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 adapted from the New York Times Narrative Best-Winner article, *Nothing Extrordinary* by Jennifer Kim.

It was a Saturday. Whether it was sunny or cloudy, hot or cold, I cannot remember, but I do remember it was a Saturday because the mall was packed with people. I was with my mom. Mom is short. Skinny. It is easy to overlook her in a crowd simply because sdhe is nothing extraordinary to see.

On that day we strolled down the slippery-slick tiles with soft, inconspicuous steps, peeking at window boutiques in fleeting glances because we both knew we wouldn't be buying much, like always.

I remember I was looking up at the people we passed as we walked — at first apathetically, but then more attentively. Ladies wore five-inch heels that clicked importantly on the floor and bright, elaborate clothing. Men strode by smelling of sharp cologne, faces clear of wrinkles — wiped away with expensive creams.

An uneasy feeling started to settle in my chest. I tried to push it out, but once it took root it refused to be yanked up and tossed away. It got more unbearable with every second until I could deny it no longer; I was ashamed of my mother. We were in a high-class neighborhood, I knew that.

We lived in a small, overpriced apartment building that hung on to the edge of our county that Mom chose to move to because she knew the schools were good. We were in a high-class neighborhood, but as I scrutinized the passers-by and then turned accusing eyes on Mom, I realized for the first time that we didn't belong there.

I could see the heavy lines around Mom's eyes and mouth, etched deep into her skin without luxurious lotions to ease them away. She wore cheap, ragged clothes with the seams torn, shoes with the soles worn down. Her eyes were tired from working long hours to make ends meet and her hair too gray for her age. I looked at her, and I was ashamed. My mom is nothing extraordinary, yet at that moment she stood out because she was just so plain.

Mumbling I'd meet her at the clothes outlet around the corner, I hurried away to the bathroom. I didn't want to be seen with her, although there was no one important around to see me anyway. When I finally made my way to the outlet with grudging steps, I found that Mom wasn't there. With no other options, I had to scour the other stores in the area for her. I was dreading returning to her side, already feeling the secondhand embarrassment that I'd recently discovered came with being with her. I couldn't have been more wrong. Mom was standing in the middle of a high-end store, holding a sweater that looked much too expensive.

She said, "This will look good on you. Do you want it?" Then I took a closer look at the small, weary woman with a big smile stretching across her narrow face and a sweater in her hands, happy to be giving me something so nice, and my words died in my throat. I felt like I'd been dropped into a cold lake. Her clothes were tattered and old because she spent her money buying me new ones. She looked so tired and ragged all the time because she was busy working to provide for me. She didn't wear jewelry or scented perfumes because she

CONTINUE

she was just content with me. Suddenly, Mother was beautiful and extraordinarily wonderful in my eyes. I was no longer ashamed of her, but of myself.
"Do you want it?" My mom repeated.
65 "No thanks."

1

Over the course of the passage, the narrator's attitude towards his mother shifts from one of

A) regret to pure hatred.
B) disappointment to affection.
C) disgust to admiration.
D) curiousity to acknowledgment.

2

As used in line 27, "scrutinized" most nearly means

A) watched.
B) judged.
C) obtained.
D) guided.

3

It can most reasonably be inferred from the passage that the narrator's mom

A) dislikes wealthy attire.
B) fears disappointing the narrator.
C) is significantly old.
D) cares for the narrator's well-being.

4

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

A) lines 23-25 ("We . . . good")
B) lines 30-31 ("I . . . mouth")
C) lines 32-33 ("She . . . down")
D) lines 51-52 ("She . . . it?")

5

The main purpose of the last paragraph is to

A) indicate a revelation.
B) compare two characters.
C) discuss reasons for an action.
D) describe the qualities of an object.

6

In line 24, the word "hung" most nearly means

A) clinches.
B) lay.
C) gripped.
D) weighed.

7

Why does the narrator begin to feel an unsettling feeling in his stomach?

A) The individuals at the mall appear gaudy.
B) The mall is extremely materialistic.
C) The narrator's mother is not meeting the status-quo.
D) The narrator's family is unfit to be in the neighborhood.

8

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

A) lines 13-14 ("Ladies . . . clothing")
B) lines 15-16 ("Men . . . creams")
C) lines 28-29 ("I . . . there")
D) lines 36-38 ("My . . . plain")

CONTINUE

9

It can most likely be assumed that the narrator says "No thanks" (line 65) to his mom's proposal because

A) he believes the sweater holds no value.

B) he has another purchase in mind.

C) he is too ashamed to accept.

D) he would like his mom to buy something for herself.

10

What do lines 41-42 (although . . . anyway) primarily serve to do in the passage?

A) Emphasize an unsettling event

B) Undermine a situation.

C) Support an argument

D) Question a stance.

Questions 11-21 are based on the following passage.

This passage is adapted from the Washington Post Science Section, *The science of sticking to your New Year's resolutions*.

Old habits, especially bad ones, can be hard to break. People often make fun of New Year's resolutions. However, resolutions present a big opportunity for self-improvement, according to research on human behavior. On New Year's, we look back on past failures and feel an uncommon burst of optimism. We decide that it was "the old me" who failed to change, but this year will be different. A full 40 percent of Americans make New Year's resolutions, and, fortunately for them, social science has some insights into how to break a bad habit or start a good one. time. People might be tempted to set easy New Year's resolutions to avoid failure. Failure is discouraging and can lead us to give up on our goals. On the other hand, research has shown that setting harder goals is more motivating than setting easy ones.

Gary Charness and Uri Gneezy are both economists at the University of Chicago. A few years ago, they asked 120 students to participate in an experiment about exercise habits. The students were randomly assigned to three groups. The first group got $175 for just attending an information session and giving researchers permission to track their gym attendance. The second group went to the session and gave permission, but they had to go to the gym at least once the next month. The final group went to the session and gave permission and had the hardest goal of going to the gym eight times that month.

Unsurprisingly, the group that had to make eight gym visits to get paid exercised more than the other two groups. After the payments stopped, though, these students kept going to the gym at higher rates. They went to the gym about twice as often as the other two groups.

The study shows that trying something new intensively for as little as a month can kick-start a lasting change in behavior. Even if you cannot promise yourself to stick with something for long, there is a huge benefit in putting in a burst of energy for a few weeks. It may pay off for longer than you think.

Many of us find it hard to stick to good behaviors all the time. People might be tempted to set easy New Year's resolutions to avoid failure. Failure is discouraging and can lead us to give up on our goals. On the other hand, research has shown that setting harder goals is more motivating than setting easy ones. Marissa Sharif and Suzanne Shu are marketing professors. They offered hundreds of people $1 each day if they went online and completed a set of 35 annoying tasks. These wage-earners were then randomly assigned different goals and were given a $5 bonus on top of their other earnings if they achieved their goal.

For some participants, the goal was to complete their assignment seven days out of seven, a tough but achievable goal. Others had to complete their assignment on five days out of seven to get the bonus. Finally, a "mulligan" group was also given the goal of completing their assignment seven days out of seven. However, they were told they could miss two days if they needed to.

Set A Goal, But Don't Be Discouraged By Slip-Ups

Remarkably, the "mulligan" group did much better than the other groups. Fifty-three percent of them earned $5. Only 26 percent of the participants with the easy goal and 21 percent of participants with the seven day per week goal earned the bonus. The perfect goal, then, is probably a tough one but with multiple tries so you will not be discouraged by the occasional slip-up.

Research points to the benefits of a method called "piggy-backing." Piggybacking involves linking something you would like to start doing more often with something you already do regularly. For instance, if you want to start flossing, it is best to pair it with brushing your teeth. Related to piggybacking is temptation-bundling, or linking something you would like to do more often with something you love.

In one study of 151 people who wanted to exercise more, we randomly assigned 75 to a temptation-bundling group. These people came to the gym for a workout. As they exercised, they listened to the start of a tempting audio-novel of their choice. At the end of their workout, participants were told that if they wanted to hear what happened next in their book, they would have to come back to the gym. They could only listen to the audiobook while exercising. The other 76 participants in our study also completed an initial workout but without any kind of temptation bundle.

The study followed the participants over the next seven weeks. Participants in the temptation-bundling group visited the gym 27 percent more frequently than participants in the control group. Sadly, the temptation- bundling trick fell apart over the Thanksgiving holiday when the gym closed. Temptation-bundling, then, may not have the staying power to kick-start a habit that will last through all of the next year. Still, it may be a useful method for changing behavior, particularly when combined with other tactics.

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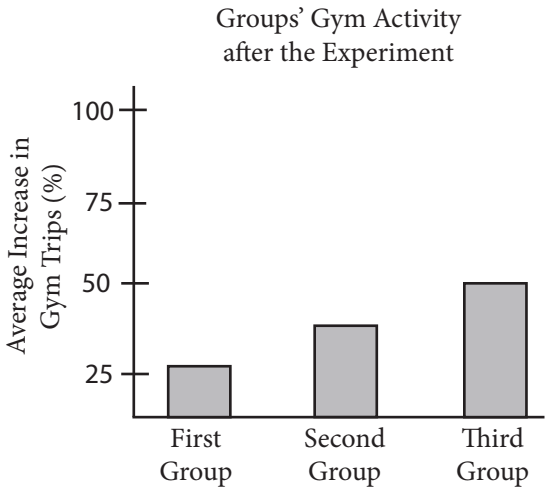


Group one was given little incentive, group two was given medium incentive, and the third group was given the most incentive

11

The primary purpose of the passage is to

A) analyze behavior surrounding a common occurence.

B) inform readers of a helpful quality.

C) defend a specific process.

D) provide data analysis of several expiriments.

12

What can most reasonably be inferred from the experiments held by Gary Charness and Uri Gneezy?

A) Setting small attainable goals is the perfect way to acheive them.

B) Motivating yourself for just a month to a habitat can cause a burst of enthusiasm.

C) Small goals are just an attempt to avoid failure.

D) Human nature avoids goal setting because it often leads to failure.

13

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

A) Lines 17-19 ("First ... attendance")

B) Lines 24-27 ("Unsuprisingly ... rates")

C) Lines 29-33 ("The study ... weeks")

D) Lines 34-36 ("Many ... failure")

14

The central problem that the author address about failure is that

A) failure is necessary, but goals should outline multiple tries to keep them from discouraging the goal maker.

B) failure causes discouragement so avoiding failure is key to making good goals.

C) failure does not exist, and it is actually learning.

D) failure should happen but at a relatively slow pace.

15

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

A) Lines 4-5 ("On. . . optimism")

B) Lines 11-12 ("Failure. . . goals")

C) Lines 58-59 ("The. . . slip-up")

D) Lines 39-41 ("They. . . tasks")

16

As used in line 29, "intensively" most nearly means

A) ambivalently

B) passionately

C) carefully

D) vigorously.

17

How would the author distinguish between "piggybacking" and "temptation-bundling"?

A) Piggybacking is based upon things you already do while temptation-bundling is based upon things you love.

B) Piggybacking is a form of procrastation while temptation building promotes being proactive.

C) Piggybacking is less rigorous as compared to temptation-building.

D) Piggybacking attaches goals with things you love to do while temptation-building attaches goals to things you already like doing.

18

As used in line 65, "linking" most nearly means

A) associating with

B) bonding together

C) binding objects

D) tearing apart

19

In the graph, what group saw an increase in gym trips between 30% to 45%?

A) Group 1

B) Group 2

C) Group 3

D) All groups

20

Which of the following is accuratley protrayed by the graph?

A) The third group saw the lowest increase in gym trips.

B) The first group saw the lowest increase in gym trips.

C) The first and second group increased the same percentage in gym trips

D) People going to the gym decresed for all groups.

21

What happens to the gap between the groups as the incentive increases?

A) The gap grows smaller

B) The gap grows larger

C) The gap remains roughly the same

D) The groups have the same results

Questions 22-31 are based on the following passage.

This passage is adapted from a New York Times article, *Why Scientists Made Venus Flytraps That Glow* by Cara Giaimo.

Provoking a Venus flytrap takes a certain amount of finesse. If you brush just one of the trigger hairs inside of its leaves, the plant likely won't react. But if you trigger it again quickly enough, it will spring into action, swinging its famous mouth shut. Waiting for a double trip probably keeps the plant from wasting energy on raindrops or other things that aren't nutritious flies. But despite centuries of interest in the species, no one was quite certain how the plants remember the first trigger in order to act on a second.

In a paper published last week in Nature Plants, researchers reported they had found the cause: calcium ions. By inducing the flytraps to glow when calcium entered their cells, a team of scientists was able to show how the ions build up as the hairs are triggered, eventually causing the snap.

Calcium is used for conveying information between cells in many different life-forms, said Mitsuyasu Hasebe, the leader of the lab at the National Institute for Basic Biology in Okazaki, Japan, where the research was done. The molecule is normally "scarce in the cell, but abundant out of it," he said, making it easy for cells to recognize and react to changes in concentration. In 1988, a pair of plant scientists hypothesized that two overlapping rushes of calcium ions might spur the Venus flytrap to close, but had no way to test their idea. More recently, another group of researchers — including Rainer Hedrich, who participated in the new paper — solved part of the puzzle, showing that electrical signals tell the flytrap when its trigger hairs have been pressed. They also speculated that calcium helps the plant keep track.

To visualize the flytrap's memory mechanism, Dr. Hasebe and his colleagues spliced a special type of gene into the plant. This gene, widely used in biology, produces a protein that turns fluorescent green when it binds to a target — in this case, a calcium ion.

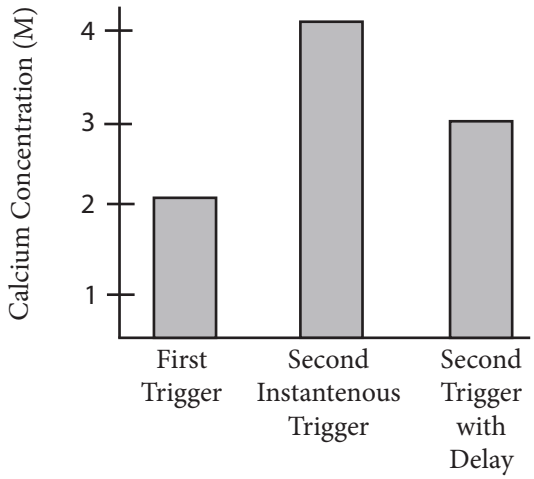
Hiraku Suda — the paper's lead author and a doctoral student in Dr. Hasebe's lab at the time of the research — was in charge of integrating the gene, which required infecting the plant's leaves and then using those leaves to grow new shoots. It took him two and a half years to figure it out. The key, it turned out, was raising the plants in the dark, which may have made them easier to infect with the bacteria. When it finally worked, he was so excited, "I didn't sleep for a week," he said. Next, the researchers started poking the plant. After a single tap to a sensory hair, a green flush appeared at the hair's base and quickly spread across the leaves, indicating a surge of calcium ions. A second tap within about 30 seconds spurred an additional surge , pushing the total calcium amount over a threshold that caused the trap to close. (In videos of the experiment, the glowing, chomping flytrap looks like a carnival fun house entrance.) But if the researchers waited too long between taps, the concentration decreased again, and the trap didn't budge.

"Being able to actually see the calcium wave start in the deflected hair and travel across the leaf is truly amazing," said Ueli Grossniklaus, a plant biologist at the University of Zurich who was not involved in the research. Earlier this year, Dr. Grossniklaus helped to show that in some cases, a single, slow deflection of a trigger hair can also cause the flytrap to close. He said that more research on how the calcium and electrical activity relate, and on the force and speed of the trigger taps, would further illuminate the plant's workings.

Dr. Suda, now a postdoctoral fellow at Saitama University in Japan, plans to use his new method to study the capturing of prey, digestion and other activities of the flytrap. They are "beautiful plants," he said. "I can always make new questions from seeing them."

Figure 1

Calcium Concentration after Trigers



CONTINUE

22

The primary purpose of the passage is to

A) explain an evolutionary development.

B) describe a particular ion.

C) discuss a series of experiments.

D) stress the implications of an issue.

23

A student claims that changes in calcium ions is an ineffective communication mechanism. Which of the following statements in the passage best contradicts the student's claim?

A) Lines 11-14 ("By . . . snap")

B) Lines 15-16 ("Calcium . . . forms")

C) Lines 18-20 ("The . . . concentration")

D) Lines 30-33 ("This . . . ion")

24

Why did researchers insert a specific gene into the Venus Flytrap?

A) To limit calcium ions in the Venus Flytrap

B) To force the trap of the Venus Flytrap to close.

C) To trace locations of stress in the Venus Flytrap

D) To track calcium ions in the Venus Flytrap.

25

As used in line 29, "mechanism" most nearly means

A) gadget

B) action

C) capability

D) process

26

The primary effect of Dr. Grossniklaus's statement in the second-to-last paragraph (lines 57-60) is

A) to emphasize the need for further research.

B) to describe the beauty of a particular plant.

C) to undermine the findings of an experiment.

D) to discuss the large-scale impacts of a conclusion.

27

It can most reasonably be assumed that Hiraku Suda

A) used a bacterium to insert a gene into the Venus Flytrap

B) believes that calcium ions increase in a Venus Flytrap when they are touched.

C) does not warrant the use of empirical data as an estimate for calcium concentration.

D) is an advocate for the manipulation of genes to gain data.

28

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

A) engage.

B) move.

C) obtain.

D) activate.

29

Based on Figure 1 and the passage, what is the calcium concentration that will cause the Venus Flytrap's mouth to shut?

A) 1 M
B) 2 M
C) 3 M
D) 4 M

30

Based on Figure 1, what decrease in calcium concentration is caused by a delay in the second trigger?

A) 1 M
B) 2 M
C) 3 M
D) 4 M

31

Based on Figure 1, how much larger is the calcium concentration of the Second Instantenous Trigger compared to that of the First Trigger?

A) 1 M
B) 1.5 M
C) 2 M
D) 4 M

CONTINUE

Questions 32-41 are based on the following passage.

Passage 1 is from a speech delivered in 1830 by President Andrew Jackson, "On Indian Removal." Passage 2 is adapted from a speech delivered in 1830 by Theodore Frelinghuysen as a response to President Jackson's speech.

Passage 1

"It gives me pleasure to announce to Congress that the benevolent policy of the Government, steadily pursued for nearly thirty years, in relation to the removal of the Indians beyond the white settlements is approaching to a happy consummation. Two important tribes have accepted the provision made for their removal at the last session of Congress, and it is believed that their example will induce the remaining tribes also to seek the same obvious advantages.

The present policy of the Government is but a continuation of the same progressive change by a milder process. The tribes which occupied the countries now constituting the Eastern States were annihilated or have melted away to make room for the whites. The waves of population and civilization are rolling to the westward, and we now propose to acquire the countries occupied by the red men of the South and West by a fair exchange, and, at the expense of the United States, to send them to land where their existence may be prolonged and perhaps made perpetual. Doubtless it will be painful to leave the graves of their fathers; but what do they more than our ancestors did or than our children are now doing? To better their condition in an unknown land our forefathers left all that was dear in earthly objects. Our children by thousands yearly leave the land of their birth to seek new homes in distant regions. Does Humanity weep at these painful separations from everything, animate and inanimate, with which the young heart has become entwined? Far from it. It is rather a source of joy that our country affords scope where our young population may range unconstrained in body or in mind, developing the power and facilities of man in their highest perfection. These remove hundreds and almost thousands of miles at their own expense, purchase the lands they occupy, and support themselves at their new homes from the moment of their arrival. Can it be cruel in this Government when, by events which it cannot control, the Indian is made discontented in his ancient home to purchase his lands, to give him a new and extensive territory, to pay the expense of his removal, and support him a year in his new abode? How many thousands of our own people would gladly embrace National Park Service, Park Museum Management Program Teaching with Museum Collections the opportunity of removing to the West on such conditions! If the offers made to the Indians were extended to them, they would be hailed with gratitude and joy.

Passage 2

It is however admitted, Sir, that when the increase of population and the wants of mankind demand the cultivation of the earth, a duty is thereby devolved upon the proprietors of large and uncultivated regions, of devoting them to such useful purposes. But such appropriations are to be obtained by fair contract, and for reason able compensation. It is, in such a case, the duty of the proprietor to sell-we may properly address his reason to induce him; but we cannot rightfully compel the cession of his lands, or take them by violence if his consent be withheld. It is with great satisfaction, that I am enabled upon the best authority to affirm, that this duty has been largely and generously met and fulfilled on the part of the aboriginal proprietors of this continent. Several years ago, official reports to Congress stated the amount of Indian grants to the United States to exceed 214 millions of acres. Yes, Sir, we have acquired, and now own, more land as the fruits of the bounty, than we shall dispose of at the present rate to actual settlers in two hundred years. For, very recently, it has been ascertained on this floor, that our public sales average not more than about one million of acres annually. It greatly aggravates the wrong that is now mediated against these tribes to survey the rich and ample districts of their territories that either force or persuasion have incorporated into our public domains. As the tide of our population has rolled on, we have added purchase to purchase- the confiding Indian listened to our professions of friendship--we called him brother, and he believed us-millions after millions, he has yielded to our importunity, until we have acquired more than can be cultivated in centuries--and yet we crave more. We have crowded the tribes upon a few miserable acres on our Southern frontier--it is all that is left to them of their once boundless forests, and still, like the horseleech, our insatiated cupidity cries give, give.

32

The primary purpose of Passage 1 is to

A) explain why Indians should move out of their territories

B) present the Indian Removal Act and its benefits

C) discuss the Indian's reaction to the Indian Removal Act

D) announce the nation's support for moving westward

CONTINUE

33

According to Passage 1, removing Indians from their current territory is no different from Americans when

A) contemporary Americans moving westward.

B) Indians held strong emotions for material goods.

C) Christopher Columbus discovered the Americas.

D) the United States declared independence from Britain.

34

Passage 1 suggests that if the Indian Removal Act extends its effects to Americans, Americans would be

A) welcomed.

B) repulsed.

C) composed.

D) provoked.

35

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

A) Lines 1-5 ("It gives . . . consummation")

B) Lines 18-21 ("Doubtless . . . doing")

C) Lines 27-30 ("Far from . . . perfection")

D) Lines 37-42 ("How many . . . joy")

36

As used in line 42, "hailed" most nearly means

A) accosted.

B) acclaimed.

C) beat.

D) condemned.

37

According to Passage 2, the American behavior when confronting Indians has been

A) lust.

B) greed.

C) sloth.

D) envy.

38

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

A) Lines 50-54 ("It is ... withheld")

B) Lines 65-69 ("It ... domains")

C) Lines 71-75 ("We called ... more")

D) Lines 75-78 ("We have ... give")

39

As used in line 71, "professions" most nearly means

A) truths.

B) ideas.

C) claims.

D) declarations.

40

The authors of both passages would most likely disagree with which statements about the nation's westward expansion?

A) Indians are happy that they are given the opportunity to move into new territory.

B) Americans have used military force to conquer territory from the Indians.

C) Americans have desired to move and expand westward since colonial times.

D) Indians have been relocated multiple times in American History.

CONTINUE

41

The author of Passage 2 would most likely claim that the statement suggested in the last sentence of Passage 1 is

A) false and idealistic.

B) realistic and expected.

C) effective but unpractical.

D) understandable but skeptical.

Questions 42-52 are based on the following passage.

This passage is adapted from the article, "Structure and Chemistry Dictate How Cicada Wings Repel Water and Kill Bacteria." ©2020 by Jillian Kramer from Scientific American. © 2020 StudySet. All rights reserved.

Nature often inspires engineering. Cicada wings, for example, have long tantalized researchers with their water-repellent and antimicrobial properties, which would be useful to replicate in manufactured products. But previous studies involved totally removing the wings' surface chemicals, sometimes damaging the wings and giving an incomplete picture of how those chemicals work together with the wings' structure. New research investigates substances coating cicada wings layer by layer, revealing a complex interplay between topography and chemistry.

Researchers analyzed two cicada species, Neotibicen pruinosus and Cicadetta calliope, and a control species that each have a highly ordered pattern of tiny, conelike structures called nanopillars on their wings. Previous work suggested nanopillars contribute to the insects' ability to shed water and help kill microbes.

To avoid wing damage, the team tested a method called microwave-assisted extraction that had not been used on intact insect wings before, says Jessica Román-Kustas, an analytical chemist at Sandia National Laboratories. Román-Kustas is lead author on the new study, which appeared in May in Advanced Materials Interfaces. Previous methods had been used to keep Cicada wings attatched, giving more accurate results; however, all previously used techniques have failed, and microwave-assisted extraction is one of the "new generation" methods. The method involves heating and cooling wings immersed in chloroform and methanol, analyzing layers of chemicals as they came off. "It [was] days of sitting at the microwave with a timer and a computer," she says.

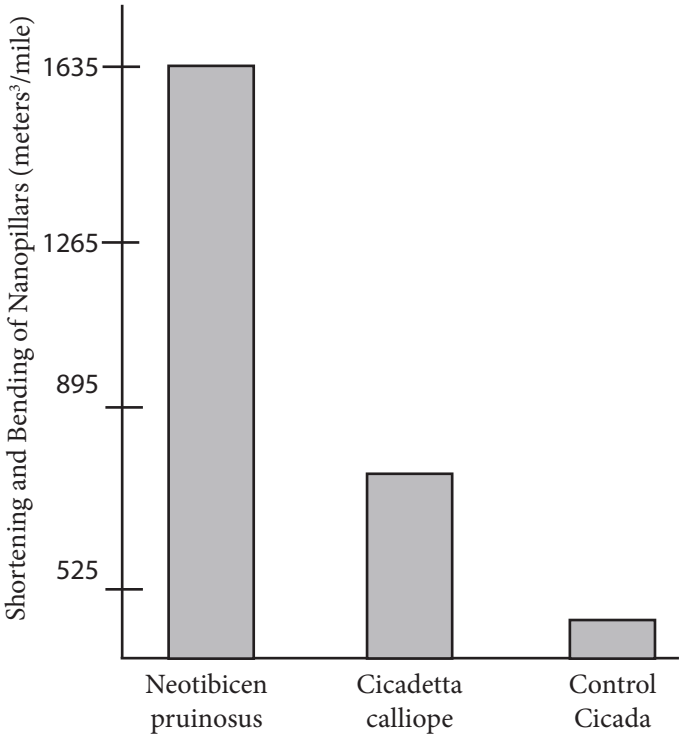
In both cicada species, the researchers found that the nanopillars' chemical makeup is important for maintaining structural integrity. " When you remove the outer [chemical] layers from the nanopillar, the pillars become shorter and bend toward each other," says Marianne Alleyne, a biologist at the University of Illinois at Urbana-Champaign and a senior author on the study.

In the cicada Neotibicen pruinosus, this wilting effect was more extreme and made the wings less water-repellent at first (although they recovered some of that ability as more chemicals were removed). However, in the control species, who were not exposed to the process of microwave-assisted extraction, the species nanopillars's stayed stringent, maintaining their structural integrity. For the Neotibicen pruinosus, bacteria-killing activity actually increased as the first layers were removed but then decreased again as more compounds were stripped. The team found that the cicada Magicicada cassinii, which emerges every 17 years and has shorter nanopillars, has surface chemicals that by themselves seem to have bactericidal properties—suggesting these cicadas rely more on their chemical components than structure to kill microbes.

"It is clear … that different layers serve different purposes," says Terry Gullion, a physical chemist at West Virginia University, who was not involved in the study, "and the ability to probe only specific layers is very important [to obtain] a much better understanding of the overall physical properties' dependence on chemical makeup."

Understanding how chemicals do (or do not) affect structure may help scientists engineer better products. "By having this fundamental knowledge about how structure and chemistry relate to each other," Alleyne says, "we can design new materials more rationally, making choices about the structure and chemistry … based on what we have observed in nature."In the cicada species, the researchers found that the nanopillars' chemical makeup is important for maintaining structural integrity. "When you remove the outer [chemical] layers from the nanopillar, the pillars become shorter and bend toward each other," says Marianne Alleyne, a biologist at the University of Illinois at Urbana-Champaign and a senior author on the study.

Figure 1



Treatment Groups of Cicada Species exposed to microwave-assisted extraction

CONTINUE

42

The main purpose of the passage is to

A) discuss the accomplishments of scientists in the field of Cicada Wings.

B) describe an experiment about the impact of chemicals on Cicada Wings.

C) explain the function of nanopillars in Cicadas.

D) describe the Neotibicen pruinosus.

43

As used in line 26, "immersed" most nearly means

A) lingered

B) mixed

C) submerged

D) restricted

44

The primary effect of Terry Guillion's remark (lines 51-53) is

A) emphasizing an empirical discovery

B) undermining a controversial finding

C) implicating the need for additional research

D) negating a proposed counterargument

45

It can reasonably assumed that the researches used the "microwave-assisted extraction" (line 18) because they

A) want to research the cicadas in the future.

B) care for the well-being of the cicadas.

C) need the Cicadas' wings attatched for proper results.

D) do not have another experimental technique to use.

46

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

A) Lines 17-20 ("To . . . Labortories")

B) Lines 22-23 ("Previous . . . results")

C) Lines 23-25 ("however . . . methods")

D) Lines 26-29 ("The . . . says")

47

As used in line 42, "stringent" most nearly means

A) immobile

B) indifferent

C) discertain

D) malleable

48

Why does "bacteria-killing activity" (line 43-44) fluctuate between layers in nanopillars ?

A) Nanopillar effects on bacteria are only for a specific duration of time.

B) Anti-bacterial fungi levels change as nanopillar layers are removed.

C) Experimental errors are affecting abiltiy of nanopillars to fight off bacteria

D) Each layer contains different chemicals that can affect bactericidal activity.

49

The primary purpose of the last paragraph of the passage is to

A) discuss the implications of a finding.

B) explain reservations about an experiment.

C) rebuttal a counterargument to a finding.

D) describe the findings of an experiment.

CONTINUE

50

Based on Figure 1, which choice gives the approximate meters^3/ mile of the difference between Neotibicen pruinosus and Cicadetta calliope shortening and bending of nanopillars ?

A) 370

B) 400

C) 1035

D) 1535

51

Based on Figure 1 and the passage, what can be concluded about the effect of microwave-assisted extraction ?

A) The techniques causes the elongation and increased strength of nanopillars.

B) The method has a greater effect on nanopillars of specific Cicada species.

C) The technique is a lengthy process, requiring diligence to obtain data.

D) The method is always performed on only three treatment groups

52

Based on Figure 1, which choice gives a true statement about Neotibicen pruinosus and Cicadetta calliope shortening and bending of nanopillars ?

A) Cicadetta callipe has a two times greater shortening and bending.

B) Cicadetta callipe has a three times greater shortening and bending.

C) Neotibicen pruinosus has a two times greater shortening and bending.

D) Neotibicen pruinosus has a three times greater shortening and bending.

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.

"Collar the Cat!"

"Tom and Jerry" is television gold. Its basic premise of "cat-chases-mouse" glued generations of kids to the screen. Yet, unlike Tom, house cats are ruthless predators that almost always catch their prey. New research shows that house cats are 1 unsustainably clawing their way through bird populations across the United States. In fact, more birds die by cats than by collisions with buildings, cars and other anthropogenic activities combined.

[1] Since when did Tom actually catch Jerry and Tweety? Since always. [2] We just never noticed. [3] Cats bring home 2 "copious sums of rodents" according to Professor Roland Kays in the NPR article "Why House Cats Are God's Perfect Little Killing Machines." [4] On its own, this cat fact isn't too surprising. [5] But when we consider almost four in 10 households own

1

A) NO CHANGE
B) unknowingly
C) unrelentingly
D) viciously

2

Which choice provides the most relevant detail?

A) NO CHANGE
B) "up to 23 dead birds, rodents, and lizards a month,"
C) "multiple species of lizards"
D) "approximately 45 dead birds every year"

CONTINUE

a cat, feline predation 3 has an outsized impact. [6] Due to their constrained roaming grounds, cats have four-to-10 times the effect of a wild predator in the local community. [7] Think about bird seeds you put out for observing songbirds? [8] Let's just say you aren't the only one watching the feeder. [9] The Fish and Wildlife Service tally annual feline kill counts at 2.4 billion birds across the United States. [10] This simple fact has had a devastating effect on the bird population, according to The New York Times, 4 Washington Post: and Wall Street Journal. [11] Bird counts across the United States have fallen a staggering 29 percent in the last 50 years. [12] At the same time, the popularity of cats in America has exploded. [13] Humans can also influence feline predation on birds. 5

Traditional bird conservation efforts cannot counteract a cat's primal instincts. Considering my project was built in a neighborhood that houses an estimated 50 cats, my hard work has likely not resulted in any net increase of the bird population. 6 Yet, attempting to muzzle our pet with a stay-at-home order is not a practical, long-term solution for cats.

3

A) NO CHANGE

B) have an outsized impact's

C) has been having a outsized impacts'

D) had an outsized impact

4

A) NO CHANGE

B) Washington Post - and

C) Washington Post, and

D) Washington Post; and,

5

To make this paragraph the most logical, sentence 13 should be placed

A) where it is now.

B) after sentence 4.

C) after sentence 6.

D) after sentence 7.

6

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

A) Yes, because it fails to provide relevant information to the paragraph at large.

B) Yes, because it provide an effective transition to the next paragraph

C) No, because it provides a smooth transition to the next paragraph

D) No, because it continues the explanation on why the authors project was not succesful.

Susan Willson of St. Lawrence University offers an alternative. By placing vividly colored collars 7 to be cats, Willson found that birds were much more likely to spot cats before it was too late. Consequently, collared cats killed up to 8 "19 times fewer birds than uncollared cats."

Collar scrunchies are a noiseless, effective alternative to the traditional "cat bell," and still 9 it allows cats to exercise their instincts on real pests. These colorful scrunchies are effective with birds but not on colorblind rodents.

It's not a cardinal sin to let a cat be a cat, but a simple colored collar around the neck will help offset 10 it's feline instincts. Plus, more cat videos sporting tylish scrunchies is something none of us could ever refuse. You know what they say: a group of cats 11 are the impact makers.

7

A) NO CHANGE
B) on
C) as
D) from

8

Which choice best supports the main idea of the paragraph?

A) NO CHANGE
B) 5 times more birds compared to that of uncollared cats
C) 25 times more birds compared to that of uncollared cats
D) the same amount of birds when compared to the uncollared cats

9

A) NO CHANGE
B) they allows
C) they allow
D) it will be allowing

10

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

11

A) NO CHANGE
B) is
C) were
D) will become

CONTINUE

Questions 12-22 are based on the following passage.

Let Teenagers Sleep In

Starting schools before 8:30 a.m. shows a tragic disregard for both the mental health of children and for science. In the mornings, many are forced to get to school much too early. Being the kids they are, 12 electronic screens usually command students during the night. This double whammy is a perfect lesson in sleep deprivation.

[1] Three out of every four students in grades 9 to 12 fail to sleep the minimum of eight hours that the American Academy of Sleep Medicine recommends for their age group. [2] This sleep deprivation is 13 intermittent bad news. Anyone who talks about sleep as if it's some kind of inconvenience and getting less of it is a virtue 14 should be challenged, moreover, people who belive they do not need sleep are delusional. [3] These people are dangerous. [4] A fresh-faced batch of teenagers just began a new school year, but will they get the most out of it? 15

12

A) NO CHANGE
B) students use their electronic devices during the night
C) the night is used by students with electronic devices
D) most command electronic screens during the night

13

A) NO CHANGE
B) discontinuously
C) tremendously
D) unremittingly

14

A) NO CHANGE
B) should be challenged; moreover,
C) should be challenged: moreover,
D) should be challenged, moreover:

15

To make this paragraph most logical, sentence 4 should be placed
A) where it is now
B) before sentence 1
C) after sentence 1
D) after sentence 2

CONTINUE

At its most basic, insufficient sleep results in 16 reduced attention, impaired memory, hindered student progress, and lowered grades. More alarmingly, sleep deprivation is likely to lead to 17 mood and emotional problems, increasing the risk of mental illness. Chronic sleep deprivation is also a major risk factor for obesity, Type 2 diabetes, hypertension, cardiovascular disease and cancer. As if this weren't enough, it also makes falling asleep at the wheel much more likely.

18 Though sleeping protects teenagers from fatal diseases, it also reduces a teenagers' time to do their daily chores like homeworks.

It is important to understand why teenagers have a particularly hard time getting enough sleep 19 compared to adults.

16

A) NO CHANGE
B) reduced attention, impaired memory, and hindered student progress and lowered grades.
C) reduced attention; impaired memory; hindered student progress; lowered grades.
D) reduced attention and impaired memory, hindered student progress and lowered grades.

17

A) NO CHANGE
B) mood, emotional, and personal
C) emotional
D) emotional and mood

18

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 idea of the paragraph.
C) No, because it provides relevant information to the authors claim.
D) No, because it acts as an effective transition into the next paragraph.

19

A) NO CHANGE
B) compared to those of adults
C) than adults
D) compared to that of adults

CONTINUE

First, a reminder of the basic biology: After puberty, adolescents are no longer the morning larks of their younger years. 20 <u>They have become</u> rewired as night owls, staying awake later and then sleeping in. This is not part of a feeble project to frustrate parents, but is driven by changes in the way the brain responds to 21 <u>light: and the new found glories of being a teenager.</u>

New technology habits aren't helping. More teenagers now turn to activities involving screens at night. 22 <u>On top of that,</u> according to a report this year from the Pew Research Center, some 95 percent of children aged 13 to 17 now have access to a smartphone, up from 37 percent in 2012 and 73 percent in 2015. A Centers for Disease Control and Prevention survey from 2017 reveals that 43 percent of high-school students are playing computer or video games for more than three hours on an average school night.

20

A) NO CHANGE
B) They will become
C) They become
D) They became

21

A) NO CHANGE
B) light: and the new found glories of being a teenager.
C) light; and the new found glories of being a teenager.
D) light - and the new found glories of being a teenager.

22

A) NO CHANGE
B) In addition,
C) For example,
D) DELETE the underlined portion, and end the sentence with a period.

CONTINUE

Questions 23-33 are based on the following passage.

Zoo Animals

Humans beings have kept animals in zoos for centuries, but only relatively recently have the ethical considerations of this practice been widely considered. Having much to say about these considerations, 23 beliefs have been shared by humans. At one extreme are those individuals and organizations that see no problem in 24 rapidly capturing animals quickly in zoos and other attractions, in keeping with the long history of animal confinement in the service of human entertainment, and and at the other extreme are those individuals and groups arguing that animals should not be kept 25 in zoos for ethical considerations.

23

A) NO CHANGE
B) shared beliefs by humans have spread.
C) humans have shared their beliefs.
D) spreading shared beliefs by humans.

24

A) NO CHANGE
B) rapidly capturing animals with nets
C) capturing animals
D) rapid capturing animals

25

A) NO CHANGE
B) into
C) from
D) under

CONTINUE

26 However, this difference has been complicated in recent years as zoos have increasingly become some of the most important centres of animal 27 conservancy efforts forcing a reevaluation of the ethical status of zoos in regards to the animals they contain, and the potential benefit they provide. 28 These zoos cost an average annual amount of $150,000 to maintain and, usually, get government backing. Examinig the history of zoos, their potential for harm, and the ways they might better consider animal welfare reveals that not only is the practice of keeping animals in zoo ethically sound so long as the welfare of these animals is maintained.

26

A) NO CHANGE
B) Likewise,
C) Therefore,
D) Furthermore,

27

A) NO CHANGE
B) conservancy effort; forcing
C) conservancy effort: forcing
D) conservancy effort, forcing

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

CONTINUE

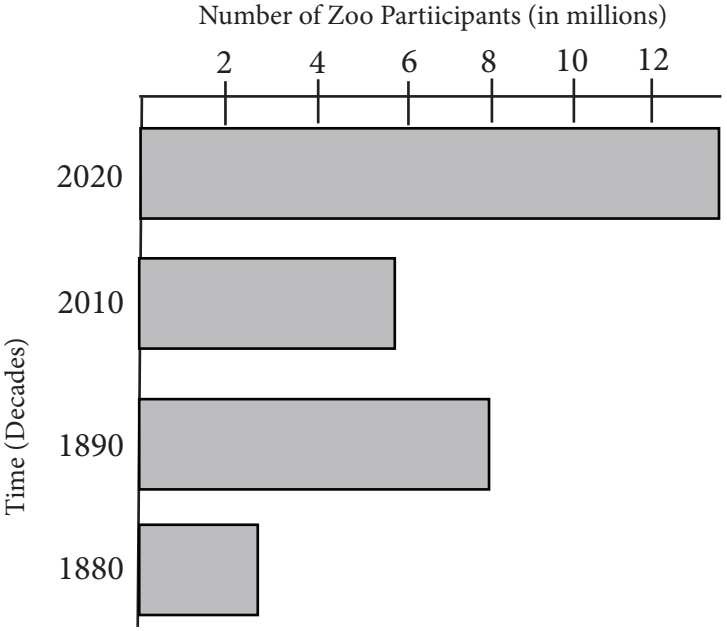
but that it is actually essential for zoos to continue and even expand their conservancy effort: because only by treating the animals already in captivity better will their conservancy efforts begin to benefit animal populations as a whole, both in zoos and out.

While zoos gradually developed over the course of history, beginning with the aforementioned Egyptian gardens, for much of human history they generally remained only within reach of the rich and powerful. The last few centuries, however, with the institution of national scientific societies and endownments, zoos gradually become more public attractions, to the point that "29 in 2020 more than 130 million Americans visit zoos -- more people than that 30 whom attend professional baseball, football, and hockey games combined".

29

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

Zoo Participation over the last 4 Decades in the U.S



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

A) NO CHANGE

B) In 2010, a decrease in zoo participation in the United States showed the breaking of an increased participation trend.

C) As of 2020, only 12 thousand people visited zoos in the United States.

D) In 1880, 2 million Americans attented Zoos in the United States.

30

A) NO CHANGE

B) which attend

C) whom attends

D) who attend

CONTINUE

More recently, "the exciting developments in zoos have been largely in America and Europe," and indeed, the majority of major zoos and conservancies are now in America, whether they be the Smithsonian National Zoological Park in Washington, DC, or the San Diego Zoo and Wild Animal Park in California. These zoos 31 is at the forefront of the debate concerning the ethics of keeping animals, because they have been forced to find ways to maintain their revenues and visitors while responding to the growing concerns regarding the treatment of animals. A 32 zoos problems are never-ending, but ethical treatment of their animals is 33 systematically on top.

31

A) NO CHANGE
B) are
C) were
D) is going to be

32

A) NO CHANGE
B) zoos' problems
C) zoo's problems
D) zoos problem

33

A) NO CHANGE
B) drastically
C) instantly
D) tragically

CONTINUE

Questions 34-44 are based on the following passage.

Illusions and Time

"Gather your rosebuds while yours may, old time is still a-flying." So wrote 17th-century English poet Robert Herrick, capturing the universal cliché that time flies. And who could doubt that it does? The passage of time is probably the most basic facet of human perception, for we feel time slipping by in our innermost selves in a manner that is altogether more intimate than our experience of, say, space or mass. 34 Therefore, the passage of time has been compared to the flight of an arrow and to an ever rolling stream, bearing us inexorably from past to future. 35 Later, more elaborately, Shakespeare wrote of "the whirligig of time," giving a new point of view on the concept of time.

No matter how evocative Shakespere's writing about time may be, it runs afoul of a deep and devastating paradox. Nothing in known physics corresponds to the passage of time. Indeed, physicists insist that time doesn't flow at all; it merely is. Some philosophers argue that the very notion of the passage of time is nonsensical and that talk of the river or flux of time is founded on a misconception. How can something so basic to our experience of the physical world 36 turn out to be a case of confusion? Or is there a key quality of time that science has not yet identified?

34

A) NO CHANGE
B) Furthermore,
C) However,
D) Subsequently,

35

A) NO CHANGE
B) Elaboratley, in a concise way,
C) In a more elabrote manner, later,
D) Later, with more elaboration,

36

A) NO CHANGE
B) turn out to be a case of confusion.
C) turn out to be such a massive and enormous case of confusion?
D) turn out to be such a massive and enormous case of confusion.

CONTINUE

In daily life we divide time 37 about three parts: past, present and future. The grammatical structure of language revolves around this fundamental distinction. Reality is associated with the present moment. The past - the point in time that is said to occur previous to the 38 present, can be thought of as having slipped out of existence. 39 The future is even more shadowy, its details still unformed. In this model of time, the "now" of our conscious awareness glides steadily onward, transforming events that were once in the unformed future into the concrete but fleeting reality of the present—and thence relegating them to the fixed past.

Obvious though this commonsense description may seem, it is seriously at odds with modern physics. Albert Einstein famously expressed this point when he wrote to a friend, "The past, present and future are only illusions, even if stubborn ones." Einstein's startling conclusion stems directly from his special theory of relativity, which denies any absolute, universal significance to the present moment. According to the theory, simultaneity is relative. 40 In other words, two events that occur at the same moment if observed from one reference frame may occur at different moments if viewed from another.

37

A) NO CHANGE
B) onto
C) upon
D) into

38

A) NO CHANGE
B) present;
C) present
D) present -

39

Which choice provides information that best supports the claim made by this sentence?

A) The future describes events that have not occured yet and could possibly change.
B) The future is a clear set of patterns that happen after the present.
C) The future is inconsistent compared to the past but consistent compared to the present.
D) The future is predeterimed events that follow the flow of time.

40

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

A) Yes, because it fails to effectivley explain Einstein's theory.
B) Yes, because the sentence provides irrelevant information the main idea of the passage.
C) No, because the sentence provides a good transition into the next paragraph.
D) No, because the sentence further clarifies Einstein's theory of time.

CONTINUE

An innocuous question that concerns time is "What is happening on Mars now?"; however, this question has no definite answer. The key point is that Earth and Mars are a long way apart—up to about 20 light-minutes. Because information cannot travel faster than light, an Earth-based observer, 41 whom is watching Mars, is unable to know the situation on Mars at the same instant. He must infer the answer after the event, when light has had a chance to pass between the planets.

[1] 42 Therefore, during a future manned expedition to Mars, mission controllers back on Earth might say, "I wonder what Commander Jones is doing at Alpha Base now." [2] Looking at their clock and seeing that it was 12:00 P.M. on Mars, their answer might be "eating lunch." [3] But an astronaut zooming past Earth at near the speed of light at the same moment could, on looking at his clock, may say that the time on Mars was earlier or later than 43 12:00 P.M., depending on his direction of motion. [4] That astronaut's answer to the question about Commander Jones's activities would be "cooking lunch" or "washing dishes" [see "It's All Relative" graphic, below]. [5] Such mismatches make a mockery of any attempt to confer special status on the present moment, for whose "now" does that moment refer to? [6]Here is another example, if you and I were in relative motion, an event that I might judge to be in the as yet undecided future might for you already exist in the present. 44

41

A) NO CHANGE
B) who are
C) who is
D) whom are

42

A) NO CHANGE
B) Likewise,
C) However,
D) For example,

43

A) NO CHANGE
B) 12:00 P.M.; depending
C) 12:00 P.M.. depending
D) 12:00 P.M.: depending

44

To make this paragraph most logical, sentence 6 should be placed

A) where it is now
B) before sentence 1
C) after sentence 3
D) after sentence 4

CONTINUE

Math Test - No Calculator

25 MINUTES, 20 QUESTIONS

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

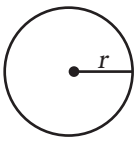
DIRECTIONS

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

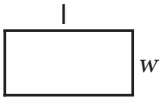
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

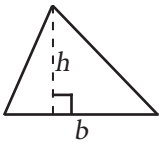


$A = \pi r^2$

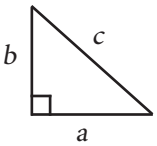
$C = 2\pi r$



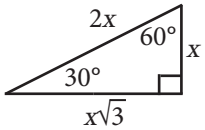
$A = lw$

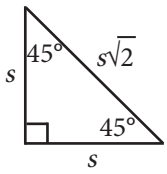


$A = \frac{1}{2}bh$

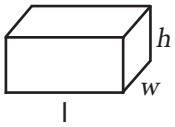


$c^2 = a^2 + b^2$

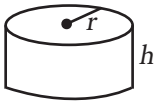




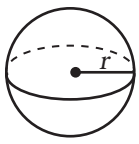
Special Right Triangles



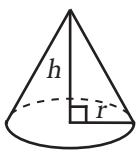
$V = lwh$



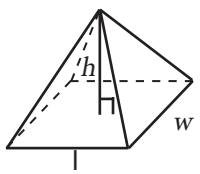
$V = \pi r^2 h$



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



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



$V = \frac{1}{3}lwh$

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.

CONTINUE

1

If $\frac{y - 5}{8} = w$ and $w = 2$, what is the value of y?

A) 11
B) 19
C) 20
D) 21

2

For $i = \sqrt{-1}$, what is the value of $(12 - 5i) - (7 - 3i)$?

A) $5 - 8i$
B) $5 - 2i$
C) $19 - 8i$
D) $19 - 2i$

3

On saturday afternoon, Becky makes cookies at a rate of p for 3 hours, and Charolette makes cookies at a rate of q for 5 hours. Which of the following expressions gives the total number of cookies made by Becky and Charolette on saturday afternoon?

A) $8pq$
B) $15pq$
C) $3p + 5q$
D) $5p + 3q$

4

The monthly household electricity bill in a state includes a minimum charge of $12.5 for any amount of conusmption under 200 units and an additionol cost of 13 cents for every unit consumed hence. If y is the billed amount in dollars and x is the number of units consumed, then which of the following best describes the relation between x and y if $x > 200$?

A) $y = 0.13x$
B) $y = 200x$
C) $y = 12.5 + 0.13\ (x - 200)$
D) $y = 12.5 + 13\ (x - 200)$

CONTINUE

5

$(2x + 1)^2 - (3x + 2)^2$

Which of the following is not a factor of the given expression?

A) $3x + 5$
B) $5x + 3$
C) $x + 1$
D) -1

6

The sum of two numbers is 15 and their product is 44 . What is the difference between them?

A) 3
B) 4
C) 7
D) 8

7

The graph of a line in the xy-plane has slope 5 and contains the point (0, 6). The graph of a second line passes through the points (0, 2) and (4, 6). If the two lines intersect at the point (a , b) , what is the value of b - a?

A) 1
B) 2
C) 3
D) 4

8

If $\frac{k^2 + 1}{k} = 2$, what is k?

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

9

Ron can complete his work in p days, Mike can complete the same work in q days how long will it take to complete the work if both of them work together?

A) $p - q$ days
B) $\frac{p + q}{2}$ days
C) $\frac{p + q}{pq}$ days
D) $\frac{pq}{p + q}$ days

10

$P(x) = 3x^2 - 7x + 2$, what is the remainder when $P(x)$ is divided by $x - 3$?

A) 7
B) 8
C) 9
D) 10

CONTINUE

11

$y = 3x - 13$
$y = 5x - 18$

If both of the prior represent linear lines on a cordinate plane, where do the two lines intersect?

A) $\left(\frac{5}{2}, \frac{-11}{2}\right)$

B) $\left(\frac{-11}{2}, \frac{5}{2}\right)$

C) $\left(\frac{2}{5}, \frac{-11}{2}\right)$

D) $\left(\frac{2}{11}, \frac{-5}{2}\right)$

12

$y = 3.5x + 23$

A line whose equation is above, does not pass the origin. What ordered pair lies on the line at a *y*-value of 58?

A) (58, 81)
B) (10, 58)
C) (12, 58)
D) (23, 58)

13

If $2a - 2b = 6$ what is the value of $\frac{9^a}{3^b}$?

A) 4^2
B) 3^3
C) 9^2
D) The value cannot be determined from the information

14

If x > 2, which of the following is equivalent to $\frac{2}{\frac{1}{9x} - \frac{1}{x+3}}$

A) $\frac{2x^2 + 6x}{12x + 3}$

B) $\frac{x^2 + 3x}{-8x + 3}$

C) $\frac{9x^2 + 36x}{12x + 3}$

D) $\frac{18x^2 + 54x}{-8x + 3}$

15

Carbon-15 decays at an annual rate of 17 percent. If the initial amount of the Carbon-15 is 400 grams, which of the following functions f models the remaining amount of the substance, in grams, t years later?

A) $f(t) = 400(0.83)^t$
B) $f(t) = 400(0.17)^t$
C) $f(t) = 0.17(400)^t$
D) $f(t) = 0.83(400)^t$

CONTINUE

Free-Response Section Next Page

CONTINUE

16

In a right triangle, one angle measures $x°$, where $\sin x° = \frac{5}{13}$. What is $\cos(90° - x°)$?

17

If $x > 0$ and $(x^2 - 9) = 0$, what is the value of x?

18

$$2x + 4y = -6$$
$$x + 3y = -8$$

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

19

If $x = 3(4 - 2)$ and $3y = \frac{3x}{4}$, what is the value of y?

20

A construction company is working on a budget of $3,880 and is purchasing material for its new operation. The company must buy granite and wood. If a log of wood costs $220, and the granite $460, how much granite must be bought to spend the entire budget if three logs were purchased?

CONTINUE

Math Test - Calculator

55 MINUTES, 38 QUESTIONS

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

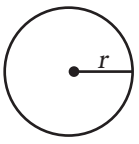
DIRECTIONS

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

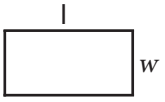
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

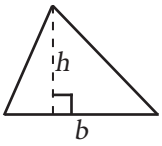


$A = \pi r^2$

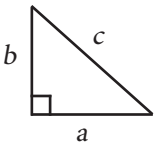
$C = 2\pi r$



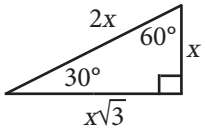
$A = lw$

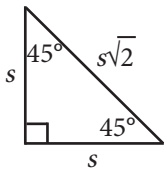


$A = \frac{1}{2}bh$

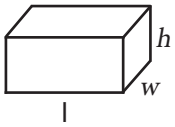


$c^2 = a^2 + b^2$

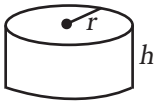




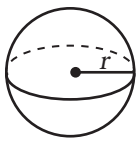
Special Right Triangles



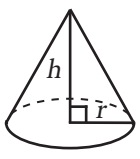
$V = lwh$



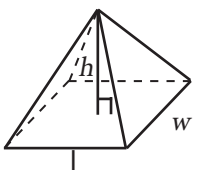
$V = \pi r^2 h$



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



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

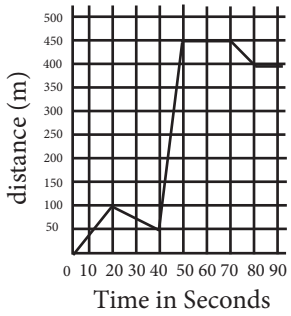


$V = \frac{1}{3}lwh$

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

An object is moving at various speeds. On which interval does the function go from increasing to decreasing?



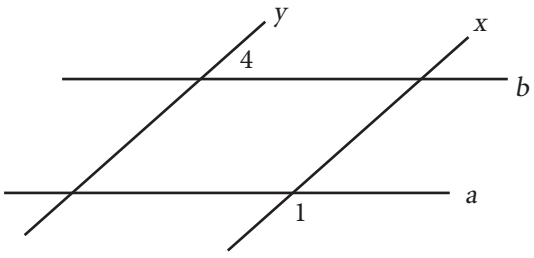
A) Between 10 and 20 seconds
B) Between 10 and 30 seconds
C) Between 20 and 40 seconds
D) Between 40 and 70 seconds

2

If $y = ab$ where a is a constant, and y is equal to 49 when $b = 7$, what is the value of y when $b = 3$?

A) 9
B) 16
C) 21
D) 28

3



In the diagram above, line x and y are parallel. Similarly, line a and b are parallel. If the measure of angle 4 is 70° then what is the measure of angle 1 ?

A) 20°
B) 70°
C) 90°
D) 110°

4

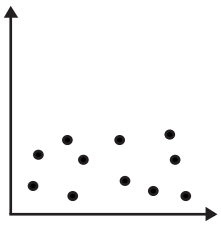
If $4x - 12$ is 16 more than 64, what is the value of $3x$?

A) 33
B) 45
C) 69
D) 108

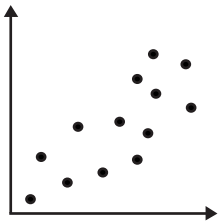
5

Which of the following shows a positive corelation between x and y ?

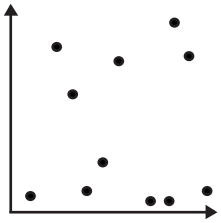
A)



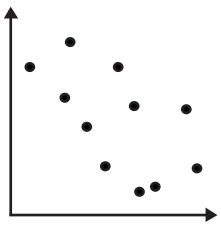
B)



C)



D)



CONTINUE

6

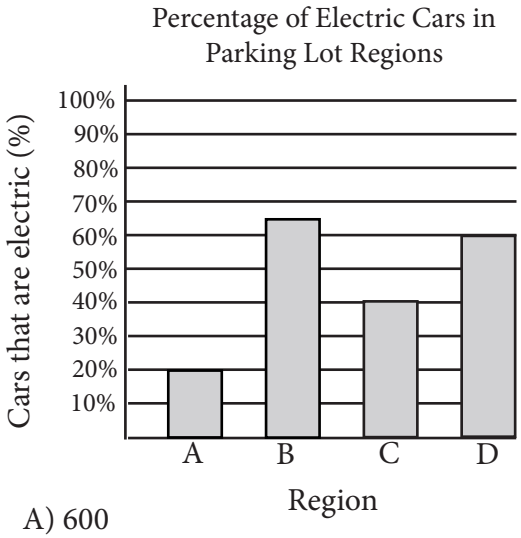
1 kilometer = 1000 meters
1 meter = 100 centimenter

A farmer has a ranch that is 3 km by 3 km. What is that area of the Ranch in centimeters?

A) 9,000
B) 90,000
C) 300,000
D) 900,000

7

If there are 3,000 cars in Parking Lot A and 5,000 in Parking Lot B, how many more electric cars are there in Parking Lot B than Parking Lot A ?



A) 600
B) 2,000
C) 2,650
D) 3,250

8

What is a value of x so that $|x - 4| + 2$ is equal to 3 ?

A) 3
B) 6
C) 8
D) 9

Questions 9 and 10 refer to the following information.

$$V = IR$$

The voltage, V, in volts of a particular electrical circuit depends on the current, I, in ampere and resistance, R, in Ohms. The formula above shows the relationship between voltage, current, and resistance in an electrical circuit.

9

Which of the following represents the current in terms of the voltage and resistance?

A) $R = \frac{V}{I}$

B) $I = \frac{V}{R}$

C) $I = \frac{R}{V}$

D) $V = \frac{R}{I}$

10

If the voltage of an electrical circuit is 3,000 volts, at which of the following current will the resistance in ohms be the closest to 270 ?

A) 1
B) 5
C) 10
D) 11

CONTINUE

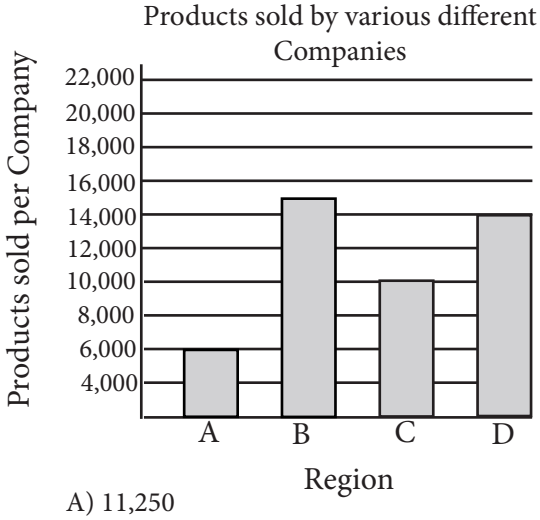
11

Which of the following is NOT a solution of the inequality $5x - 24 \geq 3x + 8$?

A) 15
B) 16
C) 18
D) 20

12

What is the average (arithmetic mean) number of products sold by the companies?



A) 11,250
B) 11,640
C) 11,750
D) 12,340

13

	Mode of Transport			
	Bike	Scooter	Bus	Total
Male	43	21	34	98
Female	50	33	19	102
Total	93	54	53	200

A group of high school students are surveyed. Each student's data was recorded on what mode of transport they use to get to school. What percentage of bike riders were female?

A) 22.5%
B) 46.2%
C) 53.7%
D) 64.2%

14

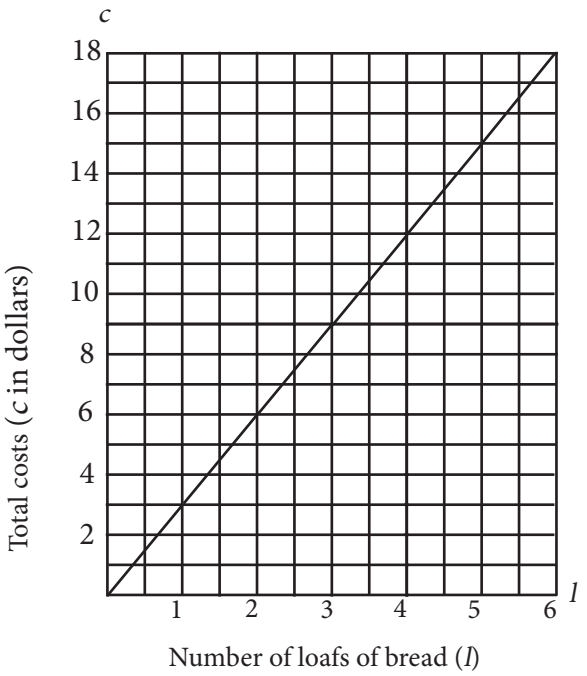
The Length of Starfish (Inches)					
7	9	3	5	8	2
2	2	6	3	8	5
3	4	5	3	4	12

The table above lists the lengths, to the nearest inch, of a random sample of 18 Choriaster Starfish. The outlier measurement of 12 inches is an error. Of the mean, median, and range of the values listed, which will change the most if the 12-inch measurement is removed from the data?

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

CONTINUE

Questions 15 and 16 refer to the foloowing graph.



15

If the trend continues, how much would 8 loafs of bread cost?

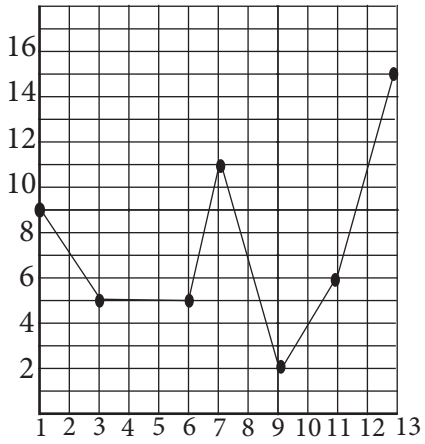
A) $8
B) $18
C) $20
D) $24

16

Which of the following represents the relationship between l and c ?

A) $c = 2l$
B) $c = 3l$
C) $c = l + 3$
D) $l = 3c$

17



A graph of the complete function of g(x) is shown above. For what value of x is the value of g(x) at its minimum?

A) 1
B) 3
C) 9
D) 13

18

$$y = 2x + 1$$
$$b = y - x$$

If $b > 1$, which of the following relationships between b and x must be true?

A) $b = 2x + 1$
B) $b = 2x$
C) $b = x + 1$
D) $x = -2x$

CONTINUE

19

A grocery store is selling watermelon for $2 each and bannans for $3 each. The grocery store's revenue from selling a total of 16 watermelons and bannans was $35. How many bannas were sold?

A) 3

B) 6

C) 13

D) 21

20

Richard bought a textbook at a store that gave a 10 percent discount off its original price. The total amount she paid to the cashier was p dollars, including an 5 percent sales tax on the discounted price. Which of the following represents the original price of the computer in terms of p ?

A) $(.90)(1.05)p$

B) $.90p$

C) $\frac{p}{(1.05)(.90)}$

D) $\frac{p}{.75}$

21

Marital Status of Women

	18-29	30-64	65 and over	Total
Married	7,842	43,808	8,270	59,920
Divorced	36	2,523	8,385	10,944
Widowed	704	9,174	1,263	11,141
Total	8,582	55,505	17,918	82,005

The data above was produced by a researcher that shows the marital status of adult women broken down by age group. If a female is chosen at random that is at least 30 years old, what is the probability that the female is married?

A) $\frac{43,808}{55,505}$

B) $\frac{52,078}{55,505}$

C) $\frac{52,078}{73,423}$

D) $\frac{52,078}{82,005}$

Questions 22 and 23 refer to the following information

Number of Hospital Survivors in Specific Hospitals

Hospital	Year			
	1998	1999	2000	2001
Hospital A	1,521	2,879	3,409	5,092
Hospital B	1,291	1,830	2,242	4,123
Hospital C	2,593	3,453	4,234	6,345
Hospital D	2,345	2,634	2,456	2,467
Hospital E	1,324	4,452	2,345	2,345

The table above shows the total number of hospital surviors in 6 specific hospital in the United States of America

22

Of the following, which hospital's ratio of its 1998 number of survivors to its 2001 number of survivors is closest to the Hospital B's ratio of its 1998 number of survivors to its 2001 number of survivors ?

A) Hospital A
B) Hospital C
C) Hospital D
D) Hospital E

23

Which of the following best approximates the average rate of change in the number of hospital survivors in Hospital A from 1999 to 2001?

A) 750
B) 900
C) 1,100
D) 1,200

CONTINUE

24

Which of the following is an equation of a circle in the *xy*-plane with a center at (5,-2) and a radius with the end point (-1,6) ?

A) $x^2 + (y + 2)^2 = 81$
B) $(x - 5)^2 + (y + 2)^2 = 81$
C) $(x + 2)^2 + (y - 5)^2 = 100$
D) $(x - 5)^2 + (y + 2)^2 = 100$

25

$$h = -16t^2 - 4t + 20$$

The equation above expresses the approximate height h, in meters, of a ball t seconds after it is launched vertically upward from the ground. What does the 20 in the equation represent ?

A) The inital height of the ball
B) The final height of the ball
C) The intial speed of the ball
D) The final speed of the ball

26

James is a zoologist studying the number of offspring born in different species of monkeys. He observes that the species Monkey A produces 24% more offspring than that of species Monkey B. Based on James' observations, if the number of offspring produced by species Monkey A is 155, how many offspring were produced by the species Monkey B ?

A) 37
B) 118
C) 125
D) 192

27

A researcher is using a tagging system to count the number of squirrels in a specific regions of a forest that is 15 m x 15 m. He divides the forest into 5 square regions; each region has a side length of 1 meter. The resercher counts the number of squirrels in each region. The results are shown in the table below.

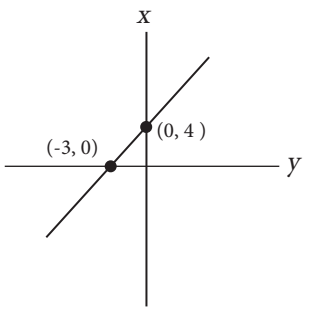
Regions	Number of Squirrels
A	24
B	14
C	17
D	19
E	13

Which of the following is a reasonable approximation of the number of squirrels in the entire forest ?

A) 90
B) 260
C) 435
D) 3,915

CONTINUE

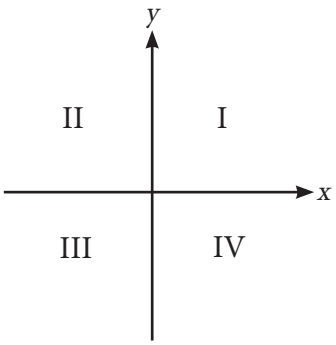
28



The straight line represents the equation, $y = mx + c$ what are the values of m and c respectively?

A) 0.75 and 4
B) 1.25 and 4
C) -0.75 and 4
D) -4 and -1.25

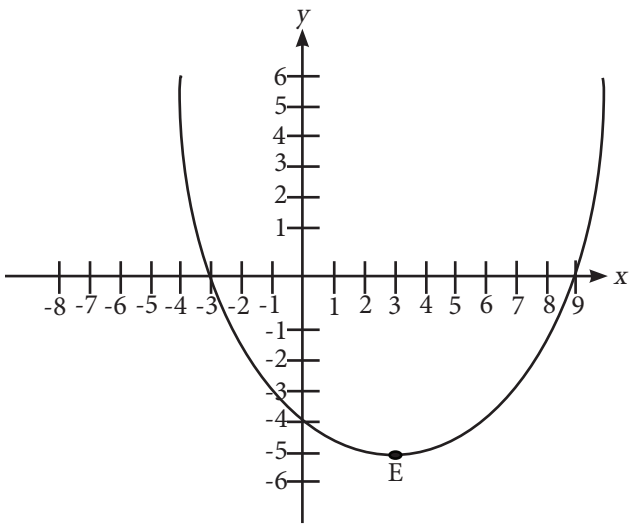
29



If the system of inequalities $y \leq -x + 2$ and $y \geq x^2 - 2$ graphed in the xy-plane above, which quadrant contains no solutions to the system?

A) Quadrant I
B) Quadrant II
C) Quadrant III
D) Quandrant IV

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 E can be identified as constants in the equation?

A) $y = (x + 3)(x - 9)$
B) $y = (x - 3)(x + 9)$
C) $y = (x - 3)^2 - 5$
D) $y = x(x - 3) - 6$

CONTINUE

Free-Response Section Next Page

CONTINUE

Questions 31 and 32 refer to the following information.

Arnold is saving money for his retirment. He puts an investment of $200 in a bank account that compounds annually at an interest rate of 1%. Arnold uses the expression $200(z)^t$ to figure out the amount of money he saves after *t* years.

31

What does *z* represent in the expression ?

32

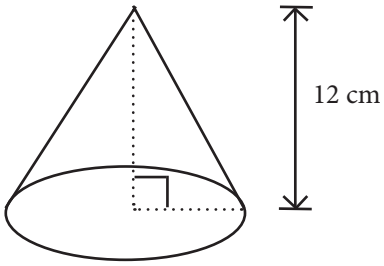
Arnold's friend Jim also wants to retire and found an account that earns 2.5 percent interest compounded annually. Jim made an initial deposit of $500 into this account at the same time Arnold made a deposit of $200 into her account. After 10 years, how much more money will Jim's initial deposit have earned than Arnold's initial deposit? (Round your answer to the whole number and ignore the dollar sign when gridding yourresponse.)

33

$$\frac{x^2 \pm 1}{3} = 1$$

What is the maximum value of *x* in the given equation?

34

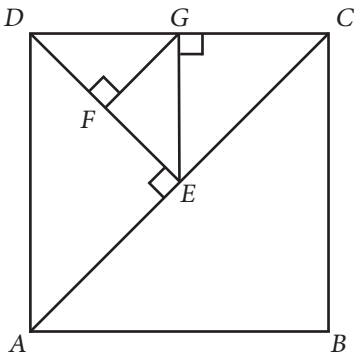


What is the measure of the radius of the right circular cone if the volume of the cone is 154 cm^3 (Round your answer to the nearest tenth's place) ?

35

The restricted weight limit for a bridge in California is is 10,000 pounds. A shipment truck that is carrying x identical boxes each weighing 12 pounds will pass over the bridge. If the combined weight of the empty shipment truck and its driver is 6500 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 restricted weight limit?

36



ABCD is a square, what percent of the area of *ABCD* is the area of the triangle *DFG*?

37

$$5x - 2y = 22$$
$$6x - 7y = 8$$

For the solution (x, y) for the given system of linear equations, what is the value of $x + y$?

38

400, 700, a, 800, 1200, b

If the mean of the given numbers is 670, what is the value of $a + b$?

CONTINUE