CollegeBoard

SAT® Practice Test #1

IMPORTANT REMINDERS

1

A No. 2 pencil is required for the test. Do not use a mechanical pencil or pen.

2

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Test begins on the next page.

Reading Test

65 MINUTES, 52 QUESTIONS

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

DIRECTIONS

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

Questions 1-10 are based on the following passage.

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

Akira came directly, breaking all tradition. Was that it? Had he followed form—had he asked his mother to speak to his father to approach a
Line go-between—would Chie have been more receptive?
5 He came on a winter's eve. He pounded on the door while a cold rain beat on the shuttered veranda, so at first Chie thought him only the wind. The maid knew better. Chie heard her soft scuttling footsteps, the creak of the door. Then the maid brought a
10 calling card to the drawing room, for Chie.

Chie was reluctant to go to her guest; perhaps she was feeling too cozy. She and Naomi were reading at a low table set atop a charcoal brazier. A thick quilt spread over the sides of the table so their legs were
15 tucked inside with the heat.

"Who is it at this hour, in this weather?" Chie questioned as she picked the name card off the maid's lacquer tray.

"Shinoda, Akira. Kobe Dental College," she read.
20 Naomi recognized the name. Chie heard a soft intake of air.

"I think you should go," said Naomi.

Akira was waiting in the entry. He was in his early twenties, slim and serious, wearing the black
25 military-style uniform of a student. As he bowed—his hands hanging straight down, a black cap in one, a yellow oil-paper umbrella in the other—Chie glanced beyond him. In the glistening surface of the courtyard's rain-drenched paving
30 stones, she saw his reflection like a dark double.

"Madame," said Akira, "forgive my disruption, but I come with a matter of urgency."

His voice was soft, refined. He straightened and stole a deferential peek at her face.
35 In the dim light his eyes shone with sincerity. Chie felt herself starting to like him.

"Come inside, get out of this nasty night. Surely your business can wait for a moment or two."

"I don't want to trouble you. Normally I would
40 approach you more properly but I've received word of a position. I've an opportunity to go to America, as dentist for Seattle's Japanese community."

"Congratulations," Chie said with amusement. "That is an opportunity, I'm sure. But how am I
45 involved?"

Even noting Naomi's breathless reaction to the name card, Chie had no idea. Akira's message, delivered like a formal speech, filled her with maternal amusement. You know how children speak
50 so earnestly, so hurriedly, so endearingly about things that have no importance in an adult's mind? That's how she viewed him, as a child.

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CONTINUE

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

Akira blushed.

"Depending on your response, I may stay in Japan. I've come to ask for Naomi's hand."

Suddenly Chie felt the dampness of the night.

"Does Naomi know anything of your . . . ambitions?"

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

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

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

"Mother?" Chie heard Naomi's low voice and turned from the door. "He has asked you?"

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

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

Chie waited for Naomi's ripe laughter.

Naomi was silent. She stood a full half minute looking straight into Chie's eyes. Finally, she spoke. "I met him at my literary meeting."

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

"Mother."

"Yes?"

"I mean to have him."

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

1

Which choice best describes what happens in the passage?

A) One character argues with another character who intrudes on her home.

B) One character receives a surprising request from another character.

C) One character reminisces about choices she has made over the years.

D) One character criticizes another character for pursuing an unexpected course of action.

2

Which choice best describes the developmental pattern of the passage?

A) A careful analysis of a traditional practice

B) A detailed depiction of a meaningful encounter

C) A definitive response to a series of questions

D) A cheerful recounting of an amusing anecdote

3

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

A) frankly.

B) confidently.

C) without mediation.

D) with precision.

4

Which reaction does Akira most fear from Chie?

A) She will consider his proposal inappropriate.

B) She will mistake his earnestness for immaturity.

C) She will consider his unscheduled visit an imposition.

D) She will underestimate the sincerity of his emotions.

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5

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

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

6

In the passage, Akira addresses Chie with

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

7

The main purpose of the first paragraph is to

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

8

As used in line 2, "form" most nearly means

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

9

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

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

10

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

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

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

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

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

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

What is surprising is that gift-givers have considerable experience acting as both gift-givers and gift-recipients, but nevertheless tend to overspend each time they set out to purchase a meaningful gift. In the present research, we propose a unique psychological explanation for this overspending problem—i.e., that gift-givers equate how much they spend with how much recipients will appreciate the gift (the more expensive the gift, the stronger a gift-recipient's feelings of appreciation). Although a link between gift price and feelings of appreciation might seem intuitive to gift-givers, such an assumption may be unfounded. Indeed, we propose that gift-recipients will be less inclined to base their feelings of appreciation on the magnitude of a gift than givers assume.

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

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

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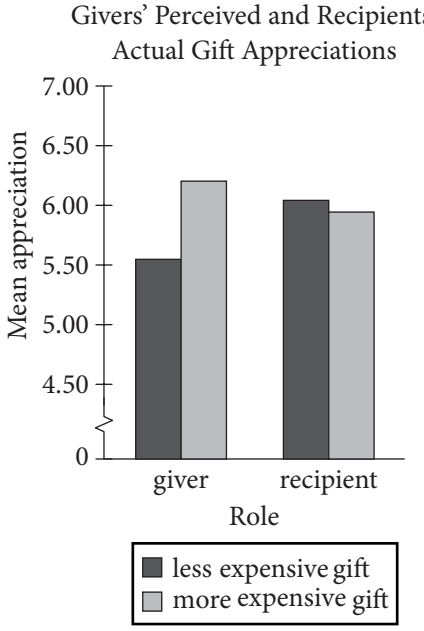

11

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

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

12

In line 10, the word "ambivalent" most nearly means

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

13

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

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

14

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

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

15

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

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

16

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

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

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17

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

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

18

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

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

19

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

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

20

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

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

21

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

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

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

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

The chemical formula of deoxyribonucleic acid (DNA) is now well established. The molecule is a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups. To each sugar is attached a nitrogenous base, which can be of four different types. Two of the possible bases—adenine and guanine—are purines, and the other two—thymine and cytosine—are pyrimidines. So far as is known, the sequence of bases along the chain is irregular. The monomer unit, consisting of phosphate, sugar and base, is known as a nucleotide.

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

The other biologically important feature is the manner in which the two chains are held together. This is done by hydrogen bonds between the bases. The bases are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other. The important point is that only certain pairs of bases will fit into the structure. One member of a pair must be a purine and the other a pyrimidine in order to bridge between the two chains. If a pair consisted of two purines, for example, there would not be room for it.

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

The phosphate-sugar backbone of our model is completely regular, but any sequence of the pairs of bases can fit into the structure. It follows that in a long molecule many different permutations are possible, and it therefore seems likely that the precise sequence of bases is the code which carries the genetical information. If the actual order of the bases on one of the pair of chains were given, one could write down the exact order of the bases on the other one, because of the specific pairing. Thus one chain is, as it were, the complement of the other, and it is this feature which suggests how the deoxyribonucleic acid molecule might duplicate itself.

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

Base Composition of DNA

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

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

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CONTINUE

22

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

A) only very long chains of DNA can be taken from an organism with a spinal column.

B) the main structure of a chain in a DNA molecule is composed of repeating units.

C) a chain in a DNA molecule consists entirely of phosphate groups or of sugars.

D) nitrogenous bases form the main structural unit of DNA.

23

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

A) Lines 5-6 ("To each . . . types")

B) Lines 9-10 ("So far . . . irregular")

C) Lines 23-25 ("The bases . . . other")

D) Lines 27-29 ("One member . . . chains")

24

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

A) The chemical formula of DNA

B) The common fiber axis

C) The X-ray evidence

D) DNA consisting of two chains

25

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

A) establish that DNA is the molecule that carries the genetic information.

B) present an alternate hypothesis about the composition of a nucleotide.

C) provide support for the authors' claim about the number of chains in a molecule of DNA.

D) confirm the relationship between the density of DNA and the known chemical formula of DNA.

26

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

A) of purines would be larger than the space between a sugar and a phosphate group.

B) of purines would be larger than a pair consisting of a purine and a pyrimidine.

C) of pyrimidines would be larger than a pair of purines.

D) consisting of a purine and a pyrimidine would be larger than a pair of pyrimidines.

27

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

A) confirm that the nucleotide sequences are known for most molecules of DNA.

B) counter the claim that the sequences of bases along a chain can occur in any order.

C) support the claim that the phosphate-sugar backbone of the authors' model is completely regular.

D) emphasize how one chain of DNA may serve as a template to be copied during DNA replication.

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28

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

A) 17.1% and 18.7%

B) 17.1% and 32.9%

C) 18.7% and 31.3%

D) 31.3% and 32.9%

29

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

A) Yes, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.

B) Yes, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.

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

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

30

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

A) 17.3% and 17.7%

B) 17.3% and 32.1%

C) 17.3% and 32.8%

D) 17.7% and 32.8%

31

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

A) The same; "Two of . . . pyrimidines" (lines 6-8)

B) The same; "The important . . . structure" (lines 25-26)

C) It varies; "Adenine . . . thymine" (lines 36-38)

D) It varies; "It follows . . . information" (lines 41-45)

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CONTINUE

Questions 32-41 are based on the following passage.

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

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

There they go, our brothers who have been educated at public schools and universities, mounting those steps, passing in and out of those doors, ascending those pulpits, preaching, teaching, administering justice, practising medicine, transacting business, making money. It is a solemn sight always—a procession, like a caravanserai crossing a desert. . . . But now, for the past twenty years or so, it is no longer a sight merely, a photograph, or fresco scrawled upon the walls of time, at which we can look with merely an esthetic appreciation. For there, trapesing along at the tail end of the procession, we go ourselves. And that makes a difference. We who have looked so long at the pageant in books, or from a curtained window watched educated men leaving the house at about nine-thirty to go to an office, returning to the house at about six-thirty from an office, need look passively no longer. We too can leave the house, can mount those steps, pass in and out of those doors, . . . make money, administer justice. . . . We who now agitate these humble pens may in another century or two speak from a pulpit. Nobody will dare contradict us then; we shall be the mouthpieces of the divine spirit—a solemn thought, is it not? Who can say whether, as time goes on, we may not dress in military uniform, with gold lace on our breasts, swords at our sides, and something like the old family coal-scuttle on our heads, save that that venerable object was never decorated with plumes of white horsehair. You laugh—indeed the shadow of the private house still makes those dresses look a little queer. We have worn private clothes so long. . . . But we have not come here to laugh, or to talk of fashions—men's and women's. We are here, on the bridge, to ask ourselves certain questions. And they are very important questions; and we have very little time in which to answer them. The questions that we have to ask and to answer about that procession during this moment of transition are so important that they may well change the lives of all men and women for ever. For we have to ask ourselves, here and now, do we wish to join that procession, or don't we? On what terms shall we join that procession? Above all, where is it leading us, the procession of educated men? The moment is short; it may last five years; ten years, or perhaps only a matter of a few months longer. . . . But, you will object, you have no time to think; you have your battles to fight, your rent to pay, your bazaars to organize. That excuse shall not serve you, Madam. As you know from your own experience, and there are facts that prove it, the daughters of educated men have always done their thinking from hand to mouth; not under green lamps at study tables in the cloisters of secluded colleges. They have thought while they stirred the pot, while they rocked the cradle. It was thus that they won us the right to our brand-new sixpence. It falls to us now to go on thinking; how are we to spend that sixpence? Think we must. Let us think in offices; in omnibuses; while we are standing in the crowd watching Coronations and Lord Mayor's Shows; let us think . . . in the gallery of the House of Commons; in the Law Courts; let us think at baptisms and marriages and funerals. Let us never cease from thinking—what is this "civilization" in which we find ourselves? What are these ceremonies and why should we take part in them? What are these professions and why should we make money out of them? Where in short is it leading us, the procession of the sons of educated men?

32

The main purpose of the passage is to

A) emphasize the value of a tradition.

B) stress the urgency of an issue.

C) highlight the severity of social divisions.

D) question the feasibility of an undertaking.

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CONTINUE

33

The central claim of the passage is that

A) educated women face a decision about how to engage with existing institutions.

B) women can have positions of influence in English society only if they give up some of their traditional roles.

C) the male monopoly on power in English society has had grave and continuing effects.

D) the entry of educated women into positions of power traditionally held by men will transform those positions.

34

Woolf uses the word "we" throughout the passage mainly to

A) reflect the growing friendliness among a group of people.

B) advance the need for candor among a group of people.

C) establish a sense of solidarity among a group of people.

D) reinforce the need for respect among a group of people.

35

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

A) is conducive to a mood of fanciful reflection.

B) provides a good view of the procession of the sons of educated men.

C) is within sight of historic episodes to which she alludes.

D) is symbolic of the legacy of past and present sons of educated men.

36

Woolf indicates that the procession she describes in the passage

A) has come to have more practical influence in recent years.

B) has become a celebrated feature of English public life.

C) includes all of the richest and most powerful men in England.

D) has become less exclusionary in its membership in recent years.

37

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

A) Lines 12-17 ("There . . . money")

B) Lines 17-19 ("It . . . desert")

C) Lines 23-24 ("For . . . ourselves")

D) Lines 30-34 ("We . . . pulpit")

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CONTINUE

38

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

A) controversial and threatening.

B) weighty and unanswerable.

C) momentous and pressing.

D) provocative and mysterious.

39

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

A) Lines 46-47 ("We . . . questions")

B) Lines 48-49 ("And . . . them")

C) Line 57 ("The moment . . . short")

D) Line 62 ("That . . . Madam")

40

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

A) Tolerance

B) Knowledge

C) Opportunity

D) Perspective

41

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

A) novel the challenge faced by women is.

B) pervasive the need for critical reflection is.

C) complex the political and social issues of the day are.

D) enjoyable the career possibilities for women are.

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Questions 42-52 are based on the following passages.

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

Passage 1

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

Line

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

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

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

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

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

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

Passage 2

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

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

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

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

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

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

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CONTINUE

42

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

A) note the technological advances that make space mining possible.

B) provide evidence of the growing interest in space mining.

C) emphasize the large profits to be made from space mining.

D) highlight the diverse ways to carry out space mining operations.

43

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

A) It could yield materials important to Earth's economy.

B) It could raise the value of some precious metals on Earth.

C) It could create unanticipated technological innovations.

D) It could change scientists' understanding of space resources.

44

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

A) Lines 18-22 ("Within . . . lanthanum")

B) Lines 24-28 ("They . . . projects")

C) Lines 29-30 ("In this . . . commodity")

D) Lines 41-44 ("Companies . . . machinery")

45

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

A) offers.

B) claims.

C) inquiries.

D) desires.

46

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

A) It continues an extended comparison that begins in the previous paragraph.

B) It provides an unexpected answer to a question raised in the previous paragraph.

C) It offers hypothetical examples supporting a claim made in the previous paragraph.

D) It examines possible outcomes of a proposal put forth in the previous paragraph.

47

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

A) it will end up encouraging humanity's reckless treatment of the environment.

B) its effects should be thoughtfully considered before it becomes a reality.

C) such potential may not include replenishing key resources that are disappearing on Earth.

D) experts disagree about the commercial viability of the discoveries it could yield.

48

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

A) maintain.

B) grip.

C) restrain.

D) withstand.

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CONTINUE

49

Which statement best describes the relationship between the passages?

A) Passage 2 refutes the central claim advanced in Passage 1.

B) Passage 2 illustrates the phenomenon described in more general terms in Passage 1.

C) Passage 2 argues against the practicality of the proposals put forth in Passage 1.

D) Passage 2 expresses reservations about developments discussed in Passage 1.

50

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

A) is inconsistent with the sustainable use of space resources.

B) will be difficult to bring about in the absence of regulations.

C) cannot be attained without technologies that do not yet exist.

D) seems certain to affect Earth's economy in a negative way.

51

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

A) Lines 60-63 ("Some . . . pristine")

B) Lines 74-76 ("The resources . . . Earth")

C) Lines 81-83 ("One . . . avoided")

D) Lines 85-87 ("Without . . . insecure")

52

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

A) They may be different resources from those that are valuable on Earth.

B) They will be valuable only if they can be harvested cheaply.

C) They are likely to be primarily precious metals and rare earth elements.

D) They may increase in value as those same resources become rare on Earth.

STOP

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

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No Test Material On This Page

Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

DIRECTIONS

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

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

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

Whey to Go

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

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

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CONTINUE

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

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

1

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

2

Which choice provides the most relevant detail?

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

3

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

4

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

5

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

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

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CONTINUE

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

6

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

A) Yes, because it does not provide a transition from the previous paragraph.

B) Yes, because it fails to support the main argument of the passage as introduced in the first paragraph.

C) No, because it continues the explanation of how acid whey can be disposed of safely.

D) No, because it sets up the argument in the paragraph for the benefits of Greek yogurt.

7

A) NO CHANGE

B) as

C) like

D) for

8

A) NO CHANGE

B) containing

C) contains

D) will contain

9

A) NO CHANGE

B) In other words,

C) Therefore,

D) For instance,

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CONTINUE

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

10

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

11

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

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CONTINUE

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

Dark Snow

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

12

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

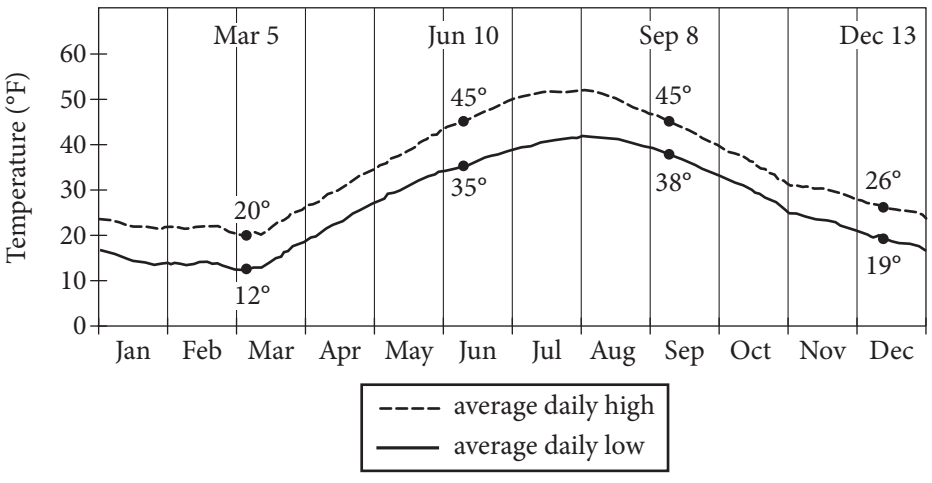
A) NO CHANGE

B) to 12 degrees Fahrenheit.

C) to their lowest point on December 13.

D) to 10 degrees Fahrenheit and stay there for months.

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



Adapted from WMO. ©2014 by World Meteorological Organization.

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CONTINUE

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

13

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

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

14

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

15

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

16

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

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CONTINUE

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

17

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

18

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

19

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

20

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

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

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CONTINUE

[1] Box's research is important because the fires of 2012 may not be a one-time phenomenon. [2] According to scientists, rising Arctic temperatures are making northern latitudes greener and thus more fire prone. [3] The pattern Box observed in 2012 may repeat **21** itself again, with harmful effects on the Arctic ecosystem. [4] Box is currently organizing an expedition to gather this crucial information. [5] The next step for Box and his team is to travel to Greenland to perform direct sampling of the ice in order to determine just how much the soot is contributing to the melting of the ice sheet. [6] Members of the public will be able to track his team's progress—and even help fund the expedition—through a website Box has created. **22**

21

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

22

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

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

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CONTINUE

Questions 23-33 are based on the following passage.

Coworking: A Creative Solution

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

23

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

24

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

25

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

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CONTINUE

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

26

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

27

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

28

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

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

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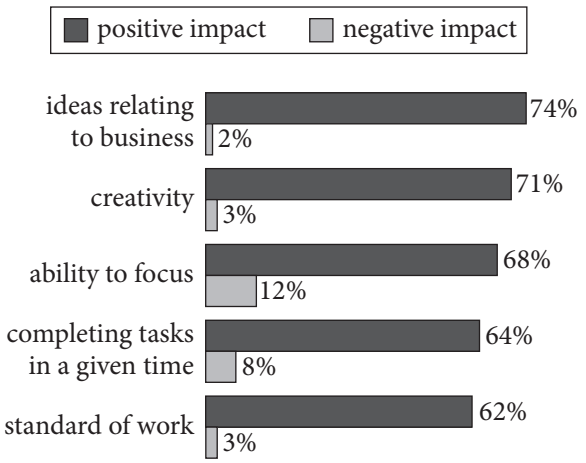
CONTINUE

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

29

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

Perceived Effect of Coworking on Business Skills



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

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

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

30

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

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CONTINUE

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

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

31

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

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

The best placement for the sentence is immediately

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

32

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

33

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

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CONTINUE

Questions 34-44 are based on the following passage.

The Consolations of Philosophy

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

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

34

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

35

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

36

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

37

Which choice most effectively sets up the information that follows?

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

38

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

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CONTINUE

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

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

39

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

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

40

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

41

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

42

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

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

Should the writer make this addition here?

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

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CONTINUE

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

43

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

44

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

STOP

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

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No Test Material On This Page

Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

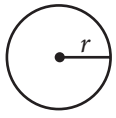
DIRECTIONS

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

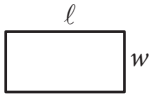
NOTES

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

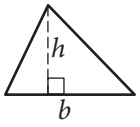
REFERENCE



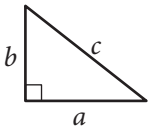
$A = \pi r^2$
$C = 2\pi r$



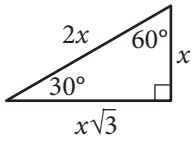
$A = \ell w$

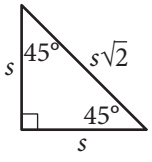


$A = \frac{1}{2}bh$

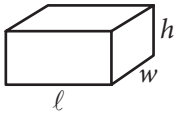


$c^2 = a^2 + b^2$

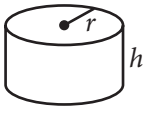




Special Right Triangles

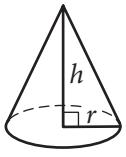


$V = \ell wh$

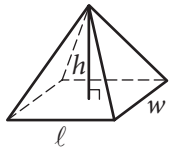


$V = \pi r^2 h$

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



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



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

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

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CONTINUE

1

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

A) 2

B) 4

C) 9

D) 10

2

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

A) $-1 + 12i$

B) $-1 - 6i$

C) $15 + 12i$

D) $15 - 6i$

3

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

A) $9mp$

B) $20mp$

C) $5m + 4p$

D) $4m + 5p$

4

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

A) Kathy will complete the repairs within 108 days.

B) Kathy starts each week with 108 phones to fix.

C) Kathy repairs phones at a rate of 108 per hour.

D) Kathy repairs phones at a rate of 108 per day.

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CONTINUE

5

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

Which of the following is equivalent to the expression above?

A) $4x^2y^2$

B) $8xy^2 - 6y^2$

C) $2x^2y + 2xy^2$

D) $2x^2y + 8xy^2 - 6y^2$

6

$$h = 3a + 28.6$$

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

A) 3

B) 5.7

C) 9.5

D) 14.3

7

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

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

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

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

C) $P = \left(\dfrac{r}{1{,}200}\right) m$

D) $P = \left(\dfrac{1{,}200}{r}\right) m$

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CONTINUE

8

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

A) 0

B) 1

C) 2

D) 4

9

$$3x + 4y = -23$$
$$2y - x = -19$$

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

A) $(-5, -2)$

B) $(3, -8)$

C) $(4, -6)$

D) $(9, -6)$

10

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

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

A) 8

B) 0

C) -1

D) -8

11

$$b = 2.35 + 0.25x$$
$$c = 1.75 + 0.40x$$

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

A) \$2.60

B) \$2.85

C) \$2.95

D) \$3.35

12

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

A) $(0, 7)$

B) $(1, 7)$

C) $(7, 7)$

D) $(14, 2)$

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CONTINUE

13

If $x > 3$, which of the following is equivalent to $\dfrac{1}{\dfrac{1}{x+2}+\dfrac{1}{x+3}}$?

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

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

C) $2x+5$

D) x^2+5x+6

14

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

A) 2^{12}

B) 4^4

C) 8^2

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

15

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

A) 3 and 5

B) 6 and 35

C) 10 and 21

D) 31 and 41

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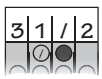
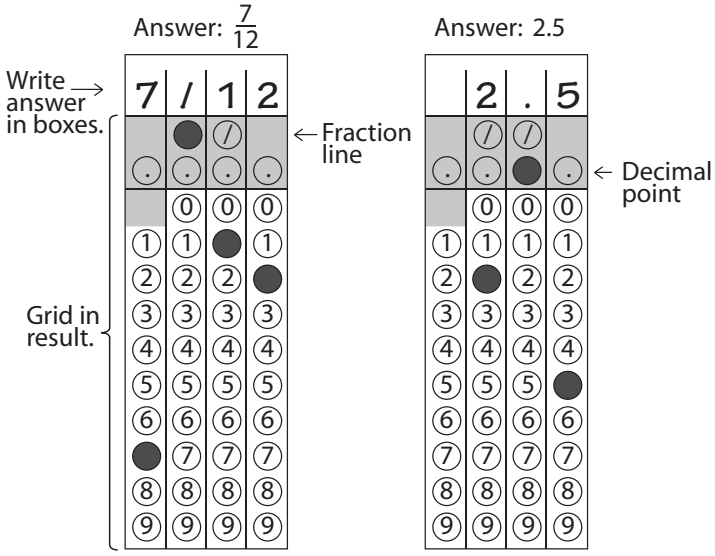
CONTINUE

DIRECTIONS

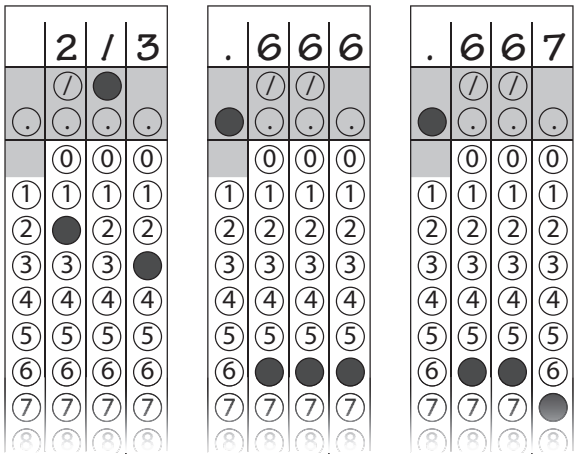
For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. 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.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If 

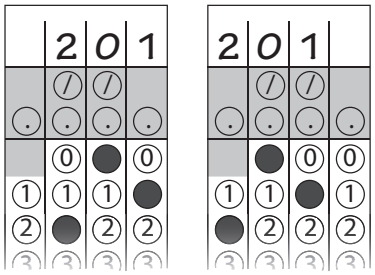
is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



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.

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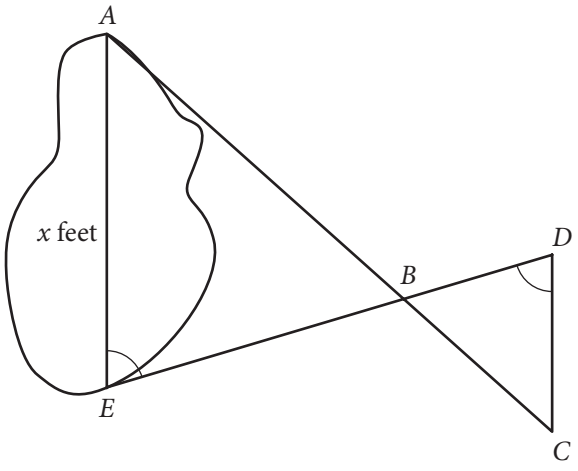
CONTINUE

16

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

17



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

18

$$x + y = -9$$
$$x + 2y = -25$$

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

19

In a right triangle, one angle measures $x°$, where $\sin x° = \frac{4}{5}$. What is $\cos(90° - x°)$?

20

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

STOP

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

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No Test Material On This Page

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

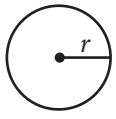
DIRECTIONS

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

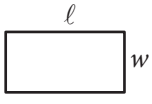
NOTES

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

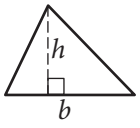
REFERENCE



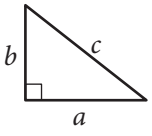
$A = \pi r^2$
$C = 2\pi r$



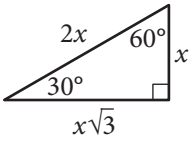
$A = \ell w$

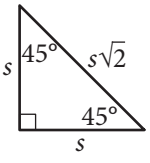


$A = \frac{1}{2}bh$

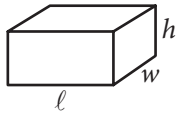


$c^2 = a^2 + b^2$

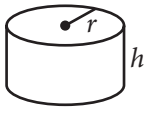




Special Right Triangles

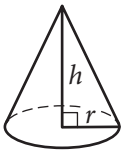


$V = \ell wh$

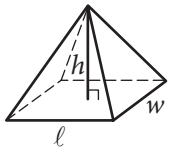


$V = \pi r^2 h$

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



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



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

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

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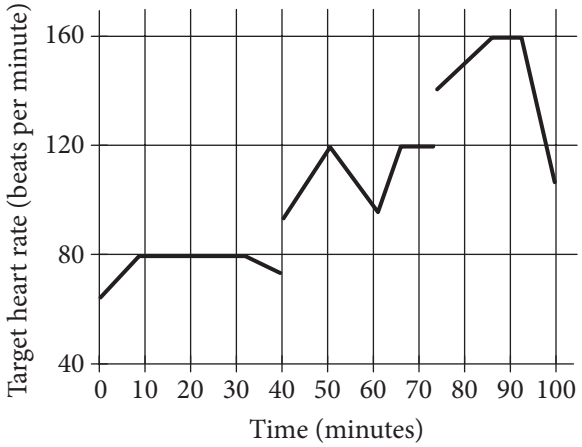
CONTINUE

1

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



A) Between 0 and 30 minutes

B) Between 40 and 60 minutes

C) Between 50 and 65 minutes

D) Between 70 and 90 minutes

2

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

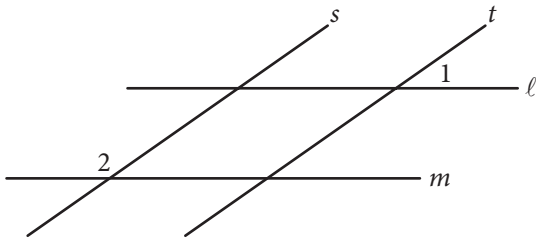
A) 6

B) 15

C) 20

D) 23

3



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

A) 35°

B) 55°

C) 70°

D) 145°

4

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

A) 2

B) 6

C) 16

D) 80

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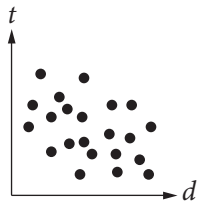
CONTINUE

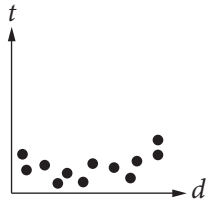
5

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

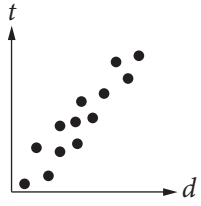
A)



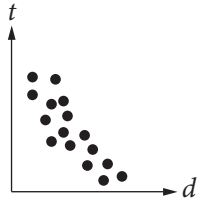
B)



C)



D)



6

1 decagram = 10 grams
1,000 milligrams = 1 gram

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

A) 0.002

B) 200

C) 2,000

D) 20,000

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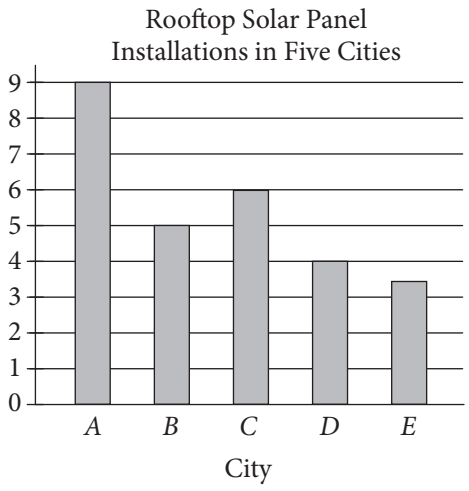
CONTINUE

7



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

A) Number of installations (in tens)

B) Number of installations (in hundreds)

C) Number of installations (in thousands)

D) Number of installations (in tens of thousands)

8

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

A) 0

B) 1

C) 2

D) There is no such value of n.

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CONTINUE

Questions 9 and 10 refer to the following information.

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

The speed of a sound wave in air depends on the air temperature. The formula above shows the relationship between a, the speed of a sound wave, in feet per second, and t, the air temperature, in degrees Fahrenheit (°F).

9

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

A) $t = \dfrac{a - 1{,}052}{1.08}$

B) $t = \dfrac{a + 1{,}052}{1.08}$

C) $t = \dfrac{1{,}052 - a}{1.08}$

D) $t = \dfrac{1.08}{a + 1{,}052}$

10

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

A) −46°F

B) −48°F

C) −49°F

D) −50°F

11

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

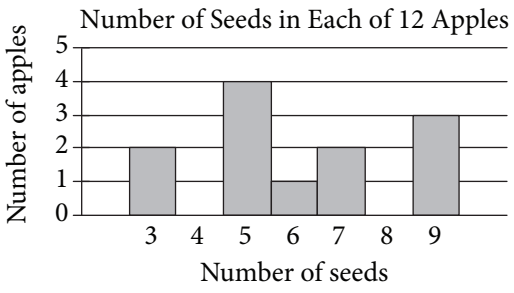
A) −1

B) −2

C) −3

D) −5

12



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

A) 4

B) 5

C) 6

D) 7

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CONTINUE

13

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

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

A) Females taking Geometry

B) Females taking Algebra II

C) Males taking Geometry

D) Males taking Algebra I

14

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

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

A) Mean

B) Median

C) Range

D) They will all change by the same amount.

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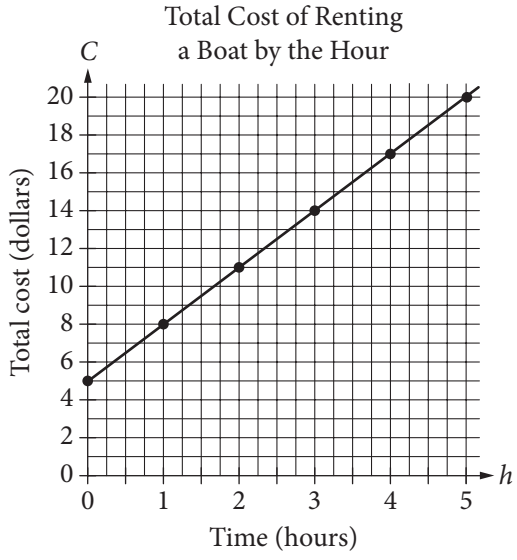
CONTINUE

Questions 15 and 16 refer to the following information.



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

15

What does the C-intercept represent in the graph?

A) The initial cost of renting the boat

B) The total number of boats rented

C) The total number of hours the boat is rented

D) The increase in cost to rent the boat for each additional hour

16

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

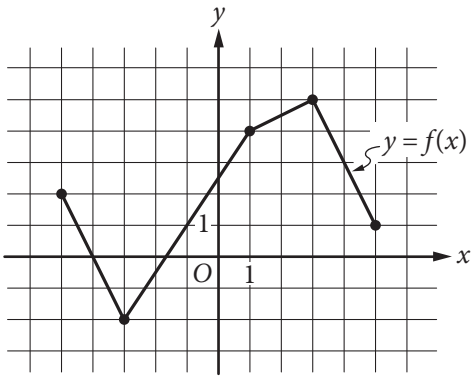
A) $C = 5h$

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

C) $C = 3h + 5$

D) $h = 3C$

17



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

A) -5

B) -3

C) -2

D) 3

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CONTINUE

18

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

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

A) $a > b$

B) $b > a$

C) $|a| > |b|$

D) $a = -b$

19

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

A) 77

B) 93

C) 99

D) 105

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CONTINUE

20

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

A) $0.88p$

B) $\frac{p}{0.88}$

C) $(0.8)(1.08)p$

D) $\frac{p}{(0.8)(1.08)}$

21

Dreams Recalled during One Week

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

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

A) $\frac{68}{100}$

B) $\frac{79}{100}$

C) $\frac{79}{164}$

D) $\frac{164}{200}$

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CONTINUE

Questions 22 and 23 refer to the following information.

Annual Budgets for Different Programs in Kansas, 2007 to 2010

Program	Year			
	2007	2008	2009	2010
Agriculture/natural resources	373,904	358,708	485,807	488,106
Education	2,164,607	2,413,984	2,274,514	3,008,036
General government	14,347,325	12,554,845	10,392,107	14,716,155
Highways and transportation	1,468,482	1,665,636	1,539,480	1,773,893
Human resources	4,051,050	4,099,067	4,618,444	5,921,379
Public safety	263,463	398,326	355,935	464,233

The table above lists the annual budget, in thousands of dollars, for each of six different state programs in Kansas from 2007 to 2010.

22

Which of the following best approximates the average rate of change in the annual budget for agriculture/natural resources in Kansas from 2008 to 2010 ?

A) $50,000,000 per year
B) $65,000,000 per year
C) $75,000,000 per year
D) $130,000,000 per year

23

Of the following, which program's ratio of its 2007 budget to its 2010 budget is closest to the human resources program's ratio of its 2007 budget to its 2010 budget?

A) Agriculture/natural resources
B) Education
C) Highways and transportation
D) Public safety

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CONTINUE

24

Which of the following is an equation of a circle in the xy-plane with center $(0, 4)$ and a radius with endpoint $\left(\frac{4}{3}, 5\right)$?

A) $x^2 + (y - 4)^2 = \frac{25}{9}$

B) $x^2 + (y + 4)^2 = \frac{25}{9}$

C) $x^2 + (y - 4)^2 = \frac{5}{3}$

D) $x^2 + (y + 4)^2 = \frac{3}{5}$

25

$$h = -4.9t^2 + 25t$$

The equation above expresses the approximate height h, in meters, of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground?

A) 3.5

B) 4.0

C) 4.5

D) 5.0

26

Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce?

A) 115

B) 120

C) 124

D) 173

27

A square field measures 10 meters by 10 meters. Ten students each mark off a randomly selected region of the field; each region is square and has side lengths of 1 meter, and no two regions overlap. The students count the earthworms contained in the soil to a depth of 5 centimeters beneath the ground's surface in each region. The results are shown in the table below.

Region	Number of earthworms	Region	Number of earthworms
A	107	F	141
B	147	G	150
C	146	H	154
D	135	I	176
E	149	J	166

Which of the following is a reasonable approximation of the number of earthworms to a depth of 5 centimeters beneath the ground's surface in the entire field?

A) 150

B) 1,500

C) 15,000

D) 150,000

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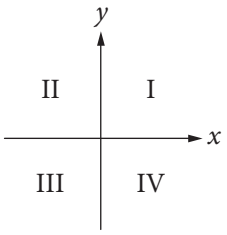
CONTINUE

28



If the system of inequalities $y \geq 2x + 1$ and $y > \frac{1}{2}x - 1$ is graphed in the xy-plane above, which quadrant contains no solutions to the system?

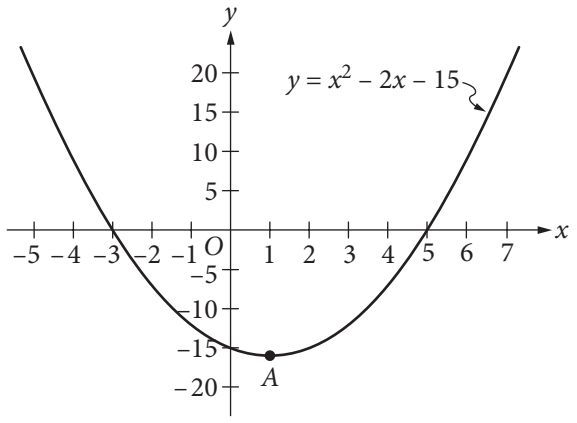
A) Quadrant II
B) Quadrant III
C) Quadrant IV
D) There are solutions in all four quadrants.

29

For a polynomial $p(x)$, the value of $p(3)$ is -2. Which of the following must be true about $p(x)$?

A) $x - 5$ is a factor of $p(x)$.
B) $x - 2$ is a factor of $p(x)$.
C) $x + 2$ is a factor of $p(x)$.
D) The remainder when $p(x)$ is divided by $x - 3$ is -2.

30



Which of the following is an equivalent form of the equation of the graph shown in the xy-plane above, from which the coordinates of vertex A can be identified as constants in the equation?

A) $y = (x + 3)(x - 5)$
B) $y = (x - 3)(x + 5)$
C) $y = x(x - 2) - 15$
D) $y = (x - 1)^2 - 16$

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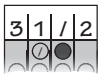
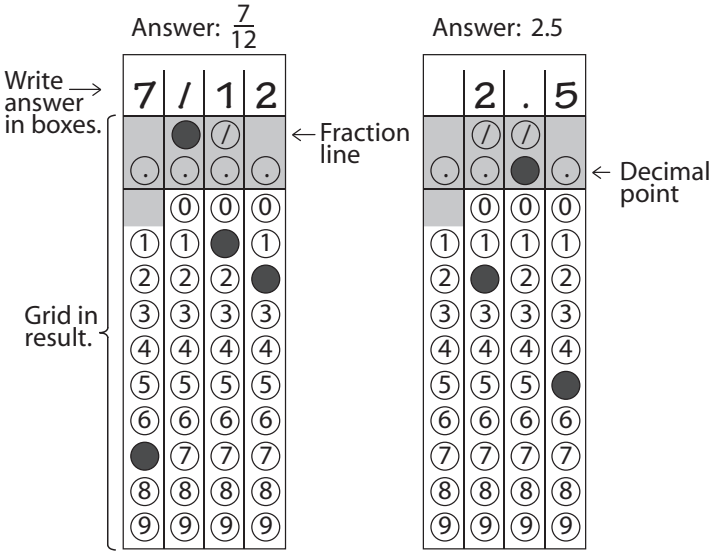
CONTINUE

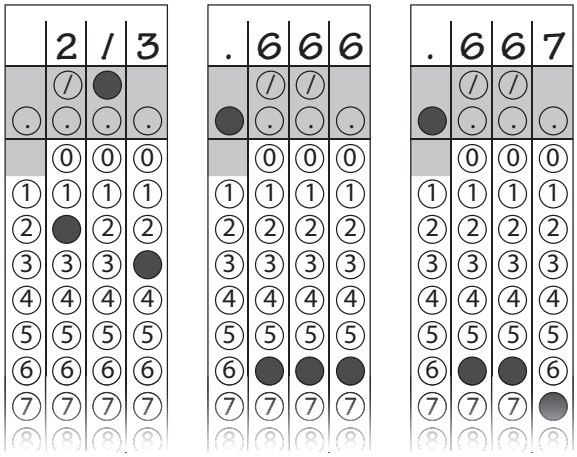
DIRECTIONS

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

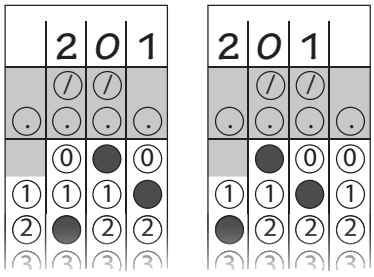
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **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.

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CONTINUE

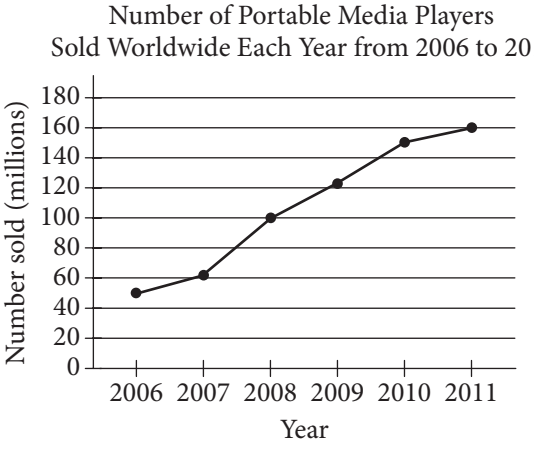
31

Wyatt can husk at least 12 dozen ears of corn per hour and at most 18 dozen ears of corn per hour. Based on this information, what is a possible amount of time, in hours, that it could take Wyatt to husk 72 dozen ears of corn?

32

The posted weight limit for a covered wooden bridge in Pennsylvania is 6000 pounds. A delivery truck that is carrying x identical boxes each weighing 14 pounds will pass over the bridge. If the combined weight of the empty delivery truck and its driver is 4500 pounds, what is the maximum possible value for x that will keep the combined weight of the truck, driver, and boxes below the bridge's posted weight limit?

33



According to the line graph above, the number of portable media players sold in 2008 is what fraction of the number sold in 2011 ?

34

A local television station sells time slots for programs in 30-minute intervals. If the station operates 24 hours per day, every day of the week, what is the total number of 30-minute time slots the station can sell for Tuesday and Wednesday?

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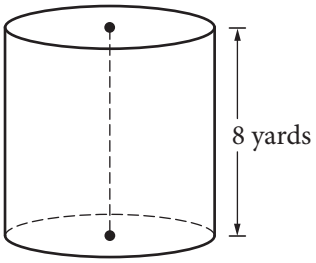
CONTINUE

35



A dairy farmer uses a storage silo that is in the shape of the right circular cylinder above. If the volume of the silo is 72π cubic yards, what is the diameter of the base of the cylinder, in yards?

36

$$h(x) = \frac{1}{(x-5)^2 + 4(x-5) + 4}$$

For what value of x is the function h above undefined?

Questions 37 and 38 refer to the following information.

Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression $\$100(x)^t$ to find the value of the account after t years.

37

What is the value of x in the expression?

38

Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of \$100 into this account at the same time Jessica made a deposit of \$100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)

STOP

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

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No Test Material On This Page

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YOUR NAME (PRINT) .....

LAST FIRST MI

TEST CENTER .....

NUMBER NAME OF TEST CENTER ROOM NUMBER

The SAT

GENERAL DIRECTIONS

- You may work on only one section at a time.
- If you finish a section before time is called, check your work on that section. You may NOT turn to any other section.

MARKING ANSWERS

- Be sure to mark your answer sheet properly.

COMPLETE MARK ● **EXAMPLES OF INCOMPLETE MARKS**

- You must use a No. 2 pencil.
- Carefully mark only one answer for each question.
- Make sure you fill the entire circle darkly and completely.
- Do not make any stray marks on your answer sheet.
- If you erase, do so completely. Incomplete erasures may be scored as intended answers.
- Use only the answer spaces that correspond to the question numbers.

USING YOUR TEST BOOK

- You may use the test book for scratch work, but you will not receive credit for anything that you write in your test book.
- After time has been called, you may not transfer answers from your test book to your answer sheet or fill in circles.
- You may not fold or remove pages or portions of a page from this book, or take the book or answer sheet from the testing room.

SCORING

- For each correct answer, you receive one point.
- You do not lose points for wrong answers; therefore, you should try to answer every question even if you are not sure of the correct answer.

IMPORTANT

The codes below are unique to your test book.
Copy them on your answer sheet in boxes 8 and 9 and fill in the corresponding circles exactly as shown.

9 TEST ID
(Copy from back of test book.)

8 FORM CODE
(Copy and grid as on back of test book.)

A	A	A	A	0	0	0
B	B	B	B	1	1	1
C	C	C	C	2	2	2
D	D	D	D	3	3	3
E	E	E	E	4	4	4
F	F	F	F	5	5	5
G	G	G	G	6	6	6
H	H	H	H	7	7	7
I	I	I	I	8	8	8
J	J	J	J	9	9	9
K	K	K	K			
L	L	L	L			
M	M	M	M			
N	N	N	N			
O	O	O	O			
P	P	P	P			
Q	Q	Q	Q			
R	R	R	R			
S	S	S	S			
T	T	T	T			
U	U	U	U			
V	V	V	V			
W	W	W	W			
X	X	X	X			
Y	Y	Y	Y			
Z	Z	Z	Z			

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www.sat.org/scoring

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