

# **GEORGIA END-OF-COURSE TESTS**

## **MATHEMATICS I: ALGEBRA/GEOMETRY/STATISTICS**

### **RELEASED ITEM COMMENTARY**



ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
1	MM1A3c, MM1P5e	1	C

**COMMENTARY:**

A student must know what a solution is, be able to understand it graphically, and be able to read the x-coordinate(s) from where the graph intersects the x-axis. Note that this question requires no symbolic manipulation, just graphic representation. Answer choice A is incorrect because the minimum is confused with the solution; answer choice B is incorrect because the x- and y-intercepts are confused; answer choice D is incorrect because all intercepts were considered as solutions. The content was addressed in Units 2 & 5 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
2	MM1A2d, MM1P1b, MM1Pc	1	D

**COMMENTARY:**

Students need to understand symbolic manipulation; however, the method used is not specified. A student could choose to multiply all three binomials, use the binomial theorem, or use Pascal's triangle. The method was not the point, rather that students could access a method to do it. Answer choice A shows misuse of the Distributive Property; answer choice B shows lack of understanding that the binomial is a unit and not just terms; answer choice C shows an inappropriate use of Pascal's triangle. The content was addressed in Unit 2 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
3	MM1A2c, MM1P1b, MM1P1c	2	A

**COMMENTARY:**

In this item, students must recognize that area is the product of the length and width, and therefore the trinomial is a product of two binomials. Students could choose to find the answer by factoring or multiplying  $(b + 3)$  by each of the answer choices. Answer choice B multiplied positive and positive eight, which does not equal a negative 24; answer choice C multiplied negative and positive three; answer choice D multiplied positive and positive five. The content was addressed in Unit 2 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
4	MM1A2f, MM1P1b, MM1P1c	1	C

**COMMENTARY:**

Students should have noticed that the answer choices are all the same in factored form, but students need to look at the choices to see which signs will give you the correct factorization. The content is addressed in Unit 2 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
5	MM1A1d, MM1P3d, MM1P4c	1	C

**COMMENTARY:**

By correctly solving this item, students will demonstrate an understanding of the graphical representation of the quadratic function. Students who have had many experiences with graphing the model and interpreting their characteristics will easily answer this question as no symbolic manipulation is required, just graphic representation. Answer choices A & B are y-values and Answer choices C & D are x-values. The content is addressed in Units 1 and 5 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
6	MM1A2g, MM1P1b, MM1P1c, MM1P5c	1	C

**COMMENTARY:**

This question requires that students have knowledge of volume and how to calculate volume. Answer choice A is incorrect because the Distributive Property was used incorrectly; answer choice B is incorrect because the values were added instead of multiplied; answer choice D is incorrect because the coefficients of the x terms were added and then the Distributive Property was applied. The content was addressed in Unit 2 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
7	MM1A3a, MM1P1b, MM1P1c, MM1P4c	2	B

**COMMENTARY:**

Algebraic manipulation is used to solve the expression. Students must recognize that the question is only asking for the positive values and not the negative values. The most popular errors made are the signs and inappropriate simplification of square roots. The content is addressed in Unit 2 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
8	MM1A1d	2	A

**COMMENTARY:**

This question asks students to demonstrate an understanding of the relationship of the domain of a function and the graph of the function. With the given range, we know the quadratic function opens up with a minimum at its vertex so it will never have x-intercepts. This question is another example of a problem that requires conceptual understanding with no symbolic manipulation. The content is addressed in Unit 1 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
9	MM1A1b, MM1P5b	1	A

**COMMENTARY:**

Item 9 requires that students demonstrate knowledge of the basic function families addressed throughout Mathematics I. Students must be comfortable relating algebraic and graphical representations. Answer choice B is incorrect because it is a square root graph; answer choice C is incorrect because it is an inverse function; answer choice D is incorrect because the graph is a cubic function. The content is addressed in Unit 1 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
10	MM1A1d, MM1P1b	2	C

**COMMENTARY:**

For this item, students must recognize that zeros of a function occur when  $f(x) = 0$ . Students can factor to find the value, or since each pair is distinct, they can substitute in for  $x$  until they find the answer they are looking for, which is zero. Answer choices A and D are incorrect because the factors listed are not zeros of the function. Answer choice B is incorrect because the signs are interchanged. The content is addressed in Units 1 and 5 in the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
11	MM1G1b, MM1P1b, MM1P1c, MM1P4c	2	B

**COMMENTARY:**

Students must understand the distance formula and that the shortest distance between a line and a point not on the line is the distance along a line perpendicular to that line to answer this question. Students will need experience with translating problem situations into graphical representations as students who struggled with this question did so because the graph was not given and they did not know to make one themselves. Answer choice A is incorrect because only the yards to and from Main Street at the perpendiculars were counted; answer choice C is based on estimation; answer choice D is incorrect because the distance walked along the lines to and along Main Street at the perpendiculars was counted. The content was addressed in Unit 6 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
12	MM1G1a, MM1P1	2	C

**COMMENTARY:**

Students must recognize the properties of parallelograms and use them to answer this question. The students must once again use the distance formula or the Pythagorean theorem to find the length of one side of the quadrilateral, then multiply by 4. Answer choice A is incorrect because the student counted the number of squares that a side went through (3.5) and multiplied the 3.5 times 4; answer choice B is incorrect because the student used (3.5, 5) for T and (1, 2.5) for W;

answer choice D is incorrect because the student assumes the perimeter for PQRS is the same as the perimeter for TUVW. The content is addressed in Unit 3 and Unit 6 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
13	MM1G3e, MM1P1b, MM1P1c	2	D

**COMMENTARY:**

Students should have a deep understanding of the differences between the points of concurrency and how they are constructed and specifically, which center is made by angle bisectors. This question requires conceptual understanding with no symbolic manipulation. Answer choice A is incorrect because the centroid is the point of concurrency for the medians; answer choice B is incorrect because the circumcenter is the point of concurrency for the perpendicular bisectors; answer choice C is incorrect because the incenter is the point of concurrency for the bisectors of the angles. The content is addressed in Unit 3 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
14	MM1G3b, MM1P1b, MM1P1c	2	A

**COMMENTARY:**

This question addresses a student’s understanding of triangle inequalities, specifically that any two sides must sum to more than the third. In looking at the given information, students need to be able to recognize which side is the longest and which side is the shortest, then use these in the triangle inequality appropriately. Answer choice B is incorrect because an error was made in addition and subtraction; answer choices C and D are incorrect because an error was made in the understanding of how to find the length of the third side. The content is addressed in Unit 3 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
15	MM1G3e, MM1P1b, MM1P1c, MM1P4c, MM1P5b	2	D

**COMMENTARY:**

Students are asked to determine the point equidistant from three given points. Again, a thorough understanding of points of concurrency allows the student to recognize that a circle that contains each of the three points means that the center of the circle is the point that we are looking for. Thus to answer this question, students can quickly find the answer once they determine the center they need. All of the incorrect answers are based on the incorrect centers. The content is addressed in Unit 3 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>16</b>	<b>MM1G3c, MM1P1b, MM1P2b, MM1P2d, MM1P5b</b>	<b>2</b>	<b>A</b>

**COMMENTARY:**

Students must reflect on methods of proving triangles congruent and the use of information that can legitimately be determined from a figure. In this instance, students will use the reflexive property to determine a second side of the triangle as congruent. Therefore, the only information that is needed is the third side. Many students will be tempted to presume congruent angles because of the congruent sides; the fact that the choices for answers don't reflect this should be a clue to the student. Using the corresponding sides of the congruence statement given, answer choice B is incorrect because the sides are not corresponding sides; answer choices C and D are incorrect because the segments named are not sides of the referenced triangles. The content is addressed in Unit 3 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>17</b>	<b>MM1G3d, MM1P1b, MM1P1c, MM1P5b</b>	<b>2</b>	<b>D</b>

**COMMENTARY:**

This item requires that students know the properties of rectangles. The diagonals are congruent and bisect each other. The student could approach this by making equations of halves of diagonals using the same variables, thus allowing the students to find the value of the variable and re-substitute that value in to find the length of the whole diagonal. However, students could also choose to use the properties to find the length of half of the diagonal without finding the values of the variable, thus going directly to the answer that is asked. All the incorrect answers are based on using the first approach to solve the problem, but stopping before the student has found the answer to the question. Answer choice A is the value of x; answer choice B is the value of y; answer choice C is the length of half of a diagonal. The content is addressed in Unit 3 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>18</b>	<b>MM1G3b, M1P1b, MM1P1c, MM1P5b</b>	<b>2</b>	<b>B</b>

**COMMENTARY:**

Item 18 uses exterior angles and interior angles, and the relationship between them. The most direct way to solve this problem is to set up the equation using exterior angle measure equal to the sum of the measures of the remote interior angles, solve for x, then substitute the value in the expression for the angle requested. Again, the students must be sure they are answering the question that is asked. Answer choice A is based on the misuse of angles sum to 180 degrees; answer choice C is the measure of the exterior angle and therefore, not answering the question.

that is asked; answer choice D is based on an arithmetic mistake. The content is addressed in Unit 3 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>19</b>	<b>MM1G1c, MM1P1b, MM1P1c, MM1P4a, MM1P5b</b>	<b>2</b>	<b>C</b>

**COMMENTARY:**

This item appears to use properties of mid-segments of triangles and trapezoids. However, it really only uses the idea of a midpoint. Students should approach this problem as a situation where the given is one endpoint and the midpoint, and the unknown is the other endpoint. The student must ignore the “look” of the figure on the grid and resist the temptation to just trust that it is drawn to scale and estimate. Answer choice A is incorrect based on the “look” assumption; answer choice B is incorrect because it uses half of the x-coordinate of L; answer choice D is incorrect because the coordinates are reversed, confusing the x and y coordinates. The content is addressed in Unit 6 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>20</b>	<b>MM1G3c, MM1P1b, MM1P2d, MM1P5b</b>	<b>2</b>	<b>C</b>

**COMMENTARY:**

In this item, students are asked to recognize when enough appropriate information is given to determine the congruence of given triangles. Students who have had experiences with labeling figures and with discussing correct usage of congruency theorems will find this problem easy. Students who have had only experiences with formal proofs will find this problem confusing, especially if they did not understand what the proof meant. Again, the emphasis is on understanding the theorems, not in the formal proof process. Answer choice A is missing the appropriate angle measure; answer choice B is based on an incorrect application of theorems; answer choice D is based on knowing the measures of all angles and therefore similarity and congruency are confused. The content is addressed in Unit 3 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>21</b>	<b>MM1D2c, MM1P1</b>	<b>2</b>	<b>A</b>

**COMMENTARY:**

Item 21 requires an understanding of the phrase “without replacement” and how that affects the number of choices. Answer choice B uses the card as if replaced; answer choice C is the probability of yellow on the first pick; answer choice D is based on one blue card out of 9 yellow cards, demonstrating a misunderstanding of probability. The content is addressed in Unit 4 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>22</b>	<b>MM1D1a, MM1P1</b>	<b>2</b>	<b>B</b>

**COMMENTARY:**

Item 22 addresses the understanding of union and intersection in probability. The question needs to be interpreted as Saturday or Sunday on the first spin and Saturday or Sunday on the second spin. The student will need to recognize that the probability of Saturday or Sunday on any spin is  $\frac{2}{7}$ ; then recognize that if this must happen two times in a row, the answer is the product. However, the preferable method for solving this problem is for a student to understand that modeling probability using area models will give the answer without “memorizing” any formulas. Students who have had experience with area models will not make the interpretation mistake that the formula process lends itself to. Answer choice A is based on listing out the possibilities and leaving one out; answer choice C is based misinterpretation of consecutive events; answer choice D is based on using addition of probabilities. The content is addressed in Unit 4 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>23</b>	<b>MM1D3a, MM1P1a</b>	<b>3</b>	<b>D</b>

**COMMENTARY:**

This item requires an in-depth understanding of median and interquartile range. The student must be able to draw, compare, and make conclusions from a box and whisker display using two sets of data on the same display. Students will need to look at the overlap in the boxes and find the regions that meet the conditions. Answer choice A is incorrect because the student used the widest endpoints from both classes; answer choice B is incorrect because it only uses class 1 information; answer choice C is incorrect because it only uses class 2 information. The content is addressed in Unit 4 of the Mathematics I frameworks.

<b>ITEM NUMBER</b>	<b>STANDARD ALIGNMENT</b>	<b>DOK</b>	<b>KEY</b>
<b>24</b>	<b>MM1D2d, MM1P1b</b>	<b>2</b>	<b>B</b>

**COMMENTARY:**

This item requires that students understand how to calculate expected value. The information is given in a way that also requires students to understand that fractional area is the probability of landing in that region. Answer choice A is  $\frac{2}{3}$  rounded off; answer choice C is the average of the possible points earned; answer choice D is the sum of the three outcomes. The content is addressed in Unit 4 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
25	MM1D4, MM1P1b	2	C

**COMMENTARY:**

This item requires students to understand how to find the mean absolute deviation. The set of data given is small and the data values are small. The question is not testing whether students can do difficult calculations, just that they understand and can find the MAD. Students should have had experiences with finding and interpreting the MAD for small sets of data similar to this one. Answer choice A is incorrect because it finds the sum of the deviations but does not divide to find the mean of them; answer choice B is incorrect because it is the mean of the set; answer choice D is incorrect because the mean is divided by the number of items, not the sum of the deviations. The content is addressed in Unit 4 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
26	MM1D2b, MM1P1	2	B

**COMMENTARY:**

Item 26 involves multiple drawings without replacement and conditional probability. Again, students who had experience with area models for these types of problems will find this an easy question, while students who only know a formula will struggle in interpretation. Answer choice A is incorrect because it uses replacement; answer choice C is incorrect because the numerators and denominators are added separately; answer choice D is incorrect because addition was used. The content is addressed in Unit 4 of the Mathematics I frameworks.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
27	MM1D1b, MM1P1	1	C

**COMMENTARY:**

Here, students will need a clear understanding of order as a permutation. Students can find this answer by modeling the situation or by using the permutation formula. Answer choice A is incorrect because choices 7 and 2 are multiplied together; answer choice B is incorrect because combinations were used; answer choice D is incorrect because it simply multiplied 7 by 7. The content is addressed in Unit 4 of the Mathematics I frameworks.

**Note:** This item is one of three items that refer to the original information given regarding the programming of television shows. This type of item is called a **cluster item**; students must refer back to the given information to answer the question.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
28	MM1D1b, MM1P1	1	B

**COMMENTARY:**

This item addresses the understanding of combinations. Students need to know that order does not matter and how to find all possible combinations of seven things taken four at a time. Answer choice A is incorrect because choices 7 and 4 were multiplied together, a misapplication of the counting principle; answer choice C is incorrect because a truncated permutation was used; answer choice D is incorrect because a permutation was used. The content is addressed in Unit 4 of the Mathematics I frameworks.

**Note:** This item is one of three items that refer to the original information given regarding the programming of television shows. This type of item is called a **cluster item**; students must refer back to the given information to answer the question.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
29	MM1D1b, MM1P1	2	B

**COMMENTARY:**

This item addresses the use of multiple applications of combinations. The student must find how many ways to choose the talk shows, the number of ways to choose the comedies, and then multiply those together based on the counting principle. Again, repeated modeling of this type of problem will lead to understanding by the student. Answer choice A is incorrect because the student found the separate combinations but then added instead of multiplying them; answer choice C is incorrect because a truncated permutation was used; answer choice D is incorrect because the work used only the counting principle. The content is addressed in Unit 4 of the Mathematics I frameworks.

**Note:** This item is one of three items that refer to the original information given regarding the programming of television shows. This type of item is called a **cluster item**; students must refer back to the given information to answer the question.

ITEM NUMBER	STANDARD ALIGNMENT	DOK	KEY
30	MM1D2a, MM1P1	1	D

**COMMENTARY:**

To answer this item, students must have an understanding of multiple mutually exclusive events in probability. Answer choice A is incorrect because it is the probability of just the yellow sections; answer choice B is incorrect because it is the probability of any one of the nine sections; answer choice C is incorrect because it is the probability of just the blue sections. The content is addressed in Unit 4 of the Mathematics I frameworks.