

Wednesday
October 28, 2015

PSAT/NMSQT[®]

Preliminary SAT/National Merit Scholarship Qualifying Test

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2

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Preliminary SAT/National Merit Scholarship Qualifying Test
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Test begins on the next page.

Reading Test

60 MINUTES, 47 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 1-9 are based on the following passage.

This passage is adapted from A. S. Byatt, *The Children's Book*. ©2009 by A. S. Byatt. It is set at the turn of the twentieth century. Olive Wellwood is a prosperous author of fantasy books who grew up poor in a mining village. She now lives in a country house, Todefright, with her large family.

Olive Wellwood became, not very willingly, a matriarch. She had constructed her own good picture of the Todefright family, which was innocent and comfortable. There were sons and daughters and babies in various stages of creeping, crawling and tottering, there were children having real and imaginary adventures in the woods, there were informal gatherings round the fire in winter, on the lawn in summer, where old and young mingled and discussed things with laughter and serious common sense. There was the steady scratch of the pen in the study, parcels of manuscript her sister Violet took to the post office, the satisfactory checks that arrived with the admiring letters of readers, both children and adults. This she had made, as surely as she made the worlds of fairytale and adventure which were nevertheless often more real to her than breakfast or bathtime. She and Violet alone knew that both worlds were constructed against and despite the pinched life of ash pits, cinders, rumbling subterranean horrors and black dust settling everywhere. The woods, the lawn, the hearth, the stables were a *real* reality, kept in being by

continuous inventive willpower. In weak moments, she thought of her garden as the fairytale palace the prince, or princess, must not leave on pain of bleak disaster. They were inside a firewall, outside which grim goblins mopped and mowed. She had made, had *written*, this world with the inventive power with which she told her stories.

She could not, and did not, imagine any of the inhabitants of this walled garden wanting to leave it, or change it, though her stories knew better. And she had to ignore a great deal, in order to persist in her calm, and listen steadily to the quick scratch of the pen.

In 1901, she had a popular success with a collection of tales, which included the tale of the wraiths and puppets at the Grande Exposition, and the sinister and sly tale of *The People in the House in the House*, in which a child imprisoned some tiny folk in her doll's house, and was in turn imprisoned by a giant child.

A fashionable magazine sent a young woman to interview Mrs. Wellwood, and a photographer, who posed her, sitting by the fire in a rocking-chair in a velvet gown, reading to the assembled younger children. Violet handed round cocoa and biscuits, and did not appear in the picture. The interviewer, whose name was Louisa Catchpole, wrote reverently of the shining heads of the listeners—"you could have heard a mouse squeak, or a beetle scurry," she wrote, entering into the style. She asked the children which was each one's favorite tale, and was slightly

55 baffled by their answers. This meant that Olive found herself explaining that each child had his or her very own story, which was continually added to, and kept in the glass cupboard in a specially decorated book. Louisa Catchpole said this was a *charming* idea, and
 60 begged to see the books. The photographer took pictures of the cupboard, and of the imaginatively decorated covers of the individual tales. Miss Catchpole said to the children that they must feel they were very special people, having their *own*
 65 stories in this way. It was Phyllis who replied solemnly, oh yes, they *did* feel special.

The interview and pictures appeared under the headline “A Modern Mother Goose.” The article spoke of Mrs. Wellwood’s calm motherly presence,
 70 and her expressive voice, spicing the stories with mystery, thrills and dangers, all by the flickering firelight, in which more magical creatures could be seen. Mrs. Wellwood, Miss Catchpole said, held strong beliefs about the imaginative lives of children
 75 being just as important in education as verbs and triangles. Her grateful family extended far beyond the pretty children clustered round her, into all sorts of homes, privileged and plain, wherever a book of tales could be bought or borrowed. People in the
 80 present age, she opined, did not leave their childhoods behind them. Tales for children, like Mrs. Wellwood’s, were read and discussed with delight, by old and young. There is an eager young child persisting in every lively grown-up.

1

The main purpose of the passage is to

- A) portray a central character through her work and family life.
- B) describe the changes that shaped a family’s identity.
- C) explain the personal values asserted by a central character.
- D) trace the development of a central character’s career.

2

The passage suggests that Olive Wellwood’s chosen response to certain disturbing aspects of life involves

- A) attempting to overlook their existence.
- B) using common sense to find practical solutions.
- C) accepting misfortune as inevitable.
- D) seeking the serenity of natural surroundings.

3

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

- A) Lines 1-2 (“Olive . . . matriarch”)
- B) Lines 6-11 (“there were children . . . sense”)
- C) Lines 24-27 (“In weak moments . . . disaster”)
- D) Lines 33-36 (“And she . . . pen”)

4

Which choice best captures the meaning of “her stories knew better” in line 33?

- A) Her stories offered a more judgmental perspective on the situation.
- B) Her stories preserved a factually accurate account of the situation.
- C) Her stories consisted of satirical criticism of the situation.
- D) Her stories revealed a more realistic understanding of the situation.

5

The inclusion in the narrative of Louisa Catchpole and her magazine article primarily has the effect of

- A) demonstrating Olive Wellwood’s popularity with children.
- B) illustrating a particular view of Olive Wellwood’s public image.
- C) establishing the necessity of individual attention for young children.
- D) exploring the philosophical theories that shape the Todefright household.

6

The passage indicates that Louisa Catchpole views Olive Wellwood and her family with

- A) great admiration.
- B) open affection.
- C) private amusement.
- D) objective detachment.

7

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

- A) Lines 49-53 (“The interviewer . . . style”)
- B) Lines 53-55 (“She asked . . . answers”)
- C) Lines 65-66 (“It was . . . special”)
- D) Lines 67-68 (“The interview . . . Goose”)

8

Which choice best captures what is meant by Louisa Catchpole’s “entering into the style” in line 53?

- A) Assuming the children’s way of listening
- B) Embracing the family’s style of talking
- C) Demonstrating her own literary elegance
- D) Imitating Olive Wellwood’s literary style

9

The detail that Olive Wellwood writes an ongoing story for each of the children illustrates the point that Olive

- A) supports herself through diligent work.
- B) regrets the deprivation of her own childhood.
- C) continues to add to her invented worlds.
- D) appreciates the widespread popularity of her tales.

Questions 10-18 are based on the following passage and supplementary material.

This passage is adapted from Michael Moyer, “Manipulation of the Crowd: How Trustworthy Are Online Ratings?” ©2010 by Scientific American.

Web sites such as Amazon, TripAdvisor and Yelp have long depended on customers to rate books, hotels and restaurants. The philosophy behind this so-called crowdsourcing strategy holds that the truest and most accurate evaluations will come from aggregating the opinions of a large and diverse group of people. Yet a closer look reveals that the wisdom of crowds may neither be wise nor necessarily made by a crowd. Its judgments are inaccurate at best, fraudulent at worst.

According to Eric K. Clemons, a professor of operations and systems management at the Wharton School of the University of Pennsylvania, online ranking systems suffer from a number of inherent biases. The first is deceptively obvious: people who rate purchases have already made the purchase. Therefore, they are disposed to like the product. “I happen to love Larry Niven novels,” Clemons says. “So whenever Larry Niven has a novel out, I buy it. Other fans do, too, and so the initial reviews are very high—five stars.” The high ratings draw people who would never have considered a science-fiction novel. And if they hate it, their spite could lead to an overcorrection, with a spate of one-star ratings.

Such negativity exposes another, more pernicious bias: people tend not to review things they find merely satisfactory. They evangelize what they love and trash things they hate. These feelings lead to a lot of one- and five-star reviews of the same product.

A controlled offline survey of some of these supposedly polarizing products revealed that individuals’ true opinions fit a bell-shaped curve—ratings cluster around three or four, with fewer scores of two and almost no ones and fives. Self-selected online voting creates an artificial judgment gap; as in modern politics, only the loudest voices at the furthest ends of the spectrum seem to get heard.

This self-selection process manifests itself in other ways. In a 2009 study of more than 20,000 items on Amazon, Vassilis Kostakos, a computer scientist at the University of Madeira in Portugal, found that a small percentage of users accounted for a huge majority of the reviews.

These super-reviewers—often celebrated with “Top Reviewer” badges and ranked against one another to encourage their participation—each contribute thousands of reviews, ultimately drowning out the voices of more typical users (95 percent of Amazon reviewers have rated fewer than eight products). “There is nothing to say that these people are good at what they do,” Kostakos says. “They just do a lot of it.” What appears to be a wise crowd is just an oligarchy of the enthusiastic.

The existence of super-reviewers has one unassailable advantage, though: they are rarely shills. The deliberate manipulation of review sites by people directly involved with a product—the author of the book, say—is one of the oldest and most difficult problems for online-rating communities to solve.

All things considered, an old truism could be consumers’ best advice: buyer beware.

Figure 1

Average Ratings of Movies
on the Internet Movie Database
(IMDb)

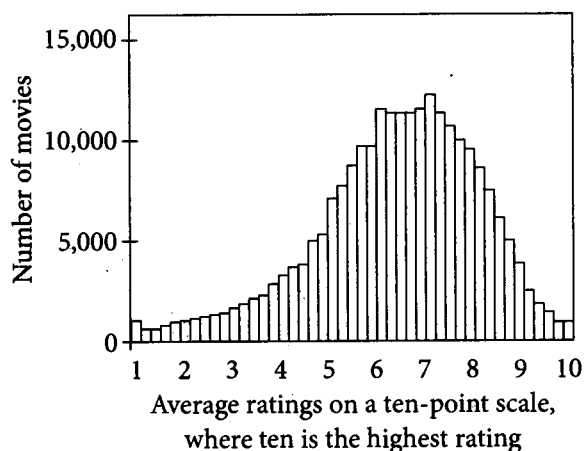


Figure 2

Average Ratings of Products
for Sale on Amazon.com

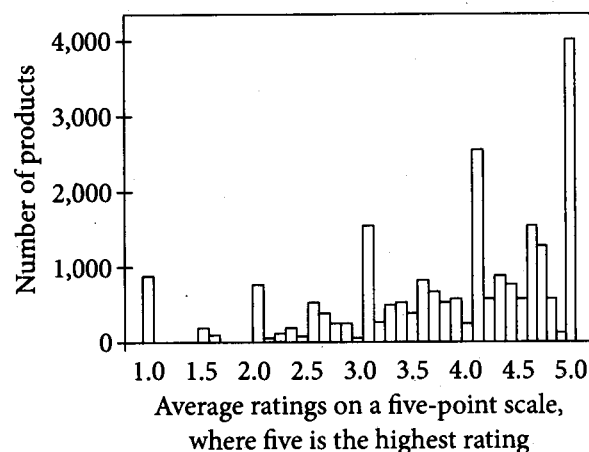


Figure 1 and figure 2 are adapted from Vassilis Kostakos, “Is the Crowd’s Wisdom Biased?” ©2009 by Vassilis Kostakos.

10

The primary purpose of the passage is to

- A) examine a proposal to improve the validity of online reviews.
- B) discuss some ways in which companies manipulate online reviews.
- C) analyze the motivations of people who produce online reviews.
- D) challenge a belief about the accuracy of online reviews.

11

The passage most strongly suggests which point about the practice of combining the opinions of a large number of online reviewers?

- A) It is a reliable way of determining the quality of products.
- B) It does not necessarily yield the results it is intended to.
- C) It minimizes the influence of falsified or self-promoting reviews.
- D) It enhances the freedom of expression of all but a small group of reviewers.

12

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

- A) Lines 3-7 ("The philosophy . . . people")
- B) Lines 7-9 ("Yet . . . crowd")
- C) Lines 20-21 ("Other . . . stars")
- D) Lines 58-61 ("The deliberate . . . solve")

13

As used in line 22, "draw" most nearly means

- A) take.
- B) attract.
- C) trace.
- D) portray.

14

The passage implies that people who perform online reviews are motivated by a desire to

- A) damage the reputations of certain manufacturers.
- B) influence the stock prices of companies they invest in.
- C) form contacts with other reviewers who seem to have the same tastes.
- D) express their strong opinions about the goods and services they review.

15

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

- A) Lines 23-25 ("And if . . . ratings")
- B) Lines 28-29 ("They evangelize . . . hate")
- C) Lines 41-45 ("In a . . . reviews")
- D) Lines 52-53 ("There . . . do")

16

As used in line 45, "accounted for" most nearly means

- A) explained.
- B) ascribed.
- C) rationalized.
- D) produced.

17

Which claim in the passage is most directly challenged by figure 1?

- A) Most online ratings are produced by super-reviewers.
- B) On the whole, online reviews tend to be more negative than positive.
- C) Online ratings tend to cluster at the lowest and highest ends of the scale.
- D) The reliability of online ratings is called into question by the presence of shills.

18

Based on figure 2, which of the following statements is true of products for sale on Amazon?

- A) A significant majority of those products receive the highest average rating.
- B) On average, those products are rated higher than are products sold by Amazon's online competitors.
- C) More of those products have an average rating at the highest level than have any other average rating.
- D) Those products have received increasingly higher average ratings over time.

Questions 19-27 are based on the following passage and supplementary material.

This passage is adapted from Gloria Dawson, "The Fast Food Fruit." ©2013 by Nautilus.

A truck is traveling on the freeway. Inside, stacks of bananas are piled high. Picked a few weeks ago at a plantation, they've traveled overseas in climate-controlled cargo ships, their color still green and unappetizing. But that won't last for long. A colorless gas seeps from an open pouch placed inside the truck, quietly transforming the fruit en route. By the time the tropical fruits are in your grocery basket, they are a golden yellow.

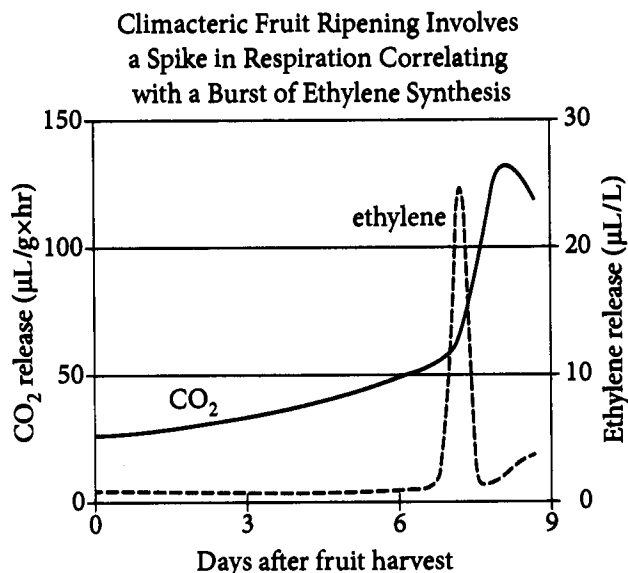
- 10 This is not science fiction, but yet another attempt at perfecting the tropical fruit delivery process—a new ripening-on-the-go trick that Professor Bheshe Bhandari and his Ph.D. student Binh Ho at the University of Queensland, Australia, are now
15 experimenting with. In his book, *Banana: The Fate of the Fruit that Changed the World*, Dan Koeppel says that the banana industry "invented fast food in a way." A banana may be healthier than a burger, but how it's brought to you is not all that different.
20 Before the fast-food industry learned to process, pack, and ship inexpensive temperature-controlled meals, banana carriers had already perfected their own shipping process. "If you look at the model of the industrialized supply chain, what they really
25 came up with was a lot closer to what a fast-food chain does," he says. The result "is bananas that arrive at the market on their final green day, and which will last exactly seven days before turning brown."
30 By the time bananas land on the supermarket shelf, their ripening process has already been carefully engineered through the use of three gases: ethylene, carbon dioxide, and oxygen.

- The banana is "a climacteric fruit, which means
35 that once the ripening process begins, you can't stop it," explains Randy Ploetz, a professor of plant pathology at the University of Florida. "So the idea is to harvest the fruits when they are mature but not ripening." When banana bunches are cut off at
40 harvest, they start to release ethylene, triggering a decrease of pectin and a breakdown of starch, which softens and sweetens the fruit. As part of that "senescence process," Ploetz adds, bananas also release carbon dioxide. But high levels of carbon
45 dioxide and ethylene would cause bananas to ripen too fast or to spoil before they arrive to consumers.

- Like many other climacteric fruits, bananas are sensitive to carbon dioxide—if carbon dioxide levels rise to more than 7 percent, the fruit will soften while
50 still green and won't taste good. So the transportation companies use a full-blown climate-control system for their capricious passengers. When bananas are loaded onto a ship, they are cooled off to 54 to 58 degrees Fahrenheit, depending on the length of
55 the future voyage, and the levels of oxygen and carbon dioxide are maintained at 5 percent each, according to Carrier Transicold, a company that designs trucks and ships to transport bananas worldwide. Plus, humidity levels are kept between
60 90 and 95 percent, to keep the fruit moist.

- Before bananas board refrigerated ships bound for foreign ports, plantation workers place a tracking device that looks like a complex calculator into each crate to record the climate-control data vital for the
65 fruits' health. The device stays with the dainty travelers throughout the entire journey until they arrive at a store. Since the 1930s, bananas always had to make a stopover between the ship and the supermarket—namely at a ripening room, a massive
70 warehouse where they are not only allowed to finally turn yellow, but are gassed with ethylene to quicken the process. Such rooms are expensive to maintain, and Bhandari and Ho are experimenting with ripening fruits en route. But gassing fruits inside
75 moving trucks is problematic—ethylene is combustible and can't safely be used in large volumes. So the scientists developed a way to store ethylene in a powder form.

- The new invention encapsulates ethylene into
80 modified cyclodextrin, a compound made up of sugar molecules bound together in a ring—essentially a form of starch. Cyclodextrin has cavities in its crystalline structure which can entrap the ethylene molecules. Cameron Turner,
85 whose role at the university is to commercialize new technologies, likens the structure to an egg carton—a degradable shell that hosts molecules rather than eggs. When a bag or box of the powder is opened in a truck full of produce, the cyclodextrin's crystalline
90 structure breaks down because of the humidity in the air—and begins to slowly release ethylene over time.



Adapted from Ross Koning, Plant Physiology Information website.

19

In the passage, the comparison of a fast-food burger to a banana primarily serves to

- A) highlight the similar complexities in fast-food and banana production.
- B) support the author's claim that the banana industry needs regulation.
- C) illustrate why bananas are cheaper than fast-food burgers to produce.
- D) provide examples of the types of foods affected by Koeppel's research.

20

According to the passage, tracking devices are placed into crates of bananas in order to

- A) record climate-control data.
- B) locate the crates after delivery.
- C) monitor truck drivers' progress.
- D) time the release of ethylene gas.

21

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

- A) Lines 2-5 ("Picked . . . unappetizing")
- B) Lines 39-42 ("When banana . . . fruit")
- C) Lines 42-44 ("As . . . release carbon dioxide")
- D) Lines 61-65 ("Before . . . health")

22

As used in lines 65-66, "dainty travelers" refers to

- A) plantation workers.
- B) bananas.
- C) Bhandari and Ho.
- D) tracking devices.

23

According to the passage, what problem did ethylene pose for Bhandari and Ho's project?

- A) Obtaining the equipment for spraying ethylene is costly.
- B) Determining the amount of gas to apply is complicated.
- C) Creating humid conditions for spraying gas is difficult.
- D) Using combustible gas in a moving truck is dangerous.

24

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

- A) Lines 30-33 ("By . . . oxygen")
- B) Lines 47-50 ("Like . . . good")
- C) Lines 74-77 ("But . . . volumes")
- D) Lines 88-91 ("When . . . time")

25

As used in line 87, “hosts” most nearly means

- A) welcomes.
- B) assembles.
- C) contains.
- D) serves.

26

According to the graph, climacteric fruits dramatically increase their release of both carbon dioxide (CO₂) and ethylene about how many days after being harvested?

- A) 0 to 1
- B) 4 to 5
- C) 7 to 8
- D) 9 to 10

27

According to the passage, banana ripening is engineered through the use of three gases. Which of the three gases is NOT plotted on the graph?

- A) Carbon dioxide
- B) Nitrogen
- C) Hydrogen
- D) Oxygen

Questions 28-37 are based on the following passages.

Passage 1 is adapted from an Independence Day address delivered in New Harmony, Indiana, by Frances Wright in 1828. Passage 2 is adapted from an address to the American Legion Convention delivered by Adlai E. Stevenson in 1952.

Passage 1

In continental Europe, of late years, the words “patriotism” and “patriot” have been used in a more enlarged sense than it is usual here to attribute to them, or than is attached to them in Great Britain.
 5 Since the political struggles of France, Italy, Spain, and Greece, the word “patriotism” has been employed, throughout continental Europe, to express a love of the public good; a preference for the interests of the many to those of the few; a desire for
 10 the emancipation of the human race . . . ; [and an] interest felt in the human race in general [rather] than that felt for any country, or inhabitants of a country, in particular. And “patriot,” in like manner, is employed to signify a lover of human liberty and
 15 human improvement rather than a mere lover of the country in which he lives, or the tribe to which he belongs.

Used in this sense, patriotism is a virtue, and a patriot a virtuous man. With such an interpretation,
 20 a patriot is a useful member of society, capable of enlarging all minds and bettering all hearts with which he comes in contact; a useful member of the human family, capable of establishing fundamental principles and of merging his own interests, those of
 25 his associates, and those of his nation in the interests of the human race. Laurels and statues are vain things and mischievous as they are childish; but could we imagine them of use, on such a patriot alone could they be with any reason bestowed. . . .

30 If such a patriotism as we have last considered should seem likely to obtain in any country, it should be certainly in this. In this which is truly the home of all nations and in the veins of whose citizens flows the blood of every people on the globe. Patriotism, in
 35 the exclusive meaning, is surely not made for America. Mischievous everywhere, it were here both mischievous and absurd. The very origin of the people is opposed to it. The institutions, in their principle, militate against it.

Passage 2

40 True patriotism, it seems to me, is based on tolerance and a large measure of humility.

There are men among us who use “patriotism” as a club for attacking other Americans. What can we say for the self-styled patriot who thinks that a
 45 Negro, a Jew, a Catholic, or a Japanese American is less an American than he? That betrays the deepest article of our faith, the belief in individual liberty and equality which has always been the heart and soul of the American idea. . . .

50 The anatomy of patriotism is complex. But surely intolerance and public irresponsibility cannot be cloaked in the shining armor of rectitude and righteousness. Nor can the denial of the right to hold ideas that are different—the freedom of man to think
 55 as he pleases. To strike freedom of the mind with the fist of patriotism is an old and ugly subtlety. . . .

Men who have offered their lives for their country know that patriotism is not the fear of something; it is the love of something. Patriotism with us is not the
 60 hatred of Russia; it is the love of this Republic and of the ideal of liberty of man and mind in which it was born, and to which this Republic is dedicated.

With this patriotism—patriotism in its large and wholesome meaning—America can master its power
 65 and turn it to the noble cause of peace. We can maintain military power without militarism; political power without oppression; and moral power without compulsion or complacency.

28 The explanations in lines 1-17 (“the words . . . he belongs”) primarily emphasize the qualities of

- A) populism and inclusion.
- B) nationalism and elitism.
- C) expansion and conquest.
- D) competition and fairness.

29 As used in line 31, “obtain” most nearly means

- A) acquire.
- B) become established.
- C) gain.
- D) begin planning.

30

In Passage 1, Wright suggests that the key quality of a person who contributes meaningfully to society is the

- A) skill to recognize the wishes and needs of his or her fellow citizens.
- B) ability to produce goods for consumption by other people.
- C) power to exert a positive influence on the thoughts and feelings of other people.
- D) capacity to influence other people to adopt his or her way of thinking.

31

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

- A) Lines 19-22 (“With such . . . in contact”)
- B) Lines 22-26 (“a useful . . . race”)
- C) Lines 28-29 (“but . . . bestowed”)
- D) Lines 32-34 (“In this which . . . globe”)

32

The third paragraph of Passage 1 (lines 30-39) primarily serves to explain why

- A) citizens of other nations are more patriotic than Americans.
- B) American institutions are unconcerned with patriotism.
- C) people of diverse backgrounds immigrated to America.
- D) narrow definitions of “patriotism” are inappropriate in America.

33

Which choice from Passage 2 provides the best evidence that Stevenson believes that patriotism can be misused?

- A) Lines 40-41 (“True patriotism . . . humility”)
- B) Lines 42-43 (“There are . . . Americans”)
- C) Lines 46-49 (“That betrays . . . idea”)
- D) Line 50 (“The anatomy . . . complex”)

34

In their speeches, both Wright and Stevenson are primarily concerned with

- A) the true meaning of patriotism.
- B) the history of American patriotism.
- C) political intrigue in continental Europe.
- D) the appropriateness of statues and other honors.

35

Wright and Stevenson most likely would agree with which statement?

- A) Patriotism is stronger in the United States than it is in Europe.
- B) The United States has undergone several crises of patriotism.
- C) Selfish patriotism is especially inappropriate in the United States.
- D) Too much attention to individual achievement is harmful to patriotism.

36

Who is the most likely audience for both speeches?

- A) American citizens who are concerned about patriotism
- B) American leaders who wish to increase patriotism
- C) Europeans who have adopted a new type of patriotism
- D) People throughout the world who have been accused of lacking patriotism

37

Wright and Stevenson most likely would agree that the most important aspect of patriotism is

- A) support for one's national leaders.
- B) suspicion of one's enemies.
- C) reverence for heroes.
- D) tolerance of difference.

Questions 38-47 are based on the following passage.

This passage is adapted from Robert T. Bakker, *The Dinosaur Heresies*. ©1986 by Robert T. Bakker. "Duckbill dinosaurs" is a term that encompasses several species of herbivorous dinosaurs.

- Duckbill dinosaurs did not display the deadly cranial armature worn by *Triceratops*, a large, three-horned herbivorous dinosaur. Nonetheless the duckbill group enjoyed an extraordinary
- 5 evolutionary flourish of head ornaments and adaptations in the final days of the Cretaceous, a geologic period following the Jurassic. The term "duckbill" is a biomechanical misnomer. True, the duckbill dinosaurs did have wide, flattened beaks,
- 10 which at a distance vaguely resembled that of a mallard. However, the edges of their beak were turned down into a sharp, cookie-cutter edge, sheathed in life by a self-sharpening horn. The entire apparatus was a leaf-cropping adaptation for slicing
- 15 off mouthfuls of tough fodder in a single bite. Duckbill teeth were one of the true marvels of mastication, cited everywhere in texts on dental evolution. Instead of one single row of teeth along each jawline, the duckbill had multiple rows, which
- 20 combined to make a leaf-shredding surface equivalent in function to an ever-sharp carrot grater. No evolutionary device has ever evolved to masticate tough plant fiber more effectively than the dental shredder of the duckbills.
- 25 Although the feeding devices of the duckbills have provoked no end of wonder among paleontologists since the first duckbill was excavated in the phosphate fertilizer mines of New Jersey in the 1850s, it is the array of duckbill head
- 30 ornamentation that stirs up the most puzzlement and debate. The common Lance Creek duckbill, *Edmontosaurus*, seems built to a no-nonsense, practical design. Its skull houses the beak, teeth, jaw muscles, and sense organs. But close relatives from
- 35 Alberta and New Mexico show no such restraint in the headgear: *Parasaurolophus* carried a double-hollow bony tube like a trombone slide on the back of its skull; *Saurolophus* had a solid bony spike in the same position; *Hypacrosaurus* sported a
- 40 thin-shelled bony crest rising high above the full length of its forehead and skull table.

This cranial exuberance at first glance reminds one of all the head appendages some families of birds employ to show off in premating rituals, such as the

45 combs of roosters, the domed foreheads of some species of geese, the crests of cassowaries. And perhaps here the first impression is the correct one. Sex and premating ritual are parts of the basic evolutionary game: genes that produce adaptations
 50 which succeed in increasing their representation in the next generation are the genes that survive. The genes of the dinosaurs must have played by the same statistical rule. If a garish head crest and some accompanying behavior, such as a strutting
 55 head-bobbing walk, made the male *Parasaurolophus* more attractive to the female and more intimidating to his rivals, then eventually the genes responsible for this equipment and its use would be fixed in the species. For most of this century, American
 60 paleontologists avoided sexual interpretations of dinosaur structures.

The European contemporaries of American scientists weren't so prudish. The Swedish paleontologist Carl Wiman hired an
 65 American dinosaur hunter, Charles Sternberg, to quarry and crate duckbills from New Mexico and horned dinosaurs for the Swedish Museum at Uppsala. Sternberg sent a magnificent *Parasaurolophus* to Wiman, who noticed that the
 70 double-hollow tube of the crest was simply a U-shaped elaboration of the air tract from its nostril to its windpipe. Wiman was a broadly educated naturalist, well aware of the multitudinous ways in which modern species of bird, frog, and mammal
 75 attract their mates by making noise—hooting, gurgling, chirping, and bellowing. So what was Wiman to think of the U-tube in the duckbill's air passages? It looked like a trombone, it *was* a trombone! If the duckbill inhaled or exhaled with
 80 force, the U-tube would be a resonating chamber, enriching the tone and amplifying the noise. Hollow crests in other duckbills also connected the throat to nostrils, and the variety of crest shapes from species to species would certainly produce a variety
 85 of sounds specific to that species.

38

The passage as a whole is best described as

- A) a sustained argument.
- B) a philosophical analysis.
- C) an informative overview.
- D) a chronological history.

39

Over the course of the passage, the main focus shifts from a discussion of

- A) commonalities between duckbills and *Triceratops* to a discussion of features exclusive to duckbills.
- B) the discovery of duckbill fossils to a discussion of theories about duckbill genetics.
- C) anatomical differences among duckbills to a discussion of behavioral differences among duckbills.
- D) duckbill feeding devices to a discussion of the variety and possible uses of duckbill head ornamentation.

40

As used in line 16, "true" most nearly means

- A) typical.
- B) genuine.
- C) steadfast.
- D) accurate.

11

The author uses the words “at first glance” (line 42) and “perhaps” (line 47) primarily to

- A) create an indecisive tone that reflects the uncertainty described throughout the paragraph.
- B) acknowledge the seeming plausibility of a claim that is refuted later in the paragraph.
- C) indicate the initially tentative nature of a view that is supported later in the paragraph.
- D) emphasize an absence of evidence that invites the speculations offered throughout the paragraph.

12

Which statement best describes the reasoning the author employs in the third paragraph (lines 42-61)?

- A) The author explains a behavioral trait unique to duckbills by drawing an analogy with a behavioral trait unique to birds.
- B) The author accounts for the presence of certain attributes in duckbills by appealing to a general biological principle.
- C) The author refutes a theory about the purpose of particular features in duckbills by proving that the theory rests on a false assumption.
- D) The author shows that an argument about a single duckbill species applies to all duckbill species.

13

Which choice best states a central idea of the passage?

- A) The function of duckbills’ head ornamentation was likely defensive.
- B) Some cranial characteristics of duckbills may have been linked to duckbill mating activities.
- C) Scientists have failed to reach a consensus about the significance of duckbills’ unusual teeth.
- D) American and European paleontologists have irreconcilable theories about the likely mating rituals of duckbills.

11

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

- A) Lines 25-31 (“Although . . . debate”)
- B) Lines 53-59 (“If . . . species”)
- C) Lines 62-63 (“The . . . prudish”)
- D) Lines 79-81 (“If . . . noise”)

15

The author most strongly suggests that, compared with European paleontologists, American paleontologists tended to be more

- A) influenced by propriety.
- B) reluctant to collaborate.
- C) insecure about their findings.
- D) theoretical in their thinking.

16

It can most reasonably be inferred from the passage that duckbills would have been able to

- A) mate with duckbills of species other than their own and produce fertile offspring.
- B) adapt to a much wider variety of ecosystems than other groups of dinosaurs could.
- C) use their cranial ornamentation to fend off rivals physically during the competition for mates.
- D) distinguish sounds made by members of their species from sounds made by other duckbill species.

17

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

- A) Lines 34-41 ("But . . . table")
- B) Lines 42-46 ("This . . . cassowaries")
- C) Lines 48-51 ("Sex . . . survive")
- D) Lines 82-85 ("Hollow . . . species")

STOP

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

Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

DIRECTIONS

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

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

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

Questions 1-11 are based on the following passage.

The Fitness Trainer in Chief

Theodore Roosevelt, often considered one of the most dynamic presidents of the United States, is known for accomplishments as diverse as negotiating the end of the Russo-Japanese War, fighting to eliminate corruption in business and politics, and founding the modern conservation movement. He was also a significant champion of healthful habits, believing that exercise, good nutrition, and **I** someone who spends time outdoors benefited one’s body and character.

- I**
- A) NO CHANGE
 - B) time spent
 - C) to be spending time
 - D) for someone to spend time

When Roosevelt was a child, he suffered from a number of ailments, including chronic asthma, but he was determined not to let his physical condition limit his activities. After his father installed a home gymnasium, young Roosevelt undertook a daily exercise regimen. He also went on to participate in several **2** sports. While he worked as a rancher in the Dakota Territory, he began to develop what would become a lifelong enjoyment of vigorous outdoor activity and a deep appreciation of nature.

As president, Roosevelt continued to enjoy a lifestyle of exercise and physical activity. He called this lifestyle the strenuous life. He regularly swam in the Potomac River, and **3** won reelection as president in 1904. In addition to practicing the strenuous life himself, he advocated it for **4** others, publishing a book—titled *The Strenuous Life*, in 1900. He was also known to invite

2

Which choice makes the focus of the paragraph clearest?

- A) NO CHANGE
- B) sports, but no one expected him to go into politics.
- C) sports, and he studied at Harvard College.
- D) sports, though he spent much time indoors reading as well.

3

Which choice gives additional supporting information that is most similar to the example already in the sentence?

- A) NO CHANGE
- B) became a war hero after the Battle of Santiago.
- C) frequently fought against corrupt political machines.
- D) often boxed, wrestled, and played tennis.

1

- A) NO CHANGE
- B) others; publishing a book titled *The Strenuous Life*,
- C) others, publishing a book—titled *The Strenuous Life*—
- D) others, publishing a book titled *The Strenuous Life*,

White House visitors to join him on **5** long arduous, outdoor treks that often involved swimming and rock climbing. Most visitors were flattered to be invited, yet all but those in peak condition found an outing with Roosevelt to **6** be an endeavor that was one of the most demanding physical challenges of their lives.

In addition to advocating for the strenuous life by example and in his writing, Roosevelt used his position as president to enact new policies intended to **7** improve the importance of health and wellness to the public.

8 However, convinced that many military officers had become too accustomed to comfortable office jobs and

9 was unprepared for the physical rigors of war, he instituted new fitness standards for the United States

- 5**
- A) NO CHANGE
 - B) long and arduous, outdoor
 - C) long, arduous outdoor
 - D) long, arduous, outdoor,

- 6**
- A) NO CHANGE
 - B) be, as an endeavor, one of the most demanding physical challenges of their lives.
 - C) be one of the most demanding physical challenges of their lives.
 - D) be, among all the physical challenges of their lives, one of the most demanding.

- 7**
- A) NO CHANGE
 - B) emphasize
 - C) enhance
 - D) intensify

- 8**
- A) NO CHANGE
 - B) Nonetheless,
 - C) For example,
 - D) Still,

- 9**
- A) NO CHANGE
 - B) were
 - C) has been
 - D) will be

Army. When some objected that his standards were too

10 harsh, Roosevelt responded by doing himself what he expected the officers to do.

Roosevelt's legacy of advancing healthful living includes his efforts to conserve natural resources. Specifically, he was responsible for the establishment of some of the first national parks, an act he hoped would encourage people to appreciate nature and enjoy physical activity. **11**

10

- A) NO CHANGE
- B) harsh, therefore
- C) harsh, so
- D) harsh;

11

At this point, the writer wants to add a concluding sentence that restates the main point of the passage. Which choice best accomplishes this goal?

- A) However, it was not until much later in the twentieth century that Theodore Roosevelt National Park was established in his honor.
- B) His interests were so widespread that he ended up with about 2,000 published works on topics including travel, politics, and natural history.
- C) By embracing and promoting the strenuous life, Roosevelt not only overcame his own physical limitations but also led others to appreciate the value of healthful living.
- D) In fact, Theodore Roosevelt Island in Washington, D.C., was designed to have an abundance of trees and miles of trails as an homage to Roosevelt's love of the outdoors.

Questions 12-22 are based on the following passage.

Group Not So Dynamic

In a brainstorming session, people get together and **12** proposes any and all ideas that come to mind. This practice is popular in business organizations such as the design firm IDEO, **13** at IDEO it is “practically a religion,” according to general manager Tom Kelley. IDEO is best known as the company that designed the first Apple mouse. However, recent studies have shown that individuals working on their own produce a larger number and a wider variety of ideas than they would as a brainstorming group. In light of this research, business leaders should reconsider their faith in brainstorming.

In a study at Texas A&M University, students were asked to come up with ways to improve their school: some students were asked to brainstorm as a group, whereas an equal number were asked to **14** generate ideas on their own at a computer. For both groups, all of the best ideas were produced in the first five minutes; after that, the number and quality of the ideas fell off.

15

12

- A) NO CHANGE
- B) to propose
- C) proposing
- D) propose

13

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

14

- A) NO CHANGE
- B) think up stuff
- C) consolidate their impressions
- D) list a bunch of ideas

15

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

But in those five minutes, students who had worked alone came up with 44 percent more ideas than those who had participated in the brainstorming session.

Should the writer make this addition here?

- A) Yes, because it provides an explanation for the greater efficiency of students working individually.
- B) Yes, because it supports the passage’s argument that individuals are more productive working alone than in a brainstorming group.
- C) No, because it undermines the paragraph’s claim about the similarities between the two groups.
- D) No, because it introduces an aspect of the study that is irrelevant to the main idea of the paragraph.

[1] Some people in a brainstorming session may be **16** hesitant to contribute for fear that their ideas may not be well received by the group, especially if it's a group of their colleagues. [2] Psychologists who have examined the Texas A&M study **17** posits that simply being in a group setting may hamper individuals' creativity in a number of ways. [3] As a consequence, many potentially good ideas go unexpressed. [4] Attempts to make people more comfortable, such as setting ground rules prohibiting **18** criticism—can have an undesired effect in that the group may spend too much time discussing a weak idea simply to avoid seeming critical of the person who proposed it. [5] In addition, not everyone bothers to make contributions in a brainstorming session, particularly in larger groups. **19**

16

- A) NO CHANGE
- B) hesitant and reluctant
- C) both reluctant and unwilling
- D) uncomfortable as well as reluctant when called upon

17

- A) NO CHANGE
- B) having posited
- C) positing
- D) posit

18

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

19

To make this paragraph most logical, sentence 1 should be placed

- A) where it is now.
- B) after sentence 2.
- C) after sentence 3.
- D) after sentence 5.

Ironically, one of the largest hindrances to a brainstorming session can occur when a good idea is proposed. When someone introduces a feasible solution to a problem that is **20** accepted for a good idea, other group participants will often engage in a process called social matching. When this occurs, instead of adding any useful new ideas, participants will offer suggestions that simply support the good idea that was already proposed. This process **21** reduces entire areas of good ideas and possibilities that don't happen to conform to the ideas that have already been proposed. **22** In the future, companies in search of innovative ideas should send employees to their cubicles, not to a conference room.

20

- A) NO CHANGE
- B) accepted as
- C) excepted with
- D) excepted from

21

Which choice best supports the writer's discussion of social matching in the previous sentences?

- A) NO CHANGE
- B) often determines
- C) demonstrates
- D) can effectively preclude

22

The writer wants a conclusion that emphasizes the body of evidence that has been used to support the argument of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Future studies will demonstrate that
- C) Even though brainstorming remains popular,
- D) All of these results show that

Questions 23-33 are based on the following passage.

Georges Méliès: The Father of Special Effects

When movies were introduced at the turn of the twentieth century, some people viewed these motion pictures as novelties, **23** no more than just moving photographs. Georges Méliès, **24** especially, saw the potential that film had as a medium for telling meaningful stories enlivened by dramatic effects. His vision would make him a pioneer in the motion picture industry whose influence is still felt.

[1] A professional magician and stage director in Paris, Méliès was present for one of the first demonstrations of motion picture technology in 1895. [2] The films he saw immediately inspired him to create his own stories on film, and soon he acquired a camera and established the first motion picture studio in Europe. [3] At a time when most movies were mundane depictions of everyday life, Méliès set about staging rich and complex narratives. [4] His films were filled with fantasy, illusions, and humor. [5] Using his technical skills and magician's intuition, he created several techniques that are still used in the film industry, including stop-motion, slow motion, dissolve, and fade-out. [6] His ingenuity and contributions to visual enhancements in film would earn him the title the Father of Special Effects from film historians. [7] Technologically ambitious as well, Méliès began to experiment with various camera tricks to depict his films' fantastical elements. **25**

- 23**
- A) NO CHANGE
 - B) being no more than
 - C) no more than
 - D) that they were no more than

- 24**
- A) NO CHANGE
 - B) therefore,
 - C) though,
 - D) furthermore,

25

To make this paragraph most logical, sentence 7 should be placed

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

Over time, Méliès continued to push the boundaries of what a film could be. His **26** best-known film, *A Trip to the Moon*, released in 1902, broke new ground in special **27** effects: most memorably, it featured an image of a rocket ship crashing into the eye of the man in the moon. Lasting nearly fifteen minutes, *A Trip to the Moon* was, at the time, the longest film to have been produced, but it illustrated that people were interested in movies that were more than a few minutes long. Dazzling audiences with **28** it's visual effects and part-whimsical, part-dramatic adventure storyline, **29** and the film went on to become the first international blockbuster. Méliès' successes firmly established the fictional narrative **30** to be cinema's primary product.

26

- A) NO CHANGE
- B) best-known, in addition to being his most famous
- C) best-known, as well as most famous
- D) best-known, and most famous

27

Which choice adds the most relevant supporting detail to the sentence?

- A) NO CHANGE
- B) effects: like his other films, it was essentially a filmed version of a stage play, but with camera effects to create visual interest.
- C) effects, taking up nearly one entire film reel and featuring 30 scenes.
- D) effects, showing that movies could be more than just novelties.

28

- A) NO CHANGE
- B) its visual effects
- C) its visual effect's,
- D) it's visual effects,

29

- A) NO CHANGE
- B) the film went on
- C) but the film went on
- D) DELETE the underlined portion.

30

- A) NO CHANGE
- B) being
- C) in being
- D) as

31 However, technology changed rapidly, and Méliès saw his work decline in popularity as new innovators began experimenting with techniques that made his films seem dated and static to many. 32 Méliès was unable to compete in the emerging business climate of cinema. He soon found himself out of the motion picture business altogether. In his later years, however, he was recognized as a trailblazer of cinema and awarded the Legion of Honour—France’s highest 33 distinction, for demonstrating the possibilities of film. Méliès’ films, many of which have been restored and are now widely available, continue to captivate historians and movie fans alike.

31

- A) NO CHANGE
- B) Moreover,
- C) Thus,
- D) DELETE the underlined portion and capitalize the next word.

32

Which choice is the best way to combine the underlined sentences?

- A) Méliès, soon finding himself out of the motion picture business altogether, was unable to compete in the emerging business climate of cinema.
- B) Méliès would find himself out of the motion picture business altogether; he was unable to compete in the emerging business climate of cinema.
- C) Unable to compete in the emerging business climate of cinema, Méliès soon found himself out of the motion picture business altogether.
- D) Competing in the emerging business climate was something that he was unable to do, and Méliès soon found himself out of the motion picture business altogether.

33

- A) NO CHANGE
- B) distinction:
- C) distinction—
- D) distinction;

Questions 34-44 are based on the following passage and supplementary material.

The Power of Posture

Primatologists, scientists who study primates, have long observed that individuals at the top of the primate hierarchy display distinctly different postures from

34 lower-status individuals. In short, dominant primates tend to be expansive—spreading out their arms and legs, pulling their bodies up to full height, taking up more space—while others are contractive, protecting their bodies and making themselves as small as possible.

35 Interestingly, these postures correlate with levels of testosterone, a hormone associated with power, and cortisol, a hormone associated with stress. Primates that display expansive postures typically have high testosterone and low cortisol, while those using contractive postures tend to have low testosterone and high cortisol.

31

- A) NO CHANGE
- B) lower-status individuals' displays.
- C) that of lower-status individuals.
- D) those displayed by lower-status individuals.

35

- A) NO CHANGE
- B) As a result,
- C) On the other hand,
- D) At the same time,

Until recently, primatologists believed that these postures and hormones were essentially fixed and unchanging in individuals; that is, primates were born a certain way and never changed. But closer observations have **36** detected a different story. It turns out that, in instances where a dominant primate has died and another primate **37** had to assume the alpha role, the animal's postures—and, remarkably, hormone levels—have been seen to change, in just a matter of days.

38 Social psychologist Amy Cuddy learned about this phenomenon. Then she began to wonder about its applicability to human behavior. Do humans, like other primates, show a relationship between posture and hormone levels? Cuddy devised an experiment: she measured the testosterone and cortisol levels of 42 men and women, then asked the research subjects to position

36

- A) NO CHANGE
- B) revealed
- C) betrayed
- D) exposed

37

- A) NO CHANGE
- B) has
- C) having
- D) has had

38

Which choice most effectively combines the underlined sentences?

- A) Social psychologist Amy Cuddy began to wonder about this phenomenon's applicability to human behavior after she learned about it.
- B) Social psychologist Amy Cuddy learned about this phenomenon, and then Cuddy began to wonder about its applicability to human behavior.
- C) Social psychologist Amy Cuddy learned about this phenomenon, and its applicability to human behavior made her begin to wonder.
- D) Upon learning about this phenomenon, social psychologist Amy Cuddy began to wonder about its applicability to human behavior.

their bodies in either expansive (feet spread, arms out) or contractive (hunched over, arms crossed) postures and hold those postures for one minute. Each subject then switched to a different high-power or low-power posture and held **39** them for another minute. **40** Cuddy's subjects hormone levels were then measured a second time.

The results were striking: a mere *two minutes* in expansive or contractive postures caused noticeable changes in subjects' testosterone and cortisol levels. As chart 1 shows, testosterone levels decreased slightly among the subjects in low-power postures and **41** increased by a smaller amount among those in high-power postures. Chart 2, for cortisol, shows

39

- A) NO CHANGE
- B) it
- C) those
- D) those postures

40

- A) NO CHANGE
- B) Cuddy's subjects'
- C) Cuddys' subject's
- D) Cuddys' subjects

41

- A) NO CHANGE
- B) increased more substantially
- C) stayed about the same
- D) decreased similarly

Chart 1

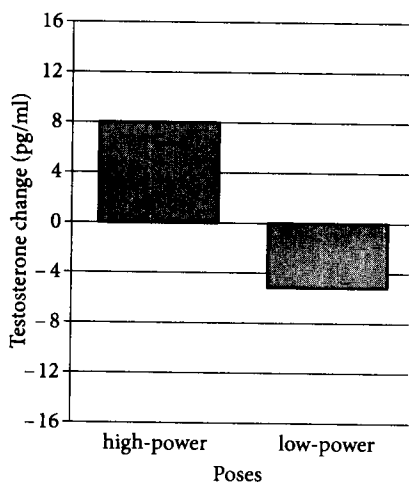
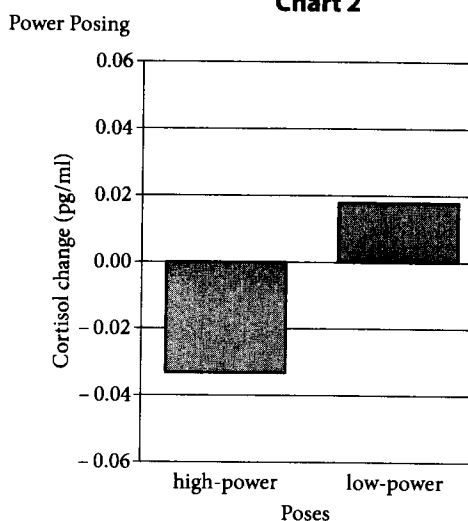


Chart 2



Adapted from Dana R. Carney et al., "Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance." ©2010 by Carney et al.

42 a less dramatic swing, with levels decreasing among the high-power posers and increasing for the low-power posers. 43 Cuddy is already demonstrating the practical applications of these 44 findings, she is coaching her students to spend at least two minutes in an expansive posture before every exam or class presentation. Anecdotal evidence from students suggests that this unusual practice can have powerful results.

12

- A) NO CHANGE
- B) the same information,
- C) essentially the reverse,
- D) a quirky variation,

13

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

Taken together, the charts highlight the particular benefits of high-power posing, which affects both testosterone and cortisol levels more positively and to a greater degree than low-power posing.

Should the writer make the addition here?

- A) Yes, because it accurately reflects the information provided in the charts and makes a connection to the next sentence.
- B) Yes, because it introduces relevant supporting information not provided in either chart.
- C) No, because it makes a claim that is unrelated to the rest of the passage.
- D) No, because it conflicts with the information provided in chart 1.

11

- A) NO CHANGE
- B) findings that she is
- C) findings also
- D) findings,

STOP

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



Math Test – No Calculator

25 MINUTES, 17 QUESTIONS

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

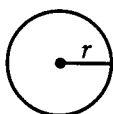
DIRECTIONS

For questions 1-13, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 14-17, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 14 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

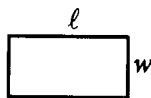
1. The use of a calculator is **not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

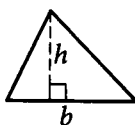


$$A = \pi r^2$$

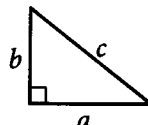
$$C = 2\pi r$$



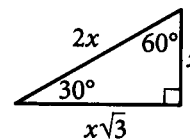
$$A = \ell w$$



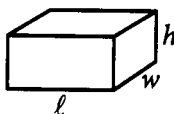
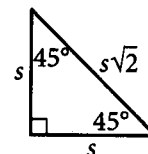
$$A = \frac{1}{2}bh$$



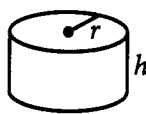
$$c^2 = a^2 + b^2$$



Special Right Triangles



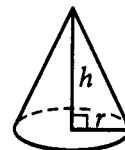
$$V = \ell wh$$



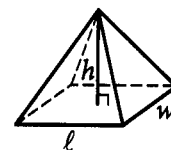
$$V = \pi r^2 h$$



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



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



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

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

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

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

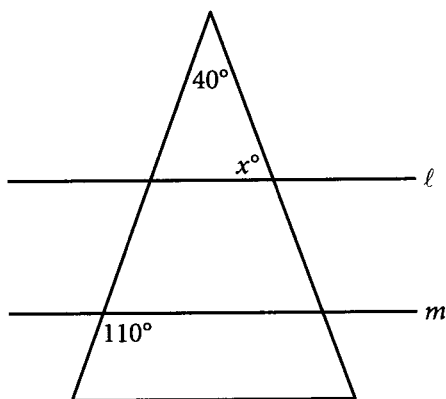


1

Which of the following is a factor of $x^2 + 6x + 9$?

- A) x
- B) $x + 3$
- C) $x + 6$
- D) $x + 9$

2



In the figure above, lines ℓ and m are parallel. What is the value of x ?

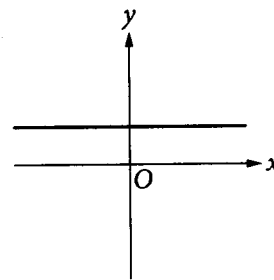
- A) 30
- B) 40
- C) 70
- D) 110

3

Which of the following is the solution of $3.2x + 14 = -4$?

- A) -5.625
- B) -3.125
- C) 3.125
- D) 5.625

1



The graph above could represent which of the following equations?

- A) $y = 2$
- B) $x = 2$
- C) $y = 2x$
- D) $x = 2y$



5

$$\begin{aligned}3x + 4y &= 18.5 \\ 2x - y &= 16\end{aligned}$$

Which of the following pairs of coordinates (x, y) satisfies the system of linear equations above?

- A) $(4, -8)$
- B) $(7.5, -1)$
- C) $(10, 4)$
- D) $(11, -5.5)$

6

Dara drove from home to the airport to pick up her friend and then came back home on the same route. Her average speed on the way to the airport was 55 miles per hour (mph), and her average speed on the way back home was 45 mph. If the total driving time was 1 hour and 20 minutes, how far, in miles, is the airport from Dara's home?

- A) 29.7
- B) 33
- C) $\frac{100}{3}$
- D) 66

7

If $f(x) = 9x + 3$ and $g(x) = 2x^2 - 4x - 9$, which of the following expressions is equivalent to $f(x) - g(x)$?

- A) $-2x^2 + 13x + 12$
- B) $-2x^2 + 5x + 12$
- C) $2x^2 - 13x - 12$
- D) $2x^2 - 5x - 12$

8

Which of the following is equivalent to

$$\left(\sqrt[3]{x^{11}}\right)\left(\sqrt[3]{x}\right)?$$

- A) x^9
- B) x^6
- C) x^4
- D) x^3



9

The average rate of change of a population over a period of t years is calculated using the formula $r = \frac{p_2 - p_1}{t}$, where p_1 is the population at the beginning of the period and p_2 is the population at the end of the period. What is p_1 in terms of p_2 , r , and t ?

- A) $p_1 = rtp_2$
- B) $p_1 = \frac{p_2}{tr}$
- C) $p_1 = \frac{tr}{p_2}$
- D) $p_1 = p_2 - rt$

10

The expression $(x^3 + 2x^2) - (x^2 + 6x)$ can be rewritten as $(x + a)(x + b)(x + c)$, where a , b , and c are constants. What is the value of $a + b + c$?

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

11

A boat is traveling in a river against the current. The boat has a maximum speed of 15 miles per hour in still water, and the river's current is 4 miles per hour. What is the maximum distance d , in miles, the boat can travel against the current in terms of t , in hours?

- A) $d = 19t$
- B) $d = 15t + 4$
- C) $d = 11t$
- D) $d = 15t - 4$



12

$$x^2 - 15x + c = 0$$

In the quadratic equation above, c is a constant. If the equation has two solutions that are positive integers, which of the following CANNOT be the value of c ?

- A) 16
- B) 26
- C) 36
- D) 56

13

$$y = ax + b$$

The equation above models the relationship between the income y and the number of years of study beyond high school x , where a and b are constants. If this equation is graphed in the xy -plane, the y -intercept of this graph predicts which of the following?

- A) A person's income x years beyond high school
- B) A person's average increase in income each year
- C) The income of a person who has not studied beyond high school
- D) The ratio of a person's income to the number of years of study beyond high school

**DIRECTIONS**

For questions 14–17, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

Write answer in boxes. →

Answer: $\frac{7}{12}$

← Fraction line

Grid in result.

7	/	1	2
0	0	0	
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5

← Decimal point

	2	.	5
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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

2	/	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

.	6	6	6
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

.	6	6	7
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

Answer: 201 – either position is correct

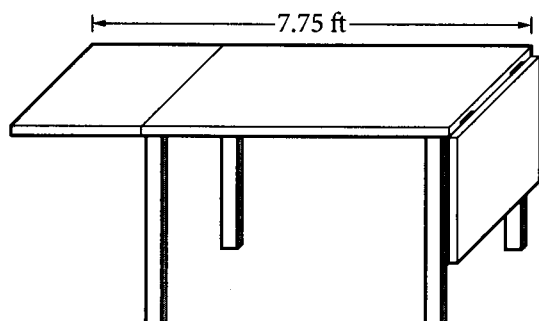
2	0	1
	0	0
1	1	1
2	2	2
3	3	3

2	0	1
	0	0
1	1	1
2	2	2
3	3	3

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



11



A carpenter specializes in building drop-leaf tables with leaves of equal size on each end. The figure above shows the length of such a table when one leaf is dropped. If the length when both leaves are raised cannot exceed 10 feet, what is the minimum length of the table top, in feet, if both leaves are dropped?

15

If $(x + 12)(x - 7) = ax^2 + bx + c$ for all values of x , where a , b , and c are constants, what is the value of b ?

16

The prices of the ferry tickets for adults and seniors differ, and children ride for free. During a ride in the ferry, there were 34 adults, 22 children, and 8 seniors. In the next ride, there were 24 adults, 28 children, and 8 seniors. If the ferry collected \$251 from the first ride and \$186 from the second ride, what was the price, in dollars, of an adult ticket? (Disregard the \$ sign when gridding your answer. If, for example, your answer is \$1.37, grid 1.37)

17

In the xy -plane, the graph of $y = x^2 + a$ contains the points $(-2, 7)$ and $(4, b)$. What is the value of b ?

STOP

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

No Test Material On This Page



Math Test – Calculator

45 MINUTES, 31 QUESTIONS

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

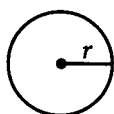
DIRECTIONS

For questions 1-27, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 28-31, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 28 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

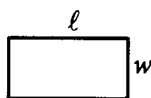
1. The use of a calculator is permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the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

REFERENCE

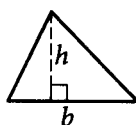


$$A = \pi r^2$$

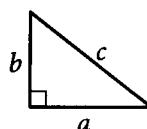
$$C = 2\pi r$$



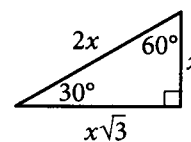
$$A = \ell w$$



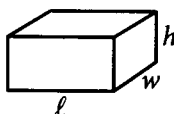
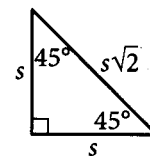
$$A = \frac{1}{2}bh$$



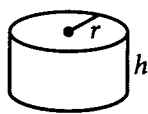
$$c^2 = a^2 + b^2$$



Special Right Triangles



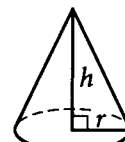
$$V = \ell wh$$



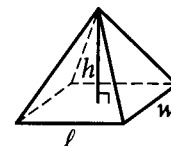
$$V = \pi r^2 h$$



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



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



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

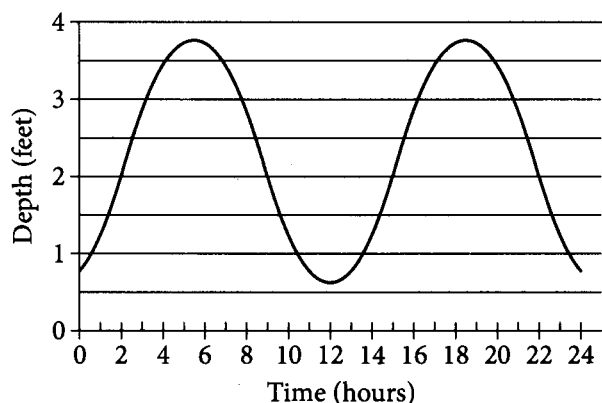
The number of degrees of arc in a circle is 360.

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.



1



The depth of an ocean close to the shore varies daily as a result of changing tides. The graph above models the depth, in feet, of the ocean near the shore at Cape May, New Jersey, over a 24-hour period, where time t corresponds to the number of hours after 12:00 a.m. During the 24-hour period, how many times is the ocean's depth exactly 2 feet?

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

2

A hardcover book has sheets of paper that are each 0.1 millimeter thick and a front cover and a back cover that are each 2 millimeters thick. What is the total thickness, in millimeters, of a book that has n sheets of paper?

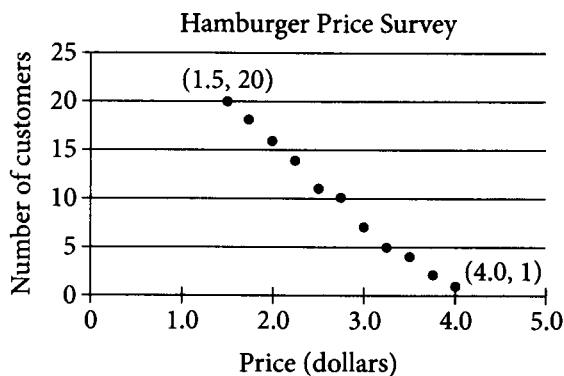
- A) $f(n) = 4 + 0.1n$
- B) $f(n) = 2 + 0.1n$
- C) $f(n) = 0.4 + 0.1n$
- D) $f(n) = 0.2 + 0.1n$



Questions 3 and 4 refer to the following information.

The district manager of a fast-food restaurant is trying to determine the selling price of a new hamburger. He surveyed 20 restaurant customers selected at random and asked those customers what prices they would be willing to pay for the new hamburger. The table and scatterplot below show the number of customers who are willing to pay for the hamburger at different prices.

Price (dollars)	Number of customers
1.50	20
1.75	18
2.00	16
2.25	14
2.50	11
2.75	10
3.00	7
3.25	5
3.50	4
3.75	2
4.00	1



Which of the following best describes how the number of customers willing to buy the hamburger changes as the price of the hamburger increases?

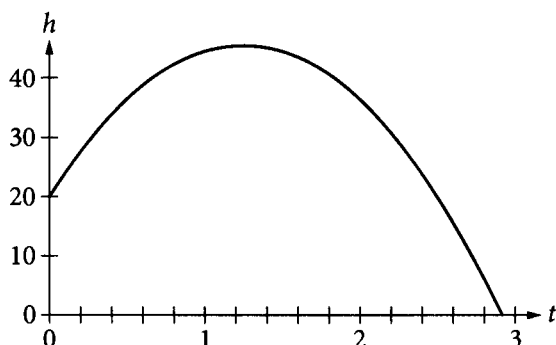
- A) The number of customers remains constant.
- B) The number of customers increases linearly.
- C) The number of customers decreases linearly.
- D) The number of customers decreases exponentially toward zero.

Which of the following equations best models the data for the restaurant in the scatterplot, where x is the price in dollars and y is the number of customers?

- A) $y = -8x + 32$
- B) $y = -32 + 8x$
- C) $y = -8x - 32$
- D) $y = 32(8)^{-x}$



5



The graph above shows the height h , in feet, of a ball t seconds after it was thrown from the top of a building. Which of the following must be true?

- A) The ball was thrown downward from a height of 20 feet.
- B) The ball was thrown upward from a height of 20 feet.
- C) The ball was thrown horizontally from a height of 20 feet.
- D) The ball was thrown upward with a velocity of 20 feet per second.

6

Jenny traveled from the United States to Argentina. She exchanged 55 US dollars for 324.95 Argentine pesos. At this rate, which of the following functions is closest to the number of Argentine pesos Jenny could expect to receive in exchange for d US dollars?

- A) $f(d) = 0.17d$
- B) $f(d) = 5.91d$
- C) $f(d) = 55d + 324.95$
- D) $f(d) = 324.95d - 55$



7

Which equation is equivalent to the statement “5 times the sum of 2 and a number is equal to 8 less than 3 times the number,” if the number is represented by n ?

- A) $n + (2)(5) = 8 - 3n$
- B) $(2)(5) + n = 3n - 8$
- C) $5(n + 2) = 8 - 3n$
- D) $5(2 + n) = 3n - 8$

8

Long-distance runners often refer to their speed in terms of pace, a rate measured in minutes per mile rounded to the nearest hundredth. A runner completed a 26.2 mile race in approximately 2 hours and 8 minutes. What was the runner’s pace for the race?

- A) 2.60
- B) 4.12
- C) 4.89
- D) 5.05

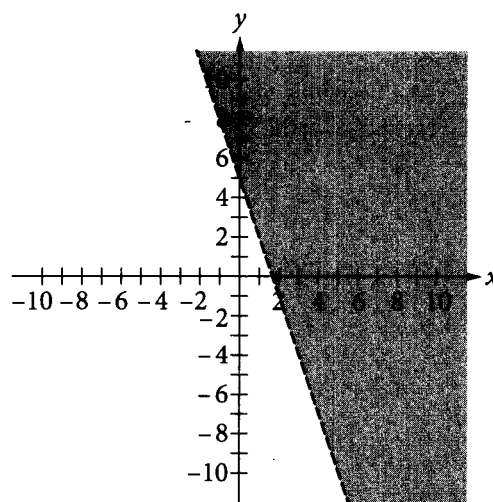
9

$$f(x) = x^2 + 4(x - 3)$$

Which of the following is an equivalent form of the expression above that displays the zeros of the function as constants or coefficients in the expression?

- A) $f(x) = x^2 + 4x - 12$
- B) $f(x) = (x - 6)(x + 2)$
- C) $f(x) = (x + 6)(x - 2)$
- D) $f(x) = (x + 2)^2 - 16$

10



Which of the following inequalities is represented by the shaded region on the coordinate plane above?

- A) $y > -3x + 5$
- B) $y < -3x + 5$
- C) $y \geq 3x - 5$
- D) $y \leq 3x - 5$



11

On a certain website, an advertiser pays a fee each time an advertisement is clicked. The advertiser's total fee, d , in dollars, is given by the equation $d = \frac{c + 6}{2}$, where c is the number of times the advertisement has been clicked. By how much does the total fee increase for each click of the advertisement?

- A) \$0.50
- B) \$1.00
- C) \$2.00
- D) \$3.00

12

A 3D-printer produces a cube with a volume of 432 cubic centimeters (cm^3). If the printer is set to produce a second cube with side lengths increased by 1 cm from the first cube, what is the volume of the second cube, to the nearest cubic centimeter?

- A) 449 cm^3
- B) 483 cm^3
- C) 627 cm^3
- D) 9,230 cm^3

13

Isabel purchased bananas and apples at a grocery store. She spent a total of \$9.90 on 3 pounds of apples and 2 pounds of bananas. If apples cost 3 times as much per pound as bananas, what is the cost per pound of apples?

- A) \$0.90
- B) \$1.80
- C) \$2.70
- D) \$3.60

14

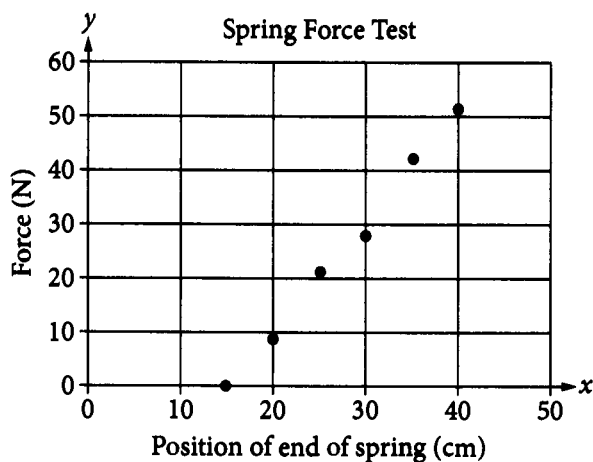
The manager of a clothing store surveyed a random sample of store customers yesterday. Members of the sample were asked if they are currently enrolled in the store's rewards program. The results of the survey are shown below.

Response	Number of customers
Currently enrolled in rewards program	120
Not currently enrolled in rewards program	280

A total of 2,040 customers were in the store yesterday. Based on the study, which interval most likely contains the total number of customers in the store yesterday who were NOT enrolled in the store's rewards program?

- A) (100, 140)
- B) (306, 510)
- C) (510, 714)
- D) (1,326, 1,530)

A student investigates the strength of a spring, one end of which is anchored at a fixed point. The student pulls the spring with a force scale and records the force exerted by the spring, in newtons (N), and the position of the end of the spring, in centimeters. The student's results are shown in the graph below.



Based on the data, which of the following equations could represent the line of best fit?

- A) $y = 0.5x + 15$
- B) $y = 2x + 15$
- C) $y = 2x - 30$
- D) $y = 0.5x - 30$

The city council plans to conduct a survey to determine which of four proposed locations for a new library branch would be most accessible for the city's 110,000 residents. Of the following sampling methods, which is most likely to yield results that best represent all the residents' preferences?

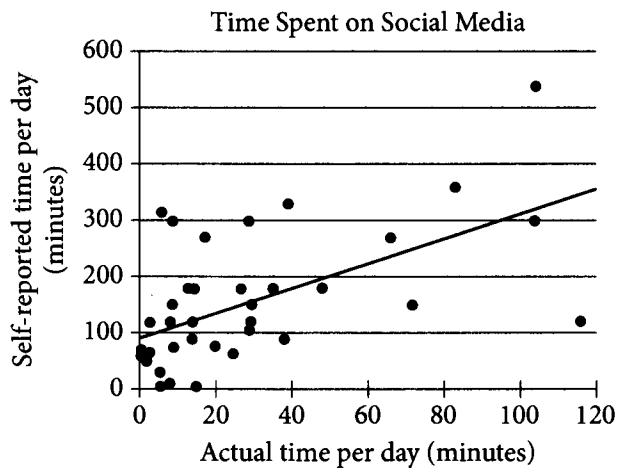
- A) Conducting an in-person survey of 1,000 people at the library branch that is already open
- B) Conducting a phone survey of the households that are closest to the four locations until 1,000 responses are received
- C) Conducting a mail survey of a total of 1,000 households randomly selected from within the city limits
- D) Conducting an online survey on one local television station's website

The original value of a car is \$22,000, and it is estimated that each year the value of the car will depreciate by approximately 8.5% from the previous year. Which type of function best models the relationship between time and the value of the car?

- A) Linear function whose graph has a positive slope
- B) Linear function whose graph has a negative slope
- C) Quadratic function
- D) Exponential function



Questions 18 and 19 refer to the following information.



A sample of students in a dormitory was selected to participate in a study in which they were asked to report how much time they were spending on a social media site. Each point on the graph above represents the amount of time one student from the sample reported spending on the social media site per day and how much time he or she actually spent on the site per day.

18

What is the approximate range of the time, in hours per day, that students self-reported being on the social media site?

- A) 2.2
- B) 9.1
- C) 13.3
- D) 550.2

19

If the number of students in the study who used the social media site for more than one hour per day represents 12 percent of all the students in the dormitory, how many students in total were in the dormitory?

- A) 41
- B) 50
- C) 62
- D) 100



20

Distribution of Weights
of Rainbow Trout

Weight range, in pounds	Frequency
0.5 up to 1.5	3
1.5 up to 2.5	5
2.5 up to 3.5	7
3.5 up to 4.5	10
4.5 up to 5.5	19
5.5 up to 6.5	7

A scientist caught, weighed, and released 51 rainbow trout to collect data. A summary of the data is shown in the table above. Which of the following could be the median weight, in pounds, of the trout caught?

- A) 2.9
- B) 4.1
- C) 4.7
- D) 5.8

21

Which of the following best describes the domain of the function f , defined as $f(x) = \sqrt{1 - x^2}$?

- A) $x \geq 0$
- B) $x \leq 1$
- C) $0 \leq x \leq 1$
- D) $-1 \leq x \leq 1$

22

$$F = \frac{9}{5}(K - 273.15) + 32$$

The conversion of temperatures measured in kelvin, K , to degrees Fahrenheit, F , is given by the formula above. Which of the following equations could be used to convert temperatures from degrees Fahrenheit to kelvin?

- A) $K = \frac{5F}{9} + 241.15$
- B) $K = \frac{5F - 160}{9} - 273.15$
- C) $K = \frac{5F - 160}{9} + 273.15$
- D) $K = \frac{9F - 288}{5} + 273.15$

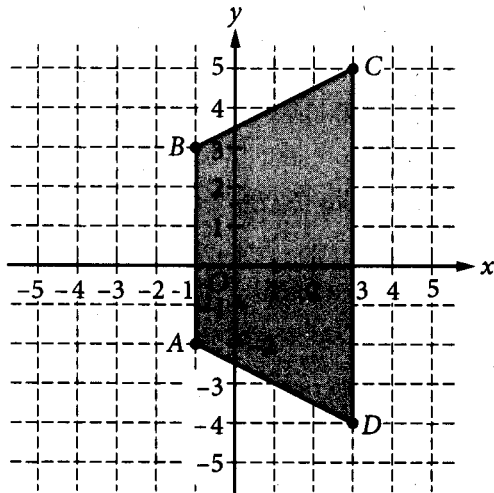
23

In the xy -plane, if the point (a, b) lies on the parabola with equation $y = x^2 - 1$, which of the following must be equal to a^4 ?

- A) $b^2 - 1$
- B) $b^2 + 1$
- C) $(b - 1)^2$
- D) $(b + 1)^2$



24



An architect has drawn trapezoid $ABCD$ in the xy -plane above to represent the stage at a theater. If each unit of the coordinate axes represents a segment of length 3 feet, what is the area, in square feet, of the stage?

- A) 28
- B) 84
- C) 168
- D) 252

25

A computer can calculate 1,000 operations in 3.8×10^{-6} seconds. At this rate, approximately how many operations can be calculated by this computer in one half hour?

- A) 4.7×10^{11}
- B) 6.8×10^{11}
- C) 9.8×10^{11}
- D) 9.8×10^{12}



26

$$ax - 2ay = 1$$

In the equation above, a is a nonzero constant. The graph of the equation in the xy -plane is a line. What is the slope of the line?

- A) $\frac{1}{2}$
- B) $\frac{a}{2}$
- C) $2a$
- D) $\frac{1}{2a}$

27

Several years ago, an initial amount of \$1,000 was invested in an account that has interest compounded yearly. No additional money was deposited in the account. The amount, in dollars, in the account can be determined by the expression $1,000(1.03)^2(1.035)^{t-2}$, where t is the number of years since the initial deposit and $t > 2$. What is a possible interpretation of $(1.03)^2$ in the expression?

- A) The interest rate of the account for the first 2 years was 3%.
- B) The interest rate of the account for the first 2 years was 0.03%.
- C) The total value of the account increased by 3% at the end of the first 2 years.
- D) The total value of the account increased by 0.03% at the end of the first 2 years.

**DIRECTIONS**

For questions 28-31, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or $7/2$. (If $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$ is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Answer: $\frac{7}{12}$

← Fraction line

Grid in result.

7	/	1	2
●	●	●	●
0	0	0	0
1	1	●	1
2	2	2	●
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
●	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5

← Decimal point

	2	.	5
●	●	●	●
0	0	0	0
1	1	1	1
2	●	2	2
3	3	3	3
4	4	4	4
5	5	5	●
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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

	2	/	3
●	●	●	●
0	0	0	0
1	1	1	1
2	●	2	2
3	3	3	●
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

.	6	6	6
●	●	●	●
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	●	●	●
7	7	7	7

.	6	6	7
●	●	●	●
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	●	●	6
7	7	7	●

Answer: 201 – either position is correct

	2	0	1
●	●	●	●
0	●	0	0
1	1	1	●
2	●	2	2
3	3	3	3

2	0	1	
●	●	●	●
0	0	0	0
1	1	●	1
2	2	2	2
3	3	3	3

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



28

$$x - 3y = -13$$

$$y - x = 3$$

If the system of equations above were graphed on the xy -plane, what would be the x -coordinate of the point where the lines intersect?

29

Members of a school soccer team are selling T-shirts to raise money for new training equipment. At a price of \$18 per shirt, the team sells 12 shirts per day. For every \$2 they decrease the shirt price, they sell 4 more shirts per day. To maximize the revenue, how much, in dollars, should they charge for 1 shirt? (Revenue = price per shirt \times number of shirts sold. Disregard the \$ sign when gridding your answer.)



Questions 30 and 31 refer to the following information.

Alice receives reward points for every dollar charged to her credit card. Different numbers of points are received depending on the type of charge, as shown in the table below.

Type of charge	Points per dollar spent
Groceries	3
Air travel	2
Gas	2
All other charges	1

30

Alice made three single purchases, one each on gas, air travel, and groceries, charging a total of \$191 on her card. She received 48 points on the grocery charge and 284 points on the air travel charge. How many total points has she received on these three charges?

31

Next month, Alice plans to spend \$200 for groceries, \$150 for gas, and \$300 for air travel. If she charges these amounts on her credit card, what percentage of the reward points in these three categories will she get from groceries? (Ignore the percent symbol when entering your answer. For example, if the answer is 42.1%, grid 42.1 in the space provided.)

STOP

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

No Test Material On This Page

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