What Every Teacher Should Know About TASC Mathematics

This is an introduction to the mathematics on the TASC exam, based on analysis of public documents provided by the publisher, sample items, and the TASC readiness exams. In this document, you will also find recommendations for teaching materials and other resources for teaching math content on the TASC.

Breakdown of Math Content

Analysis of TASC Readiness Assessment, Forms 4 & 5 (GHI) and 6 & 7 (JKL)

1. Mathematics in a Context
2. Math in Other Content Areas
3. Conceptual Understanding
4. Targeted Concepts in Functions and Algebra
5. Function and Algebra Notation
6. Targeted Concepts in Geometry
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Breakdown of Math Content

On the TASC math subtest, there are questions on number, quantity, algebra, functions, geometry, statistics and probability. Most are word problems and involve real-life situations, or ask examinees to interpret information presented in diagrams, charts, graphs, and tables.

Students can use a calculator for Section 1 of the math sub-test. For Section 2, students are not allowed to use a calculator. The calculator used for the test is the Texas Instruments’ TI-30XS. The things that students will actually have to do with the TI-30XS on the TASC are pretty limited compared to all of the buttons and capabilities it has. We created this calculator guide for students to help focus on the skills they will need. This function calculator activity will also help students get more comfortable with the TI-30XS.

On the TASC, students are given a page of mathematical formulas to reference during the test. There have been several revisions to the TASC Reference Sheet—many formulas have been removed since the TASC was first released in 2014. Teachers should make sure they are using the most up-to-date version with students.

The TASC Blueprint offers a quick overview of the breakdown of the math content.

- Algebra (26%)
- Functions (26%)
- Geometry (23%)
- Numbers and Quantity (13%)
- Statistics and Probability (12%)

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As you can see, 52% of the TASC is functions and algebra combined. Our students need extensive study in those areas of math. We sometimes hear from teachers that they believe they need to teach operations with fractions, decimals and percent before introducing functions or algebra to students. However, students cannot wait to learn “the basics” first and then squeeze these high emphasis areas in at the end of a semester. Much of the functions and algebra content on the TASC can be accessible to students even if they haven’t mastered work with fractions and decimals. **The CUNY HSE Math Curriculum Framework** offers lesson plans and a scaffolded approach that allows students to develop a conceptual understanding of functions as well as learning the formal notation and contextualized applications. It can provide the core of a course of study suited for preparing students to pass the math sub-test.

The five domains in mathematics are further broken down into subdomains you can see in the chart below. Teachers can find teaching materials on **CUNY Framework Posts** organized into these domains and subdomains. The lessons, problems, and activities on CUNY Framework Posts:

- extend and deepen the units of the CUNY HSE Math Curriculum Framework
- explore content not contained within the CUNY Framework

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>SUBDOMAINS</th>
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<tbody>
<tr>
<td>Algebra (26%)</td>
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<tr>
<td></td>
<td><strong>Creating Equations</strong> - 6%</td>
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<td></td>
<td><strong>Seeing Structure in Expressions</strong> - 6%</td>
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<td>Functions (26%)</td>
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<tr>
<td></td>
<td><strong>Building Functions</strong> - 8%</td>
</tr>
<tr>
<td></td>
<td><strong>Linear, Quadratic, and Exponential Models</strong> - 8%</td>
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<td>Geometry (23%)</td>
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<td><strong>Geometric Measurement with Dimension</strong> - 6%</td>
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<td><strong>Congruence</strong> - 5%</td>
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<tr>
<td></td>
<td><strong>Similarity, Right Triangles, and Trigonometry</strong> - 5%</td>
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<tr>
<td>Number and Quantity (13%)</td>
<td><strong>Quantities</strong> - 10%</td>
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<td></td>
<td>The Real Number System - 3%</td>
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<tr>
<td>Statistics and Probability (12%)</td>
<td><strong>Interpreting Categorical and Quantitative Data</strong> - 6%</td>
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<td></td>
<td>Making Inferences and Justifying Conclusions - 3%</td>
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<td></td>
<td><strong>Conditional Probability and Rules of Probability</strong> - 3%</td>
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A Note on Trigonometry: The Blueprint has a subdomain with the word “trigonometry” in the title, but if you look in the TASC Item Specifications and the TASC Math Blueprint, there are no longer any trigonometry standards assessed on the TASC. The word appears in the subdomains only because that is the name of the subdomain in the Common Core Standards. There is no trigonometry on the TASC.

Analysis of TASC Readiness Assessment, Forms 4 & 5 (GHI) and 6 & 7 (JKL)

The Official TASC Readiness Assessments give us a further window into the content and the kinds of questions our students will face on the TASC. Of the seven forms of the TASC Readiness Assessment, the last four (forms 4–7) are the ones that align to the current form of the actual TASC (JKL) and the most recent GHI forms. We did an extensive analysis of forms 4, 5, 6, and 7. The remainder of this document is a summary of our findings.

Each math problem on the readiness assessments corresponds to a specific content domain. We need to take that with a grain of salt. The domain emphases are helpful, but there is often additional mathematics students need to know to answer these problem. For example, a problem that is classified as a function problem might also require students to understand percent change, order of operations or multiplication with signed numbers.

![Domain Breakdown for TASC Readiness Forms 4 & 5](chart.png)
Mathematics in a Context

Fifty-two percent (52%) of the math problems on readiness tests 4–7 pose a mathematical situation in a real-world context. The following is a breakdown of the contexts and the mathematical content:

- **Workforce**:
  - Linear and exponential functions, systems of equations, systems of inequalities, reading line graphs, rate of change, starting amount, creating equations, interpreting functions, percent change, function tables, probability, charts

- **Science**:
  - Bacteria, exponential growth, percent change

- **Social Studies**:
  - Population density

- **Personal Finance**:
  - Savings accounts

- **Other**

Since almost half of the math problems involve a real-world context, it is important that our students work with contextualized math problems in our classes. Please note the math content in the graph above. A high-emphasis is placed on students being able to connect real-world situations with...
functions, equations and graphs and vice-versa. Students have to be able to recognize different ways to represent a situation. They also need to be able to understand how the different elements of the function/equation connect to the real-world situation. You can find function activities emphasizing these real-world connections in the CUNY HSE Math Curriculum Framework and the Framework Posts section of CollectEdNY.

**Math in Other Content Areas**

In addition to the math section, there is math on both the science and social studies sections of the TASC. On Readiness Assessments 4-7, there were 18 math questions in other content areas (11 in science and 7 in social studies). The following math topics can be found on the science and SS subtests: Line graphs, line of best fit, charts, interpreting data, using and manipulating formulas, pie charts, pictographs, and an equilibrium price graph. It is important to note that there is more data and statistics than the blueprint would suggest because it is found in the science and SS sections!

The following are sample graph reading TASC questions found on Social Studies subtest:

- Which factor contributed the most to the changes shown on the charts?
- Which statement describes an effect of the changes shown in the charts?
- Which of these contributed the most to the trend shown on the graph?
- Which conclusion can be drawn from the data on the graph?
- Which comparison can be supported by the information in the graph?

These questions require students to synthesize information. They have to identify general trends in graphs and charts (not just identify specific data points) and decide what is important and what they can ignore. They also have to recognize when the information they need is in the graph itself and when it requires background knowledge.

Math instruction should include graphs and charts in a science of historical context. When possible, math teachers should confer with reading/writing teachers to look for opportunities to integrate math into other disciplines, especially through the use of data, charts, and graphs. See the CUNY Data and Graph Collection for engaging data sets and ideas on how to use them in the classroom.

Another type of math problem which appears on the science section deals with formulas in a scientific context. Students are asked to use data (sometimes in a chart) to put numbers into a formula. They may also be asked about the impact of changing one of the elements of an equation. For example, students may be given the formula \( v = \frac{d}{t} \) and some data to calculate the velocity \( v \). Then they might be asked what would be the effect on the velocity if the distance \( d \) was halved.

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1 Sample TASC-style examples of Math on the Social Studies and Science sub-tests, can be found on CollectEdNY.org
2 See the Motion and Stability: Forces and Interactions section of the Detailed Description for Physical Science for sample items.
Conceptual Understanding

The following graph gives us a window into the kinds of questions our students will be facing on the TASC:

More than half of the problems on the TASC Readiness Tests we analyzed do not require students to do any calculations! More than half of the problems on the TASC Readiness Tests we analyzed do not require students to do any calculations! (Not a typo. We wrote that sentence twice).³

This has serious implications for the kind of problems we have students work on in our classes. Students need to be able to do a lot more than simply calculate an answer. These questions that do not require calculations emphasize students conceptual understanding, assessing whether our students know why they are doing the things they do. This kind of understanding is emphasized in the CUNY HSE Math Curriculum Framework.

You may be asking yourself, “What does a math problem that does not require any calculation look like?”

³ Please note, we are not talking about the calculator section. In fact, the percentages above represent the breakdown within both the calculator and non-calculator section of the TASC readiness tests.

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Here are two examples, adapted from the TASC Readiness Assessment:

Matthew took the following steps to solve for \(x\) in the equation
\[
3(x - 6) = 48
\]

Equation: \(3(x - 6) = 48\)
Step 1: \(3x - 18 = 48\)
Step 2: \(3x = 30\)
Step 3: \(x = 10\)

In which step, if any, did Matthew make an error?
A. Step 1
B. Step 2
C. Step 3
D. Matthew did not make an error

In this problem, the student is asked to evaluate a process and decide if and where an error was made.

A nutritionist has been working with clients since 2004. She has increased her hourly rate each year since then.

The equation \(y = 2.5x + 16.00\) can be used to model her hourly rate, \(y\), where \(x = 0\) represents 2004.

Which statement describes the nutritionist's hourly rate?
A. Her rate was $2.50 in 2004, and it is $16.00 now.
B. Her rate was $16.00 in 2004, and it has increased $2.50 each year.
C. Her rate was $2.50 in 2004, and it has increased $16.00 per year.
D. Her rate was $16.00 in 2004, and it has increased 2.5 times each year.

Here the problem is assessing whether the student understands what the different parts of the function mean, both mathematically and in a real-world context.  

Another way to understand how the TASC assesses students’ conceptual knowledge without requiring calculations, we can look at some question stems for the TASC Readiness Assessments. By looking at the question stems, we can look for patterns and get a sense of the kinds of questions students will have to answer. We can also use these stems to build questions in class, to ensure students have experience with these types of problems.

Here is one “genre” of question stems from the Math Readiness Assessments:

- Which statement is true...?
- Which interpretation of this... is correct?
- Which statement is correct?
- Which horizontal and vertical axes will make the graph of the profits appear the steepest?

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4 See [Unit 3: Rate of Change & Starting Amount](http://literacy.cuny.edu) in the CUNY HSE Math Curriculum Framework.
These stems ask students to interpret a mathematical situation (often a function, equation, or graph) and choose the answer that best fits. These types of problems almost always contain reasonable incorrect answers (called “distractors”) and require students to read the problem and to read and consider each answer choice carefully.

Here is another “genre” of question stems from the Readiness Assessment:

- What type of function should be used... and why?
- Which linear function models the relationship between...?
- Which equation represents...?
- Which graph represents...?
- Which system of equations can be used to...?
- Which system of inequalities can...?
- What is another way to write...?

These stems usually come from the kinds of problems discussed above in the Mathematics in Context section of this document. They require students to make connections between tables, graphs, equations, functions, real-life situations and back again. They often ask students to either build or interpret a function, equation or graph.

An important takeaway: Students need to be flexible in their conceptual understanding. We can’t prepare them for every kind of problem, but we can make sure they experience a wide range of problems. Students also need to learn to adapt to problems they haven’t seen. The CUNY HSE Math Curriculum Framework focuses on problem-solving in functions and algebra for several reasons. At 52%, those are the most emphasized domains on the test. Equally important, we wanted to create teaching materials that would help teachers meet students where they are and build a coherent understanding of functions.

**Targeted Concepts in Functions and Algebra**

52% of the TASC math is Functions and Algebra. Things students should be able to do with in functions and algebra include: (1) Create and interpret functions from a table, a graph, a rule or the description of a situation, (2) Recognize and compare linear/quadratic/exponential functions from a table, graph, rule, or description of a situation, (3) Understand elements of a function, including rate of change, starting amount, and the features of the graph and how all of those things appear in tables, rules, graphs, and descriptions of situations. Students should also understand the distributive property, be able to evaluate algebraic expressions, solve simple equations, and isolate a variable (rewriting an equation for a variable). Teachers can find dozens of activities and lessons on the section of Framework Posts.

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Function and Algebra Notation

Another aspect of functions/algebra that students need to be flexible in is their understanding of different forms of notation. Let’s look at two groups of equations adapted from those used on the Readiness Assessment.

Here’s the first group:

- \( E = 0.08d + 275 \)
- \( A = 1.15x + 11.50 \)
- \( C = 20b + 50 \)
- \( A = 0.75m + 600 \)
- \( y = -32x + 800 \)

All of these equations are in standard \( y = mx + b \) form, though most use different variables. On the readiness assessment, all of these functions are used to represent real-world situations. Several questions ask students to evaluate a series of statements and decide which one is true. Other questions ask students to identify the function or equation that represent a given situation.

A second kind of function representation that students should understand involves \( f(x) \) notation. Here are a few examples of this type of notation similar to what is found on the TASC Readiness Assessment:

- \( f(x) = 450x + 7500 \)
- \( P(t) = 15.25t + 45 \)
- \( B(t) = (1.08)^t \)
- \( p(t) = -18t^2 + 3t - 3 \)
- \( p(x) = 2x \)
- \( q(x) = x^2 \)

Most of the functions in this group were used in problems to represent real-world situations. Several of these equations are from problems asking students to choose which statement is correct/true. We see linear, exponential and quadratic functions using this notation. We also see that different variables are used.

The \( f(x) \) notation can be challenging for students because it goes against their prior knowledge. Instead of reading \( f(x) \) as equivalent to “\( y \)” or “the output for a value of \( x \)”, the most common misconception is for students to treat the “\( f \)” and the “\( x \)” in \( f(x) \) as two separate variables that are multiplied together. This is understandable since many have learned parentheses mean multiply. Unit 3 of the CUNY HSE Math Curriculum Framework has activities for helping students and teachers draw connections between the \( y = mx + b \) form and the \( f(x) \) notation.

Targeted Concepts in Geometry

23% of the TASC math is Geometry. Geometry is a significant part of the math content on the TASC. Students are very likely to see the (1) Pythagorean Theorem, (2) volume (rectangular prisms, cylinders, cones, spheres, and pyramids), (3) population density, (4) similar triangles, (5) transformations (translation, rotations, reflections), and (6) the vocabulary of geometry. Teachers can find dozens of activities and lessons on the Geometry section of Framework Posts.

Please note that the formula for finding the volume of a rectangular prism is not on the TASC Math reference sheet. For any TASC questions involving rectangular prisms, it is assumed students know the formula.
Targeted Concepts in Number & Quantity

13% of TASC math is Number & Quantity. This domain is often misunderstood as referring to things like whole numbers, the four operations, decimals, and fractions. In terms of what is on the TASC, the Number & Quantity domains means something different. A high-emphasis topic in Number & Quantity is multistep word problems dealing with the use, interpretation, and conversion of units. Students are also likely to be asked to evaluate expressions with square roots and cube roots and exponents using the properties of exponents (i.e. operations with exponents). Students may see positive exponents, negative exponents, and fractional exponents (limited to $\frac{1}{2}$ and $\frac{1}{3}$ power).

Targeted Concepts in Statistics & Probability

12% of TASC math is Statistics & Probability. Students are likely to be asked to interpret data shown in different kinds of tables and graphs (including scatter plots, dot plots, histograms, and box plots) and answer questions about mean, median, mode. Other topics may include the distinction between correlation & causation, and understanding random sampling.

Resources for Teaching TASC Math

The CUNY HSE Math Curriculum Framework: Problem-Solving in Functions and Algebra is organized into the following units:

- Overview
- Curriculum Map
- Unit 1: Introducing Functions
- Unit 2: Three Views of a Function (Rules, Tables, and Graphs)
- Unit 3: Rate of Change & Starting Amount
- Unit 4: Systems of Equations: Making and Justifying Choices
- Unit 5: Nonlinear Functions
- Unit 6: Modeling Exponential Growth
- Unit 7: Equality
- Unit 8: Developing Algebraic Reasoning Through Visual Patterns
- Unit 9: Using Area Models to Understand Polynomials

For an example of how the CUNY HSE Math Framework roots functions in the real world, see: Unit 1 (Maxine’s Rule), Unit 2 (Commission Problem), Unit 3 (Counting Antibodies, Weekend Getaway, Counting Crickets, Lightning and Thunder, Temperature Scales, Measuring Babble), Unit 4 (Choosing a Cell Phone Plan, The Price of a Math Book, Picking Apples), Unit 5 (The Job Offer, Gravity and a Dropped Ball), Unit 6 (Growth of a Smartphone App, Choosing Your Salary, Observing a Mouse Population).

Framework Posts

Teachers can find teaching resources organized by TASC domain and sub-domain on the CUNY Framework Posts section of CollectEDNY.org.
NYSED/CUNY Fast Track GRASP Math Packets

HSE math packets available for classroom use (and student independent learning):

Topics in Geometry
- Population Density - an exploration of area
- The Density of Matter - an exploration of volume with science connections
- Rigid Transformations: Shapes on a Plane
- Lines, Angles, and Shapes: Measuring Our World

Topics in Algebra
- The Power of Exponents
- Expressions, Equations, and Inequalities: Tools of Algebra (Coming Soon)
- Linear Functions: Tools of Algebra (Coming Soon)
- Non-Linear Functions: Tools of Algebra (Coming Soon)

Topics in Statistics & Probability (Coming Soon)

Detailed Description and Sample Problem Documents

Detailed Description and Sample Problem documents are available on CollectEdNY for all subject areas. They include explanations of each content standard assessed on the TASC. Teachers can see what is emphasized, along with sample questions and practice problems for each standard. These documents give teachers a sense of the kinds of problems their students may be asked to assess their understanding.

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<thead>
<tr>
<th>Detailed Description and Sample Problem Documents in Math</th>
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<tr>
<td>- For Functions</td>
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<td>- For Algebra</td>
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<td>- For Geometry</td>
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<td>- For Statistics &amp; Probability</td>
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<td>- For Number &amp; Quantity</td>
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Summary documents similar to this one are available for all TASC sub-tests at http://www.collectedny.org/fptags/overview-of-tasc-content-by-subject/

References

These resources were used in conjunction with our analysis of the TASC Readiness Assessments forms 4, 5, 6, and 7.
- The TASC Objective Structure for GHI and JKL
- The TASC Math Blueprint for GHI and JKL
- The TASC Math Item Specifications for GHI and JKL

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