HEIghten™ Quantitative Literacy
Test at a Glance

Description of the Examination

The *HEIghten™* Quantitative Literacy test evaluates college students' abilities to comprehend, detect, and solve mathematics problems in authentic contexts across a variety of mathematical content areas. The assessment focuses on two main areas**: *Problem-solving Skills*** and ***Mathematical Content*.** Primary ***Problem-solving Skills*** involve a student's ability to demonstrate: (1) ***interpretation*** skills, which can include understanding mathematical terms and representational devices; (2) ***strategic knowledge and reasoning*** skills, which can include building and developing mathematical strategies, developing and testing conjectures, evaluating the validity of mathematical strategies, and drawing appropriate inferences and conclusions; (3) ***modeling*** skills, which can include translating information into mathematical forms, mapping mathematical relationships, applying and revising mathematical models, and determining the reasonableness of a mathematical model; and (4) ***communication*** skills, which can include the presentation of mathematical concepts, data, procedures, and solutions in a variety of forms. As a secondary problem-solving skill, students are also required to demonstrate ***computation*** skills, since computation is fundamental to each of the above problem-solving skills. Computation skills can include identifying appropriate computational strategies and accurate calculation skills. In many cases, a single item requires the examinee to use both a primary and secondary problem-solving skill.

For ***Mathematical Content***, the assessment measures (1) ***number and operations***, which can include real numbers, order properties, and physical quantities; arithmetic operations on real numbers; estimation; proportional reasoning; and financial mathematics; (2) ***algebra***, which can include use of variables, algebraic expressions, and their use in representing quantities; functions, their types and properties, and their use in solving problems; and equations, inequalities, and their use in solving problems; (3) ***geometry and measurement***, which can include geometric figures in one, two, or three dimensions; geometric figure measurements (e.g., area, distance, length, volume, angles) for solving a problem; and units of systems and measurement; and (4) ***statistics and probability***, which can include data interpretation and representation; descriptive statistics; and basic probability. Each test question captures at least one problem-solving skill and a mathematical content area.

Format of the Examination

The *HEIghten* Quantitative Literacy assessment features several types of questions that assess an examinee's ability to answer quantitative items:

- Single-selection multiple choice
- Multiple-selection multiple choice
- Numeric entry, fraction entry
- Table/grid (a table with statements where the correct property is selected by check-marking a cell in the table)

The stimuli for all of these items are embedded in real-world contexts such as personal and everyday life, the workplace, and society. These contexts require an examinee to apply mathematical knowledge to authentic situations to solve the problem. Stimuli for a test

question may include a word problem or scenario that may be supplemented by a graph, table, or figure. Some test questions are quantitative comparison items, which ask test takers to compare two quantities and identify the relationship between the two quantities.

An onscreen calculator will be provided for examinees. The calculator will support the four arithmetic operations (addition, subtraction, multiplication, and division), square root operation, and percent operations. The quantitative literacy questions are designed so that they do not require difficult or extensive calculations. The calculator is provided as a convenience to test takers. Although the calculator can shorten the time it takes to perform computations, the calculator provides results that supplement, but do not replace, the examinee's knowledge of mathematics. The test takers should use their mathematical knowledge to determine whether the calculator's results are reasonable and how the results can be used to answer a question.

Knowledge and Skills Required

Each test question is intended to assess at least one primary problem-solving skill and one mathematical content area. The list below shows the primary problem-solving skills and mathematical content areas being assessed on the test and includes the approximate percentage of the questions that will assess them.

Problem Solving Skills

- *Interpretation (30%):* The understanding and explanation of mathematical information, such as the ability to understand data, read graphs, draw conclusions, and recognize sources of error.

    o Understand mathematical terms and representational devices. Read and interpret basic mathematical notation, concepts, and terminology, such as percentage and average, as well as relationships between quantities expressed in terms of equations, formulas, or data representations, such as tables, graphs, and other diagrams.
- *Strategic Knowledge & Reasoning (34%)*: The formulation and evaluation of mathematics problems using heuristics, and the ability to recognize relationships about mathematical concepts and situations.
    o Build and develop mathematical strategies. Construct and explore mathematical strategies and heuristics to solve problems using inductive and deductive reasoning.
    o Develop and test conjectures. Formulate mathematical hypotheses and evaluate their consequences.
    o Evaluate the validity of mathematical strategies. Evaluate the accuracy of solutions and detect any potential flaws or improbable results.
    o Draw appropriate inferences and conclusions. Explain and justify mathematical results in different mathematical forms.
- *Modeling (30%)*: The process of capturing relationships present in the environment or in mathematical forms, and expressing the model in one or more mathematical representations. The evaluation and revision of a model for accuracy and applicability.
    o Translate information into mathematical forms. Convert informal contextual information into equations, graphs, diagrams, tables, or mathematical text.

- o Map mathematical relationships. Use tools such as equations, inequalities, diagrams, two-way tables, graphs, flowcharts, and formulas to express quantitative relationships (e.g., linear relationships, triangle inequality).
    - o Apply mathematical models. Apply mathematical models and relationships to real-world contexts. Evaluate and revise a model for accuracy and applicability.
    - o Determine reasonableness of a mathematical model. Use estimation methods to check a solution; interpret the results and reflect on whether a solution makes sense.
    - o Revise mathematical models. Adjust mathematical models to make improvements if a model has not served its purpose.
- *Communication (6%)*: The presentation of higher-level concepts and ideas (e.g., mathematical arguments and models) as well as solutions to problems and more standard procedures. The communication may take various mathematical forms and is customized to the appropriate target audience.
    - o Present mathematical concepts, data, procedures, and solutions in a variety of forms. Communicate procedures and results in written, graphical, or tabular format using correct mathematical terminology and notation

Content

- *Number & Operations (30%)*
    - o Real numbers, order properties, and physical quantities
        - ▪ Understand fundamental types of real numbers, including positive and negative numbers, integers, fractions and decimals, even and odd integers, prime numbers, and rational and irrational numbers.
        - ▪ Understand the order properties of real numbers and the number line.
        - ▪ Understand physical quantities as real numbers with units, such as time, money, weight, temperature, distance, area, and volume.
    - o Arithmetic operations on real numbers
        - ▪ Add, subtract, multiply, and divide real numbers, as well as exponentiate and take roots.
        - ▪ Understand the properties of arithmetic operations (i.e., commutative, distributive) as well as the role the operations have in defining fractions, decimals, factors, multiples, and remainders.
        - ▪ Understand relationships between arithmetic operations and the ordering of real numbers (e.g., product of two negatives is a positive).
    - o Estimation
        - ▪ Use estimation to approximate answers.
        - ▪ Use estimation to judge reasonableness of answers.
    - o Proportional reasoning
        - ▪ Compute and interpret percent and percent change.
        - ▪ Compute and interpret rates, ratios, and proportions.
    - o Financial mathematics
        - ▪ Compute tips and taxes.
        - ▪ Compute profits and loss.
        - ▪ Compute simple and compound interest.
- *Algebra (25%)*
    - o Variables, algebraic expressions, and their use in representing quantities
        - ▪ Use variables to represent varying quantities.

- Use arithmetic operations on variables to form algebraic expressions.
- Manipulate and simplify algebraic expressions.
  - Functions, their types and properties, and their use in solving problems
    - Understand the concept of a function, including domain and range, use function notation, and evaluate functions.
    - Know various types of elementary functions, including linear, quadratic, polynomial, and exponential.
    - Understand properties of various types of functions.
    - Represent and interpret functions graphically in a coordinate plane.
    - Use functions to model varying quantities in order to solve problems.
  - Equations, inequalities, and their use in solving problems
    - Understand equations and inequalities as conditions that must be satisfied by varying quantities.
    - Solve problems using algebraic representations— set up equations or inequalities involving functions or algebraic expressions.
    - Graph equations and inequalities in a coordinate plane.
    - Solve equations or inequalities algebraically, graphically, or by ad hoc methods, such as inspection or repeated substitution.
    - Interpret solutions of equations or inequalities to solve problems.

- *Geometry & Measurement (20%)*

  - Geometric figures in one, two, and three dimensions
    - Understand lines and angles in a plane, including parallel and perpendicular lines.
    - Know two-dimensional and three-dimensional geometric figures, such as triangles, circles, polygons, rectangular solids, cylinders, and spheres.
    - Understand transformations, congruence, and similarity of two-dimensional figures.

  - Geometric figure measurements (e.g., area, distance, length, volume, angles, etc.) for solving a problem

    - Calculate area and perimeter/circumference of a two-dimensional object.
    - Calculate volume and surface area of a three-dimensional object.
    - Measure angles of polygons.
    - Use the Pythagorean Theorem to calculate the side lengths of a triangle.
    - Use measurement formulas (e.g., volume, area, etc.) to solve problems.

  - Units and systems of measurement
    - Understand units of measurement (e.g., time, money, weight, temperature, distance, area, volume) and when to apply them.
    - Make conversions within a system of measurement (e.g., inches to feet, meters to kilometers).
    - Convert from one system of measurement to another (e.g., U.S. customary units to metric system, Fahrenheit to Celsius).

- *Statistics & Probability (25%)*

  - Data interpretation and representation
    - Read and interpret data in graphical or tabular form to solve problems.

- Determine appropriateness of a table or graph used to represent a set of data (e.g., line graphs vs. bar graphs).
- Compare alternative displays of the same data set or displays across multiple data sets (e.g., bar graphs and pie graphs) for similarities and differences.
- Create a table to organize frequency data, proportional quantities, or the relationship between two variables.
- Represent the frequency distribution of data using a dotplot, histogram, boxplot, or stem-and-leaf plot.
- Plot proportional quantities using a pie or bar graph.
- Create line charts or scatterplots to represent the relationship between two variables.
  - o Descriptive statistics
    - Interpret and calculate measures of central tendency (e.g., mean, median, mode) for a distribution of data.
    - Interpret and calculate measures of dispersion or spread (e.g., standard deviation, range, interquartile range) for a distribution of data.
  - o Basic probability
    - Understand random sampling with and without replacement, and equal probability for all outcomes.
    - Calculate the probability of a single event using fractions and proportions (e.g., the probability of selecting an ace in a deck of cards).
    - Calculate the probability of two (or more) independent events (e.g., probability of a coin coming up tails after two coin tosses).
    - Understand and calculate conditional probability (e.g., probability of selecting an ace on the second draw after selecting an ace on the first draw).