the same conditions, with only the magnetic fields around them changing, Putman clearly showed that they can use these fields to find their way. In the wild, they might well also use other landmarks like the position of the sea, sun and stars.

Putman thinks that the turtles work out their position using two features of the Earth's magnetic field that change over its surface. They can sense the field's inclination, or the angle at which it dips towards the surface. At the poles, this angle is roughly 90 degrees and at the equator, it's roughly zero degrees. They can also sense its intensity, which is strongest near the poles and weakest near the Equator. Different parts of the world have unique combinations of these two variables. Neither corresponds directly to either latitude or longitude, but together, they provide a "magnetic signature" that tells the turtle where it is.



Adapted from Nathan Putman, Courtney Endres, Catherine Lohmann, and Kenneth Lohmann, "Longitude Perception and Bicoordinate Magnetic Maps in Sea Turtles." ©2011 by Elsevier Inc.

Orientation of hatchling loggerheads tested in a magnetic field that simulates a position at the west side of the Atlantic near Puerto Rico (left) and a position at the east side of the Atlantic near the Cape Verde Islands (right). The arrow in each circle indicates the mean direction that the group of hatchlings swam. Data are plotted relative to geographic north (N = 0°).

The passage most strongly suggests that Adelita used which of the following to navigate her 9,000-mile journey?

- A) The current of the North Atlantic gyre
- B) Cues from electromagnetic coils designed by Putman and Lohmann
- C) The inclination and intensity of Earth's magnetic field
- D) A simulated "magnetic signature" configured by Lohmann

<b>Estimated Difficulty:</b> Easy	<b>Key:</b> C
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**Choice C** is the best answer. The first paragraph describes the 9,000-mile journey that Adelita made and raises the question, which the rest of the passage tries to answer, of how this loggerhead turtle was able to "steer a route across two oceans to find her destination" (lines 6-7). The answer comes most directly in the last paragraph, which presents Putman's belief that loggerhead turtles "work out their position using two features of the Earth's magnetic field that change over its surface" (lines 61-63): its inclination and its intensity. It is reasonable, therefore, to infer from the passage that this was the method that Adelita used.

**Choice A** is incorrect because there is no evidence in the passage that Adelita used the current of the North Atlantic gyre to navigate her 9,000-mile journey. The passage does discuss the North Atlantic gyre but only as the place where loggerhead turtle hatchlings "born off the sea coast of Florida spend their early lives" (lines 27-28).

**Choice B** is incorrect because there is no evidence in the passage that Adelita navigated her 9,000-mile journey with the aid of cues from electromagnetic coils designed by Putman and Lohmann. The passage does say that Putman and Lohmann use electromagnetic coils as part of their research on loggerhead turtles, but the coils are part of tanks used in a laboratory to study loggerhead hatchlings (see lines 16-19).

**Choice D** is incorrect because there is no evidence in the passage that Adelita navigated her 9,000-mile journey with the aid of a simulated "magnetic signature" configured by Lohmann. The passage does describe how Lohmann and Putman manipulate magnetic fields as part of their research on loggerhead turtle hatchlings (see, for example, lines 16-23), but there is no indication that the two scientists used (or even could use) the kind of equipment necessary for this project outside of laboratory tanks or with Adelita in the wild.

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

- A) Lines 1-3 ("In 1996 . . . way")
- B) Lines 32-34 ("Using . . . surface")
- C) Lines 58-60 ("In the wild . . . stars")
- D) Lines 70-73 ("Neither . . . it is")

<b>Estimated Difficulty:</b> Medium	<b>Key:</b> D
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**Choice D** is the best answer because in lines 70-73 the author indicates that "together, [inclination and intensity] provide a 'magnetic signature' that tells the turtle where it is." Therefore, these lines serve as the best evidence for the answer to the previous question.

**Choice A** is incorrect because in lines 1-3 the author establishes that Adelita made a 9,000-mile journey but does not explain how she navigated it. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

**Choice B** is incorrect because in lines 32-34 the author indicates that Lohmann is able to "mimic the magnetic field at different parts of the Earth's surface" in his laboratory but does not explain how Adelita navigated her 9,000-mile journey or suggest that Lohmann had any influence over Adelita's trip. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

**Choice C** is incorrect because in lines 58-60 the author notes that loggerhead turtles "in the wild" may make use of "landmarks like the position of the sea, sun and stars" but does not indicate that Adelita used such landmarks to navigate her 9,000-mile journey. Therefore, these lines do not serve as the best evidence for the answer to the previous question.

As used in line 3, "tracked" most nearly means

- A) searched for.
- B) traveled over.
- C) followed.
- D) hunted.

<b>Estimated Difficulty:</b> Easy	<b>Key:</b> C
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**Choice C** is the best answer because the context makes clear that Nichols followed Adelita's "epic journey with a satellite tag" (line 4).

**Choice A** is incorrect because while "tracked" sometimes means "searched for," it would make little sense in context to say that Nichols searched for Adelita's "epic journey with a



satellite tag” (line 4). It is more reasonable to conclude from the passage that Nichols knew about Adelita and her journey and used a satellite tag to help follow it.

*Choice B* is incorrect because while “tracked” sometimes means “traveled over,” it would make no sense in context to say that Nichols traveled over Adelita’s “epic journey with a satellite tag” (line 4).

*Choice D* is incorrect because while “tracked” sometimes means “hunted,” it would make no sense in context to say that Nichols hunted Adelita’s “epic journey with a satellite tag” (line 4).

8

The author refers to reed warblers and sparrows (line 53) primarily to

- A) contrast the loggerhead turtle’s migration patterns with those of other species.
- B) provide examples of species that share one of the loggerhead turtle’s abilities.
- C) suggest that most animal species possess some ability to navigate long distances.
- D) illustrate some ways in which the ability to navigate long distances can help a species.

**Estimated Difficulty:** Easy

**Key:** B

**Choice B** is the best answer because the author indicates that reed warblers and sparrows, like loggerhead turtles, had previously been known to have “some way of working out longitude” (line 54).

*Choice A* is incorrect because although the author notes that loggerhead turtles, reed warblers, and sparrows are all “animal migrants” (line 52), he offers no specifics about the migration patterns of reed warblers and sparrows, and the only connection he draws among the three animals is their recognized ability of somehow “working out longitude” (line 54).

*Choice C* is incorrect because the author only mentions three “animal migrants” by name (loggerhead turtles, reed warblers, and sparrows) and indicates that “several” such migrants had previously been known to have “some way of working out longitude” (lines 52-54). He makes no claim in the passage that most animal species have some long-distance navigation ability.

*Choice D* is incorrect because although the author indicates that reed warblers and sparrows, like loggerhead turtles, are “animal migrants” (line 52), he offers no specifics about how the ability to navigate long distances might help reed warblers and sparrows (nor, for that matter, much information about how this ability might help loggerhead turtles).

9

It can reasonably be inferred from the passage and graphic that if scientists adjusted the coils to reverse the magnetic field simulating that in the East Atlantic (Cape Verde Islands), the hatchlings would most likely swim in which direction?

- A) Northwest
- B) Northeast
- C) Southeast
- D) Southwest

**Estimated Difficulty:** Hard

**Key:** B

**Choice B** is the best answer. The passage notes that Lohmann, who studied loggerhead turtle hatchlings “in a large water tank surrounded by a large grid of electromagnetic coils” (lines 17-19) capable of manipulating the magnetic field around the turtles, discovered that the hatchlings would start “swimming in the opposite direction” when he “reverse[d] the direction of the magnetic field around them” (lines 20-22). The graphic (whose caption establishes that geographic north is represented by 0 degrees) indicates that loggerhead hatchlings tested in a magnetic field that simulates a position at the east side of the Atlantic near the Cape Verde Islands would normally travel in a southwesterly direction (around 218 degrees). Given the above information, it is reasonable to infer that if the magnetic field were reversed, the turtles would travel in a northeasterly direction.

*Choice A* is incorrect because information in the passage and graphic suggests that the loggerhead turtle hatchlings would travel in a northeasterly, and not a northwesterly, direction if scientists reversed the magnetic field simulating a position at the east side of the Atlantic near the Cape Verde Islands.

*Choice C* is incorrect because information in the passage and graphic suggests that the loggerhead turtle hatchlings would travel in a northeasterly, and not a southeasterly, direction if scientists reversed the magnetic field simulating a position at the east side of the Atlantic near the Cape Verde Islands.

*Choice D* is incorrect because information in the passage and graphic suggests that the loggerhead turtle hatchlings would travel in a northeasterly, and not a southwesterly, direction if scientists reversed the magnetic field simulating a position at the east side of the Atlantic near the Cape Verde Islands. The graphic indicates that the hatchlings travel southwesterly under the normal (nonreversed) simulated conditions.

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In the Writing and Language Test, you will be asked to make revision and editing decisions to improve the text within a passage.

**Total questions:** 44 passage-based revision and editing questions with multiple-choice responses

**Time allotted:** 35 minutes

Calculators may not be used or be on your desk.

Writing and Language passages range in length from about 400 to 450 words, and they are well-written pieces covering topics related to careers, history/social studies, the humanities, and science. As in the Reading Test, some passages are accompanied by informational graphics such as tables, graphs, and charts; some questions require you to revise or edit a passage in light of the information conveyed graphically. (Again, mathematical computation is not required to answer these questions.)

The test comprises a series of passages and associated multiple-choice questions that put you in the role of someone revising or editing the work of an unspecified writer. You are revising the passages for development, organization, and effective language use as well as editing the passages to ensure that they follow the conventions of standard written English grammar, usage, and punctuation.

Each page of the actual 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.

Rote recall of language rules is not tested, nor are any questions based on short snippets of text taken out of context. The best answer to each question represents how a writer should develop, organize, and use language in a multiparagraph passage. You are demonstrating that you can make context-based improvements to the text.

The most common format for the questions offers three alternatives to an underlined portion of the passage along with the option of not changing the passage's original wording. Remember to answer these questions in the context of the whole passage.

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.

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 match what you will see on the actual test.

### **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 watches as Kingman squeezes dollops of paint from several tubes into a tin watercolor 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.

[1] Kingman was keenly interested in landscape painting from an early age. [2] In Hong Kong, where Kingman completed his schooling, teachers at that time customarily assigned students a formal “school name.” [3] His interest was so keen, in fact, that he was named after it. [4] The young boy who had been Dong Moy Shu became Dong Kingman. [5] The name Kingman was selected for its two parts: “king” and “man,” Cantonese for “scenery” and “composition.” [6] As Kingman developed as a painter, his works were often compared to

**1** paintings by Chinese landscape artists dating back to CE 960, a time when a strong tradition of landscape painting emerged in Chinese art.

[7] Kingman, however, **2** vacated 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. **3**

In his urban landscapes, Kingman captures the vibrancy of crowded 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 **4** 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 enormous ships docking at busy urban ports. 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 **5** internationally. He garnered 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.” 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.

**1**

- A) NO CHANGE
- B) Chinese landscape artists
- C) painters of Chinese landscapes
- D) artists

**Estimated Difficulty:** Medium

**Key:** A

**Choice A** is the best answer because it creates a comparison between like terms: “works” by Kingman and “paintings by Chinese landscape artists.”

**Choice B** is incorrect because it creates a comparison between unlike terms: “works” by Kingman and “Chinese landscape artists.”

**Choice C** is incorrect because it creates a comparison between unlike terms: “works” by Kingman and “painters of Chinese landscapes.”

**Choice D** is incorrect because it creates a comparison between unlike terms: “works” by Kingman and “artists.”

**2**

- A) NO CHANGE
- B) evacuated
- C) departed
- D) retired

**Estimated Difficulty:** Hard

**Key:** C

**Choice C** is the best answer because “departed” is the most contextually appropriate way to indicate that Kingman had deviated from the tradition of Chinese landscape painting in a number of ways.

**Choice A** is incorrect because while “vacated” does offer some sense of “leaving,” it would be awkward and unconventional to say that a person was vacating from a tradition in a number of ways.

**Choice B** is incorrect because while “evacuated” does offer some sense of “leaving,” it would be awkward and unconventional to say that a person was evacuating from a tradition in a number of ways.

**Choice D** is incorrect because while “retired” does offer some sense of “leaving,” it would be

awkward and unconventional to say that a person was retiring from a tradition in a number of ways.

3

To make this paragraph most logical, sentence 3 should be placed

- A) where it is now.
- B) before sentence 1.
- C) after sentence 1.
- D) after sentence 4.

Estimated Difficulty: Easy

Key: C

**Choice C** is the best answer because placing sentence 3 after sentence 1 makes the paragraph most cohesive. Sentence 3 refers to Kingman’s “interest” being “so keen,” a continuation of the idea in sentence 1, which says that “Kingman was keenly interested in landscape painting from an early age.”

**Choice A** is incorrect because leaving sentence 3 where it is now creates a sequence of sentences that lacks sufficient cohesion. Keeping sentence 3 in its current location disrupts the link between sentence 2 (which describes the concept of “school names” in Hong Kong) and sentence 4 (which reveals that Dong Kingman was the school name of Dong Moy Shu).

**Choice B** is incorrect because placing sentence 3 before sentence 1 creates a sequence of sentences that lacks sufficient cohesion. Putting sentence 3 at the beginning of the paragraph would offer a poor introduction to the paragraph, in large part because sentence 3 builds directly on a point made in sentence 1.

**Choice D** is incorrect because placing sentence 3 after sentence 4 creates a sequence of sentences that lacks sufficient cohesion. Putting sentence 3 after sentence 4 would disrupt the link between sentence 4 (which mentions that Dong Moy Shu was given the school name Dong Kingman) and sentence 5 (which explains what the two parts composing the name Kingman mean in Cantonese).

4

- A) NO CHANGE
- B) hydrant—
- C) hydrant:
- D) hydrant

Estimated Difficulty: Easy

Key: A

**Choice A** is the best answer because a comma after the word “hydrant” separates the phrase “a pigeon pecking for crumbs around a fire hydrant” from the phrase “an old man tending to a baby outside a doorway.” A comma is also consistent with the punctuation choice made to separate the first two phrases in the series following the colon in the sentence.

**Choice B** is incorrect because a dash is not a conventional choice for punctuating items in a series.

**Choice C** is incorrect because although a colon can be used to introduce a series, it is not a conventional choice for separating items within a series.

**Choice D** is incorrect because it fuses together two items in the series. Separating the phrases “a pigeon pecking for crumbs around a fire hydrant” and “an old man tending to a baby outside a doorway” requires punctuation (and could also involve a coordinating conjunction).

5

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

- A) internationally, and Kingman also garnered
- B) internationally; from exhibiting, he garnered
- C) internationally but garnered
- D) internationally, garnering

Estimated Difficulty: Medium

Key: D

**Choice D** is the best answer because it combines the sentences logically and efficiently, with the original second sentence becoming a participial phrase describing Kingman.

**Choice A** is incorrect because it creates a wordy and awkward construction and because it fails to link the acclaim Kingman received with the exhibition of his work.

**Choice B** is incorrect because it creates a repetitive and awkward construction.

**Choice C** is incorrect because “but” suggests contrast or exception, neither of which makes sense in the context of the sentence.

**Questions 6-12 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.

**6** To alleviate rush hour traffic jams in a congested downtown area, stoplight timing is coordinated. When any one of these changes occurs, 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 **7** they design new ones.

Most transportation planners work in or near cities, 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

**8** 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 current design of the road 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.

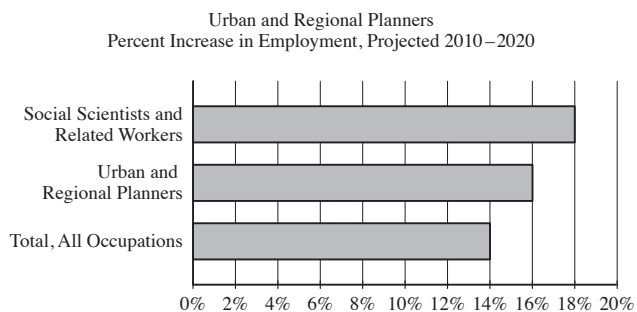
**9** Next, representatives from the local public health department might provide input in designing a network of trails and sidewalks to encourage people to walk more. **10** According to the American Heart Association, walking provides numerous benefits related to health and well-being.

Members of the Chamber of Commerce might share

suggestions about designing transportation and parking facilities to support local businesses.

**11** 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 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, **12** projecting that 16 percent of new jobs in all occupations will be related to urban and regional planning. 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

Which choice best maintains the sentence pattern already established in the paragraph?

- A) NO CHANGE
- B) Coordinating stoplight timing can help alleviate rush hour traffic jams in a congested downtown area.
- C) Stoplight timing is coordinated to alleviate rush hour traffic jams in a congested downtown area.
- D) In a congested downtown area, stoplight timing is coordinated to alleviate rush hour traffic jams.

<b>Estimated Difficulty:</b> Medium
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<b>Key:</b> C
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**Choice C** is the best answer because it most closely maintains the sentence pattern established by the two preceding sentences, which begin with noun and passive verb phrases (“A subway system is expanded,” “A bike-sharing program is adopted”).

**Choice A** is incorrect because it does not maintain the sentence pattern established by the two preceding sentences. Rather, it begins the sentence with an infinitive phrase.

**Choice B** is incorrect because it does not maintain the sentence pattern established by the two preceding sentences. Rather, it begins the sentence with a gerund phrase.

**Choice D** is incorrect because it does not maintain the sentence pattern established by the two preceding sentences. Rather, it places a prepositional phrase, “in a congested downtown area,” at the beginning of the sentence.

7

- A) NO CHANGE
- B) to design
- C) designing
- D) design

<b>Estimated Difficulty:</b> Easy
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<b>Key:</b> C
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**Choice C** is the best answer because “designing” maintains parallelism with “evaluating,” “assessing,” and “improving.”

**Choice A** is incorrect because “they design” does not maintain parallelism with “evaluating,” “assessing,” and “improving.”

**Choice B** is incorrect because “to design” does not maintain parallelism with “evaluating,” “assessing,” and “improving.”

**Choice D** is incorrect because “design” does not maintain parallelism with “evaluating,” “assessing,” and “improving.”

8

- A) NO CHANGE
- B) planner’s job
- C) planners job,
- D) planners job

<b>Estimated Difficulty:</b> Easy
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<b>Key:</b> B
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**Choice B** is the best answer because it correctly uses an apostrophe to indicate possession and does not introduce any unnecessary punctuation.

**Choice A** is incorrect because while it correctly indicates the possessive relationship between “transportation planner” and “job,” it introduces an unnecessary comma after the word “job.”

**Choice C** is incorrect because it does not indicate the possessive relationship between “transportation planner” and “job” and because it introduces an unnecessary comma after the word “job.”

**Choice D** is incorrect because it does not indicate the possessive relationship between “transportation planner” and “job.”

9

- A) NO CHANGE
- B) For instance,
- C) Furthermore,
- D) Similarly,

<b>Estimated Difficulty:</b> Medium
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<b>Key:</b> B
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**Choice B** is the best answer because the transitional phrase “For instance” logically indicates that what follows provides an example related to the previous sentence. “Representatives from the local public health department” is an example of the kinds of people with whom transportation planners work.

**Choice A** is incorrect because the transitional word “Next” indicates sequence, which is not logical given that what follows provides an example related to the previous sentence.

**Choice C** is incorrect because the transitional word “Furthermore” indicates addition, which is not logical given that what follows provides an example related to the previous sentence.

**Choice D** is incorrect because the transitional word “Similarly” indicates comparison or likeness, which is not logical given that what follows provides an example related to the previous sentence.

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.

<b>Estimated Difficulty:</b> Medium	<b>Key:</b> 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 the 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 incorrect because the underlined sentence should not be kept. Although the sentence theoretically provides 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 incorrect because the underlined sentence should not be kept. Although the American Heart Association could theoretically be an example of "other interested organizations" with which transportation planners work, the sentence does not suggest that 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 incorrect 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) People, who pursue careers in transportation planning,
- C) People who pursue careers, in transportation planning,
- D) People who pursue careers in transportation planning,

<b>Estimated Difficulty:</b> Easy	<b>Key:</b> A
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**Choice A** is the best answer because "who pursue careers in transportation planning" is, in context, a restrictive clause that should not be set off with punctuation. "Who pursue careers in transportation planning" is essential information defining who the "people" are.

**Choice B** is incorrect because it incorrectly sets off the restrictive clause "who pursue careers in transportation planning" with commas as though the clause were nonrestrictive or not essential to defining who the "people" are.

**Choice C** is incorrect because it incorrectly sets off the essential sentence element "in transportation planning" with commas as though the phrase were not essential to the meaning of the sentence. "In transportation planning" is essential information defining what the "careers" are.

**Choice D** is incorrect because it introduces an unnecessary comma after the word "planning," incorrectly setting off the subject of the sentence ("people who pursue careers in transportation planning") from the predicate ("have a wide variety of educational backgrounds").

Which choice completes the sentence with accurate data based on the graph?

- A) NO CHANGE
- B) warning, however, that job growth in urban and regional planning will slow to 14 percent by 2020.
- C) predicting that employment of urban and regional planners will increase 16 percent between 2010 and 2020.
- D) indicating that 14 to 18 percent of urban and regional planning positions will remain unfilled.

<b>Estimated Difficulty:</b> Hard	<b>Key:</b> C
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**Choice C** is the best answer because it completes the sentence with an accurate interpretation of data in the graph. The graph displays projections of how much growth in employment there is expected to be between 2010 and 2020 for "social scientists and related workers," for "urban and regional planners," and in "all occupations" in the U.S. economy. According to the graph, the employment

of urban and regional planners is expected to increase 16 percent between 2010 and 2020.

*Choice A* is incorrect because the data in the graph do not support the claim that 16 percent of new jobs in all occupations will be related to urban and regional planning.

*Choice B* is incorrect because the data in the graph do not support the claim that job growth in urban and regional planning will slow to 14 percent by 2020.

*Choice D* is incorrect because the data in the graph do not support the claim that 14 to 18 percent of urban and regional planning positions will remain unfilled.

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The Math questions test your ability to problem-solve and use appropriate approaches and tools strategically. The test 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)

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

Total questions: 48

40 multiple-choice questions

8 student-produced response questions

Time allotted for Math Test – No Calculator: 25 minutes

Time allotted for Math Test – Calculator: 45 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.

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. Other formulas that are needed are provided in the items themselves. 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, be strategic when choosing to use your 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.

Review the directions on page 28 for gridding the student-produced response questions.

Know the rules for gridding mixed numbers and repeating decimals before taking the test.

Check your work if your answer does not fit on the grid. If you obtain a negative value or a value greater than 9999, you have made an error.



A zero cannot be gridded in the leftmost column of the answer grid. For example, if your answer is 0.25, you must grid .25 or convert it to the fraction  $\frac{1}{4}$ .

A fraction does not have to be reduced unless it will not fit on the grid. For example, if  $\frac{3}{5}$  is the correct answer to a question, both  $\frac{6}{10}$  and  $\frac{9}{15}$  are considered correct and do not need to be reduced prior to entering in the grid.

The no-calculator portion has 17 questions.

The calculator portion has 31 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.

Remember to bring your calculator on test day. 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 in the calculator portion. First, decide how you will solve the problem, and then decide whether to use the calculator. The calculator is meant to aid you in solving problems, not to get in the way.

All questions in the calculator portion can be answered without a calculator, but for some questions a calculator may be helpful. Look first for algebra structures to solve problems before reaching for your calculator.

Take the practice test with a calculator at hand for the calculator portion of the test. This will help you practice determining which types of questions you should use your calculator to answer.

Do NOT bring these types of calculators to the test:

Laptops or other computers, tablets, cell phones, or smartphones

Models that can access the Internet or have wireless, Bluetooth, cellular, audio/video recording and playing, camera, or any other smartphone-type features

Models that have a 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.

All questions on the Math Test – 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 Test – Calculator portion.

Calculators permitted during testing are:

Most graphing calculators (see below)

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.

You should be familiar with the operation of your calculator and know when the calculator can be used effectively.

## Approved Graphing Calculators

Casio		Hewlett-Packard	Sharp	Texas Instruments
FX-6000 series	CFX-9800 series	HP-9G	EL-5200	TI-73
FX-6200 series	CFX-9850 series	HP-28 series	EL-9200 series	TI-80
FX-6300 series	CFX-9950 series	HP-38G	EL-9300 series	TI-81
FX-6500 series	CFX-9970 series	HP-39 series	EL-9600 series*	TI-82
FX-7000 series	FX 1.0 series	HP-40 series	EL-9900 series	TI-83/TI-83 Plus
FX-7300 series	Algebra FX 2.0 series	HP-48 series		TI-83 Plus Silver
FX-7400 series	FX-CG-10 (PRIZM)	HP-49 series	<b>Other</b>	TI-84 Plus
FX-7500 series	FX-CG-20 series	HP-50 series	Datexx DS-883	TI-84 Plus CE
FX-7700 series	FX-CG-500*	HP Prime	Micronta	TI-84 Plus Silver
FX-7800 series	Graph25 series		Smart <sup>2</sup>	TI-84 Plus C Silver
FX-8000 series	Graph35 series	<b>Radio Shack</b>		TI-85
FX-8500 series	Graph75 series	EC-4033		TI-86
FX-8700 series	Graph95 series	EC-4034		TI-89
FX-8800 series	Graph100 series	EC-4037		TI-89 Titanium
FX-9700 series				TI-Nspire
FX-9750 series				TI-Nspire CAS
FX-9860 series				TI-Nspire CM-C
				TI-Nspire CM-C CAS
				TI-Nspire CX
				TI-Nspire CX CAS
				TI-Nspire CX-C CAS

\*The use of the stylus is not permitted.

On the following pages are samples of the kinds of Math Test – No Calculator and Math Test – 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.

Read the explanation for the best answer to each question.

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 28). The directions provided here match what you will see on the actual text.

# Math Test – No Calculator

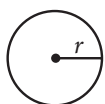
## DIRECTIONS

For questions 1-4, solve each problem and choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 5-6, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 5 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

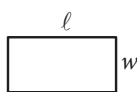
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

## REFERENCE



$$A = \pi r^2$$

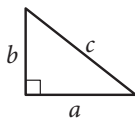
$$C = 2\pi r$$



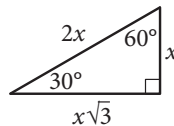
$$A = \ell w$$



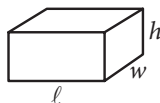
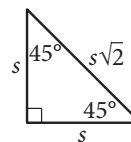
$$A = \frac{1}{2}bh$$



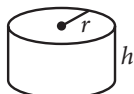
$$c^2 = a^2 + b^2$$



Special Right Triangles



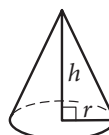
$$V = \ell wh$$



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



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



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



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

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

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

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

$$\frac{5(k+2)-7}{6} = \frac{13-(4-k)}{9}$$

In the equation above, what is the value of  $k$ ?

- A)  $\frac{9}{17}$
- B)  $\frac{9}{13}$
- C)  $\frac{33}{17}$
- D)  $\frac{33}{13}$

**Estimated Difficulty:** Medium

**Key:** B

**Choice B** is correct. Simplifying the numerators yields  $\frac{5k+3}{6} = \frac{9+k}{9}$ , and cross-multiplication gives  $45k+27 = 54+6k$ . Solving for  $k$  yields  $k = \frac{9}{13}$ .

**Choice A** is not the correct answer. This value may result from not correctly applying the distributive property on the right-hand side, resulting in the expression  $13-4-k$  in the numerator. Correctly applying the distributive property yields  $13-(4-k) = 13-4+k$  in the numerator.

**Choice C** is not the correct answer. This value may result from not correctly applying the distributive property on the left-hand side, resulting in the expression  $5k+2-7$ . Correctly applying the distributive property yields  $5(k+2)-7 = 5k+3$  in the numerator.

**Choice D** is not the correct answer. This value may result from not using the appropriate order of operations when simplifying either numerator.

$$4x - y = 3y + 7$$

$$x + 8y = 4$$

Based on the system of equations above, what is the value of the product  $xy$ ?

- A)  $-\frac{3}{2}$
- B)  $\frac{1}{4}$
- C)  $\frac{1}{2}$
- D)  $\frac{11}{9}$

**Estimated Difficulty:** Medium

**Key:** C

**Choice C** is correct. There are several solution methods possible, but all involve persevering in solving for the two variables and calculating the product. For example, combining like terms in the first equation yields  $4x-4y=7$  and then multiplying that by 2 gives  $8x-8y=14$ . When this transformed equation is added to the second given equation, the  $y$ -terms are eliminated, leaving an equation in just one variable:  $9x=18$ , or  $x=2$ . Substituting 2 for  $x$  in the second equation (one could use either to solve) yields  $2+8y=4$ , which gives  $y = \frac{1}{4}$ . Finally, the product  $xy$  is  $2 \times \frac{1}{4} = \frac{1}{2}$ .

**Choice A** is not the correct answer. Students who select this option have most likely made a calculation error in transforming the second equation (using  $-4x-8y=-16$  instead of  $-4x-32y=-16$ ) and used it to eliminate the  $x$ -terms.

**Choice B** is not the correct answer. This is the value of  $y$  for the solution of the system, but it has not been put back into the system to solve for  $x$  to determine the product  $xy$ .

**Choice D** is not the correct answer. Not understanding how to eliminate a variable when solving a system, a student may have added the equations  $4x-4y=7$  and  $x+8y=4$  to yield  $5x+4y=11$ . From here, a student may mistakenly simplify the left-hand side of this resulting equation to yield  $9xy=11$  and then proceed to use division by 9 on both sides in order to solve for  $xy$ .

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

Anise needs to complete a printing job using both of the printers in her office. One of the printers is twice as fast as the other, and together the printers can complete the job in 5 hours. The equation above represents the situation described. Which of the following describes what the expression  $\frac{1}{x}$  represents in this equation?

- A) The time, in hours, that it takes the slower printer to complete the printing job alone
- B) The portion of the job that the slower printer would complete in one hour
- C) The portion of the job that the faster printer would complete in two hours
- D) The time, in hours, that it takes the slower printer to complete  $\frac{1}{5}$  of the printing job

**Estimated Difficulty:** Hard

**Key:** B

**Choice B** is correct. From the description given,  $\frac{1}{5}$  is the portion of the job that the two printers, working together, can complete in one hour, and each term in the sum on the left side is the part of this  $\frac{1}{5}$  of the job that one of the printers contributes. Since one of the printers is twice as fast as the other,  $\frac{2}{x}$  describes the portion of the job that the faster printer is able to complete in one hour and  $\frac{1}{x}$  describes the portion of the job that the slower printer is able to complete in one hour.

**Choice A** is not the correct answer. The student may have not seen that in this context, the rates (that is, the work completed in a fixed time) of the printers can be added to get the combined rate, but the times it takes each printer to complete the job cannot be added to get the time for both printers working together, since the time for printers working together is less than, not greater than, the times for each printer alone. Hence the terms in the sum cannot refer to hours worked. In fact, the time it would take the slower printer to complete the whole job is  $x$  hours.

**Choice C** is not the correct answer. The student may have seen that  $\frac{1}{x}$  is the smaller term in the sum, wrongly concluded that the smaller term must apply to the faster printer, and then assumed the 2 in the numerator of the second term implies the equation describes work completed in 2 hours. In fact, the

portion of the job that the faster printer could complete in 2 hours is  $(2)\left(\frac{2}{x}\right) = \frac{4}{x}$ .

**Choice D** is not the correct answer. The student may have correctly seen that the value  $\frac{1}{5}$  on the right side refers to the portion of the job completed, but not seen that in this context, the rates (that is, the work completed in a fixed time) of the printers can be added to get the combined rate, but the times it takes each printer to complete the job cannot be added to get the time for both printers working together. Hence the terms in the sum cannot refer to hours worked. In fact, the time it takes the slower printer to complete  $\frac{1}{5}$  of the job is  $\frac{x}{5}$  hours.

The graph of  $y = (2x - 4)(x - 4)$  is a parabola in the  $xy$ -plane. In which of the following equivalent expressions 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 both revealed only 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.

For some questions in the Math Test, you will be asked to 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.

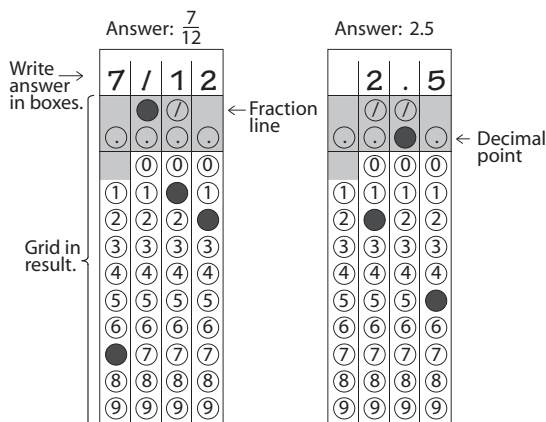
Some problems may have more than one correct answer. In such cases, grid only one answer.

**Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or

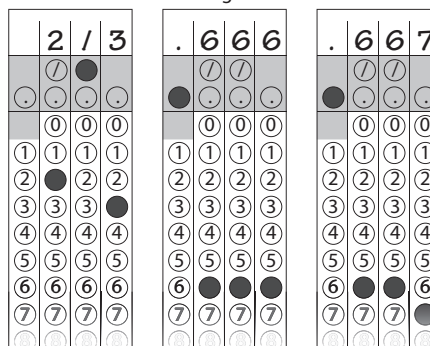
$\frac{7}{2}$ . (If  is entered into the grid, it will be

interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

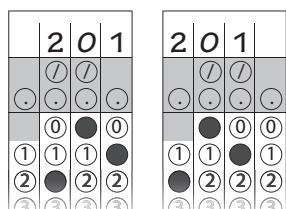
**Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



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



Answer: 201 – either position is correct



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

**5**

If  $\frac{1}{2}x + \frac{1}{3}y = 4$ , what is the value of  $3x + 2y$ ?

**Estimated Difficulty:** Medium      **Key:** 24

Using the structure of the equation allows you to quickly solve the problem if you see that multiplying both sides of the equation by 6 clears the fractions and yields  $3x + 2y = 24$ .

**6**

$$x^2 + y^2 - 6x + 8y = 144$$

The equation of a circle in the  $xy$ -plane is shown above. What is the *diameter* of the circle?

**Estimated Difficulty:** Hard      **Key:** 26

Completing the square yields the equation  $(x - 3)^2 + (y + 4)^2 = 169$ , the standard form of an equation of the circle. Understanding this form results in the equation  $r^2 = 169$ , which when solved for  $r$  gives the value of the radius as 13. The diameter is twice the value of the radius; therefore, the diameter is 26.

# Math Test – Calculator

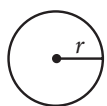
## DIRECTIONS

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

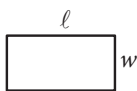
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the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

## REFERENCE

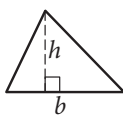


$$A = \pi r^2$$

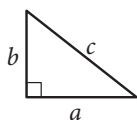
$$C = 2\pi r$$



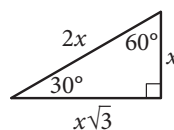
$$A = \ell w$$



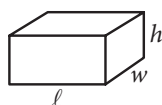
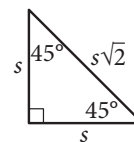
$$A = \frac{1}{2}bh$$



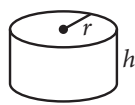
$$c^2 = a^2 + b^2$$



Special Right Triangles



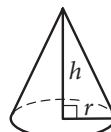
$$V = \ell wh$$



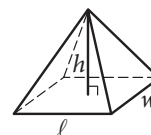
$$V = \pi r^2 h$$



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



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



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

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

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

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

## 1

Aaron is staying at a hotel that charges \$99.95 per night plus tax for a room. A tax of 8% is applied to the room rate, and an additional onetime untaxed fee of \$5.00 is charged by the hotel. Which of the following represents Aaron's total charge, in dollars, for staying  $x$  nights?

- A)  $(99.95 + 0.08x) + 5$
- B)  $1.08(99.95x) + 5$
- C)  $1.08(99.95x + 5)$
- D)  $1.08(99.95 + 5)x$

**Estimated Difficulty:** Easy

**Key:** B

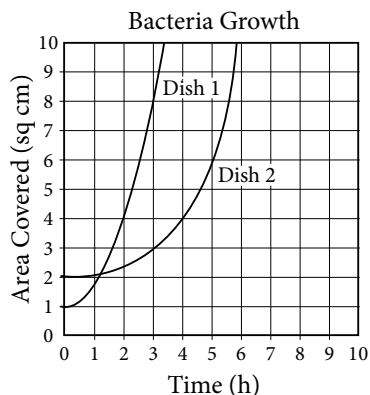
**Choice B** is correct. The total charge that Aaron will pay is the room rate, the 8% tax on the room rate, and a fixed fee. If Aaron stayed  $x$  nights, then the total charge is  $(99.95x + 0.08 \times 99.95x) + 5$ , which can be rewritten as  $1.08(99.95x) + 5$ .

**Choice A** is not the correct answer. The expression includes only one night stay in the room and does not accurately account for tax on the room.

**Choice C** is not the correct answer. The expression includes tax on the fee, and the hotel does not charge tax on the \$5.00 fee.

**Choice D** is not the correct answer. The expression includes tax on the fee and a fee charge for each night.

## 2



A researcher places two colonies of bacteria into two petri dishes that each have an area of 10 square centimeters. After the initial placement of the bacteria ( $t = 0$ ), the researcher measures and records the area covered by the bacteria in each dish every ten minutes. The data for each dish were fit by a smooth curve, as

shown in the graph, where each curve represents the area of a dish covered by bacteria as a function of time, in hours. Which of the following is a correct statement about the data above?

- A) At time  $t = 0$ , both dishes are 100% covered by bacteria.
- B) At time  $t = 0$ , bacteria covers 10% of Dish 1 and 20% of Dish 2.
- C) At time  $t = 0$ , Dish 2 is covered with 50% more bacteria than Dish 1.
- D) For the first hour, the area covered in Dish 2 is increasing at a higher average rate than the area covered in Dish 1.

**Estimated Difficulty:** Medium

**Key:** B

**Choice B** is the correct answer. Each petri dish has area 10 square centimeters, and so at time  $t = 0$ , Dish 1 is 10% covered ( $\frac{1}{10}$ ) and Dish 2 is 20% covered ( $\frac{2}{10}$ ). Thus the statement in B is true.

**Choice A** is not the correct answer. At the end of the observations, both dishes are 100% covered with bacteria, but at time  $t = 0$ , neither dish is 100% covered.

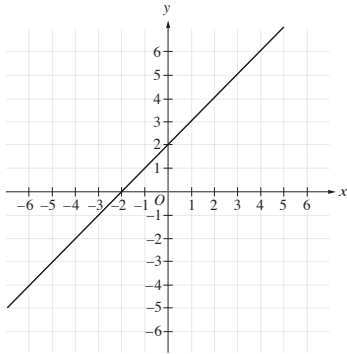
**Choice C** is not the correct answer. At time  $t = 0$ , Dish 1 is covered with 50% less bacteria than is Dish 2, but Dish 2 is covered with 100% more, not 50% more, bacteria than is Dish 1.

**Choice D** is not the correct answer. After the first hour, it is still true that more of Dish 2 is covered by bacteria than is Dish 1, but for the first hour the area of Dish 1 that is covered has been increasing at a higher average rate (about 0.8 sq cm/hour) than the area of Dish 2 (about 0.1 sq cm/hour).

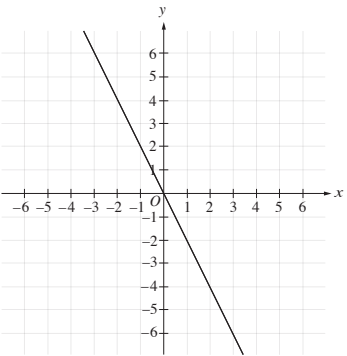


If  $k$  is a positive constant different from 1, which of the following could be the graph of  $y - x = k(x + y)$  in the  $xy$ -plane?

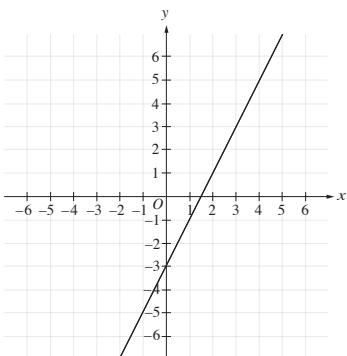
A)



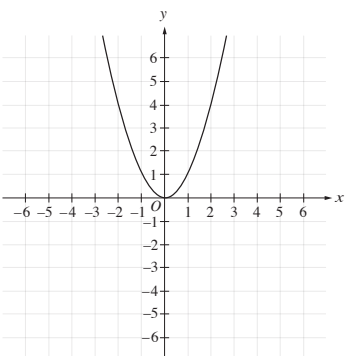
B)



C)



D)



Estimated Difficulty: Hard

Key: B

**Choice B** is correct. Manipulating the equation

to solve for  $y$  gives  $y = \left(\frac{1+k}{1-k}\right)x$ , revealing that the graph of the equation must be a line that passes through the origin. Of the choices given, only the graph shown in choice B satisfies these conditions.

**Choice A** is not the correct answer. If you selected this answer, you may have seen that the term  $k(x + y)$  is a multiple of  $x + y$  and wrongly concluded that this is the equation of a line with slope 1.

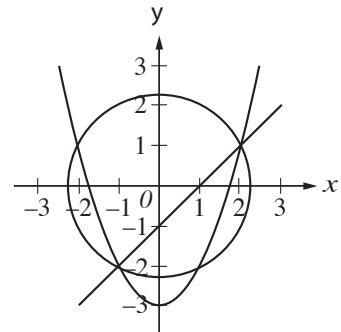
**Choice C** is not the correct answer. If you selected this answer, you may have made incorrect steps when simplifying the equation or may have not seen the advantage that putting the equation in slope-intercept form would give in determining the graph, and thus wrongly concluded the graph has a nonzero  $y$ -intercept.

**Choice D** is not the correct answer. If you selected this answer, you may not have seen that term  $k(x + y)$  can be multiplied out and the variables  $x$  and  $y$  isolated, and wrongly concluded that the graph of the equation cannot be a line.

$$x^2 + y^2 = 5$$

$$y = x^2 - 3$$

$$x - y = 1$$



A system of three equations and their graphs in the  $xy$ -plane are shown above. How many solutions does the system have?

- A) One
- B) Two
- C) Three
- D) Four

Estimated Difficulty: Easy

Key: B

**Choice B** is correct. The solutions to the system of equations are the points where the circle, parabola, and line all intersect. These points are  $(-1, -2)$  and  $(2, 1)$ , and these are the only solutions to the system.

*Choice A* is not the correct answer. This answer may reflect the misconception that a system of equations can have only one solution.

*Choice C* is not the correct answer. This answer may reflect the misconception that a system of equations has as many solutions as the number of equations in the system.

*Choice D* is not the correct answer. This answer may reflect the misconception that the solutions of the system are represented by the points where any two of the curves intersect, rather than the correct concept that the solutions are represented only by the points where all three curves intersect.

5

If the expression  $\frac{4x^2}{2x-1}$  is written in the equivalent form  $\frac{1}{2x-1} + A$ , what is  $A$  in terms of  $x$ ?

- A)  $2x + 1$
- B)  $2x - 1$
- C)  $4x^2$
- D)  $4x^2 - 1$

**Estimated Difficulty:** Hard

**Key:** A

**Choice A** is correct. The form of the equation suggests performing long division on  $\frac{4x^2}{2x-1}$ :

$$\begin{array}{r} 2x+1 \\ 2x-1 \overline{)4x^2} \\ \underline{4x^2-2x} \phantom{0} \\ 2x \phantom{0} \\ \underline{2x-1} \\ 1 \end{array}$$

Since the remainder 1 matches the numerator in  $\frac{1}{2x-1}$ , it is clear that  $A = 2x + 1$ .

A short way to find the answer is to use the structure to rewrite the numerator of the expression as  $(4x^2 - 1) + 1$ , recognizing the term in parentheses as a difference of squares, making the expression equal to

$$\frac{(2x-1)(2x+1)+1}{2x-1} = 2x+1 + \frac{1}{2x-1}. \text{ From this, the}$$

answer  $2x + 1$  is apparent. Another way to find the answer is to isolate  $A$  in the form

$$A = \frac{4x^2}{2x-1} - \frac{1}{2x-1} \text{ and simplify. As with the first}$$

approach, this approach also requires you to recognize  $4x^2 - 1$  as a difference of squares that factors.

*Choice B* is not the correct answer. If you selected this answer, you may have made a sign error while subtracting partial quotients in the long division.

*Choice C* is not the correct answer. If you selected this answer, you may have misunderstood how to work with fractions and may have tried the incorrect calculation

$$\frac{4x^2}{2x-1} = \frac{(1)(4x^2)}{2x-1} = \frac{1}{2x-1} + 4x^2.$$

*Choice D* is not the correct answer. If you selected this answer, you may have misunderstood how to work with fractions and may have tried the incorrect calculation

$$\frac{4x^2}{2x-1} = \frac{1+4x^2-1}{2x-1} = \frac{1}{2x-1} + 4x^2 - 1.$$

For question 6, you are asked to solve the problem and enter your answer in the grid, as described on page 28 of this booklet.

6

The table below classifies the first 103 elements in the periodic table 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:** .076,  $\frac{7}{92}$

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  $\frac{7}{92}$ .



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