



GACE® Special Education Mathematics and Science Assessment *Test at a Glance*

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See the GACE® Special Education Mathematics and Science Assessment Study Companion for practice questions and preparation resources.

Assessment Name	Special Education Mathematics and Science
Grade Level	P–8
Test Code	088
Testing Time	2 hours
Test Duration	2.5 hours
Test Format	Computer delivered
Number of Selected-response Questions	70
Question Format	The test consists of a variety of short-answer questions such as selected-response questions, where you select one answer choice or multiple answer choices (depending on what the question asks for), questions where you enter your answer in a text box, and other types of questions. You can review the possible question types in the <i>Guide to Taking a GACE Computer-delivered Test.</i>
Number of Constructed-response Questions	0

About this Assessment

The GACE Special Education Mathematics and Science assessment is designed to measure the professional knowledge of prospective teachers of Special Education Mathematics and Science in the state of Georgia.

The testing time is the amount of time you will have to answer the questions on the test. Test duration includes time for tutorials and directional screens that may be included in the test.

The questions in this assessment assess both basic knowledge across content areas and the ability to apply principles.

The total number of questions that are scored is typically smaller than the total number of questions on the test. Most tests that contain selected-response questions also include embedded pretest questions, which are not used in calculating your score. By including pretest questions in the assessment, ETS is able to analyze actual test-taker performance on proposed new questions and determine whether they should be included in future versions of the test.

Content Specifications

This assessment is organized into content **subareas**. Each subarea is further defined by a set of **objectives** and their **knowledge statements**.

- The objectives broadly define what an entry-level educator in this field in Georgia public schools should know and be able to do.
- The knowledge statements describe in greater detail the knowledge and skills eligible for testing.
- Some tests also include content material at the evidence level. This content serves as descriptors of what each knowledge statement encompasses.

See a breakdown of the subareas and objectives for this assessment on the following pages.

Test Subareas

Subarea	Approx. Percentage of Test
I. Mathematics	50%
II. Instruction	50%

Test Objectives

Subarea I: Mathematics

Objective 1: Understands numbers and operations, including rational numbers, proportions, number theory, and estimation

The beginning Special Education Mathematics teacher:

- A. Understands operations and properties of rational numbers
 - Solves problems involving addition, subtraction, multiplication, and division of real numbers
 - Describes the effect an operation has on a given number; e.g., adding a negative, dividing by a fraction
 - Applies the order of operations
 - Uses place value to read and write numbers in standard and expanded form
 - Identifies or applies properties of operations on a number system; i.e., commutative, associative, distributive, identity
 - Compares, classifies, and orders real numbers
 - Performs operations involving exponents, including negative exponents
 - Simplifies and approximates radicals
 - Uses scientific notation to represent and compare numbers
 - Selects the appropriate operation to use for a given problem
- B. Understands the relationships among fractions, decimals, and percents
 - Simplifies fractions to lowest terms
 - Finds equivalent fractions
 - Converts between fractions, decimals, and percents
 - Represents fractions, decimals, and percents with various models
 - Given a fraction, decimal, or percent, identifies a corresponding model, and vice versa

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- C. Knows how to use ratios and proportional relationships in solving problems
- Applies the concept of a ratio to describe a relationship between two quantities
 - Recognizes and represents proportional relationships between two quantities
 - Uses proportional relationships to solve problems; e.g., rates, scale factors
 - Solves percent problems; e.g., discounts, taxes, tips, simple interest rates
- D. Knows the basic concepts of number theory; e.g., primes, composites, factors, multiples
- Applies characteristics of prime and composite numbers
 - Applies characteristics of odd and even numbers
 - Solves problems involving factors, multiples, and divisibility
- E. Knows how to use estimation to determine the reasonableness of results
- Recognizes the reasonableness of results within the context of a given problem
 - Tests the reasonableness of results using estimation
 - Demonstrates an understanding of estimation and rounding
 - Recognizes appropriate uses of estimation and rounding

Objective 2: Understands algebra, functions, and graphs

The beginning Special Education Mathematics teacher:

- A. Knows how to perform operations on algebraic expressions
- Adds, subtracts, factors, and expands linear algebraic expressions with rational coefficients
- B. Knows how to translate verbal relationships into algebraic expressions and equations
- Translates verbal relationships into algebraic equations or expressions
- C. Understands how to recognize and represent linear relationships algebraically
- Determines the equation of a line
 - Recognizes and uses the basic forms of linear equations
 - Converts among various forms of linear equations; e.g., slope-intercept, point-slope, standard
- D. Understands how to solve equations and inequalities
- Solves one-variable linear equations and inequalities
 - Represents solutions to inequalities on the number line

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- Represents and solves systems of linear equations and inequalities with two variables
- E. Knows how to recognize and represent simple sequences or patterns; e.g., arithmetic, geometric
- Evaluates, extends, or algebraically represents rules involving number patterns
 - Describes or extends patterns involving shapes or figures
 - Forms rules based on given patterns
 - Identifies patterns based on given rules
- F. Understands how to identify and evaluate functions
- Determines whether a relation is a function
 - Evaluates functions for given input values; i.e., algebraically, graphically, tabular
- G. Knows how to determine and interpret the set of inputs and their corresponding outputs for functions represented numerically, graphically, or algebraically
- Given a table of values, determines the sets of inputs and outputs
 - Given the graph of a function, determines the sets of inputs and outputs
 - Given a function that is represented algebraically, determines the sets of inputs and outputs
 - Given a real-world setting, determines the sets of input and output values
- H. Understands basic characteristics of linear functions; e.g., slope, intercepts
- Determines the slope of a given linear function
 - Interprets slope as a constant rate of change
 - Determines the x - and y -intercepts of a given linear function
 - Interprets the x - and y -intercepts of a given linear function
- I. Understands the relationships among functions, tables, and graphs
- Determines and interprets the x - and y -intercepts of a nonlinear function
 - Given a graph (i.e., linear, quadratic, simple exponential), determines an equation that best represents the graph
 - Identifies a graph of an equation for a linear, quadratic, or simple exponential function
 - Identifies graphs showing key features for a given verbal description of a relationship
 - Compares properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)

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- J. Knows how to analyze and represent functions that model given information
- Identifies which particular model (e.g., graph, equation, table) fits a given set of conditions
 - Recognizes the relationship between two quantities by analyzing a particular mathematical model; e.g., graph, equation, table

Objective 3: Understands geometry and measurement, including points, lines, and figures of two and three dimensions

The beginning Special Education Mathematics teacher:

- A. Understands how to solve problems involving perimeter and area of plane figures
- Calculates and interprets perimeter and area of plane figures that can be composed of triangles and quadrilaterals
 - Calculates changes in perimeter and area as the dimensions of plane figures change
- B. Knows how to solve problems involving surface area and volume of solids
- Calculates and interprets surface area and volume of solids; e.g., prisms, pyramids, cylinders, spheres
 - Calculates changes in surface area and volume as the dimensions of a solid change
 - Uses two-dimensional representations of three-dimensional objects to visualize and solve problems
- C. Understands the concepts of similarity and congruence
- Determines whether two figures are similar or congruent
 - Uses similarity and congruence to solve problems with plane figures; e.g., scale problems
- D. Knows properties of and relationships between points, lines, line segments, rays, and angles
- Identifies points, lines, line segments, and rays
 - Identifies parallel and perpendicular lines
 - Solves problems involving parallel, perpendicular, and intersecting lines
 - Applies angle relationships (e.g., supplementary, vertical, alternate interior) to solve problems
- E. Knows how to solve problems involving circles
- Solves problems involving circumference and area of circles
 - Solves problems involving diameter and radius of circles

F. Knows properties of polygons

- Solves problems involving sides (e.g., Pythagorean theorem) and angles in real-world and mathematical problems using two and three dimensions
- Recognizes characteristics of special triangles; e.g., isosceles, right, 30-60-90
- Identifies geometric properties of various quadrilaterals; e.g., parallelogram, trapezoid
- Recognizes the attributes and hierarchy of quadrilaterals
- Solves problems involving sides, angles, or diagonals of polygons
- Identifies the lines of symmetry in a polygon
- Explains a proof of the Pythagorean theorem

G. Knows how to interpret geometric relationships in the xy -plane; e.g., transformations, distance, midpoint

- Identifies the x -axis, y -axis, origin, and four quadrants in the coordinate plane
- Identifies and labels ordered pairs in the coordinate plane
- Uses coordinate geometry to represent and identify the properties of geometric shapes; e.g., Pythagorean theorem, area of a rectangle
- Determines the distance between two points
- Determines the midpoint between two points
- Interprets and solves problems involving transformations; i.e., translations, reflections, rotations, dilations
- Uses coordinates to compute perimeters of polygons and areas of triangles and rectangles

H. Understands systems of measurement

- Solves measurement and estimation problems involving time, length, volume, and mass in standard measurement systems
- Converts units within a measurement system
- Uses appropriate units of measurement in a given context

Objective 4: Understands probability, statistics, and discrete math, including data, central tendency, and inference

The beginning Special Education Mathematics teacher:

A. Understands how to interpret, analyze, and represent data presented in a variety of displays

- Analyzes and interprets various displays of data; e.g., box plots, histograms, scatterplots
- Draws conclusions based on data; e.g., misleading representation of data, line of best fit, interpolation, association

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- Chooses appropriate graphs based on data; e.g., represents data accurately, chooses correct types of graphs
- B. Understands concepts associated with measures of central tendency and dispersion
- Solves for the mean and weighted average of given sets of data
 - Determines and interprets mean, median, and mode in a variety of problems
 - Determines and interprets common features of sets of data; e.g., range and outliers
 - Chooses appropriate measures of central tendency to represent given sets of data and justify the measures used
 - Identifies correct statements regarding a given numerical data set
 - Uses data to draw comparative inferences about two populations
 - Distinguishes between random and biased sampling
- C. Understands statistical processes and how to evaluate them
- Understands statistics as a process for making inferences about population parameters based on a random sample from that population
 - Decides if a specified model is consistent with results from a given data-generating process; e.g., using simulation
- D. Understands how to make inferences and justify conclusions from sample surveys, experiments, and observational studies
- Recognizes the purposes of and differences among sample surveys, experiments, and observational studies, and explains how randomization relates to each
 - Uses data from a sample survey to estimate a population mean or proportion
 - Draws inferences about populations based on collected data
- E. Knows how to develop, use, and evaluate probability models
- Uses counting techniques (e.g., the counting principle, permutations, combinations) to answer questions involving a finite sample space
 - Solves probability problems involving independent and dependent events

Subarea II: Science

Objective 1: Understands the nature of scientific inquiry and technology, and its relationship to society

The beginning Special Education Science teacher:

- A. Understands methods of scientific inquiry and design
- Identifying problems based on observations

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- Forming and testing hypotheses
 - Theories, models, and laws
 - Experimental design, including independent and dependent variables, controls, and sources of error
 - Process skills, including observing, comparing, inferring, categorizing, generalizing, and concluding
- B. Understands the history and nature of scientific knowledge
- Subject to change and consistent with evidence
 - Based on reproducible evidence
 - Unifying concepts and processes, such as systems, models, constancy and change, equilibrium, form and function
 - Accepted principles and models develop over time
 - Major developments in science, such as atomic theory and genetics
 - Contributions of major historical figures, such as Darwin and Newton
- C. Understands the processes involved in collecting and analyzing scientific data
- Common units of measurement (metric and English) including unit conversion and prefixes such as milli and kilo
 - Organization and presentation of data
 - Trends in data
 - Relationships between variables
 - Predictions and valid conclusions based on data
 - Basic data and error analysis, including determining mean, accuracy, precision, and sources of error
- D. Understands the procedures for safe and correct use of laboratory and field materials and equipment
- Appropriate and safe preparation, use, storage, and disposal of materials such as chemicals and lab specimens
 - Appropriate and safe use of equipment such as glassware and microscopes
 - Preparations for demonstrations, activities, or field use
 - Basic use and maintenance of equipment such as microscopes and balances
 - Use of standard safety equipment, such as eyewash stations and showers
 - Laboratory safety rules for students
 - Appropriate apparel and conduct in the laboratory
 - Emergency procedures for events such as fires, chemical spills, and injuries

E. Understands that science and technology impact the environment and society

- Acid rain
- Air and water pollution
- Greenhouse gases
- Ozone layer depletion
- Waste disposal and recycling
- Green chemistry
- Irrigation
- Reservoirs and levees
- Depletion of aquifers
- Loss of biodiversity

F. Understands major issues associated with energy production and the management of natural resources

- Renewable and nonrenewable energy resources
- Conservation, recycling, and sustainability
- Pros and cons of power generation based on various sources, such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power
- Issues associated with the use and extraction of Earth's resources; e.g., mining, land reclamation, and deforestation

G. Understands applications of science and technology in daily life and public health

- Chemical properties of household products
- Communication technologies; e.g., wireless devices, GPS, satellites
- Science principles applied in commonly used consumer products; e.g., batteries, sunglasses
- Water purification
- Common agricultural practices, such as the use of insecticides, herbicides, and genetically modified crops
- Medical technologies such as medical imaging, X rays, and radiation therapy

Objective 2: Understands physical science, including matter, energy, reactions, forces, electricity, and magnetism

The beginning Special Education Science teacher:

A. Understands the organization of matter

- Elements, compounds, and mixtures

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- Atoms, molecules, and ions
 - Basic properties of solids, liquids, plasma, and gases
 - Atomic structure, including nucleus, electrons, protons, and neutrons
 - Atomic number, atomic mass, and isotopes
 - Electron arrangements
 - Nature of radioactive substances
 - Chemical, electrical, and radioactive hazards
- B. Understands basic concepts and relationships involving energy and matter
- Conservation of energy and conservation of matter
 - Kinetic and potential energy
 - Conversions between different forms of energy, such as thermal, chemical, and electrical
 - Chemical and physical properties/changes
 - Phase transitions and the energy changes involved, such as heat needed to melt solid
 - Relationships between volume, pressure, and temperature of gases
 - Temperature scales, such as Celsius and Fahrenheit
 - Conduction, convection, and radiation
 - Applications of energy and matter relationships in life and Earth/space science
- C. Understands types of bonding and composition and the formulas of simple compounds
- Covalent and ionic bonding
 - Recognize names and formulas of simple compounds such as water, carbon dioxide, and sodium chloride
- D. Understands the organization of the periodic table and can use it to predict trends in physical and chemical properties
- Symbols of the elements
 - Arrangement of the elements on the table
 - Atomic number and atomic mass
 - Trends in physical and chemical properties of elements, such as metals and nonmetals, based on their position on the table
- E. Understands basic concepts involved in chemical reactions
- Balancing equations of simple chemical reactions

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- Energy consumed or produced in reactions (endothermic and exothermic reactions)
 - Factors that affect reaction rates, such as concentration, temperature, pressure, and catalysts
 - Types of basic reactions

F. Understands solutions and simple acid-base chemistry

- Dilute, concentrated, saturated, unsaturated, and supersaturated solutions
- Effect of temperature, pressure, particle size, and agitation on the rate of dissolving
- Effect of temperature, pressure, and solvent on solubility
- Chemical and physical properties of acids and bases
- pH scale
- Neutralization

G. Understands basic concepts in mechanics

- Describe motion in terms of speed, velocity, acceleration, and displacement
- Newton's laws of motion
- Gravitational attraction and acceleration due to gravity
- Distinction between mass and weight
- Work, power, and energy
- Motion and forces in applications, such as inclined planes and pendulums
- Simple machines, such as the wedge, screw, and lever
- Forces and physical properties involving fluids, including buoyancy
- Balanced and unbalanced forces, such as friction, inertia, and gravity

H. Understands basic concepts in electricity and magnetism

- Electrostatic attraction and repulsion
- Conductors and insulators
- Direct current (DC) and alternating current (AC)
- Current, resistance, power, and voltage
- Basic series and parallel circuits
- Voltage sources, such as batteries and generators
- Magnetic attractive and repulsive force and magnetic poles
- Magnetic materials and electromagnets

I. Understands concepts involving waves and optics

- Nature of light and the electromagnetic spectrum, including visible, ultraviolet, infrared, microwave, and gamma
- Wave properties, such as frequency, amplitude, wavelength, speed, and energy
- Wave phenomena, such as reflection, refraction, diffraction, and polarization
- Sound properties, such as pitch/frequency, loudness/intensity, and resonance
- Perceived change in pitch of sound coming from a moving object (Doppler effect)
- Mirrors, lenses, and prisms and their applications, such as the human eye, microscope, and telescope

Objective 3: Understands life science, including cells, genetics, evolution, organisms, and ecology

The beginning Special Education Science teacher:

A. Understands the basic structure and function of cells and their organelles

- Structure and function of cell membranes
- Structure and function of animal and plant cell organelles
- Levels of organization (cells, tissues, organs, organ systems)
- Major features of common animal cell types
- Prokaryotes and eukaryotes
- Cell cycle
- Mitosis, meiosis, cytokinesis

B. Understands the basic biochemistry of life

- Cellular respiration
- Photosynthesis
- Biological molecules, such as DNA, carbohydrates, proteins, lipids, and enzymes

C. Understands basic genetics

- Structure and function of DNA and RNA
- Chromosomes, genes, and alleles
- Dominant and recessive traits
- Mendelian inheritance, including genotype, phenotype, use of the Punnett square, and pedigrees

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- D. Understands the theory and key mechanisms of evolution
- Mechanisms of evolution and natural selection
 - Isolation mechanisms and speciation
 - Supporting evidence, including the fossil record, comparative anatomy, and homologous structures
- E. Understands the elements of the hierarchical classification scheme
- Classification schemes (taxonomy)
 - Characteristics of bacteria, animals, plants, fungi, and protists
 - Viruses
- F. Understands the major structures of plants and their functions
- Characteristics of vascular and nonvascular plants
 - Structure and function of roots, leaves, and stems
 - Asexual and sexual reproduction
 - Growth
 - Uptake and transport of nutrients and water
 - Responses to stimuli and homeostasis
- G. Understands the basic anatomy and physiology of animals, including the human body
- Response to stimuli and homeostasis
 - Systems that exchange with the environment, including respiratory, excretory, and digestive systems
 - Internal transport and exchange, including the circulatory system
 - Control systems, such as the nervous system and the endocrine systems
 - Movement and support, including the skeletal and muscular systems
 - Reproduction and development
 - Immune system
- H. Understands population dynamics
- Growth curves and carrying capacity
 - Intraspecific relationships, such as mating systems, social systems, and competition
- I. Understands community ecology
- Niche and habitat
 - Species diversity
 - Interspecific relationships, such as predator-prey and parasitism

J. Understands community ecology

- Biomes
- Stability and disturbances, such as glaciation, climate change, and succession
- Energy flow, such as trophic levels and food webs
- Biogeochemical cycles, including water, nitrogen, and carbon cycles and biotic/abiotic interaction

Objective 4: Understands Earth and space science, including geology, the hydrosphere, the atmosphere, and astronomy

The beginning Special Education Science teacher:

A. Understands the types and basic characteristics of rocks and minerals and their formation processes

- The rock cycle
- Characteristics of sedimentary, igneous, and metamorphic rocks and their formation processes
- Characteristics of minerals

B. Understands the processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation

- Erosion and deposition
- Chemical and physical weathering
- Characteristics and formation of soil
- Runoff and infiltration

C. Understands Earth's basic structure and internal processes

- Earth's layers, such as the crust, mantle, and core
- Earth's shape and size
- Geographical features
- Earth's magnetic field
- Plate tectonics
- Earthquakes and volcanoes

D. Understands historical geology

- Principle of uniformitarianism
- Basic principles of relative age dating, including superposition and fossil succession
- Geologic time scale

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- Fossil record as evidence of the origin and development of life, including fossilization methods, mass extinctions, ice ages, and meteor impacts
- E. Understands the characteristics and processes of Earth's oceans and other bodies of water
- The water cycle
 - Distribution and location of Earth's water
 - Seawater composition
 - Tides, waves, and currents
 - Estuaries, barrier islands, islands, and reefs
 - Polar ice, icebergs, and glaciers
 - Lakes, ponds, and wetlands
 - Streams, rivers, and river deltas
 - Groundwater, water table, wells, aquifers, geysers, and springs
- F. Understands the basic composition of Earth's atmosphere and basic concepts of weather
- Layers and composition of atmosphere
 - Atmospheric pressure and temperature
 - Humidity, dew, and frost
 - Wind
 - Cloud types and formation
 - Rain, snow, sleet, and hail
 - Fronts, storms, and severe weather, such as hurricanes and tornadoes
 - Basic development and movement of weather patterns
- G. Understands the major factors that affect climate and seasons
- Effects of latitude, geographical location, and elevation
 - Effects of atmospheric circulation, such as the jet stream
 - Characteristics and locations of climate zones, such as the Tropics and the Arctic
 - Effect of the tilt of Earth's axis on seasons
 - Effects of natural phenomena, such as volcanic eruptions and solar radiation variations
- H. Understands the major features of the solar system
- Structure of the solar system
 - The laws of motion and gravity

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- Characteristics of the Sun, Moon, and planets
 - Characteristics of asteroids, meteoroids, comets, and dwarf/minor planets
 - Theories of origin of the solar system
- I. Understands the interactions of the Earth-Moon-Sun system
- Effect on seasons
 - Effect on tides
 - Earth's rotation and orbital revolution around the Sun
 - Phases of the Moon
 - Solar and lunar eclipses
 - Time zones
- J. Understands major features of the universe
- Galaxies
 - Characteristics of stars and their life cycles
 - Theories about the origin of the universe
 - Contributions of space exploration and technology to our understanding of the universe