



# FTCE Elementary Education K-6 (060) Ultimate Guide

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# Preparing to take the FTCE Elementary Education K-6 (060) exam?

Awesome!

We will answer every question you have and tell you exactly what you need to study to pass the K-6 exam.

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Subtest 1: Language Arts and Reading

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# Quick Facts

## Overview:

The test covers both content and content pedagogy in the four subtest areas. The test is computer-based.

## Format:

Subtest	Number of Questions	Time in Minutes
Subtest 1: Language Arts and Reading	50	65
Subtest 2: Social Studies	45	65
Subtest 3: Science	45	70
Subtest 4: Mathematics	35	70

## Cost:

First attempt: \$150 (full battery)

Retakes: \$37.50 (one subtest)

\$75 (two subtests)

\$112.50 (three subtests)

\$150 (four subtests)

## Scoring:

Test takers must score 200 on each subtest to pass.

All subtests must be passed to pass the exam.

## Pass rate:

The table below breaks down the passing percentages for first-time test takers on each individual subtest. This can give you an idea of how test takers in 2018 performed on their first exam.

# Quick Facts

Subtest	Passing percentage on first administration
Subtest 1: Language Arts and Reading	57%
Subtest 2: Social Studies	66%
Subtest 3: Science	67%
Subtest 4: Mathematics	62%

## Study time:

The amount of time that you should study will depend on your individual needs. Some test takers will need to spend more time on some subjects than on others.

Consider the chart above. Notice that the Language Arts and Reading subtest has a passing rate that is 10 points lower than the Science subtest. This suggests that many first-time test takers underestimate how challenging the Language Arts and Reading subtest will be.

Use your knowledge of your own strengths and weaknesses and the results of practice tests to allocate study time. Generally speaking, you should reserve several weeks for your study process in order to adequately cover the content for all subtests.

## What test takers wish they'd known:

- If you take three or more subtests, you will be given a 15-minute break.
- An unofficial pass/non-pass assessment is typically given at the test site when possible.
- The test is computer-based.
- A mathematics reference sheet is provided
- You will not be penalized for incorrect multiple-choice answers, so it is to your advantage to answer all questions.

Information obtained from the FTCE and NES website: <http://www.fl.nesinc.com/>.

# Subtest 1:

## Language Arts and Reading

### Overview

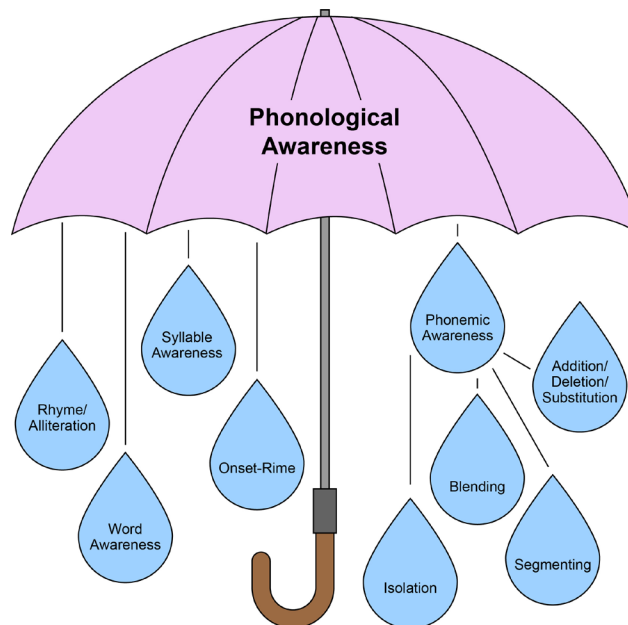
The Language Arts and Reading subtest has 60 multiple-choice questions, which account for about 27% of the entire exam. You will have 65 minutes to complete this subtest.

There are five competencies on the Language Arts and Reading subtest:

1. Reading process (29%)
2. Literary analysis and genres (16%)
3. Language and the writing process (16%)
4. Literacy instruction and assessments (23%)
5. Communication and media literacy (16%)

Let's explore a few of the specific concepts that are highly likely to appear on the exam.

### Phonological Awareness



**Phonological awareness** is an umbrella term that includes the ability to hear and comprehend individual words, syllables, and sounds in spoken language. It involves the understanding that words can be broken into parts, or sounds, which can be maneuvered, and the ability to apply that knowledge.

The skills under phonological awareness (from simple to complex):

- **Rhyme/alliteration awareness** is the ability to hear words that have the same ending or beginning sounds.
- **Word awareness** is the ability to recognize that sentences are broken down into words. Students can practice word awareness by clapping and counting the words in a sentence.
- **Syllable awareness** is the ability to segment words by syllables.
- **Onset/rime** is how the word is divided. Onset is the initial consonant or consonant blend and rime includes the vowel and consonant.

*Example: splat*  
*onset: spl- rime: -at*

- **Sound awareness** (phonemic awareness) is understanding what sounds are and how they come together to form words; phonemes are the smallest units of sound.
  - isolation
  - blending
  - segmenting
  - addition/deletion/substitution

Phonological awareness is a crucial set of skills needed to be able to understand the phonics of learning how to read. Research shows that explicit phonological awareness instruction can help all students learn to read. Phonological awareness is also a strong predictor of reading success.

## Measuring Reading Fluency

**Reading fluency** is one's ability to read, which is measured by three main components:

- **Accuracy** is the reader's ability to correctly pronounce words.
  - **Automaticity** is the ability to read words effortlessly.
- **Prosody** is the expression and emphasis used when reading. Prosody is measured by the ability to recognize when to stop after punctuation and pause after commas.
- **Speed** is the amount of time it takes for a reader to read a text (not too fast or too slow). The accuracy and speed can be used to determine a reader's words per minute.

Using repeated reading strategies will help improve a student's fluency. Repeated reading is having students read the same text over and over again until automaticity is reached with very few errors. This could look a few different ways in the classroom setting. A teacher could use a basal connected text in the classroom and facilitate conversations around the text in a whole-group setting. The text could also be used in small groups with students reading a leveled text based on their fluency level.

Running records are a great way to assess reading fluency. A running record measures a reader's accuracy, speed, and prosody to determine their words per minute. A teacher can then use that data to determine the level of text that is appropriate for that student. Running records are an ongoing process to monitor a student's progress and should be given frequently depending on the stage of reading the student is in.

## Stages of the Writing Process

1. **Prewriting/planning** is the first step. Students brainstorm ideas and determine their purpose for writing. This is the time to determine the audience and organize or research ideas to be used in the composition.
2. **Drafting** is creating the first draft of the composition.
3. **Revising** involves rearranging the ideas in the composition and deleting or adding material. There are two types of revising, peer revising and self revising. Peer revising is when another person reads and makes corrections to your paper. Self revising is when the writer is the one revising.
4. **Editing** is the process of correcting grammatical errors and mechanics problems. Writers proofread their compositions and improve any areas that need clarity.
5. **Publishing** is the final step. Writers share their compositions with others.

## Characteristics of Penmanship

Handwriting is a fine motor skill that involves three key characteristics:

- **Legibility** is the readability of one's penmanship. The way the letters are formed, the pressure of the utensil being used, spacing of the letters and words, smearing from hand placement, slanting of letters: all of these factors affect the legibility.
- **Letter formation** is the shape and size of the letters. For younger students, lined paper is a good guideline for where to begin and end each letter. Printing out directional arrows or traceable letters to show how letters are formed is also a good way to improve penmanship.
- **Spacing** is the position of letters in a word or words in a sentence. Teaching younger students to create a "finger space" between their words by using their finger after each word is a good way to improve spacing.

## Types of Assessments

- **Formal assessments** are used to gauge a student's strengths and weaknesses. They involve data that is used to compare students.
  - Criterion references are used to compare a student's knowledge on a specific skill, learning standard, or other criterion.
  - Norm-referenced standards are used when measuring how students did compared to an average student of the same age.
- **Informal assessments** are not data-driven but focus on a student's mastery of content and performance level.

- **Formative assessments** are administered frequently throughout a course, semester, or school year. They measure the progress a student is making.
  - Curriculum-based assessments measure how a student did on the subject matter taught. They usually include more than one learning standard and are administered in test form.
  - Exit slips are given at the end of a lesson to gauge the student's level of knowledge of the material.
  - Diagnostic tests cover all material that will be learned in that subject that year or course. They show a student's strengths and weaknesses in the material to be covered.
- **Summative assessments** are given at the end of a grading period, course, semester, or school year. They cumulatively measure what a student learned.
  - Formal summative assessments would include benchmarks, unit tests, and course finals.
  - Performance-based assessments give students a chance to apply the knowledge that they gained from a unit or course.

### Small Groups

A **small group** is a breakout from the whole group setting. A true small group does not consist of more than six students. Small groups are an opportunity to reinforce and strengthen gaps in learning. Students can be grouped many different ways.

- Ability grouping (same reading level)
- Skill grouping (to reinforce a learning standard)
- Strengths (as enrichment for gifted students)
- Data-driven (using formal and informal assessments to create groups based on needs)

Small groups should be fluid. They are always changing because the teacher is continuously assessing student needs. Small-group breakouts are usually scheduled after a whole group lesson while other students are working on independent or partner work. Good classroom management and consistent expectations are vital to ensure that students can work independently while you as a teacher conduct a small group.

And that's just some very basic information about the Language Arts and Reading subtest.

Now, let's look at a few practice questions



# Domain 1 Practice Questions

## Question 1

Which of the following skills is not part of phonological awareness?

- A. letter awareness
- B. sound awareness
- C. syllable awareness
- D. rhyme awareness

**Correct Answer:** A. An understanding of the names and shapes of letters does not fall under the umbrella of phonological awareness. Phonological awareness is specifically focused on sounds.

## Question 2

Ms. Morgan has been working to teach her students alphabetic principles. On Monday she began by describing the sound made by the letter “s.” Which of the following would be the most logical next step of instruction?

- A. describing the sounds made by the rest of the letters in the alphabet
- B. reading a book where many words start with the letter “s” and ask students to tally how many times they hear it
- C. having all students write a list of words that start with the letter “s”
- D. pointing out examples of “s” in familiar words and names

**Correct Answer:** D. An opportunity for practice to reinforce the relationship between newly learned letter and sound pairs would be an effective next step of instruction.

## Question 3

Which of the following best describes the segment “un” in “unbelievable.”

- A. suffix
- B. root
- C. prefix
- D. affix

**Correct Answer:** C. A prefix is a letter or letters at the beginning of a root word that changes its meaning. “Un” changes the meaning of “believable” in this word.

## Question 4

While working one-on-one with a student, a teacher administers a nonsense word test. Which of the following skills is the teacher most likely trying to assess?

- A. spelling
- B. word analysis
- C. fluency
- D. comprehension

**Correct Answer:** B. A nonsense word test is used to determine students' actual knowledge of individual sounds without allowing the knowledge of sight words to interfere with the students' thinking.

## Question 5

A third-grade class is learning the steps of the writing process. The students are currently writing sentences and paragraphs. Which of the following steps of the writing process have students already completed?

- A. brainstorming ideas on a topic
- B. rewriting sentences to correct any grammatical errors
- C. sharing the final product with classmates and the teacher
- D. adding or adjusting words in a sentence

**Correct Answer:** A. Brainstorming comes before writing sentences and paragraphs in the writing process.

## Question 6

Which of the following sentences best demonstrates active listening?

- A. "I liked the movie because of all the famous actors and action sequences."
- B. "How could you not like the movie?"
- C. "John thinks the movie overlooked the plot in favor of extended action sequences."
- D. "I will write on my blog that the movie was entertaining."

**Correct Answer:** C. This answer best exemplifies active listening. Active listening is a process of being engaged and responding to another person in a way to build and improve communication. Active listeners spend more time listening than speaking. Paraphrasing someone else's thoughts implies that the speaker has engaged in active listening because it demonstrates an understanding of another person's communication.

### Question 7

Which of the following is a primary source for a research project on Jane Goodall?

- A. My Life with Chimpanzees by Jane Goodall
- B. a news article written based on an interview with Goodall
- C. a biography of Goodall provided on the Jane Goodall Institute website
- D. a documentary providing a broad overview of her life

**Correct Answer:** A. Since this is Jane Goodall writing about her own experience, it would be a primary source.

### Question 8

A first-grade teacher can formally and informally assess the development of his/her students' phonemic awareness in all of the following ways except:

- A. having the students blend sounds together into words that the teacher says aloud.
- B. having the students repeat the words back after the teacher says them aloud.
- C. having the students read silently and write down certain syllables.
- D. having the students give rhymes to short words that the teacher says aloud.

**Correct Answer:** C. When a student is reading silently, the teacher cannot assess their pronunciation. Also, phonemic awareness is the ability to hear individual sounds, not necessarily read them.

### Question 9

Which of the following skills is NOT assessed using a reading fluency assessment?

- A. comprehension
- B. decoding
- C. intonation
- D. speed

**Correct Answer:** A. Fluency assessments do not provide information about whether or not a student comprehends (understands) what he or she has read.

## Question 10

Follow-up activities are crucial to enhancing elementary students' listening skills. After listening to a story, which of the following activities would be most appropriate for a class with many English language learners?

- A. writing answers to questions on a worksheet
- B. performing a skit about the events in the story
- C. acting out parts of the story after writing about main points
- D. asking a partner questions about the story and recording his/her answers

**Correct answer:** B. Acting out a story is an excellent follow-up activity for ELL and other students, in that the teacher can check for listening comprehension.

# Subtest 2:

## Social Science

### Overview

The Social Science subtest has 55 multiple-choice questions, which account for about 25% of the entire exam. You will have 65 minutes to complete this subtest.

There are five competencies on the Social Science subtest:

1. Effective instructional practices and assessment of the social sciences (19%)
2. History (26%)
3. Geography (18%)
4. Government and civics (20%)
5. Economics (17%)

Let's explore a few of the specific concepts that are highly likely to appear on the exam.

### African American Civil Rights Movement

Beginning in the 1950s African Americans began to formally organize to fight the systemic racism intertwined with American culture. In 1955, Rosa Parks refused to sit in the back of a segregated city bus, sparking the Montgomery Bus Boycott, a 13-month citywide protest of segregation on buses. Organized by Martin Luther King Jr., the boycott resulted in a Supreme Court decision ruling segregation on public buses unconstitutional.

With the constitutionality of "separate but equal" public facilities overturned in 1954 by *Topeka v. Board of Education*, public schools were ordered to be integrated. In 1957, nine African American students tried to enter Central High School in Little Rock, Arkansas. In response, Governor Orval Faubus sent in the Arkansas National Guard to block the students from entering. President Dwight D. Eisenhower in turn sent in federal troops to protect the students, now known as the Little Rock Nine. This event cemented the idea of equal opportunity in education.

As the Civil Rights Movement continued, larger protests began to take place. With the goal of pressuring the U.S. government to pass a Civil Rights bill, more than 200,000 protesters descended upon Washington D.C. in the summer of 1963. During this march, on August 28th, 1963, Martin Luther King delivered his famous “I have a dream” speech. Smaller marches and protests throughout the country continued. The Selma-to-Montgomery March garnered national attention, as a previous attempt to complete the march was met with a strong police presence and brutality. The goal of the march was to fight for equal voting rights. Spurred by the killing of a black preacher and activist by a white sheriff, King and the Southern Christian Leadership Conference led 3,200 protestors from Selma, Alabama, to Montgomery, Alabama.

## **Causes of Human Migration**

Human migration is the movement of people from location to another. The most basic reason for human migration is to find suitable water and food sources. Most human communities are located near a water source (lake, river, ocean) and ample food sources (arable land, fishing deposits, forests for hunting). Another reason for human migration is to find land that is militarily advantageous. Many civilizations used physical landforms such as waterways and mountain ranges to protect themselves from military invasion and the natural elements. More recently, human migration has occurred as people fled persecution. For example, the Puritans, or Pilgrims, came to North America seeking religious freedom. Finally, perhaps the most common reason for present-day human migration is the search for better economic opportunities. In the early 1900s immigrants from Southern Europe came to the United States through Ellis Island in New York, seeking a better life.

## **Ancient Greece**

Ancient Greece is responsible for developing the world’s first democracy. More impressively, the Ancient Greeks were the first people to take a scientific approach to medicine. In mathematics, the Greeks discovered the principles of geometry and laid the foundation for various other mathematical concepts. In the humanities, Greek philosophers pondered various subjects; architects used crepidoma, columns, entablature, and pediment features to build temples and other structures; and playwrights wrote and produced the first dramas in outdoor theaters. Notable Greeks include:

- (1) Philosophers Socrates, Plato, and Aristotle
- (2) Aesop, the storyteller credited with numerous fables
- (3) Homer, the author of the Iliad and the Odyssey
- (4) Hippocrates, the father of medical thought
- (5) Pythagoras, architect of geometry; known for establishing the Pythagorean Theorem
- (6) Euclid, “Father of Geometry”

Greek culture influenced the Roman Empire and many other civilizations. It continues to influence modern cultures today.

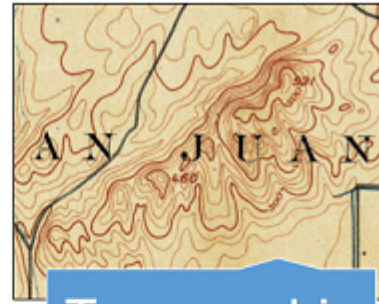
## Types of Maps



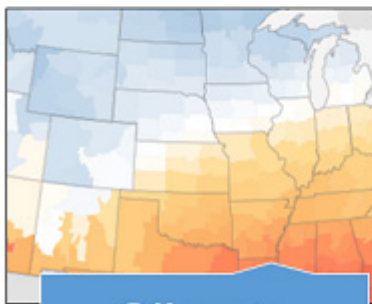
Physical



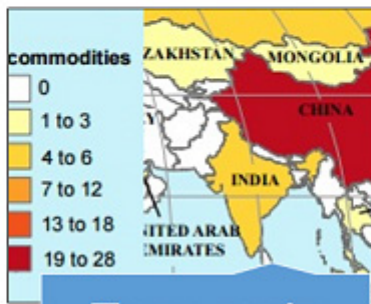
Political



Topographic



Climate



Economic



Thematic

Maps have been an essential tool throughout human history. Maps are two-dimensional renditions of a place. They can cover any area, ranging from a park to the whole world. Here are six types of maps that are commonly used:

- (1) **Physical maps** show the Earth's features or landforms, like landscapes, mountains, rivers, valleys, deserts, lakes, and oceans. They can also be used to show land use, infrastructure, and many other human-made features.
- (2) **Political maps** show the human-made political boundaries of governmental entities such as countries, states, and localities. These maps can also show roadways, city layouts, and waterway features.
- (3) **Topographic maps** show changes in elevation, such as mountains and valleys. A topographic map typically uses contour lines to show where elevation increases and decreases.
- (4) **Climate maps** show various geographic representations of climatic indicators such as temperature, precipitation, relative humidity, insolation, cloud cover, wind speed and direction, and atmospheric pressure. They are often used to predict weather and weather patterns.

- (5) **Economic maps** are used to represent various economic indicators. For example, economic maps often represent data tracking inflation, employment, housing trends, consumer spending, and consumer confidence. Economists use economic maps to make predictions to analyze economic growth and activity.
- (6) **Thematic maps** often represent a single attribute of a particular topic, theme, subject, or concept. For example, a thematic map showing various soil types throughout the United States represents a single attribute of a particular topic (soil). They are also used to display geographical concepts such as density, distribution, relative magnitudes, gradients, spatial relationships, and movements.

## Structure and Function of the Federal Government

The U.S. Constitution first took effect in 1789. The fairly brief (7,000-word) document lays out the basic framework and procedures of the U.S. government. It also sets the limits within which the government must conduct itself. The Constitution begins with the preamble, which introduces the fundamental concepts of the document. It clearly communicates the intentions of the framers and the purpose of the document. The bulk of the document consists of seven articles, which are followed by 27 amendments.

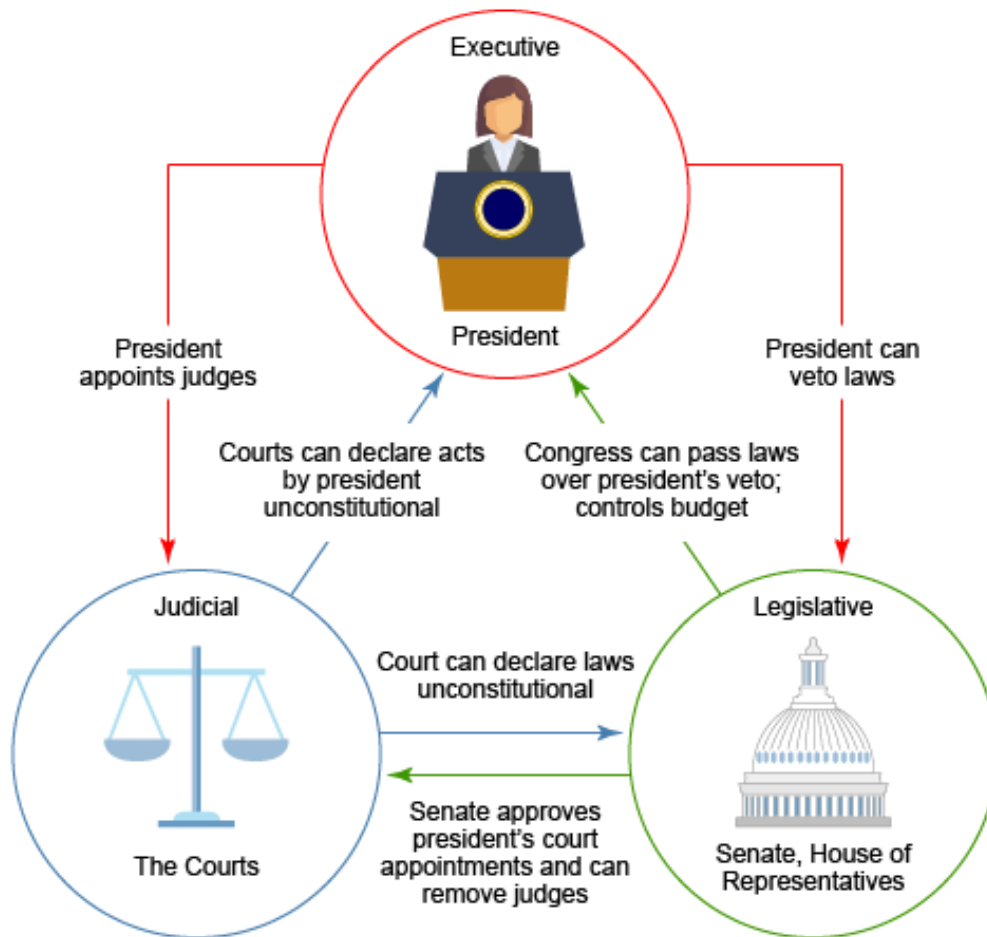
### The Articles of the Constitution:

- (1) Article I lays out the policies and procedures of the legislative branch.
- (2) Article II lays out the policies and procedures of the executive branch.
- (3) Article III lays out the policies and procedures of the judicial branch.
- (4) Article IV details the relations among states.
- (5) Article V details the framework for amending the Constitution.
- (6) Article VI deals with policies and procedures for subjects such as the national debt, the supremacy of federal law, and oaths of office.
- (7) Article VII lays out the framework for ratifying the Constitution.

Among the most important constitutional principles defining American democracy is the idea of separation of powers. It refers to the division of government responsibilities into distinct branches. (The executive branch enforces the law, the legislative branch makes the law, and the judicial branch interprets the law.) This limits any one branch from exercising or superseding the core functions of another. An important component of separation of powers is the idea of checks and balances. The constitutional principle of checks and balances assure that no one branch of government obtains absolute power. Each branch has certain powers that can limit actions by the other branches, forcing a sharing of power. For example, the president (executive branch) has the power to veto congressional bills. Congress (legislative branch) can overturn a veto with a two-thirds majority vote. The Supreme Court (judicial branch) can rule a law unconstitutional.



## Checks and balances on the U.S. government



## Types of Economic Resources

The factors of production are an essential aspect of economic production of goods and services. An entrepreneur or business owner combines the factors of production to produce goods. Those include land, labor, and capital (physical and human). The land refers to the natural resources acquired from the land to create a good. Labor is the energy or work put forth to create the good. Physical capital is the human-made tools used to help create the good and human capital is the knowledge and skills used to create the good.

And that's just some very basic information about the Social Science subtest.

Now, let's look at a few practice questions.

# Subtest 2 Practice Questions

## Question 1

What political factor distinguished Egyptians from other civilizations of the Fertile Crescent?

- A. They had a religious system in which the gods provided protection against nature.
- B. They learned how to organize workers to build temples.
- C. They had a strong central government led by a family of kings.
- D. They granted women the right to own property.

**Correct Answer:** C. The rulers of ancient Egypt were pharaohs and were the leaders of a strong centralized government. The benefit of the dynastic rule of the pharaohs is that it provided political stability to the region and allowed resources to be devoted to arts and sciences instead of war. The rule of the pharaohs was typically transferred from father to son.

## Question 2

Following the arrival of Europeans, Native American life changed immensely because of:

- A. diseases brought by the Europeans, which killed large populations.
- B. some tribes' acquisition of horses.
- C. increased violent conflict between tribes.
- D. increased peace between tribes, accompanied by significant conflict with settlers.
- E. increased reliance on railroads.

**Correct Answer:** A, B, C

- A. The Native Americans saw dramatic changes in lifestyle after European colonization as diseases such as smallpox devastated large populations.
- B. Horses acquired from colonists revolutionized the way that Native Americans lived their daily lives. The Lakota tribe, who had been sedentary forest dwellers, moved to the open plains with the acquisition of horses from the Spanish. They adopted a completely new way of life as mounted nomadic hunters.
- C. Native Americans traded animal furs for firearms from the colonists. This new technology increased the violence between tribes.

## Question 3

A market where only a few firms compete against each other is known as:

- A. a monopoly.
- B. an oligopoly.
- C. monopolistic competition.
- D. perfect competition.

**Correct answer:** B. An oligopoly is a market where only a few firms supply a good or resource.

#### Question 4

The downsides of utilizing a fixed currency include its:

- A. stability, due to having a value established against a precious metal.
- B. inability to influence the currency with monetary policy.
- C. relative lack of use worldwide.
- D. reliance on a finite resource, such as gold.

**Correct Answer:** B. Since fixed currencies are pegged to precious metals such as gold and silver, governments are unable to utilize monetary policy tools to regulate the currency. This is considered a major downside.

#### Question 5

Which of the following types of map shows a detailed and accurate graphic representation of natural features of the ground?

- A. meteorological
- B. political
- C. topographic
- D. thematic

**Correct Answer:** C. A topographic map displays, in large detail, the natural features of the ground. In general, the purpose of topographic maps is to convey the relief, or elevation changes, in a particular area using contour lines.

#### Question 6

California experienced a significant drought from 2012 to 2015. Many almond farmers began planting crops that required less water to grow. This action is an example of:

- A. adapting to environmental changes.
- B. adjusting to supply and demand.
- C. using nonrenewable resources to improve farming.
- D. changing the environment to meet human needs.

**Correct Answer:** A. The change in crop choice is an example of farmers adapting to the change in the environment.

### Question 7

A United States citizen gathers friends who share her views and hosts a peaceful protest in front of their state government building. This is an example of exercising her right to:

- A. freedom of petition.
- B. freedom of assembly.
- C. freedom of religion.
- D. freedom of press.

**Correct Answer:** B. Freedom of assembly allows citizens the right to gather in peaceful and lawful groups.

### Question 8

Which of the following flags never flew over Florida?

- A. The Dutch flag
- B. The Spanish flag
- C. The flag of the Confederate States of America
- D. The flag of the United States of America

**Correct Answer:** A. The Dutch never held Florida territory.

### Question 9

Which president is commonly considered the architect of the Great Society?

- A. Franklin D. Roosevelt
- B. Lyndon Johnson
- C. Ronald Reagan
- D. John F. Kennedy

**Correct Answer:** B. Lyndon Johnson promoted the legislation that would be deemed “The Great Society.” The legislation created domestic programs with two goals: the elimination of poverty and the end of racial injustice. Major aspects of the legislation were the creation of Medicare and Medicaid and the expansion of welfare programs.

## Question 10

A sixth-grade student is researching the Civil War and has read two conflicting secondary sources about the motivations of Abraham Lincoln in issuing the Emancipation Proclamation. He asks the teacher how he can find which secondary source is most accurate in the matter. Which of the following responses by the teacher would be most appropriate?

- A. suggesting that the student read the primary sources quoted by the secondary sources so the student can draw an independent conclusion
- B. urging the student to look at online reviews of the book to find which one is more accurate
- C. identifying which book has a larger bibliography as a means of deciding which book is more accurate
- D. telling the student which book is more accurate

Correct Answer: A. This is the best answer. If a student has two conflicting reports and motivations, reading the primary sources of the secondary sources will provide detail and allow the student to come to their own conclusions.

# Subtest 4:

## Science

### Overview

The Science subtest has 55 multiple-choice questions, which account for about 25% of the entire exam. You will have 70 minutes to complete this subtest.

There are five competencies on the Science subtest:

1. Effective science instruction (20%)
2. Nature of science (18%)
3. Physical sciences (20%)
4. Earth and space (19%)
5. Life science (23%)

Let's explore a few of the specific concepts that are highly likely to appear on the exam.

### Physical vs. Chemical Changes

Changes in matter can either be physical or chemical. Physical changes are changes in matter's appearance and do not affect the chemical composition of the matter. Phase changes, such as ice turning to water and then to steam, are also physical changes because the chemical structure,  $H_2O$ , does not change. Other examples of physical changes are tearing a piece of paper and smashing a soda can.

A chemical change requires bonds to be broken or formed during chemical reactions. Sometimes chemical changes cannot be seen. Other times there is evidence of a chemical change, such as color change, bubbles, odor release, or temperature change. One example of a chemical change is when a shiny new penny turns from copper-colored to green. This happens because the copper reacts with oxygen and creates a new compound- copper oxide. Other examples include rusting of iron, burning wood, and cooking an egg.

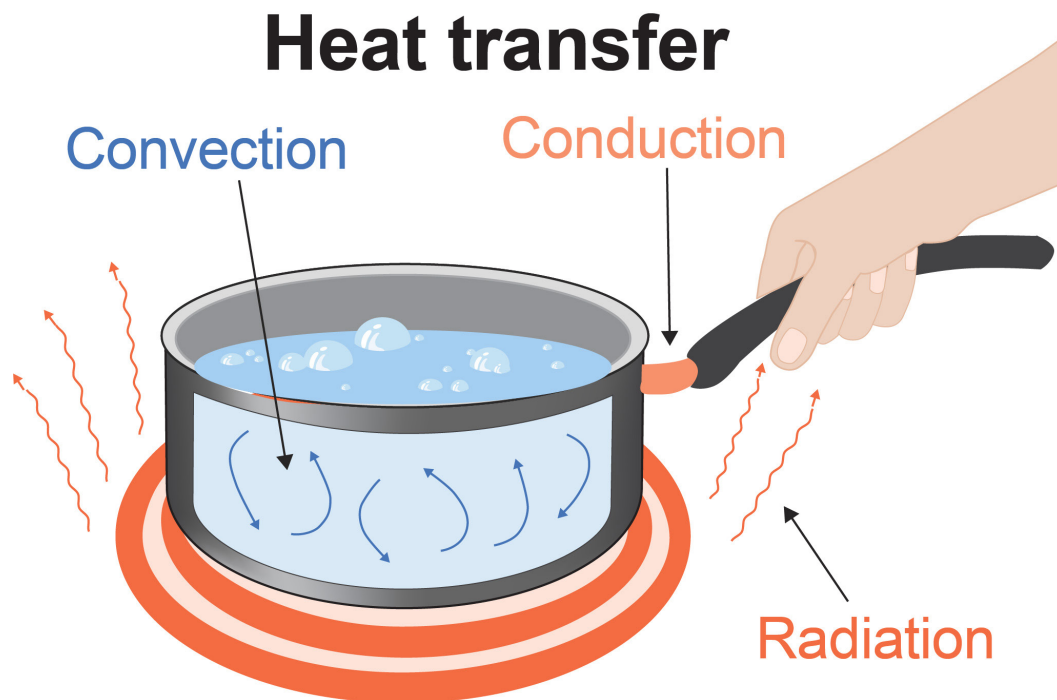
### Heat Transfer

Heat and temperature are related but different. Temperature is the measure of average heat in a substance. Heat is a transfer of kinetic energy from a hotter substance or system to a cooler one. Energy will flow from the hotter object to the cooler object until both objects are the same temperature. This is called thermal equilibrium.

Heat can be transferred in three different ways: conduction, convection, and radiation. Conduction occurs when heat flows from a hotter substance to a cooler substance by contact. In our example below, heat is flowing from the hot pot handle to a cooler hand touching it. Another example of conduction is a piece of ice melting in your hand. The heat from your hand is transferring to the ice and causing it to melt.

Convection occurs when liquids or gases are heated through a current. In our example below, as the hot burner heats the water, the water rises. As the water gets further from the heat source (the burner), it begins to cool and falls to the bottom of the pot where it heats again. This continues over and over again, causing circular convection currents. Another example of convection is a hot air balloon. The heat from the flame at the base of the balloon causes the balloon to rise. Turning the flame off causes the balloon to fall.

Radiation is when heat is transferred from a hotter object to a cooler object without the objects touching. In the example of a pot on a burner, radiation is the heat coming from the burner. Without touching the burner, you can feel the heat on your hand. Another example of radiation is being able to feel the heat from the Sun.

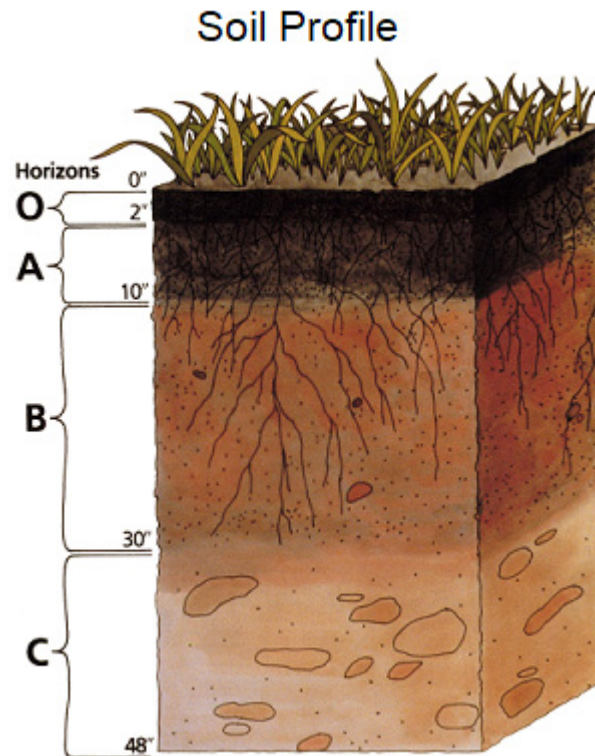


## Soil

Soil consists of a mix of minerals, organic material, water, air, and many organisms. Soil is the media in which plants grow and serves as a filter to clean water. Soil is roughly 45% rocks and minerals, 25% water, 25% air, and 5% organic matter. Soil forms by weathering of the parent material, which is rocks. When rock is exposed to wind, water, and climate, it breaks down into smaller pieces. Eventually, it becomes soil.

If you were able to look at a cross-section of soil, you would find at least three separate layers, or **horizons**. These horizons can be differentiated by how they look and their chemical composition. Scientists label the four main horizons O, A, B, and C.

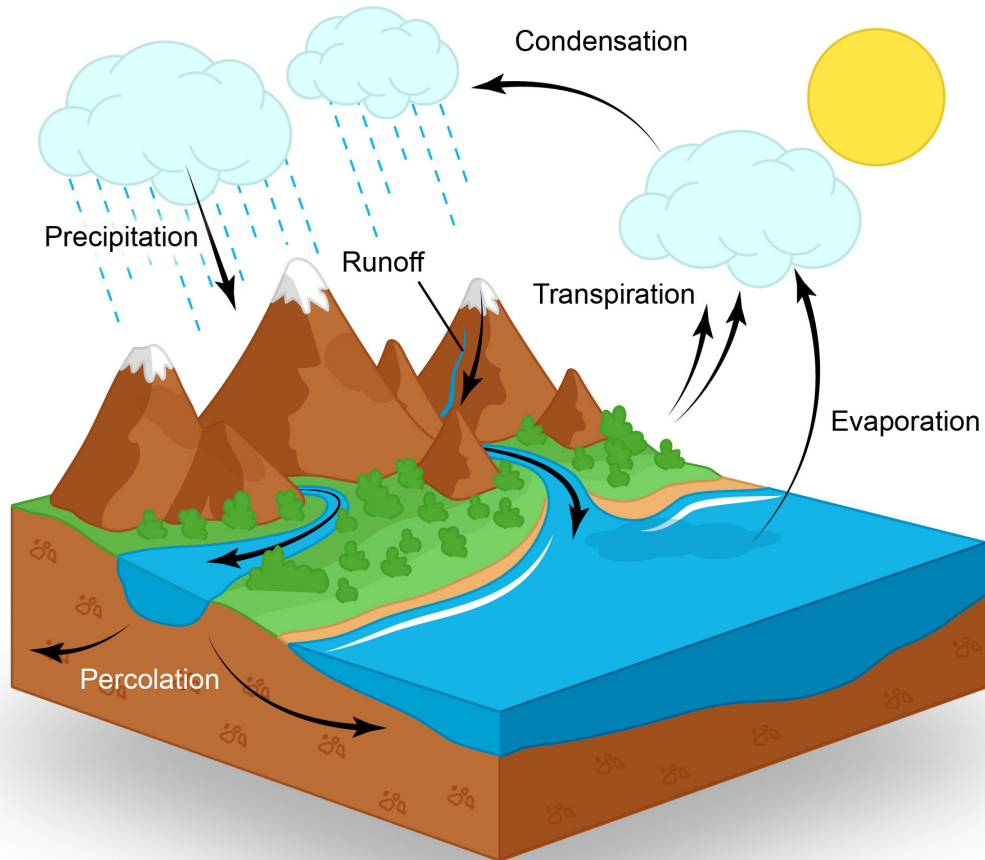
- Layer O is the organic material on the top. It can be thick, thin, or non-existent.
- Layer A is the surface horizon and is made of mostly minerals with some organic material mixed in.
- Layer B is the subsoil and is full of minerals that leached from layer A.
- Layer C is the substratum. This is the parent material from which the soil developed.





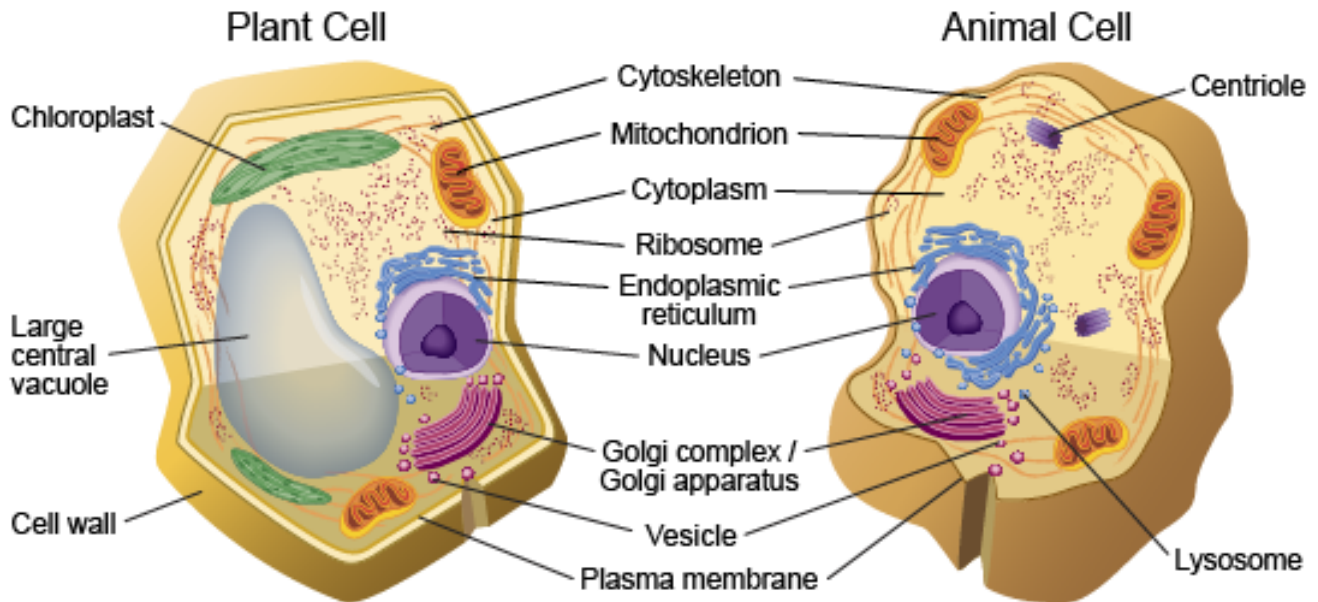
## The Water Cycle

### Water Cycle



Water on Earth is always moving and changing phases. Water is held in oceans, lakes, glaciers, icebergs, and rivers. Water evaporates from bodies of water and rises into the atmosphere. Evaporation also occurs at the surface of plant leaves, a process known as transpiration. As it cools in the atmosphere, water vapor condenses to a liquid, forming rain or snow and falling to the Earth as precipitation. It runs off mountains and collects in oceans, lakes, rivers, and soil. This cycle repeats over and over again.

## Parts of the Cell



Plant and animal cells have a lot of similarities. For example, they both contain mitochondria, which supply the cell with energy and are considered the powerhouses of the cell. They also both contain a nucleus, which is where DNA is stored. However, they also have many differences to meet their specialized needs. Plant and animal cells are compared and contrasted in the table below.

Characteristic	Plant cell	Animal cell
Size	Large	Smaller than plant cells
Shape	Rectangular	Circular
Chloroplasts	Contain chlorophyll and are where photosynthesis takes place	No chloroplasts and no photosynthesis
Cell wall	Supports the cell and helps keep its shape.	No cell wall; having just a cell membrane allows the cell to change shape.
Vacuoles	One large vacuole that stores water and helps the cell stay rigid	Multiple small vacuoles that store water and waste
Centrioles	No centrioles; plants only have a microtubule organizing center	Centrioles, with the microtubule organizing center, help in cell division

## Photosynthesis

Photosynthesis is the process of converting light energy into a form of chemical energy a plant can use: sugars. In plants, most photosynthesis takes place in the leaves. Chloroplasts are organelles that are specialized for photosynthesis. Chloroplasts are located in the mesophyll cells and contain chlorophyll, which is a light absorbing molecule.

The first part of photosynthesis occurs inside the chloroplasts across the thylakoid membrane. Light is converted to ATP and NADPH and water is converted to oxygen. The second part of photosynthesis occurs in the stroma of the chloroplast, between the inner and outer membrane. ATP and NADPH provide the energy needed to fix carbon dioxide, producing glucose. This is called the Calvin cycle. The chemical equation of photosynthesis is written like this:



And that's just some very basic information about the Science subtest.

Now, let's look at a few practice questions.

# Subtest 4 Practice Questions

## Question 1

When deciding to house a live animal in the classroom, the risk of a potential health hazard to the students or animal must be weighed against the educational value added. What guidelines must first be considered to address this potential hazard prior to getting the animal for the classroom?

- A. the children who might be affected by allergic symptoms
- B. plans for food, housing, and comfort of the animal
- C. standards for keeping the conditions sanitary and odor free
- D. procedures for caring for the animal during weekends and holidays

**Correct Answer:** A. Safety standards require that any live animal in the classroom must be fed and kept in sanitary conditions every day. Although the care and comfort of the animal is important, the safety concern with regard to the students is the teacher's first priority.

## Question 2

Suppose Mike's actual weight is 165 lbs. His scale says his weight is 164 lbs. What can be said about his scale?

- A. It is accurate.
- B. It is precise.
- C. It is neither precise nor accurate.
- D. It is both precise and accurate.

**Correct Answer:** A. This scale is accurate because it gives a weight close to his actual weight.

## Question 3

Which of the following is true in science?

- A. Scientific laws are the same as facts.
- B. Science is open to change.
- C. Scientific theories always evolve into scientific laws.
- D. Scientific laws and theories are the same.

**Correct Answer:** B. Science is open to change as new information is discovered.

**Correct answer:** A. Introducing new vocabulary words by introducing them in a variety of contexts and in instruction is the best way to promote vocabulary development among students.

#### Question 4

A liquid is heated to its boiling point temperature. If further heat is added to the liquid it will:

- A. increase in temperature as the liquid evaporates.
- B. increase in temperature but remain a liquid.
- C. stay at its boiling point temperature until all of the liquid has evaporated.
- D. decrease in temperature until all of the liquid has evaporated.

**Correct Answer:** C. When heat is added to a liquid at its boiling point temperature, the heat energy breaks the bonds holding the atoms together as a liquid rather than raising the temperature of the liquid. The temperature remains at the boiling point temperature until all of the liquid has evaporated.

#### Question 5

Samuel rides his bike around the park and over to the pond, and then back to where he started. Which is greater: the distance he traveled or his displacement?

- A. The displacement is greater.
- B. The distance is greater.
- C. The distance and the displacement are the same.
- D. It is impossible to tell from the information given.

**Correct Answer:** B. The distance is greater. It includes the length of the entire path he followed. His displacement is zero.

#### Question 6

Which list has the layers of the Earth in the correct order, from center outward?

- A. inner core, outer core, mantle, crust
- B. outer core, inner core, mantle, crust
- C. core, mantle, crust, outer crust
- D. crust, mantle, outer core, inner core

**Correct Answer:** A. From center outward, the layers are inner core, outer core, mantle, crust.

### Question 7

What powers the ocean's surface currents?

- A. atmospheric pressure, geothermal vents, and the gravitational pull of the moon
- B. temperature variations in the ocean, plastics pollution, and the movement of the tides
- C. wind currents, the uneven heating of Earth's surface, and the shape of landforms on Earth
- D. the path of watercraft, the migration patterns of marine organisms, and wind currents

**Correct Answer:** C. Wind currents, the uneven heating of Earth's surface, and the shape of landforms on Earth drive the ocean's surface currents.

### Question 8

How do a population and a community differ?

- A. A population is a group of only one species.
- B. Populations are groups of animals while communities are groups of plants.
- C. A community includes the nonliving things in the area.
- D. They are the same thing.

**Correct Answer:** A. Multiple organisms of the same species form a population and multiple populations form a community.

### Question 9

In humans, the allele for freckles (F) is dominant and the allele for no freckles (f) is recessive. Which of the following is a genotype of people without freckles?

- A. FF
- B. ff
- C. Ff
- D. ffff

**Correct Answer:** B. Both alleles must be recessive if a person is to exhibit a recessive trait such as lack of freckles.

### Question 10

Which of the following colors of visible light has the longest wavelength?

- A. violet
- B. green
- C. yellow
- D. red

**Correct Answer:** D. Red has the longest wavelength in the visible spectrum.

# Subtest 5:

## Mathematics

### Overview

The Mathematics subtest has 50 multiple-choice questions, which account for about 23% of the entire exam. You will have 70 minutes to complete this subtest.

There are five competencies on the Mathematics subtest:

1. Student thinking and instructional practices (26%)
2. Operations, algebraic thinking, counting and number in base ten (28%)
3. Fractions, ratios, and integers (18%)
4. Measurement, data, and statistics (16%)
5. Geometric concepts (12%)

Let's explore a few of the specific concepts that are highly likely to appear on the exam.

### Greatest Common Factor

The Greatest Common Factor, or GCF, is the largest number or factor that goes into a set of numbers.

**Example 1:** Find the greatest common factor of 24 and 36.

List the factors of 24: 2, 3, 4, 6, 8, **12**, 24

List the factors of 36: 2, 3, 4, 6, 9, **12**, 36

The largest factor the two numbers have in common is 12, so that is the GCF.

**Example 2:** Find the GCF of 10, 25, and 35.

List the factors of 10: 2, **5**, 10

List the factors of 25: **5**, 25

List the factors of 35: **5**, 7, 35

The GCF is 5.



## Measures of Central Tendency

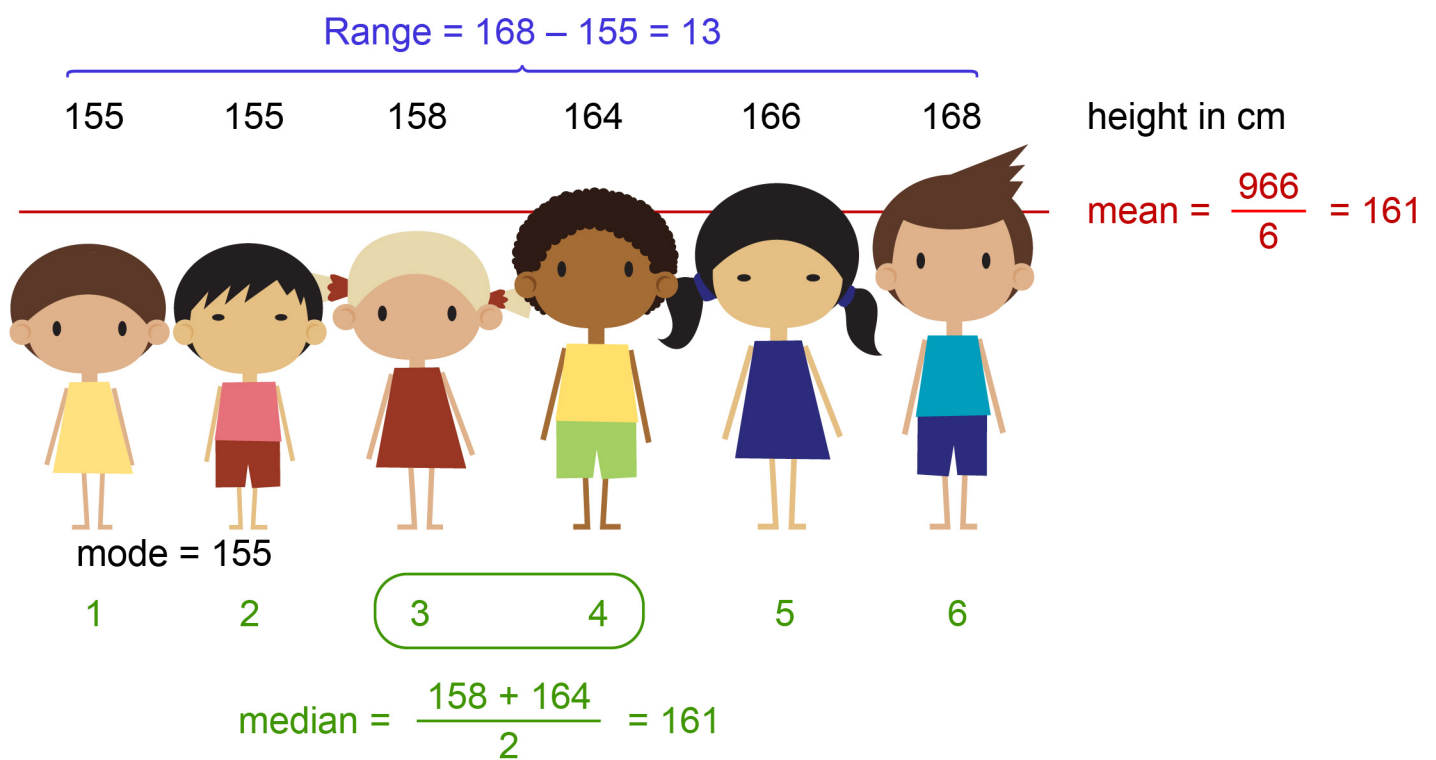
The measures of central tendency are ways to describe a set of data.

The **mean** is the average of the data and is found by adding all of the numbers in a data set and dividing that sum by the number of numbers (the  $n$ ) in the data set.

The **median** is the middle value of the data. It is found by listing the data values from least to greatest and then identifying the middle value. If there is an even number of data points, then the median is the mean of the two numbers in the middle.

The **mode** is the value that occurs the most often.

The **range** is the difference between the largest and the smallest values.



**Example 1:** Ms. Smith gave a mathematics test to her 6th grade class. The scores were 56, 87, 65, 91, 76, 83, 91, 84, 79.

Find the mean, median, mode, and range of the test scores.

Mean:

First add  $56 + 87 + 65 + 91 + 76 + 83 + 91 + 84 + 79 = 712$ , then divide by 9 since there are 9 scores. So  $712 / 9 = 79.11$ .

Median:

Put the numbers in order from least to greatest:

56, 65, 76, 79, 83, 84, 87, 91, 91

The middle number is 83, so that is the median.

Mode:

The score of 91 appears twice, so that is the mode.

Range:

The highest score is 91 and the lowest score is 56.  $91 - 56 = 35$ .

The range is 35.

**Example 2:** The principal surveyed the teachers in his school to find out the best day to hold a faculty meeting. Of the teachers, 10% said Monday, 45% said Tuesday, 15% said Wednesday, 20% said Thursday, and 10% said Friday. Which measure of central tendency should the principal use to decide which day to hold the faculty meeting?

- A. mean
- B. median
- C. mode
- D. range

**Answer:** C. Mode will tell the principal which day the MOST people prefer for the meeting.

### Professional Vocabulary

In the mathematics classroom, professional vocabulary can be used to evaluate student solutions.

- **Subitizing** is the ability to correctly assess the number of objects in a set without counting. This helps students develop mental math strategies. An example is grouping objects into sets of 10 to quickly add the number.
- **Transitivity** is seen in a variety of math concepts. Transitivity means that if object a is related to object b and object b is related to object c, then object a must be related to object c. This allows students to make connections in their work.
- **Iteration** occurs when a function is used repeatedly. This is used to introduce concepts related to functions and equations.
- **Tiling** in mathematics is often used in geometry, specifically in tessellations. At the elementary level, the visual procedure of tiling helps introduce students to patterns.

## Math Fluency

Fluency in mathematics is the ability to perform math problems both accurately and quickly. Components of math fluency include accuracy, efficiency, flexibility, automaticity, and rate.

- **Accuracy** is completing the problems correctly.
- **Efficiency** is the ability to solve a problem using a strategy that can be completed quickly and doesn't lose the logic of the problem.
- **Flexibility** is being comfortable using more than one approach to the problem.
- **Automaticity** is the ability to deliver the answer based on memorization, such as with multiplication facts.
- **Rate** is an agreed-upon measurement with which to measure success on a skill.

**Example:** All 3rd graders in the district are given a 20-question multiple-choice quarterly mathematics exam. The student grades are compared between the different schools in the district and discussed. What component of math fluency is being targeted by this assessment?

- A. automaticity
- B. flexibility
- C. rate
- D. accuracy

**Answer:** D. The district is looking for the correct answers. The use of multiple-choice questions means they are not targeting work or processes.

- **Complex Parentheses**

Recall that we evaluate expressions using the order of operations. The acronym for the order of operations is PEMDAS:

P: parenthesis (or brackets)

E: exponents

M/D: multiplication and division (work left to right)

A/S: addition and subtraction (work left to right)

Now let's look at a complex expression.

Example 1: Simplify  $[3(2+1)+5]/\{3[2+4(-2)]+2\}$

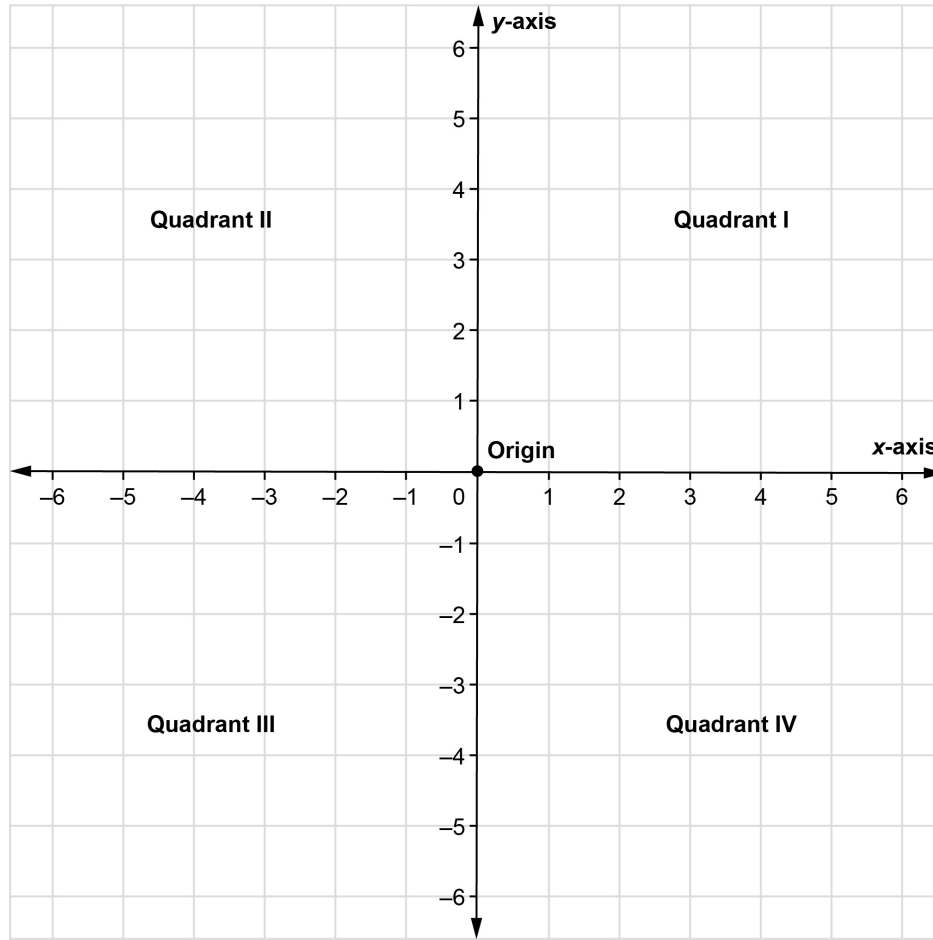
$[3(2+1)+5]/\{3[2+4(-2)]+2\}$	Begin with the parenthesis from left to right
$[3(3)+5]/\{3[2+4(-2)]+2\}$	Multiply
$[9+5]/\{3[2+4(-2)]+2\}$	Multiply
$[9+5]/\{3[2+-8]+2\}$	Move on to next parenthesis (brackets), left to right
$[14]/\{3[2+-8]+2\}$	Simplify the next bracket
$[14]/\{3[-6]+2\}$	Multiply
$[14]/\{-18+2\}$	Add inside the {}
$[14]/\{-16\}$	Simplify fraction
$7/-8$	Final answer

Example 2: Simplify  $\{4[6(2+4)]-[3(6-2)]\}$

$\{4[6(2+4)]-[3(6-2)]\}$	Begin with parenthesis, left to right
$\{4[6(6)]-[3(4)]\}$	Multiply
$\{4[36]-[3(4)]\}$	Multiply
$\{4[36]-[12]\}$	Distribute
$\{144-[12]\}$	Subtract
132	Final answer

## The Coordinate Plane

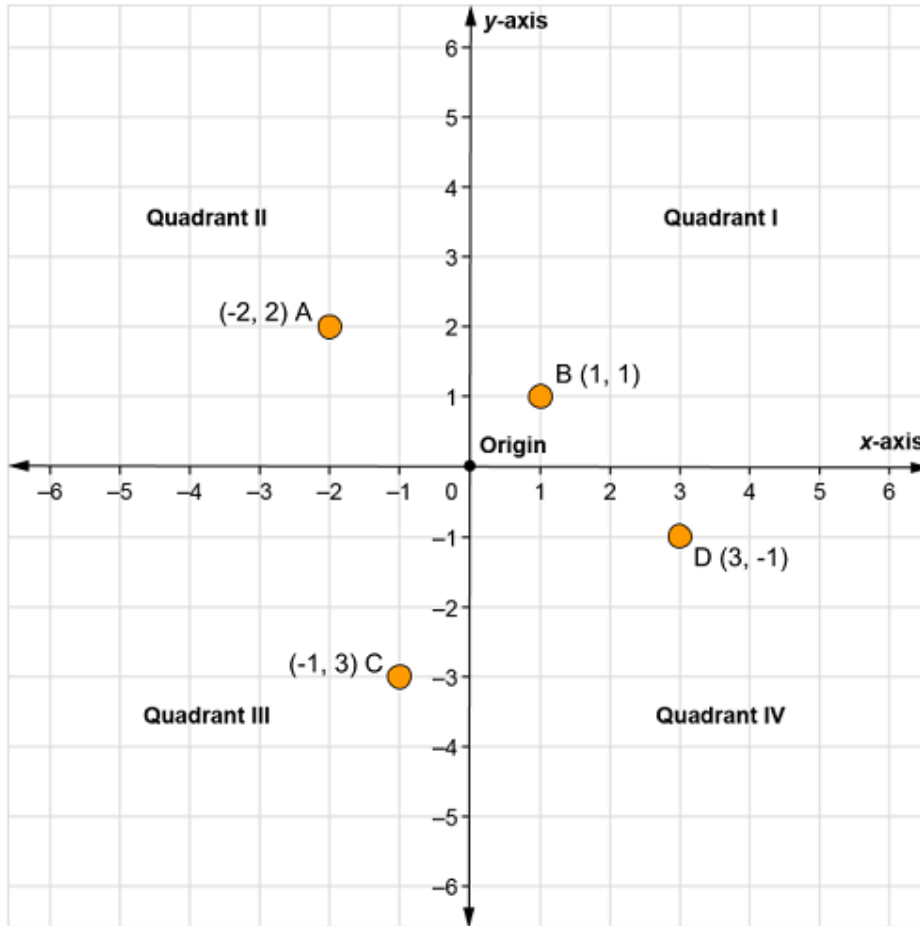
The coordinate plane is divided into four quadrants, as shown below. The quadrants are numbered counterclockwise.



To locate an ordered pair,  $(x, y)$  in the coordinate plane, begin at the origin  $(0, 0)$  then count  $x$  places horizontally and  $y$  places vertically.

For example, in the graph below, point A is located at  $(-2, 2)$ . To locate and label the point, begin at the origin  $(0,0)$  and move 2 places left, then 2 places up.

Point D is located at  $(3, -1)$ . Starting at the origin, move 3 places right, then one place down.



Example: The vertices of a rectangle are plotted on a coordinate plane. Three of the points are located at  $(2, 4)$ ,  $(-2, 4)$ , and  $(2, -1)$ . In which quadrant would the final vertex be located?

- A. I
- B. II
- C. III
- D. IV

**Answer:** C. The final vertex would be located at  $(-2, -1)$ , which is in the third quadrant.

And that's just some very basic information about the Mathematics subtest.

Now, let's look at a few practice questions.

# Subtest 4 Practice Questions

## Question 1

A teacher is preparing a unit on simplifying algebraic expressions and plans to use the expression shown as an example. Before introducing the example, which of the following concepts is best for the teacher to review?

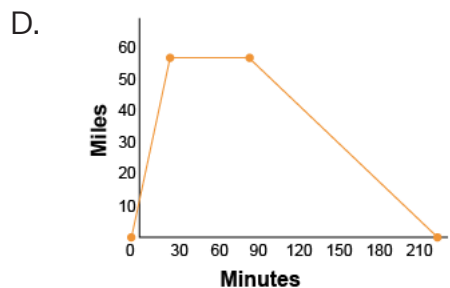
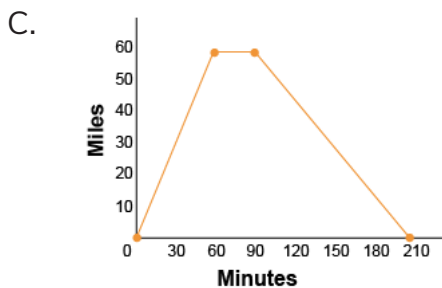
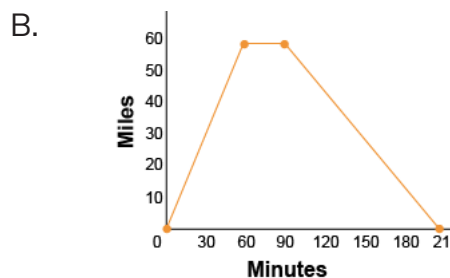
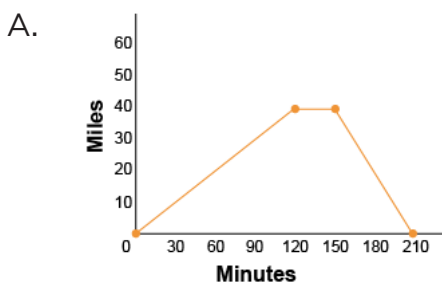
$$(6x^2y^{-5}z^4)^2(2x^{-1}y^{-2}z^3)$$

- A. the laws of exponents
- B. the properties of multiplication of integers
- C. the properties of addition of integers
- D. the distributive property

Correct Answer: A. The laws of exponents will be used to simplify the expression.

## Question 2

The Chen family loves to go to new places. They drove on the highway at an average speed of 60 miles per hour to try out a new restaurant. They had lunch there for about a half hour and decided to take the scenic route home, driving on smaller roads and averaging 30 miles per hour for the return trip. If the restaurant is about 60 miles from their home, which graph best models the Chen family's journey?



**Correct answer:** C. If the Chens travel at 60 miles per hour while on the highway en route to the restaurant 60 miles away, then they will reach the restaurant in 1 hour, which is expressed as 60 minutes on this graph.

During the half hour (30 minutes) that they spend eating lunch at the restaurant, their distance from home will remain constant. Accordingly, the correct graph shows a horizontal segment at 60 miles from home for 30 minutes, and so extending until the 90-minute mark.

Finally, on their way home, the Chens travel at a rate of 30 miles per hour. At that rate, the 60-mile return trip will take 2 hours, or 120 minutes, from the 90-minute mark. Therefore, their arrival home occurs at  $90 + 120 = 210$  minutes.

Upon their arrival home, the Chens are 0 miles from home, and so the graph shows a point at (210, 0), representing the 3.5 hours that the Chens spent on their excursion. None of the other graphs correctly illustrate this journey.

### Question 3

The function  $f(x) = 26.00 + 13.75x$  describes the rental fee for an air compressor, where  $f(x)$  is the total cost and  $x$  is the number of rental hours. The equation models which of the following situations?

- A. a fixed rental charge of \$26.00 plus an additional charge of \$13.75 per hour
- B. a rental charge of \$26.00 per hour plus an additional charge of \$13.75 per hour
- C. a fixed rental charge of \$13.75 plus an additional charge of \$26.00 per hour
- D. a rental charge of \$39.75

**Correct Answer:** A. The total rental fee  $f(x)$  equals the \$26.00 base rate plus \$13.75 times the number of hours,  $x$ .

### Question 4

The Booster Club at Martin MS is selling spirit buttons for homecoming. The buttons cost \$0.75 to make and will be sold for \$2 each. How many buttons,  $b$ , must be sold to make a profit of \$500?

- A.  $\$500 = \$2b + \$0.75b$
- B.  $\$500 + \$2b = \$0.75b$
- C.  $\$500 = \$2b - \$0.75b$
- D.  $\$500 - \$0.75b = \$2b$

**Correct Answer:** C. The profit is equal to the selling price minus whatever costs are applicable. So if the profit is to be \$500, then enough buttons must be sold to reach that profit. If we are selling the buttons for \$2 each, but it costs \$0.75 to make each one, then there is a profit of  $\$2 - .75$  or \$1.25 on each button. How many buttons will we have to sell to reach \$500 profit?  $\$500 = \$1.25b$ ?  $\$500 = \$2b - 0.75c = 1.25b$ , so the Booster Club will have to sell 400 buttons.



### Question 5

Which of the following is equivalent to the expression below?

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

- A.  $5x + 4y + 6$
- B.  $9xy$
- C.  $-x + 4y + 6$
- D.  $-x^2 + 4y + 6$

**Correct Answer:** C. In the expression,  $2x$  and  $-3x$  are like terms and therefore can be combined by adding the coefficients and keeping the variables the same.  $2x$  and  $-3x$  is  $-x$ .  $4y$  and  $6$  cannot be combined, and are therefore left as is. The resulting expression is  $-x + 4y + 6$ .

### Question 6

What is the prime factorization of 36?

- A.  $2 \times 3$
- B.  $(2^2) \times (3^2)$
- C.  $(2^3) \times (3^2)$
- D.  $(2^2) \times (3^3)$

**Correct Answer:** B. The prime factors of a number are the prime numbers that divide the integer exactly. The prime numbers then can be multiplied together to equal that number. The prime factors of 36 are  $(2^2) \times (3^2)$ . For 36, the factor tree would be:  $36 = 4 \times 9 = (2^2) \times (3^2)$ .

### Question 7

Put the following fractions in order from least to greatest:

$$\frac{1}{2}, \frac{3}{4}, \frac{5}{7}, \frac{3}{16}$$

- A.  $\frac{3}{16}, \frac{1}{2}, \frac{5}{7}, \frac{3}{4}$
- B.  $\frac{1}{2}, \frac{3}{4}, \frac{3}{16}, \frac{5}{7}$
- C.  $\frac{1}{2}, \frac{3}{16}, \frac{3}{4}, \frac{5}{7}$
- D.  $\frac{3}{16}, \frac{5}{7}, \frac{1}{2}, \frac{3}{4}$

**Correct answer:** A. The easiest way to order these is to convert them to decimals and round to the hundredths place:

- $1/2 = 0.5$
- $3/4 = 0.75$
- $5/7 = 0.71$
- $3/16 = 0.19$

Then order the decimals and pair with their fraction equivalent.

### Question 8

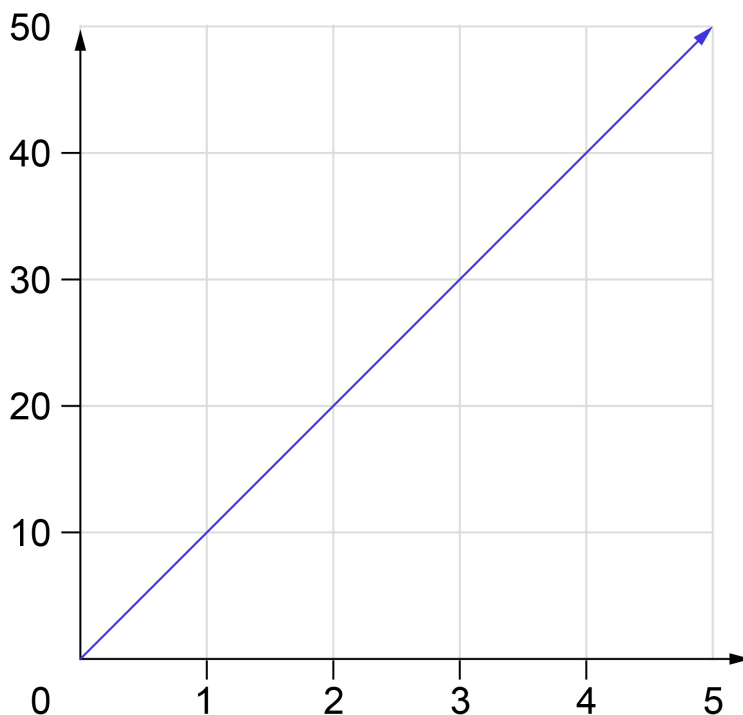
Tom wants to mentally calculate a 20% tip on his bill of \$40. Which of the following is best for Tom to use in the mental calculation of the tip?

- A.  $40 \times .02$
- B.  $40 \times (20/100)$
- C.  $40 \times (200/1000)$
- D.  $40 \times .1 \times 2$

**Correct Answer:** D. Tom can quickly find 10% of 40 and then double it. In this case the answer is \$8 because 10% of 40 is 4 and  $4 \times 2$  is 8.

### Question 9

For any point on the line, if x represents centuries, then y could equal the equivalent number of \_\_\_\_\_?






- A. decades
- B. years
- C. months
- D. week


**Correct Answer:** A. The y-values on the line are 10 times the x-values. A decade is 10 years and  $10 \times 10 = 100$  years, which is a century.

### Question 10

Student council members are selling valentine cards as a fundraiser. They make \$0.50 for each card they sell and want to sell 750 total. The graph shows the number of cards that have been sold thus far by each grade. How many more must be sold overall to meet their goal?

### Valentine Card Sales

Grade Level	6th	
	7th	
	8th	

 = 20 cards

- A. 200 cards
- B. 210 cards
- C. 265 cards
- D. 550 cards

**Correct Answer:** A. They have sold 550 cards and must sell 200 more to meet the goal of 750 cards. (Note that the profit per card (\$0.50) is extra information)

To find the total sold so far (550): There are 6 hearts on the top row, which equals 120 cards sold. There are 12 hearts in the second row, which equals 240 cards sold. There are  $9 \frac{1}{2}$  hearts in the third row, which equals 190 cards sold. All together they have sold 550 cards.