Overview of TASC Mathematics

Analysis of TASC Readiness Assessment, Forms 4 & 5 (GHI)

Allocated Testing Times	55 Minutes (Section 1 English) 50 Minutes (Section 2 English) **105 Total Minutes**
Number of Questions and Format	45 (Paper-Based) Multiple-Choice Items (43 on the Computer-based) 12 Gridded-Response Items 1 Constructed-Response Item 2 Technology-Enhanced Items (Computer-Based)

On the Mathematics test, there are number, quantity, algebra, functions, and geometry questions, as well as some that cover 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 Mathematics test. For Section 2, students are not allowed to use a calculator. Students are also given a page of mathematic formulas to reference during the test.[i]

The TASC Blueprint[ii] 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%)

As you can see, the TASC is 52% 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. It is possible to teach these fundamental subjects at the same time as functions. The CUNY HSE Math Curriculum Framework offers lessons and a scaffolded approach that allows students to develop a conceptual understanding of functions as well as learning the formal notation and contextualized applications.

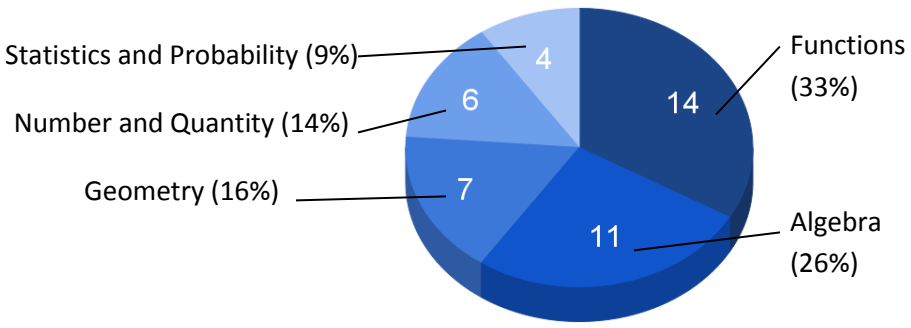
The five domains in mathematics are further broken down into sub-domains you can see in the chart below. Teachers can find teaching materials on CUNY Framework Posts organized into these domains and sub-domains.

Domain/ Reporting Category	Subdomain/Core Idea	Subdomain %	Domain %
Algebra	Arithmetic with Polynomials and Rational Expressions	6%	26%
	Reasoning with Equations and Inequalities	8%	
	Creating Equations	6%	
	Seeing Structure in Expressions	6%	
Geometry	Geometric Measurement with Dimension	6%	23%
	Modeling with Geometry	7%	
	Congruence	5%	
	Similarity, Right Triangles, and Trigonometry	5%	
Functions	Interpreting Functions	10%	26%
	Linear, Quadratic, and Exponential Models	8%	
	Building Functions	8%	
Number and Quantity	Quantities	10%	13%
	The Real Number System	3%	
Statistics and Probability	Making Inferences and Justifying Conclusions	3%	12%
	Interpreting Categorical and Quantitative Data	6%	
	Conditional Probability and Rules of Probability	3%	

Note: The Blueprint has a subdomain with trigonometry in the title, but if you look in the TASC Item Specifications[iii], there are no longer any trigonometry standards assessed on the TASC. It is listed in the subdomains only because that is the name of the subdomain in the Common Core Standards. Our students are very unlikely to see any questions dealing with trigonometry.

The Official TASC Readiness Assessments, which are basically 1/3 of an actual TASC test, give us a further window into the content and the kinds of questions our students will face on the TASC. Of the five forms of the TASC Readiness Assessment – the last two, forms 4 and 5, are the ones that align to the current form of the actual TASC (GHI). We did an extensive analysis of forms 4 and 5. The remainder of this document is a summary of our findings.

If we look at the domain breakdown based on an analysis of the actual readiness tests (4 & 5), we see an even greater emphasis on functions than is suggested on the Blueprint.[1]



Out of 42 unique questions on ORT 4 & 5

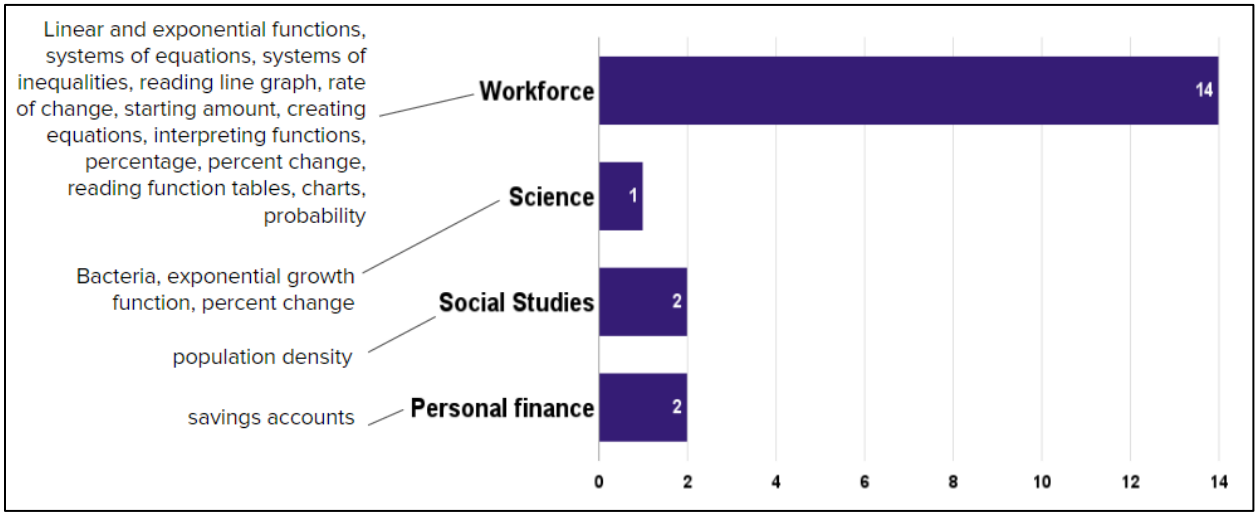
Each math problem on the readiness assessments corresponds to a specific content domain. We need to take that with a grain of salt. The domain emphases are helpful, but

[1] Students who answer 7 out of 20 on Form 5 and 8 out of 20 on Form 4 are expected to pass the TASC.

there are often other things 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 operations with signed numbers.

Mathematics in a Context

Forty-five percent (45%) of the math problems on readiness tests 4 and 5 have a real-world context. The following is a breakdown of the contexts and the mathematical content:



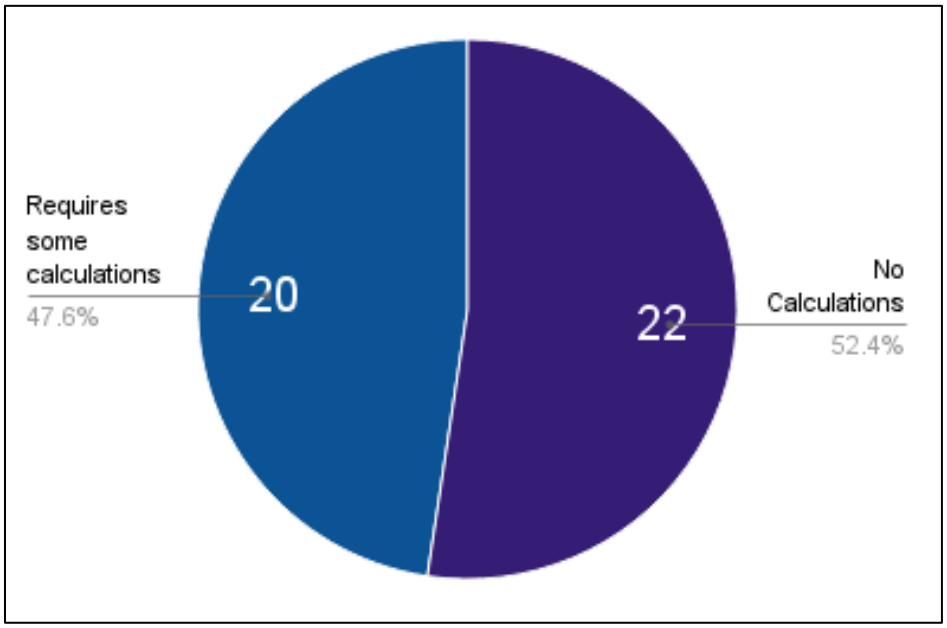
Since almost half of the math problems involve a real-world context, it is important that our students work with contexualized math problems in our classes. Please note the math content in the graph above. A high-emphasis is placed on students being able to connect real-world situations with functions, 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.[iv]

Math in Other Content Areas

In addition to the math section, there is math on both the science and social studies sections. On Readiness Assessments 4 and 5, there were 11 math questions in other content areas (5 in science and 6 in Social Studies). The following math topics are present: Line graphs, line of best fit, charts, interpreting data, using formula, pie charts, pictograph, and an equilibrium price graph. Note that there is more data and statistics than the blueprint would suggest because it is found in the science and social studies sections. 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.

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 do not require students to do any calculations! 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 – they are 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.

Consider the following example, adapted from the TASC Readiness Assessment:

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.

Sample Question Stems from TASC Math Readiness Assessment, Forms 4 & 5[2]

To get a sense of how the TASC assesses students' conceptual knowledge without requiring calculations, let's look at some sample question stems for the TASC Readiness Assessments, forms 4 & 5. 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 Readiness Assessment:

- *Which statement is true about…?*
- *What is the correct interpretation of…?*
- *Which interpretation of this… is correct?*
- *Which statement is correct?*
- *Which statement about the… is true?*

These stems ask students to be able 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 *in*correct answers and require students to read the problem 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.

[2] This is an overview of the kinds of problems students will see on the TASC. For more information, please see the Detailed TASC Content Descriptions (by Subject), which have sample items for each of the standards assessed on the TASC.

Five Ways of Looking at a Function Problem

Another useful way of thinking about the kinds of problems our students may face was explored in the CUNY Webinar: Teaching High Emphasis/High Utility Math Content for the TASC.

Consider the following situation and corresponding table.

Four friends used the same taxi service to meet at a restaurant for dinner. When they arrived at the restaurant, they compared their cab fare and tried to figure out a rule that the taxi company used to calculate cost.

Passenger	Distance (in miles)	Cost
Denise	1	$4.50
Mark	6	$12
Solange	3	$7.50
Kate	8	$15

Here are just 4 possible questions, any one of which could be asked using the situation and table above to assess different student understandings within functions:

Which linear function models the relationship between the number of miles driven, *m*, and the cost of the cab ride, *C*?

A. $C = 4.5m$
B. $C = 2.5m$
C. $C = 1.5m + 3$
D. $C = 3m + 1.50$

Which linear function models the relationship between the number of miles driven, *m*, and the cost of the cab ride, *C(m)*?

A. $C(m) = 4.5m$
B. $C(m) = 2.5m$
C. $C(m) = 1.5m + 3$
D. $C(m) = 3m + 1.50$

Which statement is true about the cab fare?

A. The ride costs $4.50 for each mile.
B. The ride costs $3.00 for each mile driven plus $1.50
C. For each 10 miles driven, the cab ride costs $18.00
D. The ride costs $1.50 for each mile plus a flat fee of $3.00

Four friends used the same taxi service to meet at a restaurant for dinner. When they arrived at the restaurant, they compared their cab fare and figured out they could calculate the cost of a ride using the following function: $C = 1.5m + 3$, where m is the number of miles traveled and C is the cost of the ride.

Halfway through the meal, the group's friend, Isabel, arrives. Isabel who also used the same taxi service, paid $22.50 for the ride. **What distance did she travel?**

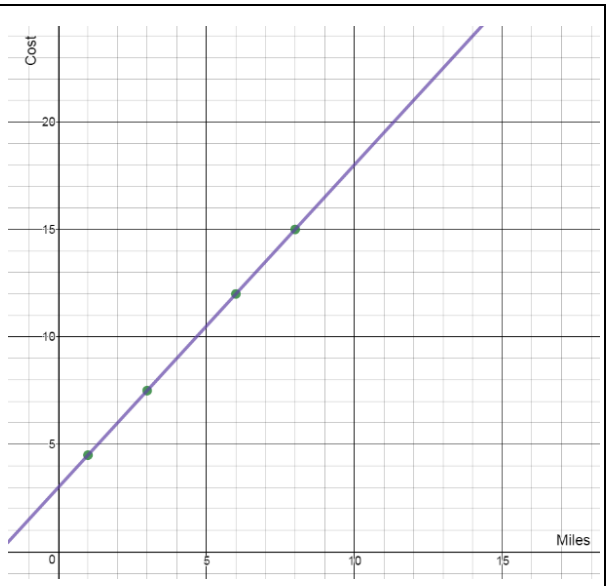
Giving students the same information in a graph as opposed to a table offers another opportunity for the TASC to test the depth of student understanding.

Four friends used the same taxi service to meet at a restaurant for dinner. The graph to the right shows the distance traveled, in miles, and the cost of each friends' ride.

How much would it cost to ride for 10 miles?

If C is the cost of a ride that is m miles, which function can be used to calculate the cost of a taxi ride?

A. $C = 4.5m$
B. $C = 2.5m$
C. $C = 1.5m + 3$
D. $C = 3m + 1.50$



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 be able 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.

Sample Equations and Inequalities from TASC Readiness Assessment, Forms 4 & 5

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/inequalities 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.

- Three questions ask students to consider a series of statements. Students must choose which statement is a true/correct interpretation of the function equation.
- Two of these equations come from questions that 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:

$f(x) = 450x + 7500$	$P(t) = 15.25t + 45$	$B(t) = (1.08)^t$
$p(t) = -\frac{1}{8}t^2 + 3t - 3$		$p(x) = 2^x$ $q(x) = x^2$

- All of the functions in this group were used in problems to represent real-world situations.
- Three of these equations are from problems asking students to choose which statement is correct/true.
- One of these functions appears in a collected response, short-answer question.
- 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.

The following resources were used in conjunction with our analysis of the TASC Readiness Assessments for TASC forms G, H, and I.

[i] The TASC Objective Structure

[ii] The TASC Math Blueprint document provides an overview of the domain and subdomain content for the math section of the TASC. It also lists out the standards assessed within each domain and the degree to which each standard is emphasized (high, medium, or low).

[iii] The TASC Math Item Specifications document is a guide created for test question writers that provides some insight into the test. It is 82 pages long and can be a little intimidating. The most useful materials here for teachers are probably (1) the sample items and sample item stems for each standard, (2) information about what *is* (called "evidence statements") and what *isn't* (called "assessment limits") fair game within each standard, (3) information about the different kinds of questions (Multiple-selected response items, multiple-choice, gridded response, constructed response), and (4) the sample rubrics for the constructed response questions.

[iv] For an example of how these resources make strong connections between functions and the real-world, check out the Paycheck Problem (CUNY Framework Posts). The following are problems from the CUNY HSE Math Curriculum Framework that root functions in the real world: Unit 2 (the 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).