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Preparing Non-Native English Speakers for the Mathematical Vocabulary
in the GRE and GMAT

Irina Mikhailovna Baskova

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Arts

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ABSTRACT

Preparing Non-Native English Speakers for the Mathematical Vocabulary in the GRE and GMAT

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The purpose of this study was to develop vocabulary materials to aid non-native English speakers, specifically Russian speaking test-takers, in their preparation for the mathematical sections of the General Record Examination (GRE) and the Graduate Management Admission Test (GMAT) in terms of English mathematical vocabulary. GRE and GMAT preparation materials and practice tests published by the Educational Testing Service, Kaplan, and Barron's were analyzed with the help of computer software. This data was then used to determine which key words to include in the vocabulary tool, which is now available on Quizlet (www.quizlet.com). The developed materials were further proofread by competent mathematics and English language professionals and assessed with the help of a questionnaire administered to them. The rationale of the materials development and the procedures used for the process are described in detail in this thesis project.

Keywords: Vocabulary, ESL Mathematical Vocabulary, GRE, GMAT, Flashcards

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CHAPTER ONE: INTRODUCTION

Interest in obtaining higher education in English-speaking countries has dramatically increased in many countries around the world in recent years. This has fueled the need for professional teaching and materials to help prepare students for English language proficiency tests and standardized tests that are necessary to apply for undergraduate and graduate programs abroad.

The General Record Examination (GRE) and the Graduate Management Admission Test (GMAT) are among the graduate admissions tests for both native and non-native speakers of the English language, which are needed for many graduate schools and graduate business schools in the United States of America and other English-speaking countries. The GRE and GMAT are comprised of several sections, including those that measure test-takers' mathematical abilities. The focus of this thesis will be on the GRE Quantitative Reasoning section and the GMAT Quantitative and Integrated Reasoning Sections. For non-native English speakers, success in passing the quantitative sections of both tests and the integrated reasoning section of the GMAT depends greatly on their mathematical skills and the vocabulary that supports them.

There are multiple publishers of GRE and GMAT test preparation materials. These preparation materials usually describe the tests' content, test-taking strategies, including general math strategies. They also provide sample test questions and practice tests for independent study. Whereas there are numerous GRE and GMAT preparation materials developed and published for native English speakers, what is not available are preparation materials developed specifically for non-native English speakers with the focus on mathematical vocabulary. Those GRE and GMAT test-takers whose first language is other than English and who have little or no background in Greek, Latin, or a Romance language may have a unique need different from the need of other

test-takers. It is necessary for students to develop adequate vocabulary to deal with mathematical texts as "few contextual clues are given to help decode the meaning of specialized words" (Reehm & Long, 1996, p. 37). Therefore, there is a definite need to provide support for this target population's vocabulary instruction. Since the purpose of the GRE and GMAT Quantitative Reasoning sections and the GMAT Integrated Reasoning Section is to test students' math knowledge and skills as well as data interpretation ability, it is indispensable to make certain that it is these aspects that are tested in the GRE and GMAT, and not the test-takers English language or English mathematical vocabulary knowledge. It is also important to minimize the lack of English mathematical vocabulary knowledge interference or eliminate it completely. Thus, the issue still needs to be addressed.

For my mixed methods research study, I will discuss possible difficulties related to vocabulary teaching and learning, suggest a possible solution for facilitating preparation for the quantitative and integrated reasoning sections of the GRE and the GMAT tests in terms of mathematical vocabulary, and describe a tool I developed to assist Russian test-takers with GRE and GMAT mathematics vocabulary. The purpose of this vocabulary tool is not to teach the learners mathematical skills or test-taking strategies, but rather the mathematical vocabulary contained in the tests. Since my vocabulary tool is designed to facilitate GRE and GMAT test preparation – not in terms of mathematical competency but in terms of mathematical vocabulary only – it is assumed that the GRE and GMAT prospective test-takers are already familiar with the mathematical concepts contained in the tests.

CHAPTER TWO: REVIEW OF LITERATURE

The GRE revised General Test (GRE) is developed and administered by the Educational Testing Services (ETS), the world's largest private nonprofit educational testing and assessment organization. The test “features question types that closely reflect the kind of thinking [students] do in graduate or business school,” and “is accepted at thousands of graduate and business schools as well as departments and divisions within these schools” (Educational Testing Service, 2017a).

The GRE consists of three sections: Verbal Reasoning, Quantitative Reasoning, and Analytical Writing. Due to the scope of this thesis, there will be no focus on the Verbal Reasoning and Analytical Writing sections of the GRE. As far as the Quantitative Reasoning section is concerned, it “measures problem-solving ability, the ability to understand quantitative information, interpret and analyze quantitative information, solve problems using mathematical models, apply basic mathematical skills and elementary mathematical concepts of arithmetic, algebra, geometry, and data interpretation, and includes real-life scenarios” (Educational Testing Service, 2017c). The content in these areas includes high school mathematics and statistics with the mathematical symbols, terminology and conventions that are standard at this level.

The GRE Quantitative Reasoning Measure consists of two sections with 20 questions (quantitative comparison questions, multiple-choice questions with one or more answer choices, and numeric entry questions). The first section is, overall, of average difficulty. The difficulty of the second section depends on the test-taker's performance on the first section: the better the student does on the first section, the higher the level of difficulty the second section will be, which means that the Quantitative Reasoning section is section-level adaptive. The scoring for the Quantitative Reasoning “takes into consideration the total number of questions answered

correctly across the two sections, as well as the difficulty level of the section” (Educational Testing Service, 2017b)

The Graduate Management Admission Test is a computer-adaptive test developed and administered by the Graduate Management Admission Council (GMAC), the owner of the GMAT exam and “the leading provider of market intelligence and information about the graduate management education industry.” (Graduate Management Admission Council, 2016). “Over 6,000 graduate business programs at approximately 1,700 universities and organizations around the world accept the GMAT exam” (Graduate Management Admission Council, 2017a).

The GMAT consists of four sections: Analytical Writing Assessment, Integrated Reasoning Section, Quantitative Section, and Verbal Section. Again, there will be no focus on the Analytical Writing Assessment and the Verbal Reasoning sections of the GMAT due to the scope of this thesis. The Integrated Reasoning section measures [students’] ability to evaluate information presented in multiple formats from multiple sources – skills [students] need to succeed in our technologically advanced, data-driven world. (Graduate Management Admission Council, 2017c). The GMAT Integrated Reasoning Section contains 12 questions (Multi-Source Reasoning, Graphics Interpretation, Two-Part Analysis, Table Analysis, and Multi-Source Reasoning) with 30 minutes of allotted time for the section. The four types of Integrated Reasoning (IR) questions measure how well students can integrate data to solve complex problems. The four types of IR also test such skills as synthesizing, evaluating, organizing, combining, and manipulating information.

The Quantitative section measures students’ ability to analyze data and draw conclusions using reasoning skills and contains 37 questions (Data Sufficiency, Problem Solving) with 75 minutes of allotted time for the section. “The mathematics needed to understand and solve the

questions in this section of the GMAT exam are no greater than what is generally taught in secondary school classes” (Graduate Management Admission Council, 2017b). The level of difficulty of a question presented in the GMAT Integrated Reasoning Section and Quantitative Section depends on the test-taker’s performance on the preceding question, which means that the section is computer-adaptive.

Role of Vocabulary in Language Learning

The process of second language vocabulary acquisition starts in the very first stages of learning and can be viewed as an ongoing challenge for ESL learners. The importance of vocabulary learning for ELLs cannot be over-emphasized. Bohlke (2013) states that “for a language learner to communicate effectively, it is necessary to have a reasonable command of grammar and vocabulary” (p. 123). I believe that this statement is axiomatic. Gardner (2013) views grammar “as the engine of language, giving it order and structure, “and vocabulary “as the fuel of language without which nothing meaningful can be understood or communicated” (p. 2). Thus, since communication is the primary goal of using a language, vocabulary is central to second language learning.

Since “[r]esearch tells us that one of the areas ELLs need a lot of instruction in, throughout their schooling, is in vocabulary development” (Ediger, 2014, p.159), it is indispensable for ESL teachers to decide which words to focus on in which circumstances. It is impossible to teach all the English words that ELLs need to know: “Even the best teachers in the most ideal settings can never teach all of the words that learners need. Choices need to be made” (Zimmerman, 2013, p. 293). These choices are not easy ones to make, though: “Just as word learning is daunting for the student, vocabulary teaching may appear intimidating to the instructor. There are so many words! There is so much to know about each word! And there is so little time!” (Zimmerman, 2014, p.

300). This is especially problematic in preparing ELLs for studying in an English speaking academic environment. Besides teaching general vocabulary that students need to know to communicate effectively, ESL professionals need to also teach learners academic vocabulary and genre-specific academic vocabulary.

Academic Vocabulary

Nagy and Townsend (2012) define academic vocabulary as “the specialized language, both oral and written, of academic settings that facilitates communication and thinking about disciplinary content,” where academic settings are “educational institutions, print publications, and digital media” (p. 92). This specialized language requires competence in all the subgroups of academic vocabulary. According to Bauman and Graves (2010), academic vocabulary can be defined “(1) as *domain-specific academic vocabulary*, or the content-specific words used in disciplines like biology, geometry, civics, and geography; or (2) as *general academic vocabulary*, or the broad, all-purpose terms that appear across content areas but that may vary in meaning because of the discipline itself” (p. 6). This potential for discipline specific meanings in core academic words adds yet another learning burden. “Consider the words *force* and *function*; these words have technical, discipline-specific meanings in physics and in math but are used liberally across academic disciplines in a variety of contexts” (Nagy & Townsend, 2012, p.97).

Knowledge of domain-specific academic vocabulary, general academic words, and cross-discipline words is crucial for functioning successfully in an English speaking academic environment. This fact and the potential polysemous nature of general academic vocabulary (Hyland & Tse, 2007, p. 243) create an immense vocabulary load and a necessity to make informed choices. Bauman and Graves (2010) further describe Fisher and Frey's (2008) suggestions for identifying academic vocabulary for instruction by “first examining the text to be

read and determining which words fit within their technical words and specialized words categories” (p. 8), which may be done with the help of modern technology.

Vocabulary Learning Strategies

Students' effective vocabulary acquisition does not depend solely on the instructor's teaching but also on the effort, amount of time, and strategies that learners use for their independent vocabulary learning. Zimmerman (2009) believes that “students learn only a fraction of the words they need in the classroom, and they often have only partial knowledge of the ones they do learn. Therefore, teaching students to be independent word learners is critical” (p. 114). There are many different strategies that may be employed by ELLs in learning new words, such as reading and learning words from context, using vocabulary lists, writing words on index cards and reviewing these cards periodically, and using electronic flashcards.

Context vs. Translation

Research has not demonstrated that using context to learn and retain L2 vocabulary is more effective than using a translation (Zimmerman, 2009; Mondira, 2003). Mondira's (2003) study of the learning effect of the “meaning-inferred” and “meaning-given” methods has shown that “[t]he meaning-inferred method leads to a similar level of retention as the meaning-given method, but the former is considerably more time-consuming and therefore less efficient” (p. 473). Thus, when the focus of L2 vocabulary instruction is placed on efficiency (gaining knowledge rapidly), it is preferable to employ the “meaning-given” method, i.e. providing learners with translations or definitions.

Flashcards vs. Word Lists

Word lists and flashcards (both paper and electronic) are a common method for developing L2 vocabulary. While word lists consist of L2 words and L1 translations or

definitions next to them, flashcards are two-sided cards containing a word written in the L2 on one side and the L1 (translation or definition) on the other side. Even though both of these methods for L2 vocabulary development are based on providing learners with L2 words and their L1 translations or definitions, research has demonstrated that flashcards are more effective than word lists in terms of L2 vocabulary acquisition. Nakata (2008) mentions several reasons why flashcards are a more effective way of enhancing L2 lexical acquisition:

- implementation of expanded rehearsal (cards can be grouped and regrouped into sets based on the difficulty of the words, and more difficult words can be reviewed more frequently than the easier ones)
- retrieval practice effect (recalling can be practiced more rapidly by using flashcards since L2 words and L1 translations are not placed next to each other but on different sides of flashcards)
- elimination of the list effect (inappropriate remembering of the position of the word in the list), since cards can be easily rearranged, shuffled, etc.
- flexibility in the ordering of items which helps to avoid a situation when “words in particular positions on the list tend to get more attention than others (p.7).

Zimmerman (2009) also believes that word cards are effective since they “lend themselves to the frequent review that leads to word memory” (p.125). In addition, learners may use different combinations of words, their definitions, L1 glosses (L1 equivalent words), and visual support, according to their preferences and learning styles. By using word cards and online flashcards, students have the possibility to learn and practice general English words as well as general academic vocabulary and domain-specific academic vocabulary.

Paper Word Cards vs. Online Flashcards

Gardner (2013) views flashcards as “a staple in vocabulary learning since the first half of the nineteenth century,” the power of which “has been greatly enhanced through technology” (p. 121). Studies on using paper cards versus digital cards have shown different results. For example, Lees’s (2013) study has shown that “focused vocabulary learning using digital wordcards, such as Quizlet, on smartphones produced roughly equivalent results when compared with the more traditional paper word-cards” (p.69). On the other hand, Nakata (2011) argues that flashcard technology solutions “may allow learners to learn more effectively than paper ones because the former offer benefits that the latter do not” (p. 34). The benefits of using electronic flashcards include utilizing both presentation mode (where learners familiarize themselves with the L2 words and their translations or definitions) and retrieval mode (where learners practice recalling), as well as adding various kinds of information such as contexts, audios, or images to flashcards, and using various types of exercises (Nakata, 2011, p. 32). Electronic flashcards also provide portability and convenience (p. 64) and “have potential for expansion and greater uptake in the future” (Lees, 2013, p.69). There is a possibility, however, that those students who lack computer skills or do not feel comfortable using technology will not find electronic flashcards convenient to use. Thus, students can choose their preferred flashcard based method of acquiring L2 vocabulary depending on their computer skills and learning styles.

Online Studying Platforms

Online studying platforms such as BrainScape, StudyBlue, and Quizlet can be used by second language learners for independent vocabulary learning. They allow users to create electronic flashcards to study and share with other users. A comparison of some of the programs’ features is available in Table 1.

Table 1

Online Flashcard Program Comparison

Feature	BrainScape	StudyBlue	Quizlet
Audio			x
Mark those you don't know	x		x
Quiz features	x	x	x
Games			x
Mobile application	x	x	x
Facebook sync	x	x	x
Images/media		x	x
Ads		x	x
No fee			x

The three programs all allow users to create sets of flashcards. I view flashcards (paper or online versions) as an especially excellent way to practice domain-specific academic vocabulary because this type of vocabulary is generally not polysemous, making it easy to include straightforward definitions for each word. Quizlet serves as a base for the vocabulary tool that I developed because it includes all of the key features included in Table 1. Quizlet will be discussed in more detail later (see Methodology Section).

Mathematical Vocabulary

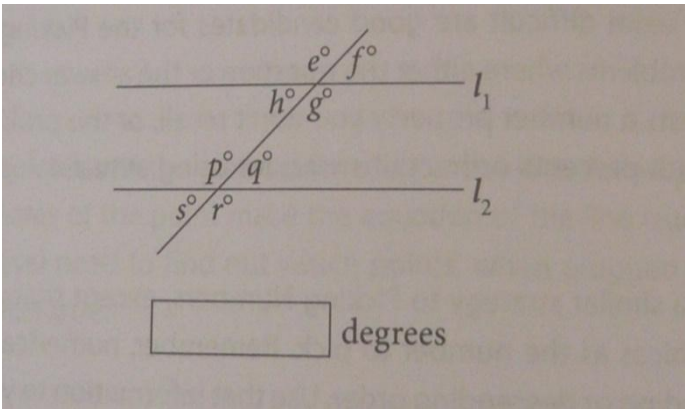
The importance of academic vocabulary knowledge cannot be overestimated. Gardner and Davies (2014) argue that “control of academic vocabulary, or the lack thereof, may be the single most important discriminator in the 'gate-keeping' tests of education” such as the “GMAT, GRE, MCAT, [etc.]” (p. 1). As mentioned above, success in passing the quantitative sections of both tests and the integrated reasoning section of the GMAT for non-native English speakers depends greatly not only on their mathematical skills, but also on their sufficient knowledge of English mathematical vocabulary.

For example, in a situation when non-native Russian speakers who are experts in

mathematics are required to solve a simple mathematical problem in Russian, the problem, which would likely take the students a short amount of time to solve in their first language, may look like the following example in Figure 1.

Figure 1. Mathematical Problem Example 1

На рисунке линия L_1 параллельна линии L_2 . Угол q равен 40 градусам. Какова сумма градусов всех острых углов на рисунке?



degrees

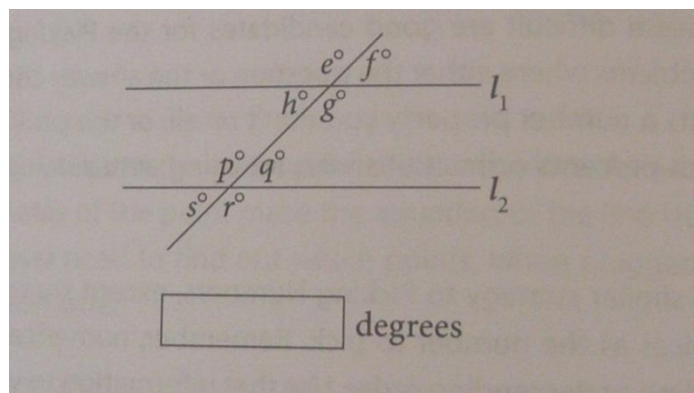
Will students be able to solve the problem if their Russian L2 proficiency level is not sufficient enough to understand the description of the problem and/or what is required from them, even if the students are highly proficient in mathematics? It is important to note that during the GRE and GMAT tests, test-takers are under a time constraint and are not allowed to use a dictionary or any other linguistic support.

The students' L2 (Russian) proficiency level may be higher than intermediate on the American Council on the Teaching of Foreign Languages (ACTFL) proficiency scale. The ACTFL scale consists of novice, intermediate, advanced, and superior levels and low, mid, and high sublevels. In this case, the problem in their L2 may look to the students like the example in

Figure 2.

Figure 2. Mathematical Problem Example 2

In the diagram, L_1 is parallel to L_2 . The measure of angle q is 40 degrees. What is the sum of the measures of ОСТРЫХ УГЛОВ shown in the diagram?



Will the test-takers be able to solve this problem now when they understand 93% (28 words out of 30) of the text and have visual support? I believe that some students may guess the answer with some possibility of a positive outcome, but, as was mentioned above, GRE and GMAT test-takers do not have the luxury of time since they are allotted limited time to solve the problems and need an exact correct answer to get a score for this task.

According to Nagy and Townsend (2012), “academic language conveys the abstract, technical, and nuanced ideas and phenomena of the disciplines, and it can help one think in the requisite abstract, technical, and nuanced ways” (p. 93). For non-native English speakers, in order to think and function effectively in the technical and concrete but nuanced field of mathematics in an English language academic setting, it is crucial to have a good command of mathematical vocabulary in English. The biggest problem with these words is that they “are not easily learned through contextual exposure” (Gardner, p. 81, 2013).

It should also be noted that “the mathematics register is clearly expository in terms of explanations, definitions, instructions, and so on, but it also contains many story problems that have narrative characteristics, including character names, time-sequence words (then, next, etc.)” (Gardner, 2013, p. 71). However, these words (Anglo-Saxon mostly) should not pose a great difficulty for the GRE and the GMAT test-takers whose English language proficiency level should not be lower than intermediate or upper-intermediate on the ACTFL scale.

Chapter Conclusion

Vocabulary learning might be an overwhelming process for ELLs, especially for those ELLS who are preparing to study in an English speaking academic environment, since they need to master not only general vocabulary to communicate effectively, but also academic vocabulary and register-specific academic vocabulary in order to function successfully in an English speaking academic environment. This potentially overwhelming process of learning English vocabulary can be facilitated by using vocabulary tools. The tool developed for this study will be described in the next chapter.

CHAPTER THREE: METHODOLOGY

The aims of this study were to assemble a representative corpus of GRE and GMAT mathematical vocabulary, isolate mathematical terms from other words, translate the terms into the Russian language, and create several sets of online flashcards.

The process of creating the vocabulary tool consisted of six phases: (1) acquiring GRE and GMAT preparation materials, (2) selecting, organizing, and translating vocabulary, (3) creating flashcards, (4) cross-checking vocabulary selection and translation, (5) implementing changes, and (6) receiving expert post review.

Phase 1: Acquiring GRE and GMAT Preparation Materials

The first step in creating the vocabulary tool was to acquire the necessary GRE and GMAT texts containing target mathematical vocabulary. For this purpose, I obtained the following GRE and GMAT preparation materials:

- *Passkey to the GRE, Intensive Preparation for the GRE* by Sharon Weiner Green M.A., Ira K. Wolf Ph.D., 5th edition;
- *GRE Most Up-to-date Review and Practice Tests Currently Available* by Sharon Weiner Green, Ira K. Wolf, 18th edition;
- *GMAT Math Workbook 8th Edition* by Kaplan; and
- *GMAT 800: Advanced Prep for Advanced Students (Perfect Score Series) 8th Edition* by Kaplan.

I scanned the quantitative sections of the GRE preparation materials and quantitative and integrated reasoning sections of the GMAT preparation materials to obtain PDF documents which were later converted into a text format document.

Furthermore, I requested the following materials from the Educational Testing Service

(ETS):

- *Math Review for the Quantitative Reasoning Measure of the GRE® revised General Test;*
- *Mathematical Conventions for the Quantitative Reasoning Measure of the GRE® revised General Test;* and
- *Practice Book for the Paper-based GRE® revised General Test Second Edition.*

I requested permission from the ETS to use these materials in Microsoft Word format for vocabulary analysis and partial reproduction of the requested materials. After submitting the Research Permissions Request Form that can be found on the ETS website (2017), I was granted royalty-free, nonexclusive, nontransferable permission to use the materials for my research purposes. After the agreement (see Appendix B) and the amendment to the agreement (Appendix C) were signed by the ETS copyright administrator and myself, the ETS texts were converted to text-only documents. All the text documents were compared to the original sources to make sure they contained all the text from the materials I scanned, in order to conduct further vocabulary analysis.

Phase 2: Vocabulary Selection, Organization, and Translation

Range Program. I ran the electronic versions of the texts through the *Range* program (Heatley, et al., 2002) to extract the vocabulary data. The Range program is freely available on Paul Nation's website (2010). The software utilizes the first and second 1,000 word families of the General Service List (GSL) (West, 1953) and 570 word families of Coxhead's (2000) Academic Word List (AWL). The GSL was developed from a corpus of five million words and contains the most frequently used 2,000 word families in English. The AWL was developed from a corpus of 3.5 million words of written academic text and contains 570 word families—sets of

words that share the same base form, but contain different affixes (Gardner, 2013, p. 20.) The *Range* program allows its users to process electronic texts and vocabulary in terms of range (in how many texts a specific word appears,) and frequency (how often a word appears in the text or texts), and groups the output lists into types found in GSL1, types found in GSL2, types found in AWL, and types not found in any list. The latter will hereafter be referred to as “specialized types.”

Vocabulary Selection. After running the texts through the *Range* program, I obtained a list of types. According to Gardner (2013), type “is the most basic form-based concept of vocabulary . . . which, in the case of English, is usually defined as one or more contiguous letters of the Roman alphabet that form a distinct word” (p. 9). This data was then copied to four excel spreadsheets (GSL1 types, GSL2 types, AWL types, and specialized types) and used to determine which key words to include in the vocabulary tool.

Even though the *Range* program allows its users to process electronic texts and vocabulary in terms of range and frequency, for the purposes of this thesis, the frequency and range of the mathematical terms were not taken into consideration during the process of selecting the mathematical vocabulary. This decision was made because a lack of knowledge of even one mathematical term may impede students’ understanding of a math problem and lead to a failure in solving it, which may result in fewer points on the GRE/GMAT mathematical section. Thus, a term with even a frequency of one on the test can impact the final score. The purpose of this thesis is to help test takers avoid such a situation.

Also, inflected forms of the words were not included in the vocabulary tool. Gardner (2013) defines inflection as “morphological changes (primarily adding suffixes) to a word that alter its grammatical function, but not its primary meaning” (p. 190), e.g. *triangle-triangles*. If

only the inflected form of the term was available in the spreadsheet document, e.g. *arcs*, it was reduced to its base form – *arc* before being included in the vocabulary tool. As far as derivation is concerned, Gardner (2013), defines it as “morphological change (adding prefixes or suffixes) to a word that alter its meaning (e.g., logical-illogical), or change its part of speech (e.g., eat-eater)” (p. 190). The word *circumscribed* in this case could be an inflection (past tense) or a derivation (changing verb to adjective). If only a derivation was available in the spreadsheet document, it was included in the vocabulary tool without being reduced to its base form in order to avoid altering its part of speech and/or meaning. Excel spreadsheets 1 and 2 contained vocabulary found in GSL1 and GSL2 respectively. Excel spreadsheets 3 and 4 contained types found in the AWL and specialized types.

Vocabulary Translation. Since my proficiency in mathematics, Russian, and English was sufficient for the first step in the translation process, I identified all mathematical terms in all four spreadsheets and translated them into Russian.

I copied terms from Excel spreadsheets 1 and 2 (GSL1 and GSL2 vocabulary) to Quizlet flashcards and translated them into Russian with the help of several online resources such as the Quizlet dictionary and the online Cambridge dictionary (2017). Then, I translated terms in spreadsheets 3 and 4 (types found in AWL and specialized types) and copied them to Quizlet flashcards.

Phase 3: Creating Initial Flashcards

Quizlet. The mathematics terms resulting from the selection and translation stages of the study were incorporated into the Quizlet flashcard program.

Quizlet is an online flashcard program which positions itself as “simple tools that let you study anything for free” (Quizlet website, 2017). It allows its registered users to create sets of

flashcards which can then be studied under several modes.

Learn mode: requires users to match terms with definitions. If the user makes a mistake, the definitions and terms are recycled until the user can match them correctly.

Test mode: allows users to create randomly generated tests and decide what type of questions (for example, multiple choice or matching) they want to have on the test.

Scatter: requires users to match terms and definitions which are scattered around the screen in the least amount of time possible.

Gravity mode: allows users to see a word and type a definition before the word disappears from the screen.

Quizlet flashcards can be studied online as well as printed out. Users can shuffle their flashcards and listen to spoken text in 18 different languages. Flashcards can also be studied anywhere and anytime with the mobile version. A recent Quizlet feature allows collaborative learning as well:

Teams of students work together, racing to learn the material in a Quizlet study set. Correct answers move teams ahead, but wrong answers send teams back to zero. In order to win, students need to communicate with each other to make sure they pick correctly. Teachers can launch Quizlet Live from any study sets and create a game in seconds (no accounts needed for your students). (Quizlet website, 2017)

Thus, flashcards can now be studied both individually and collaboratively.

Quizlet was chosen as a platform for my vocabulary tool because of the opportunity it provides to utilize expanded rehearsal and retrieval practice, as well as because of its popularity, multi-language capability, and accessibility without cost on the Quizlet website (2017).

Phase 4: Cross-checking Vocabulary Selection and Translation

To guarantee the quality of the final product, e.g. the accuracy of the mathematical vocabulary selection and the precision of translations, the Excel spreadsheets and the draft version of the flashcards were presented to the Exam Experts language school which specializes in GRE and GMAT preparation for Russian speaking students and is located in Saint-Petersburg, Russia. The Exam Experts were asked to identify any translation errors and to verify whether the tool is effective in terms of preparing students for the GRE and GMAT mathematical vocabulary.

The vocabulary tool was presented to two qualified professionals at the Exam Experts language school. The first professional was a GRE/GMAT teacher who scored 710 on the GMAT test (total GMAT scores range from 200 to 800; two-thirds of test takers score between 400 and 600). The second professional was a head teacher who is also a vocabulary teaching specialist at the Exam Experts language school and a Fulbright Scholar. I met with the head teacher in Saint-Petersburg, Russia to discuss the ways in which the flashcards could be improved.

The head teacher and the GRE/GMAT teacher found the vocabulary tool very useful in terms of preparing students for the English mathematical vocabulary in the GRE and GMAT and gladly agreed to participate in the vocabulary tool improvement process. The head teacher carefully reviewed the Excel spreadsheets. Both teachers carefully reviewed the flashcards and answered the questions sent to them in the form of a questionnaire (see Appendix A). Further improvement of the tool was managed through online communication with the head teacher.

Phase 5: Implementing Changes Based on Feedback from the Exam Experts

While the feedback from the Exam Experts was beneficial and useful for the

improvement of the vocabulary tool, not all the changes suggested by the Exam Experts have been implemented. I will discuss both the suggestions that I accepted and those I did not, and justify my decisions.

When asked if they liked this GRE/GMAT mathematical vocabulary tool overall and if the electronic flashcards are helpful for prospective GRE/GMAT test-takers (question 1), Exam Experts replied that the tool was useful for lower level students and B1 (intermediate students), and that “[f]or higher level students, bare translation into Russian may not be the best way to prepare for the tests.” I believe that students at all levels can have a very different command of mathematics terminology and can benefit from this tool since all the vocabulary found in the prep materials has been included in it. The flashcards contain the whole spectrum of mathematical vocabulary from basic (e.g., *plus* and *minus*) to advanced (e.g., *equilateral* and *isosceles*.)

As far as bare translations are concerned, they are suitable for students of all levels. This kind of feedback was received because the school focuses on teaching both math and language, whereas the focus of my vocabulary tool is solely on teaching mathematical terminology, i.e. teaching new labels for known math concepts. New labels for known concepts are defined by Gardner (2013) as “words for which learners already have a conceptual understanding (from their L1 or other language experience), but have not learned the appropriate labels in the L2” (p. 86). Even though implementation of context was suggested by the Exam Experts in order to expand the vocabulary tool, the suggestion was not accepted, since I am holding to Gardner’s (2013) point that “the concepts behind some English words can be made clear by simply using an L1 gloss, but it assumes that the learners know the concept already in their L1” (p. 120). I view word cards and online flashcards as an excellent way to practice domain-specific academic

vocabulary because this type of vocabulary is generally not polysemous. For non-native English speakers, to think and function effectively in the technical and concrete but nuanced field of mathematics in an English language academic setting, it is crucial to have a good command of English mathematical vocabulary. Even if this tool were intended to teach actual mathematical concepts, which it is not, “the biggest problem with these words is that they are not easily learned through contextual exposure” (Gardner, p. 81, 2013). Thus, context was not implemented in the vocabulary tool for several reasons.

Also, in their answer to question five, the Exam Experts suggested that the flashcards be divided into three difficulty levels: basic, intermediate, and advanced, and grouped into several chapters according to any GRE/GMAT math theory book. At the time the draft vocabulary tool was presented to the Russian language school, it was not divided into difficulty levels, even though it was the initial intent of the researcher. Currently, the tool contains six sets of flashcards: GRE basic, GRE intermediate, GRE advanced, GMAT basic, GMAT intermediate, and GMAT advanced.

Another suggestion mentioned in their answer to question five was to group flashcards into several chapters according to any GRE/GMAT math theory book (i.e. geometry, algebra, etc.), add example sentences for context clues, or include a full task in an exam format. Since the purpose of this thesis is to provide new labels for known concepts and not to teach math, breaking the sets of flashcards into several subsets according to any GRE/GMAT math theory book and including sample exam tasks would be beyond the scope of this research, but could be implemented in future projects.

The Exam Experts’ suggestion to leave out such words as *plus* and *quarter* on the premise that they believe “these are simple” and “students don’t need to learn them” has not been

taken into consideration. The knowledge of every mathematical term seems indispensable for students to succeed in the mathematical sections of the GRE and GMAT exams. Keeping these simple words will help prospective test takers make sure they know all the mathematical terms utilized in the exams. These words can then be skipped, and the student can move to a higher level set of flashcards. Also, for some students, the amount of mathematical terms they need to learn can seem daunting and discouraging. For such students, finding familiar words in a list of hundreds of mathematical terms can be encouraging and motivating. Also, the customization feature on the Quizlet website allows its users to copy lists, delete flashcards, regroup flashcards, etc., which allows Quizlet users to delete known terms and focus on the terms they need to learn. Thus, all the mathematical terms found in the scanned mathematical sections of the GRE and GMAT preparation materials have been included in the vocabulary tool.

Another suggestion mentioned by the Exam Experts in their answer to question 5 was to group irregular plurals (e.g., radius and radii) rather than present them on two different flashcards. I have followed this suggestion since I see it as valuable in terms of methodology. All the irregular plurals were paired together and each pair was presented on the same flashcard.

In their answer to question six, if they would recommend these flashcards to other teachers, the language school replied that they would recommend it to teachers who have B1 (intermediate) students or lower, as they believe that the vocabulary tool is not challenging enough. I disagree with this statement because, as it has been mentioned above, the flashcards contain the whole spectrum of mathematical vocabulary from basic (e.g., *plus* and *minus*) to advanced (e.g., *equilateral* and *isosceles*.) There is no guarantee that students at higher levels know all the math terms used in the GRE/GMAT tests, including *equilateral* and *isosceles*. Thus, students of all levels can definitely benefit from using the flashcards.

As for the answers to the last two questions (questions 7 and 8), the GRE/GMAT teacher and the head teacher have mentioned that there were many inaccuracies in the flashcards (e.g., the word *prime* was translated separately, not as *prime number*) as well as several words from the higher math course (e.g., *compact set* in the topology of metric spaces) that have no relationship to the GRE/GMAT exam. As far as higher math course terms are concerned, I decided not to delete them from the flashcards since students can still benefit from learning them and can always use the Quizlet customization feature to delete the words the learners believe are beyond the scope of their preparation for the GRE/GMAT.

As for the inaccuracies in the flashcards, after the draft version was presented to the Exam Experts and feedback from them was received, all the translation inaccuracies were corrected.

Phase 6: Receiving Expert Post Review

The Excel spreadsheets and the flashcards were proofread by a specialist whose expertise was needed for this project. The proofreader was a native Russian speaking professor who teaches math and economics at Brigham Young University and is highly proficient in Russian, math, and English. This cross-validation, e.g., cross-check to determine accuracy, by the two Exam Experts specialists and the Russian speaking math professor of both the selection of mathematics terms from the four lists and the Russian translations of those terms established a high degree of confidence in the final product.

After the flashcards were proofread by the math professor, the Exam Experts reviewed the tool and expressed their approval of the translations and the results of this project as well as their hope to be able to use the flashcards in their classes in Saint Petersburg, Russia in the near future.

CHAPTER FOUR: FINAL PRODUCT

The final product is unique since Russian students preparing for the GRE and GMAT did not have access to materials that would help them prepare specifically for the mathematical sections of the GRE and GMAT in terms of English mathematical vocabulary.

Final Product Description

The final product was designed for learners who are already familiar with mathematical concepts in their L1 (Russian), and can be used both individually and in the classroom. The flashcards are divided into GRE and GMAT sets and are further subdivided into three sets: basic, intermediate, and advanced. Table 2 shows the number of flashcards by sets.

Table 2

Number of Flashcards by Sets

Level	Number of the GRE Flashcards	Number of the GMAT Flashcards
Basic	178	167
Intermediate	115	95
Advanced	212	181
Total	505	443

The total number of all the flashcards in all levels is 948. Table 3 contains examples of words used in all six sets of flashcards.

Table 3

Examples of Words Contained in the Flashcards

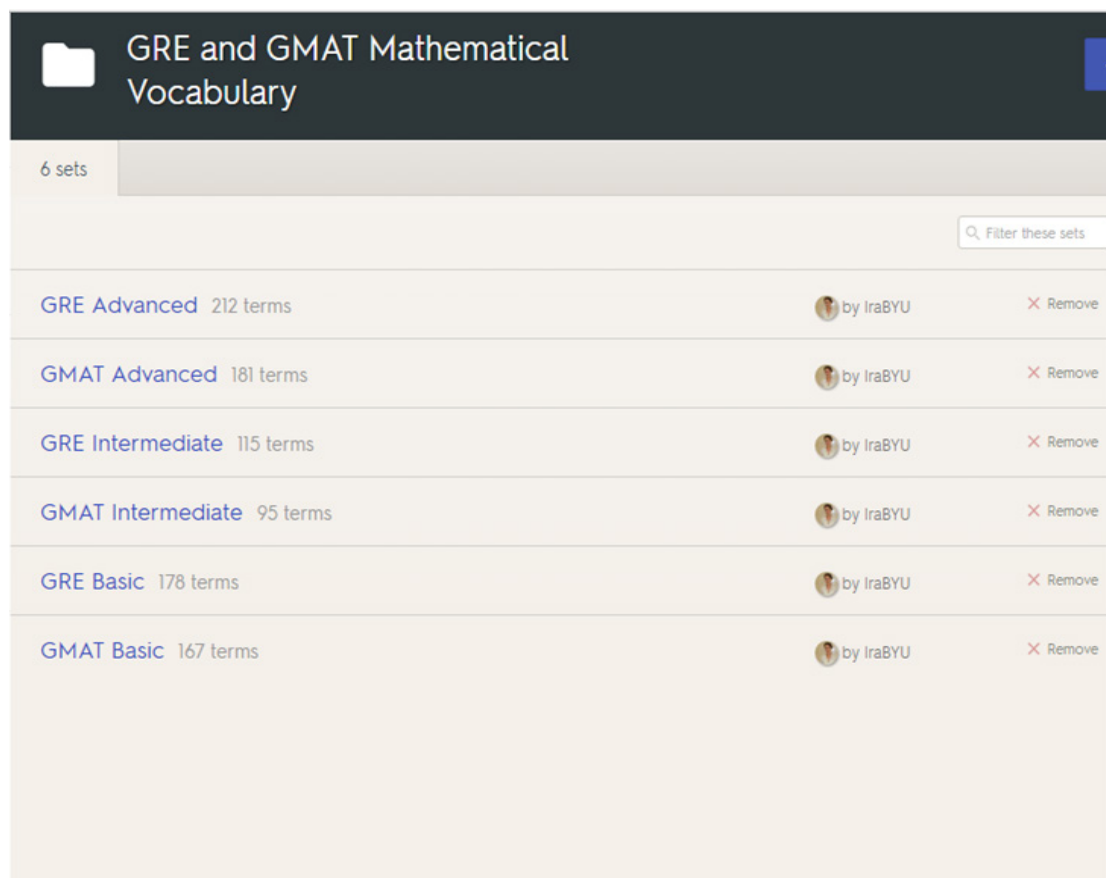
GRE			GMAT		
Basic	Intermediate	Advanced	Basic	Intermediate	Advanced
ABSOLUTE	ABSTRACT	ACUTE	ABSOLUTE	ABSTRACT	ACUTE
ACCOUNT FOR	ACCURATE	ALGEBRA	ACCORDANCE	ACCURATE	ALGEBRA
ADD	ADJACENT	ALTITUDE	ACCOUNT FOR	ADJACENT	ALTITUDE
AMOUNT	APPROACH	ARC	ADD	APPROACH	APPROXIMATELY-
ANGLE	APPROXIMATE	ARITHMETIC	AGENT	APPROXIMATE	ARC
AVERAGE	AREA	ASCENDING	AMOUNT	AREA	ARITHMETIC
BASE	ASSIGN	ASTERISKS	ANGLE	ASSIGN	ASCENDING
BELL CURVE	CHART	AXIS-AXES	AVERAGE	CHART	BACKSOLVE
BILLION	COINCIDE	BACKSOLVE	BASE	COINCIDE	BINOMIAL
BOTH	COMPLEX	BINOMIAL	BELL CURVE	COMPLEX	BISECTOR
CALCULATE	COMPONENT	BISECT	BOTH	COMPONENT	CALCULUS
CENT	COMPRISE	BRACKET	CALCULATE	COMPUTE	CANCEL
CIRCLE	COMPUTE	BUILT IN	CENT	CONSEQUENT	CENTIMETER
CIRCULAR	CONSEQUENT	CALCULUS	CIRCLE	CONSTANT	CHORD
COMBINATION	CONSTANT	CANCEL	CIRCULAR	CONVERT	CIRCUMFERENCE
COMBINE	CONSTITUTE	CELSIUS	COMBINATION	COORDINATE	CIRCUMSCRIBED
COMPARE	CONTRACT	CENTIMETER	COMBINE	CORRESPOND	COEFFICIENT
COMPLICATE	CONVERT	CIRCUMFERENCE	COMPARE	COUPLE	COMMON
CONTAIN	COORDINATE	CIRCUMSCRIBED	COMPLICATE	DATA	MULTIPLE
CONTINUOUS	CORRESPOND	CLOCKWISE	CONTAIN	DECADE	COMMUTATIVE
CORRECT	COUPLE	COEFFICIENT	CORRECT	DECLINE	COMMUTE
COUNT	CRITERIA	COMMON	COUNT	DEDUCE	COMPACT
CURVE	DATA	MULTIPLE	CURVE	DEFINE	CONCENTRIC
CUSTOMARY	DECADE	COMMUTATIVE	CUSTOMARY	DEFINITE	CONE
DECREASE	DEDUCE	CONCENTRIC	DECREASE	DENOTE	CONGRUENT
DEEP	DEFINE	CONGRUENT	DEEP	DERIVE	CONSECUTIVE
DEGREE	DEFINITE	CONSECUTIVE	DEGREE	DEVIATE	CROSS-
DEMAND	DENOTE	CONVEX	DEPTH	DIMENSION	MULTIPLICATION
DEPTH	DERIVE	CROSS	DESCENDING	DISTRIBUTE	CUBE
DESCENDING	DEVIATE	MULTIPLYING	DETERMINE	ELIMINATE	CYLINDER
DETERMINE	DIMENSION	CUBE	DIFFERENCE	EQUATE	DECIMAL
DIFFERENCE	DISCRETE	CUMULATIVE	DISTANCE	EQUIVALENT	DENOMINATIONS
DISTANCE	DISTRIBUTE	CYLINDER	DIVIDE	ERROR	DENOMINATOR
DIVIDE	DOMAIN	DECAGON	DIVISION	ESTIMATE	DIAGONAL
DIVISION	ELIMINATE	DECIMAL	DOUBLE	EVALUATE	DIAGRAM
DOUBLE	EQUATE	DEDUCT	EDGE	EXTRACT	DIAMETER
	EQUIVALENT	DELINEATE		FACTOR	DIGIT

These words were obtained after running the texts through the *Range* program ((Heatley, *et al.*, 2002) which utilizes the first and second 1,000 word families of the General Service List (GSL) (West, 1953) and 570 word families of Coxhead's (2000) Academic Word List (AWL). The GSL was developed from a corpus of five million words and contains the most frequently used 2,000 word families in English. The AWL was developed from a corpus of 3.5 million words of written academic text and contains 570 word families. The Basic GRE and GMAT sets of flashcards contain GSL words that are not only basic mathematical terms, but also basic English language words. The Intermediate GRE and GMAT sets of flashcards are composed of AWL words—academic English words that are higher level mathematical terms. The Advanced GRE and GMAT sets of flashcards contain specialized terms—types not found in either GSL or AWL, that is genre-specific academic vocabulary.

Table 3 provides only some examples of terms contained in the flashcards. See Appendix D for a complete list of words and their translations used in all the GRE sets of flashcards (GRE Basic, GRE Intermediate, and GRE Advanced). See Appendix E for a complete list of words and their translations used in all the GMAT sets of flashcards (GMAT Basic, GMAT Intermediate, and GMAT Advanced).

The vocabulary tool is now available at no cost on the Quizlet website (2017). The flashcards can be found in the GRE and GMAT Mathematical Vocabulary Folder (<https://quizlet.com/IraBYU>). The folder contains six sets of electronic flashcards (GRE Basic, GRE Intermediate, GRE Advanced, GMAT Basic, GMAT Intermediate, and GMAT Advanced). See Figure 3.

Figure 3. GRE and GMAT Mathematical Vocabulary Quizlet Flashcards Sets



Among many useful features offered by the Quizlet website, there are the Original Mode and the Alphabetical Mode features that allow students to see lists of flashcard words and translations, edit the lists, add them to a class or folder, and embed them on websites and blogs. The Original and the Alphabetical Modes also allow Quizlet users to copy, delete, combine, share, export, and print the lists of words used in the flashcards. In the Original Mode, Quizlet users can see each set of flashcards as a list of words and translations in the order the flashcards were created. See Figure 4.

Figure 4. Example of Quizlet Flashcards List in the Original Mode

List	Class Progress	Info
Original Alphabetical		
AREA	площадь, область	☆ 🔊 📄 ✎
PERCENT	процент	☆ 🔊 📄 ✎
DATA	данные	☆ 🔊 📄 ✎
TRIANGLE	треугольник	☆ 🔊 📄 ✎
EQUATE	приравнять, уравнивать, записывать в виде уравнения	☆ 🔊 📄 ✎
POSITIVE	положительный	☆ 🔊 📄 ✎
SUM	сумма, складывать	☆ 🔊 📄 ✎
RATIO	соотношение, отношение	☆ 🔊 📄 ✎
FRACTION	дробь, доля	☆ 🔊 📄 ✎
QUANTITATIVE	количественный	☆ 🔊 📄 ✎

In the Alphabetical Mode, Quizlet users can see each set of flashcards as a list of words and translations in the alphabetical order. See Figure 5.

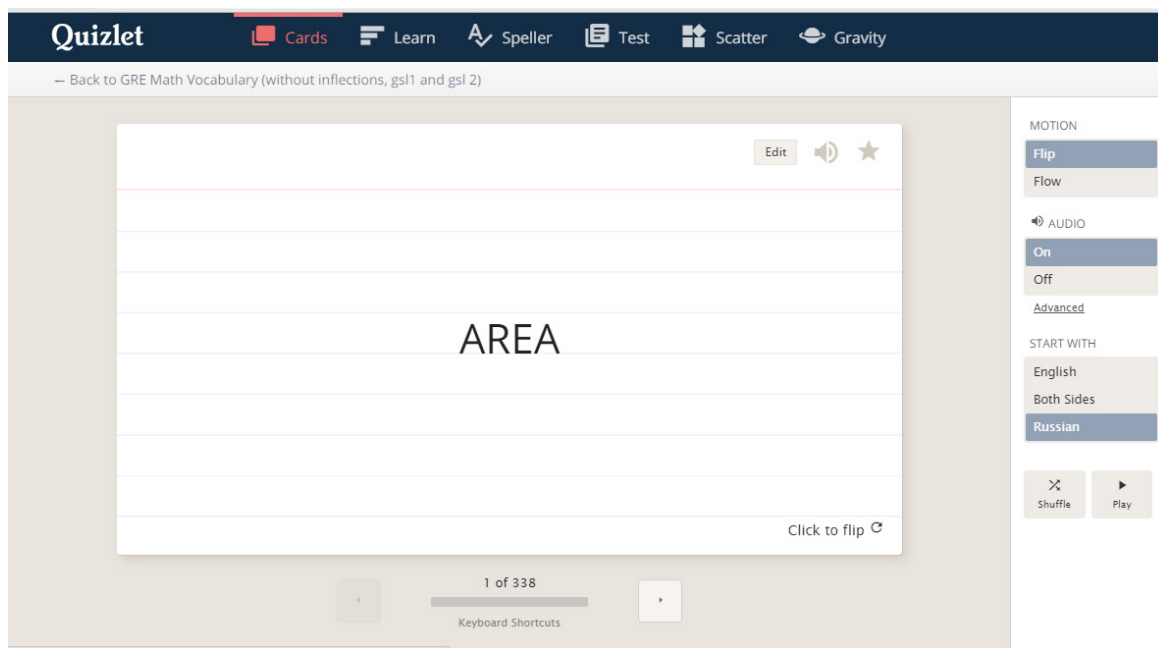
Figure 5. Example of Quizlet Flashcards List in the Alphabetical Mode

SORT Alphabetical ▾		
ABSTRACT	абстрактная (алгебра)	☆ 🔊 ✎
ACCURATE	точный	☆ 🔊 ✎
ADJACENT	примыкающий	☆ 🔊 ✎
APPROACH	стремиться (предел при стремлении x к нулю)	☆ 🔊 ✎
APPROXIMATE	приближать, приближённое (значение)	☆ 🔊 ✎
AREA	площадь, область	☆ 🔊 ✎
ASSIGN	придать численное значение	☆ 🔊 ✎
CHART	график, таблица	☆ 🔊 ✎
COINCIDE	совпадать	☆ 🔊 ✎

The Original and the Alphabetical modes allow learners to listen to the pronunciation of the words as well as mark the words they want to study separately by clicking on the star icon. This allows learners to eliminate the words they already know and group the terms they want to focus on in a new list.

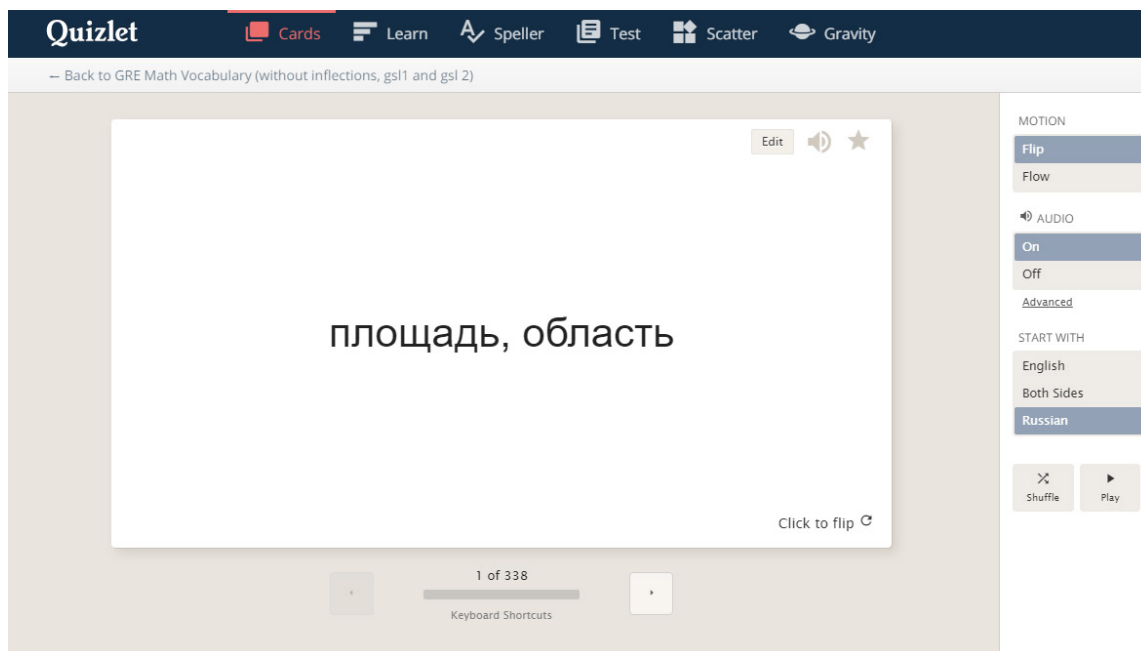
Each flashcard in each set contains a mathematical term and a gloss in Russian. Learners can listen to the pronunciation of the word by clicking on the “volume” icon in the upper right corner. They can also edit it by clicking on the “edit” icon or mark it by clicking on the star icon to study it separately. See Figure 6 below.

Figure 6. Example of Quizlet Flashcard Term



To see and listen to the translation of the term, learners can use the “click to flip” icon in the lower right corner. The translation side of the flashcard also allows learners to edit the flashcard or mark it to study it separately. See Figure 7 below.

Figure 7. Example of Quizlet Flashcard Term Translation



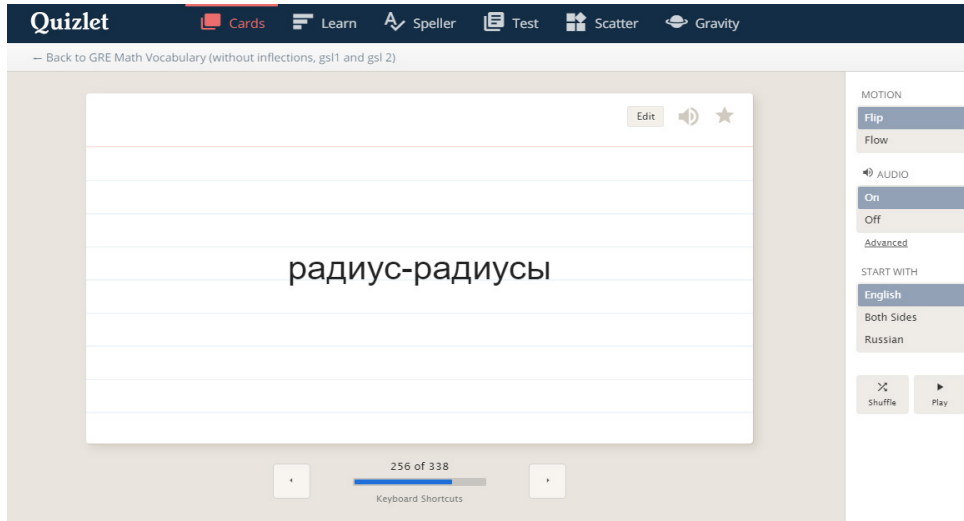
For each irregular plural, both singular and plural form (radius-radii) are included in the flashcard. See figure 8 below.

Figure 8. Example of Quizlet Irregular Plurals Flashcard



Both singular and plural forms of irregular plurals are translated into Russian and are available on the other side of the flashcard. See Figure 9.

Figure 9. Example of Quizlet Irregular Plurals Translation Flashcard



Again, the GRE and GMAT Mathematical Vocabulary flashcards folder can be accessed by following the link: <https://quizlet.com/IraBYU>.

CHAPTER FIVE: CONCLUSION

The purpose for developing the vocabulary tool was to aid non-native English speakers (specifically Russian speaking test-takers) in their preparation for the Quantitative Reasoning and Integrated Reasoning sections of the General Record Examination (GRE) and the Graduate Management Admission Test (GMAT) in terms of English mathematical vocabulary. The flashcards were not intended to teach the learners mathematical concept knowledge or GRE/GMAT test-taking strategies, but to facilitate their GRE and GMAT test preparation in terms of quickly identifying and understanding English mathematical terms that represent concepts they are already familiar with in their native Russian language.

The vocabulary tool I have developed was evaluated by professionals at the Exam Experts language school located in Saint-Petersburg, Russia. Their feedback was beneficial for the vocabulary tool improvement, and based on the feedback, several adjustments were made to better meet the needs of prospective Russian speaking GRE/GMAT test-takers. All of the inaccuracies in translation found in the flashcards were corrected. Both the GRE and the GMAT flashcards were divided into three difficulty levels: basic, intermediate, and advanced. Also, all the irregular plurals were paired together, and each pair was presented on the same flashcard.

The flashcards were then proofread by a native Russian speaking professor who teaches math and economics at Brigham Young University in Provo, Utah and is highly proficient in Russian, math, and English. This cross-validation by the three specialists established a high degree of confidence in the final product. The final product was then presented to the Exam Experts language school and approved by them.

Although care was taken to include all the mathematical terms contained in the GRE/GMAT preparation materials used for this study, and the vocabulary tool was proofread by

several specialists, one of the limitations to this study is that there is still a probability that some mathematical terms were missed. Additionally, some terms could be missed due to the fact that the received data consisted of types, not phrases. Some words change their meaning depending on how they are used—alone or in a phrase. For example, *prime number*. *Prime* has a different meaning when it is used without the word *number*, as well as *number* has a different meaning when it is used without the word *prime*. Future studies could fill in this gap by analyzing vocabulary data by phrases, not words.

Since Russian students preparing for the GRE and GMAT did not have access to materials that would help them prepare specifically for the GRE/GMAT English mathematical vocabulary, and the final product is unique for its kind, there are many other ideas for further expansion. The tool could be extended by including sample GRE/GMAT mathematical tasks containing the vocabulary presented in the flashcards, creating flashcards teaching Greek and Latin morphemes, translating flashcards into other languages, organizing flashcards by subregisters (e.g., geometry, algebra, etc.). The tool could also be assessed in term of its long-term utility and updated according to any changes implemented into the mathematical sections of the GRE and GMAT exams.

Tool extension. Future studies could extend the tool to include sample GRE/GMAT mathematical tasks containing the vocabulary presented in the flashcards to turn it into a math concept learning tool. Retired versions of the GRE/GMAT tests could also be requested from the Educational Testing Services (ETS) and the Graduate Management Admission Council (GMAC), and the vocabulary tool could be expanded with terms used in the actual tests. Furthermore, the tool could be expanded by including flashcards teaching Greek and Latin morphemes. Gardner states that "the most significant words of mathematics... are the terms used

to describe math-related concepts, processes and objects (decimal, triangle, polygon, congruent, subtraction, circumference, divisible, exponent, etc.)” (p. 75). Many of these terms contain Greek and Latin morphemes which can “give some clues to word meaning (deci=tenth; tri=three; poly=many; con=with, etc.)” (p.75). This may be true for those students who know a Romance language or who speak a Romance language, Greek, or Latin, but for students whose L1 is a Slavic language (for example, Russian or Ukrainian) and who have never had an experience with Greek, Latin, or a Romance language, there may be little or even no semantic transparency available. As a result, “if the semantic relationship is opaque (i.e., not transparent) for a word user, there is no facilitatory effect” (Corson, 1997, p. 695). Thus, developing awareness of Greek and Latin morphemes may facilitate students' understanding and learning of mathematical vocabulary. Milligan (1983) believes that “[s]ince so many mathematical terms contain Greek or Latin word elements, it would follow that teaching root elements of mathematical terms would be an especially productive technique for improving students' mathematics vocabularies” (p. 490). Hence, flashcards teaching Greek and Latin morphemes might be a useful component of the vocabulary tool.

Translating flashcards into other languages. Another suggestion for extending the tool would be to translate the flashcard vocabulary into other languages (Spanish, Chinese, etc.) so students with other language backgrounds preparing for the GRE/GMAT mathematical sections could benefit from using the tool as well.

Organizing flashcards. The flashcards could also be organized by subregisters (geometry, algebra, etc.) to emphasize the differences in meaning across different branches of mathematics. This way of organizing flashcards would also allow language schools instructors to incorporate English mathematical vocabulary instruction into teaching mathematics.

Updating the tool. The tool might need to be updated in the future if other mathematical tasks are implemented into the GRE and GMAT tests, especially if such new tasks introduce new mathematical topics—abstract algebra, logic, topology, probability and statistics, etc.; and thus introduce mathematical terms related to these topics that were not used in the tests before.

Further assessment of the tool. Since assessment of the vocabulary tool's long-term utility was beyond the scope of this study, the flashcards were assessed in terms of their content only. Thus, future research could be conducted to determine the usefulness of the vocabulary tool for native Russian speaking prospective GRE and GMAT test-takers in terms of their preparation for the mathematical sections of the GRE and GMAT.

The vocabulary tool will be used by the Exam Experts language school for preparing native Russian speaking prospective GRE and GMAT test takers for the mathematical sections of the tests in terms of English mathematical vocabulary. The link to the online Quizlet flashcards will also be sent to several other language schools in Saint-Petersburg and Moscow, Russia, including the MBA Strategy school, Globus International (UK), Global Ambassador, etc.

For further dissemination, the tool will be demonstrated at TESOL and Linguistics conferences, and the results of this study will be presented to the British Council, “the UK’s international organisation for cultural relations and educational opportunities” (British Council, 2017) in Russia. Since the British Council in Russia states that they are “happy to offer a wide range of free opportunities to learn English” (British Council, 2017), the vocabulary tool developed for this study might become one of these opportunities for Russian speaking prospective GRE and GMAT test-takers.

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APPENDIX A: Exam Experts Answers to the Questionnaire

Mathematical Vocabulary Support for Prospective GRE/GMAT Test Takers Questionnaire

This is a questionnaire about the flashcards designed to help prospective Russian speaking GRE/GMAT test-takers study for the mathematical sections of the tests in terms of math/economics vocabulary. The sets of flashcards are designed to provide necessary practice for test-takers to understand more GRE/GMAT math and economics vocabulary, which is indispensable for successful passing of these sections of the tests. Please let me know if you have any questions about the flashcards. You can email me at irabaskova@gmail.com.

1. *Overall, do you like this GRE/GMAT mathematical vocabulary tool? Why or why not?*

At present, the tool is basic and will be useful for lower level students (which not many test takers are).

For higher level students, bare translation into Russian may not be the best way to prepare for the tests. The math vocabulary is specific in the kind that you may not know the exact translation to your mother tongue, but you have to understand what is being asked in every given task. And this understanding comes with the math definitions (in English) and properties of the terms, which flashcards don't give as they provide the notions out of the context.

As a successful test taker (GMAT 710), I couldn't answer the first 10 questions of the test. And when I saw my mistakes, I realized, that the translation of some terms was wrong.

2. *Are the flashcards convenient to use?*

Yes, but the tool definitely needs to be expanded.

3. *Are the electronic flashcards helpful for prospective GRE/GMAT test-takers?*

Only for students who are at level B1 or lower. Or for those who don't know a lot of math vocabulary and don't need to take the test soon.

4. *What are the most helpful features of the flashcards?*

They cover several aspects of GMAT math.

5. *How could the flashcards be improved?*

Firstly, they could be divided into difficulty levels – basic, intermediate and advanced.

Secondly, they should be grouped into the several chapters according to any GMAT/GRE math theory book. The vocabulary will be easier to learn and this is how teachers organize GMAT preparation.

Additionally, it is a good idea to provide example sentences / phrases in English which the students are likely to read in test tasks. Or even a full task in an exam format.

Some words can be left out – words like “plus”, “quarter” – these are simple, students don't need to learn them. Some words can be grouped together, like plurals “radius - radii”, rather than presented on two different cards.

6. *Would you recommend these flashcards to other teachers? Why or why not?*

At present, I would recommend it to teachers who have B1 students (or lower) wishing to take GMAT/GRE. But I suppose all the students who want to master this exam are B2-C1 level or higher. For such students the tool is not challenging enough and does not prepare them for the real skills necessary to get high score. If the tool is improved I would recommend it, as teachers can assign homework based on this tool and wouldn't need to spend time explaining some vocabulary in class.

7. *Are there any translation inaccuracies?*

Yes, and quite many. The author did not take into account the mathematical essence of the exam. Many words are translated as if they are common, and this does not shed the light on their meaning in the terms of math. For example, “zeroes”, ‘factor’, ‘prime’ and many others.

Completed by

The GRE/GMAT teacher

(comments related to math)

The head teacher, IELTS, TOEFL, GRE Verbal teacher

(comments related to methodology)

Exam Experts

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23.07.2015

APPENDIX B: ETS Agreement



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Educational Testing Service
 One Lake Road, MS 0701
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August 7, 2014

Irina Baskova
 Brigham Young University
 4064 JFSB
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Stella DeVries
 Copyright Administrator SA
 Phone: 1-609-683-2825
 Email: stdevries@ets.org

Dear Ms. Baskova:

This Letter Agreement is in response to your request to use Educational Testing Service copyrighted materials. It is our understanding that you will be using the following GRE materials as part of your research proposal at Brigham Young University:

1. Practice Book for the Paper-based GRE® revised General Test Second Edition p. 21-32, p. 74-93
2. Math Review for the Quantitative Reasoning Measure of the GRE® revised General Test p. 13-16, 40-44, 57-60, 94-99
3. Mathematical Conventions for the Quantitative Reasoning Measure of the GRE® revised General Test - for mathematical vocabulary analysis only

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IRINA BASKOVA
Print Name

Stella DeVries
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Educational Testing Service

Signature _____

8/20/14
Date

Brigham Young University
Company Name

08.20.2014
Date

APPENDIX C: Amendment to the ETS Agreement



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Educational Testing Service
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March 11, 2015

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Dear Ms. Baskova:

This is an amendment to ETS Letter Agreement 38128 dated August 7, 2014 with regard to your use of the following Educational Testing Service copyrighted GRE materials as part of your research proposal at Brigham Young University:

1. Practice Book for the Paper-based GRE® revised General Test Second Edition p. 21-32, p. 74-93
2. Math Review for the Quantitative Reasoning Measure of the GRE® revised General Test p. 13-16, 40-44, 57-60, 94-99
3. Mathematical Conventions for the Quantitative Reasoning Measure of the GRE® revised General Test - for mathematical vocabulary analysis only

This amendment shall include permission to use the Math Review for the Quantitative Reasoning Measure of the GRE® revised General Test for vocabulary analysis for inclusion in your thesis.

This amendment shall be considered null and void if not signed and returned within 30 days of the date of this letter.

The signing of this amendment shall constitute agreement of the above terms and shall be considered a binding contract once a countersigned copy is returned to you.

IRINA BASKOVA
Print Name

Stella DeVries
Copyright Group
Educational Testing Service

Signature

3/12/15
Date

Brigham Young University
Company Name

03/11/2015
Date

Request # ETS036

APPENDIX D: Words Contained in all the GRE Sets of Flashcards

GRE Terms and Translations		
Basic	Intermediate	Advanced
<p>1. ABSOLUTE: абсолютный</p> <p>2. ACCOUNT FOR: составлять сколько-то (насчитывать)</p> <p>3. ADD: прибавлять</p> <p>4. AMOUNT: количество, сумма</p> <p>5. ANGLE: угол</p> <p>6. AVERAGE: средняя величина, средний, среднестатистический</p> <p>7. BASE: основа</p> <p>8. BELL CURVE: кривая нормального распределения</p> <p>9. BILLION: миллиард</p> <p>10. BOTH: оба, обе</p> <p>11. CALCULATE: вычислять</p> <p>12. CENT: цент</p> <p>13. CIRCLE: круг, окружность</p> <p>14. CIRCULAR: круговой</p> <p>15. COMBINATION: сочетание, комбинация</p> <p>16. COMBINE: объединять</p> <p>17. COMPARE: сравнивать</p> <p>18. COMPLICATE: усложнять</p> <p>19. CONTAIN: содержать</p> <p>20. CONTINUOUS: непрерывный</p> <p>21. CORRECT: правильный</p> <p>22. COUNT: считать, подсчет</p> <p>23. CURVE: кривая</p> <p>24. CUSTOMARY: обычный</p> <p>25. DECREASE: уменьшаться</p> <p>26. DEEP: глубокий</p> <p>27. DEGREE: степень, градус</p> <p>28. DEMAND: спрос</p> <p>29. DEPTH: глубина</p> <p>30. DESCENDING: нисходящий, понижающийся</p> <p>31. DETERMINE: определять</p> <p>32. DIFFERENCE: разница</p> <p>33. DISTANCE: расстояние</p> <p>34. DIVIDE: делить</p> <p>35. DIVISION: деление</p> <p>36. DOUBLE: двойной</p> <p>37. DOZEN: дюжина</p> <p>38. EDGE: ребро</p> <p>39. EFFICIENCY: эффективность</p> <p>40. EIGHT: восемь</p> <p>41. ELEVEN: одиннадцать</p> <p>42. EQUAL: равный</p> <p>43. EQUALITY: равенство</p> <p>44. EXACT: точный</p> <p>45. EXPLANATION: объяснение</p> <p>46. EXTENSION: расширение</p> <p>47. EXTENT: степень, мера</p> <p>48. EXTRA: дополнительный, лишний</p> <p>49. EXTREME: экстремальный, предельный</p> <p>50. FEWER: меньше</p> <p>51. FIFTEEN: пятнадцать</p> <p>52. FIFTH: пятый</p> <p>53. FIGURE: число, изображение</p>	<p>1. ABSTRACT: абстрактная (алгебра)</p> <p>2. ACCURATE: точный</p> <p>3. ADJACENT: примыкающий</p> <p>4. APPROACH: стремиться (предел при стремлении x к нулю)</p> <p>5. APPROXIMATE: приближать, приближённое (значение)</p> <p>6. AREA: площадь, область</p> <p>7. ASSIGN: придать численное значение</p> <p>8. CHART: график, таблица</p> <p>9. COINCIDE: совпадать</p> <p>10. COMPLEX: комплексный (комплексное число)</p> <p>11. COMPONENT: компонент</p> <p>12. COMPRISE: включать, заключать в себе</p> <p>13. COMPUTE: вычислять, считать</p> <p>14. CONSEQUENT: второй член пропорции, результат</p> <p>15. CONSTANT: постоянная, постоянный</p> <p>16. CONSTITUTE: составлять</p> <p>17. CONTRACT: сократить</p> <p>18. CONVERT: преобразовать, обратить (уравнение в безразмерный вид)</p> <p>19. COORDINATE: координата</p> <p>20. CORRESPOND: соответствовать</p> <p>21. COUPLE: пара</p> <p>22. CRITERIA: критерий</p> <p>23. DATA: данные</p> <p>24. DECADE: десяток</p> <p>25. DEDUCE: делать вывод</p> <p>26. DEFINE: определять</p> <p>27. DEFINITE: точный, определенный</p> <p>28. DENOTE: обозначать величины (обозначим неизвестное с помощью x)</p> <p>29. DERIVE: вывести (формулу, уравнение, математическое уравнение)</p> <p>30. DEVIATE: отклоняться</p> <p>31. DIMENSION: измерение</p> <p>32. DISCRETE: не непрерывная, а поточечная (дискретная переменная)</p> <p>33. DISTRIBUTE: распределять</p> <p>34. DOMAIN: область определения функции</p> <p>35. ELIMINATE: исключать (неизвестное)</p> <p>36. EQUATE: приравнивать, уравнивать</p> <p>37. EQUIVALENT: эквивалент, эквивалентный</p> <p>38. ERROR: ошибка, погрешность (вычисления)</p> <p>39. ESTIMATE: оценка, оценивать</p> <p>40. EVALUATE: вычислять значение</p> <p>41. EXCEED: превышать</p> <p>42. EXPAND: развернуть, разложить в ряд (разложить функцию в ряд Тэйлора)</p> <p>43. EXPLICIT: явный (явное решение, явная функция)</p> <p>44. EXTRACT: извлекать</p> <p>45. FACTOR: коэффициент, множитель</p> <p>46. FINAL: конечный</p>	<p>1. ACUTE: острый</p> <p>2. ALGEBRA: алгебра</p> <p>3. ALTITUDE: высота</p> <p>4. ARC: дуга (в геометрии, часть окружности)</p> <p>5. ARITHMETIC: арифметический</p> <p>6. ASCENDING: возрастающий (функция)</p> <p>7. ASTERISKS: звездочка</p> <p>8. AXIS-AXES: ось-оси</p> <p>9. BACKSOLVE: повторение решения в обратном порядке (начать с ответа и вернуться к начальной задаче)</p> <p>10. BINOMIAL: двучлен</p> <p>11. BISECT: делить пополам</p> <p>12. BRACKET: квадратная скобка</p> <p>13. BUILT IN: вписанный</p> <p>14. CALCULUS: математический анализ</p> <p>15. CANCEL: взаимно уничтожить члены в уравнении</p> <p>16. CELSIUS: цельсий</p> <p>17. CENTIMETER: сантиметр</p> <p>18. CIRCUMFERENCE: окружность круга</p> <p>19. CIRCUMSCRIBED: ограниченный, описанный</p> <p>20. CLOCKWISE: по часовой стрелке</p> <p>21. COEFFICIENT: коэффициент</p> <p>22. COMMON MULTIPLE: общее кратное</p> <p>23. COMMUTATIVE: коммутативный</p> <p>24. CONCENTRIC: коцентрический (коцентрические окружности, цилиндры, сферы)</p> <p>25. CONGRUENT: конгруэнтные (равные треугольники)</p> <p>26. CONSECUTIVE: последовательный</p> <p>27. CONVEX: выпуклый</p> <p>28. CROSS MULTIPLYING: векторное произведение</p> <p>29. CUBE: куб, возводить в куб</p> <p>30. CUMULATIVE: совокупный</p> <p>31. CYLINDER: цилиндр</p> <p>32. DECAGON: десятиугольник</p> <p>33. DECIMAL: десятичная дробь, десятичный</p> <p>34. DEDUCT: вычитать</p> <p>35. DELINEATE: очерчивать</p> <p>36. DENOMINATOR: знаменатель</p> <p>37. DIAGONAL: диагональ, диагональный</p> <p>38. DIAGRAM: график, изображать в виде диаграммы</p> <p>39. DIAMETER: диаметр</p> <p>40. DIGIT: цифра</p> <p>41. DISCOUNT: скидка</p> <p>42. DISJOINT: раздельные (множества), непересекающиеся</p> <p>43. DISPERSION: дисперсия</p> <p>44. DIVISIBILITY: делимость</p> <p>45. DIVISIBLE: делящийся без остатка</p> <p>46. DIVISOR: делитель</p>

54. FIRST : первый	47. FINITE : имеющий предел, конечный	47. DOWNWARD : направленный вниз (вектор)
55. FOOT-FEET : фут-футы	48. FOCUS : фокус (геометрический)	48. DUB : ровнять
56. FOURTH : четвёртый	49. FORMULA : формула	49. ENDPOINT : крайняя точка (отрезка, интервала)
57. FREQUENCY : частотность	50. FUNCTION : функция	50. EQUILATERAL : равносторонний
58. GALLON : галлон (мера жидких и сыпучих тел)	51. FUNDAMENTAL : основное, фундаментальное (уравнение)	51. EQUIVALENT : эквивалент, эквивалентный, равнозначный,
59. GRAM : грамм	52. GRADE : степень, градуировать, оценка, класс	52. EVALUATE : оценивать, вычислить
60. GREATER : больше	53. HYPOTHESIS : гипотеза	53. EXPONENT : степень, показатель степени
61. HALF : половина	54. IDENTICAL : идентичный, равный	54. EXPONENTIATION : возведение в степень
62. HUNDRED : сто	55. IDENTIFY : определять	55. EXTERIOR : внешний
63. IMPROPER FRACTION : дробь, у которой числитель больше знаменателя, например, 7/5	56. IMAGE : значение функции	56. FACTORIAL : факториал, факториальный
64. IMPROPER RATIONAL FUNCTION : рациональная функция, у которой степень полинома в числителе больше степени полинома знаменателя, например, $(x^3+x-1)/(x^2+2)$.	57. IMPLEMENT : применять (формулу)	57. FACTORIZATION : разложение на множители
65. INCH : дюйм	58. INDICATE : указывать, означать	58. FAHRENHEIT : Фаренгейт
66. INCREASE : увеличивать, увеличение	59. INPUT : ввод, входные данные	59. FIFTHS : пять
67. INEQUALITY : неравенство	60. INSERT : вставлять, поставлять значение переменной в уравнение	60. FIVE-SIDED : пятисторонний
68. IRREGULAR : неправильный, незакономерный, непостоянный	61. INTERMEDIATE : промежуточный (значение, теорема о промежуточном значении)	61. FOUR-DIGIT : четырехзначный
69. KILOGRAM : килограмм	62. INTERVAL : интервал	62. FOURTHS : 4ые
70. LEG : катет	63. LOGIC : логика, логический	63. FRACTION : дробь, доля
71. LENGTH : длина, продолжительность, отрезок	64. MAXIMIZE : увеличивать до предела, максимизировать	64. GEOMETRY : геометрия
72. LESS : меньше, менее	65. MINIMIZE : минимизировать	65. GRAPH : диаграмма, график
73. LIKELIHOOD : вероятность	66. MINIMUM : минимум, минимальный	66. GRID : шкала, сетка (координат для графика)
74. LINE : линия	67. MODE : мода (в статистике)	67. HEIGHT : высота
75. A LOT OF : много	68. MODIFY : изменять, модифицировать	68. HEXAGON : шестиугольник
76. MASS : масса	69. MUTUAL : взаимно (перпендикулярные векторы)	69. HISTOGRAM : гистограмма
77. MATCH : сопоставлять	70. NORMAL : перпендикулярный, нормальный (вектор), нормальное (распределение)	70. HORIZONTAL : горизонтальный
78. MEAN : среднее значение	71. NOTION : понятие, определение	71. HUNDREDTHS : сотые
79. MEASURE : измерять, измерение	72. ODD : нечетный	72. HYPOTENUSE : гипотенуза
80. MEASUREMENT : измерение	73. ORIENT : ориентировать (систему координат)	73. INACCURATELY : неточно
81. MEMBER : член, элемент	74. OUTCOME : результат	74. INCREMENT : (малое) приращение
82. MIDDLE : середина, средний	75. OVERALL : в целом, валовой	75. INSCRIBED : вписанный
83. MILE : миля	76. OVERLAP : перекрывать	76. INTEGER : целое число
84. MILLION : миллион	77. PARALLEL : параллельный	77. INTERCEPT : точка пересечения графика с одной из осей координат
85. MINUTE : минута	78. PERCENT : процент	78. INTERCHANGE : поменять местами члены в уравнении
86. MODERATELY : умеренно	79. PERIOD : период (тригонометрической функции)	79. INTERIOR : внутренний
87. MULTIPLE : многочисленный	80. PLUS : плюс	80. INTERQUARTILE : межквартильный
88. MULTIPLY : умножать	81. POSITIVE : положительный	81. INTERSECT : пересекать
89. NINTH : девятый	82. PRECEDE : предшествовать	82. INVERT : обращать функцию, выражение (математическая операция)
90. NUMBER : число, номер, количество	83. PRECISE : точный	83. ISOSCELES : равнобедренный
91. NUMERICAL : числовой	84. PRIMARY : первичный	84. JUXTAPOSITION : сопоставление
92. NUMEROUS : многочисленный	85. PRIME NUMBER : простое число	85. KILOMETER : километр
93. OMITTED : пропущенный, упущенный	86. PROJECT : проецировать, чертить проекцию	86. LATERAL : боковой, продольный, горизонтальный
94. OPERATIONS : математические операции	87. PROPORTION : соотношение, пропорция	87. LEAGUE : лье
95. OPPOSITE : противоположный, противоположащий	88. RADICAL : радикал, корень, символ квадратного корня	88. LINEAR : линейный
96. ORDINARILY : обычным путем	89. RANDOM : случайный, произвольный	89. MAGNITUDE : амплитуда изменения функции
97. OUTER : внешний	90. RANGE : диапазон, область (множество) значений функции	90. MATH : математика
98. OVER : свыше, сверх, больше	91. RATIO : соотношение, отношение	91. MATHEMATICS : математика
99. PAIR : пара	92. RATIONAL : рациональное	92. MEDIAN : медиана (геом), срединное значение (арифм)
100. PATTERN : закономерность, повторяющаяся структура, образец	93. REGION : область	93. MERCHANDISE : товар
101. PLANE : плоскость	94. RESOLVE : решать	94. METER : метр
102. POINT : точка, указывать	95. REVERSE : обратный, перевернутый	95. METRIC : метрическое (пространство, в котором определено расстояние между точками)
103. POSSIBILITY : вероятность, возможность	96. SCOPE : рамки	96. MICRON : микрон (единица измерения)
104. POUND : фунт	97. SECTOR : сектор	
105. POWER : степень		
106. PROBABILITY : вероятность		

<p>107.PROBLEM: задача 108.PRODUCT: произведение, результат 109.PRODUCTION: производство 110.PROPER FRACTION: дробь, у которой числитель меньше знаменателя, например, $3/5$ 111.PROPER RATIONAL FUNCTION: рациональная функция, у которой степень полинома в числителе меньше степени полинома знаменателя, например, $(x-1)/(x^2+2)$. 112.PROPERTIES: свойства 113.PROVIDED: при условии, если только; в том случае, если 114.PROVIDING: при условии, что 115.QUANTITY: количество 116.QUARTER: четверть, четвертая часть 117.RAISE: поднять, повышать 118.RATE: ставка, частота, процент, коэффициент, норма 119.REDUCE: уменьшать, сокращать 120.RELATION: отношение 121.RELATIVE: относительный 122.REMAIN: оставаться 123.REMAINDER: остаток, остаточный член 124.REPLACE: заменять 125.RESPECTIVELY: соответственно 126.RESULT: результат 127.RISE: подъём, увеличение, возрастать, увеличиваться 128.ROOT: корень 129.ROUNDED: округленный 130.SAVE: экономить, сохранять 131.SCALE: масштаб 132.SCATTERED: рассеянный, разбросанный 133.SCATTERED SET: множество, состоящее только из изолированных точек 134.SECOND: секунда 135.SET: множество, задавать 136.SEVEN: семь 137.SHADED: затушеванный, заштрихованный 138.SHAPED: имеющий определенную форму 139.SIDE: сторона 140.SIMPLIFY: упрощать 141.SIX: шесть 142.SLOPE: наклон, угол наклона, тангенс угла наклона 143.SOLID: трехмерный 144.SOLUTION: решение 145.SOLVE: решать 146.SPACED: повторение с интервалами 147.SPEED: скорость 148.SPLIT: делить на части 149.SQUARE: квадрат, площадь, квадратный, возводить в квадрат 150.STANDARD: стандарт, стандартный 151.STATEMENT: утверждение 152.STEM: основа 153.SURFACE: поверхность 154.SYSTEM: система 155.TABLE: таблица</p>	<p>98.SEQUENCE: последовательность 99.SERIES: ряд (числовой ряд) 100.SHIFT: сдвиг (по фазе), смещение, перенос (графика функции) 101.SIGNIFICANT: значительный 102.SIMILAR: подобный 103.SPECIFIC: заданное значение (specific value) 104.SPECIFY: придать значение переменной величине, зафиксировать значение 105.SPHERE: сфера, шар 106.SUBSTITUTE: подставлять, заменитель 107.SUM: сумма, находить сумму 108.SUPPLEMENT: дополнительный 109.SYMBOL: символ 110.TRANSFER: преобразовывать (преобразовать в безразмерную форму) 111.TRANSFORM: преобразовать (уравнение, систему координат, единицы измерения) 112.UNIFORM: равномерный (равномерная сходимость) 113.UNIQUE: единственное (решение) 114.VALID: правильный 115.VOLUME: объем</p>	<p>97.MIDPOINT: средняя точка 98.MINUS: минус 99.MONOMIAL: одночлен 100.MORTGAGE: ипотека 101.MORTGAGE INSURANCE PROPERTY: застрахованная ипотека на недвижимость 102.MULTIPLE:- многократный 103.MULTIPLES: множители, кратные 104.MULTIPLICATION: умножение 105.NONADJACENT: несмежные 106.NONNEGATIVE: неотрицательный 107.NONPOSITIVE: непустое (множество чисел, содержащее по крайней мере одно число) 108.NONZERO: ненулевое значение 109.NOTATION: обозначение 110.NOTATIONS: обозначения 111.NUMERAL: числовой, цифровой 112.NUMERATOR: числитель 113.NUMERIC: цифровой, числовой 114.OBTUSE: тупой (угол) 115.OCTAGON: восьмиугольник 116.ONE-FIFTH: $1/5$ 117.ONE-FOURTH: $1/4$ 118.ONE-HALF: одна вторая 119.ONE-THIRD: $1/3$ 120.ONE-VARIABLE: (функция) одной переменной 121.OUNCE: унция 122.OVAL: овал, овальный 123.PALINDROME: палиндром 124.PARABOLA: парабола 125.PARALLELOGRAM: параллелограмм 126.PARENTHESIS-PARENTHESES: круглая скобка-круглые скобки 127.PARTITION: разбиение 128.PENTAGON: пентагон, пятиугольник 129.PERCENT: процент 130.PERCENTILE: процентильный или процентный 131.PERIMETER: периметр 132.PERMUTATION: перестановка 133.PERPENDICULAR: перпендикулярный 134.PI: число пи (3.14...) 135.PINPOINT: точный 136.PLOT: график (функции) 137.PLUG: подставлять (значение переменной в уравнение) 138.POLE: полюс (полярной системы координат) 139.POLY: много- 140.POLYGON: многоугольник 141.POLYNOMIAL: многочлен, полином 142.PROBABILITY:- вероятностно 143.PROPOSITION: математическое утверждение (теорема) 144.PYRAMID: пирамида 145.PYTHAGOREAN THEOREM: (теорема) Пифагора 146.PYTHAGOREAN TRIPLES: пифагорова тройка (числа, удовлетворяющие теореме Пифагора) 147.QUADRANT: квадрант (в прямоугольной системе координат,</p>
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<p>156. TAIL: хвост, truncated tail of infinite series = отброшенная часть бесконечного ряда</p> <p>157. TEMPERATURE: температура</p> <p>158. TEN: десять</p> <p>159. TENDENCY: тенденция</p> <p>160. THIRD: третий</p> <p>161. THIRTY: тридцать</p> <p>162. THOUSAND: тысяча</p> <p>163. THREE: три</p> <p>164. TIMES: разы</p> <p>165. TOTAL: общее число</p> <p>166. TOTALING: насчитывающий</p> <p>167. TWELVE: двенадцать</p> <p>168. TWENTY: двадцать</p> <p>169. TWICE: дважды</p> <p>170. TWO: два</p> <p>171. UNLIMITED: неограниченный</p> <p>172. VALUE: значение, величина, показатель</p> <p>173. WEIGH: взвешивать, весить</p> <p>174. WEIGHT: вес, масса</p> <p>175. WHOLE: весь, целый</p> <p>176. WIDTH: ширина</p> <p>177. YARD: ярд</p> <p>178. ZERO: ноль</p>		<p>первый квадрант, второй и т.д.), квадрант (четверть) круга</p> <p>148. QUADRATIC: квадратный (многочлен, уравнение), квадратичный</p> <p>149. QUADRATIC</p> <p>MEAN: среднеквадратичное значение</p> <p>150. QUADRILATERAL: четырехугольник</p> <p>151. QUANTITATIVE: количественный</p> <p>152. QUARTER-CIRCLE: четверть круга</p> <p>153. QUARTILE: квартиль</p> <p>154. QUOTIENT: частное, доля, коэффициент</p> <p>155. RADIUS-RADII: радиус-радиусы</p> <p>156. REARRANGING: перестановка членов (в ряде, в уравнении)</p> <p>157. RECIPROCAL: обратная величина</p> <p>158. RECTANGLE: прямоугольник</p> <p>159. RECTANGULAR: прямоугольный</p> <p>160. REPETITION: повторение (математической операции)</p> <p>161. ROUND: круглый</p> <p>162. SCORE: результат, счёт (в игре), два десятка</p> <p>163. SEGMENT: отрезок, сегмент</p> <p>164. SEMICIRCLE: полукруг</p> <p>165. SETTINGS: постановка задачи</p> <p>166. SEVENTHS: седьмые</p> <p>167. SIMPLIFY: упрощать</p> <p>168. SIMULTANEOUS: одновременный</p> <p>169. SIX-SIDED: шестисторонний</p> <p>170. SLANTED: наклонный</p> <p>171. SPAN: линейная оболочка (базисных векторов)</p> <p>172. SQUARED: возведенный в квадрат</p> <p>173. STACK: пучок, масса, множество</p> <p>174. SUB: под (подмножество subset)</p> <p>175. SUBDIVIDE: подразделять</p> <p>176. SUBSET: подмножество</p> <p>177. SUBSTITUTION: подстановка</p> <p>178. SUBTRACT: вычитать, отнимать</p> <p>179. SYMMETRY: симметрия</p> <p>180. TANGENCY: касание</p> <p>181. TANGENT: касательная, тангенс</p> <p>182. THEOREM: теорема</p> <p>183. THREE-DIMENSIONAL трехмерный</p> <p>184. THREE-DIGIT: состоящий из трех цифр</p> <p>185. THREE-FIFTHS: 3/5</p> <p>186. THREE-QUARTERS: 3/4</p> <p>187. TRANSVERSAL: поперечный, секущий</p> <p>188. TRAPEZOID: трапеция</p> <p>189. TRIANGLE: треугольник</p> <p>190. TRIGONOMETRY: тригонометрия</p> <p>191. TRINOMIAL: трехчлен</p> <p>192. TRIPLE: тройной</p> <p>193. TRIVIAL: очевидный</p> <p>194. TWO-THIRDS 2/3</p> <p>195. TWO-DIMENSIONAL: двумерный</p> <p>196. UNKNOWN: неизвестные (в уравнении)</p> <p>197. UNSHADED: незаштрихованный</p> <p>198. VELOCITY: скорость</p> <p>199. VENN: Венн (диаграмма Венна)</p> <p>200. VERIFY: проверять правильность формулы</p> <p>201. VERTEX-VERTICES: вершина-вершины</p> <p>202. VERTICAL: вертикальный</p>
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		<p>203.WEIGHT: вес 204.WEIGHTED: взвешенный (взвешенные значения функции для численного интегрирования) 205.WHOLESALE: оптом 206.X-AXIS: ось x 207.X-COORDINATE: координата x 208.XY: PLANE плоскость xy 209.Y-AXIS: ось y 210.Y-COORDINATE: координата y 211.ZEROS: корни уравнения</p>
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APPENDIX E: Words Contained in all the GMAT Sets of Flashcards

GMAT Terms and Translations		
Basic	Intermediate	Advanced
<p>1. ABSOLUTE: абсолютный</p> <p>2. ACCORDANCE: соответствие</p> <p>3. ACCOUNT FOR: составлять сколько-то (насчитывать)</p> <p>4. ADD: прибавлять</p> <p>5. AGENT: звено</p> <p>6. AMOUNT: количество, сумма</p> <p>7. ANGLE: угол</p> <p>8. AVERAGE: средняя величина, средний, среднестатистический</p> <p>9. BASE: основа</p> <p>10. BELL CURVE: кривая нормального распределения</p> <p>11. BOTH: оба, обе</p> <p>12. CALCULATE: вычислять</p> <p>13. CENT: цент</p> <p>14. CIRCLE: круг, окружность</p> <p>15. CIRCULAR: круговой</p> <p>16. COMBINATION: сочетание, комбинация</p> <p>17. COMBINE: объединять</p> <p>18. COMPARE: сравнивать</p> <p>19. COMPLICATE: усложнять</p> <p>20. CONTAIN: содержать</p> <p>21. CORRECT: правильный</p> <p>22. COUNT: считать, подсчет</p> <p>23. CURVE: кривая линия</p> <p>24. CUSTOMARY: обычный</p> <p>25. DECREASE: уменьшаться</p> <p>26. DEEP: глубокий</p> <p>27. DEGREE: степень, градус</p> <p>28. DEPTH: глубина</p> <p>29. DESCENDING: нисходящий, понижающийся</p> <p>30. DETERMINE: определять</p> <p>31. DIFFERENCE: разница</p> <p>32. DISTANCE: расстояние</p> <p>33. DIVIDE: делить</p> <p>34. DIVISION: деление</p> <p>35. DOUBLE: двойной</p> <p>36. EDGE: ребро</p> <p>37. EIGHT: восемь</p> <p>38. EIGHTEEN: восемнадцать</p> <p>39. EQUAL: равный</p> <p>40. EQUALITY: равенство</p> <p>41. EXACT: точный</p> <p>42. EXPLANATION: объяснение</p> <p>43. EXTENT: степень, мера</p> <p>44. EXTRA: дополнительный, лишний</p> <p>45. EXTREME: экстремальный, предельный</p> <p>46. FEWER: меньше</p> <p>47. FIFTEEN: пятнадцать</p> <p>48. FIFTH: пятый</p> <p>49. FIFTY: пятьдесят</p> <p>50. FIGURE: число, изображение</p> <p>51. FIRST: первый</p> <p>52. FOOT-FEET: фут-футы</p> <p>53. FOURTEEN: четырнадцать</p>	<p>1. ABSTRACT: абстрактная (алгебра)</p> <p>2. ACCURATE: точный</p> <p>3. ADJACENT: примыкающий</p> <p>4. APPROACH: стремиться (предел при стремлении к нулю)</p> <p>5. APPROXIMATE: приближать, приближённое (значение)</p> <p>6. AREA: площадь, область</p> <p>7. ASSIGN: придать численное значение</p> <p>8. CHART: график, таблица</p> <p>9. COINCIDE: совпадать</p> <p>10. COMPLEX: комплексный (комплексное число)</p> <p>11. COMPONENT: компонент</p> <p>12. COMPUTE: вычислять, считать</p> <p>13. CONSEQUENT: второй член пропорции, результат</p> <p>14. CONSTANT: постоянная, постоянный</p> <p>15. CONVERT: преобразовать, обратить (уравнение в безразмерный вид)</p> <p>16. COORDINATE: координата</p> <p>17. CORRESPOND: соответствовать</p> <p>18. COUPLE: пара</p> <p>19. DATA: данные</p> <p>20. DECADE: десяток</p> <p>21. DECLINE: спад</p> <p>22. DEDUCE: делать вывод</p> <p>23. DEFINE: определять</p> <p>24. DEFINITE: точный, определенный</p> <p>25. DENOTE: обозначать величины (обозначим неизвестное с помощью x)</p> <p>26. DERIVE: вывести(формулу, уравнение, математическое уравнение)</p> <p>27. DEVIATE: отклоняться</p> <p>28. DIMENSION: измерение</p> <p>29. DISTRIBUTE: распределять</p> <p>30. ELIMINATE: исключать (неизвестное)</p> <p>31. EQUATE: приравнивать, уравнивать</p> <p>32. EQUIVALENT: эквивалент, эквивалентный</p> <p>33. ERROR: ошибка, погрешность (вычисления)</p> <p>34. ESTIMATE: оценка, оценивать</p> <p>35. EVALUATE: вычислять значение</p> <p>36. EXTRACT: извлекать</p> <p>37. FACTOR: коэффициент, множитель</p> <p>38. FINAL: конечный</p> <p>39. FINITE: имеющий предел, конечный</p> <p>40. FOCUS: фокус (геометрический)</p> <p>41. FORMULA: формула</p> <p>42. FUNCTION: функция</p> <p>43. FUNDAMENTAL: основное, фундаментальное (уравнение)</p> <p>44. GRADE: степень, градуировать, оценка, класс</p> <p>45. HYPOTHESIS: гипотеза</p> <p>46. IDENTICAL: идентичный, равный</p> <p>47. IDENTIFY: определять</p> <p>48. INDICATE: указывать, означать</p>	<p>1. ACRE: акр</p> <p>2. ACUTE: острый</p> <p>3. ALGEBRA: алгебра</p> <p>4. ALTITUDE: высота</p> <p>5. APPROXIMATELY -: приближенно</p> <p>6. ARC: дуга (в геометрии- часть окружности)</p> <p>7. ARITHMETIC: арифметический</p> <p>8. ASCENDING: возрастающий (функция)</p> <p>9. BACKSOLVE: повторение решения в обратном порядке (начать с ответа и вернуться к начальной задаче)</p> <p>10. BINOMIAL: двучлен</p> <p>11. BISECTOR: биссектриса</p> <p>12. CALCULUS: математический анализ</p> <p>13. CANCEL: взаимно уничтожить члены в уравнении</p> <p>14. CENTIMETER: сантиметр</p> <p>15. CHORD: хорда (в геометрии)</p> <p>16. CIRCUMFERENCE: окружность круга</p> <p>17. CIRCUMSCRIBED: ограниченный, описанный</p> <p>18. COEFFICIENT: коэффициент</p> <p>19. COMMON MULTIPLE: общее кратное</p> <p>20. COMMUTATIVE: коммутативный</p> <p>21. COMMUTE: быть способным к перестановке (от перестановки мест слагаемых ...)</p> <p>22. COMPACT: компактное множество (замкнутое и ограниченное множество в маттопологии)</p> <p>23. CONCENTRIC: коцентрический (коцентрические окружности, цилиндры, сферы)</p> <p>24. CONE: конус</p> <p>25. CONGRUENT: когруэнтные (равные треугольники)</p> <p>26. CONSECUTIVE: последовательный</p> <p>27. CROSS-MULTIPLICATION: векторное произведение векторов (в отличие от скалярного произведения векторов)</p> <p>28. CUBE: куб, возводить в куб</p> <p>29. CYLINDER: цилиндр</p> <p>30. DECIMAL: десятичная дробь, десятичный</p> <p>31. DENOMINATIONS: номинал</p> <p>32. DENOMINATOR: знаменатель</p> <p>33. DIAGONAL: диагональ, диагональный</p> <p>34. DIAGRAM: график, изображать в виде диаграммы</p> <p>35. DIAMETER: диаметр</p> <p>36. DIGIT: цифра</p> <p>37. DIVISIBILITY: делимость</p> <p>38. DIVISIBLE: делящийся без остатка</p> <p>39. DIVISOR: делитель</p> <p>40. ELEMENTARY: элементарный, простой (простая функция)</p> <p>41. ENDPOINT: крайняя точка (отрезка, интервала)</p>

54. FOURTH : четвёртый	49. INTERMEDIATE : промежуточный (значение, теорема о промежуточном значении)	42. EQUILATERAL : равносторонний
55. FREQUENCY : частотность	50. INTERVAL : интервал	43. EQUIVALENT : эквивалент, эквивалентный, равнозначный,
56. GAIN : прибыль, выгода, зарабатывать	51. INVEST : инвестировать	44. EVALUATE : оценивать, вычислить,
57. GALLON : галлон (мера жидких и сыпучих тел)	52. LOGIC : логика, логический	45. EVEN-NUMBERED : четный
58. GRAM : грамм	53. MAXIMIZE : увеличивать до предела, максимизировать	46. EXPONENT : степень, показатель степени
59. GREATER : больше	54. MINIMUM : минимум, минимальный	47. EXPONENTIAL : экспоненциальный
60. HALF : половина	55. MODIFY : изменять, модифицировать	48. EXTERIOR : внешний
61. HUNDRED : сто	56. NORMAL : перпендикулярный, нормальный (вектор), нормальное (распределение)	49. EXTRAPOLATE : экстраполировать (за пределы определения)
62. INCH : дюйм	57. ODD : нечетный	50. FACTORIAL : факториал, факториальный
63. INCREASE : увеличивать, увеличение	58. OUTCOME : результат	51. FACTORIZATION : разложение на множители
64. INEQUALITY : неравенство	59. OVERALL : в целом, валовой	52. FAHRENHEIT : Фаренгейт
65. IRREGULAR : неправильный, незакономерный, непостоянный	60. OVERLAP : перекрывать	53. FOUR-SIDED : четырехсторонний
66. KILOGRAM : килограмм	61. PARALLEL : параллельный	54. FOURTHS : 4ые
67. LEG : катет	62. PARAMETER : параметер, переменная	55. FRACTION : дробь, доля
68. LENGTH : длина, продолжительность, отрезок	63. PERCENT : процент	56. GEOMETRY : геометрия
69. LESS : меньше, менее	64. PERIOD : период (тригонометрической функции)	57. GRAPH : диаграмма, график
70. LINE : линия	65. PLUS : плюс	58. GRID : шкала, сетка (координат для графика)
71. A LOT OF : много	66. POSITIVE : положительный	59. HALVE : делить на два, на две части
72. MASS : масса	67. POTENTIAL : потенциальный	60. HEIGHT : высота
73. MATCH : сопоставлять	68. PRECEDE : предшествовать	61. HEXAGON : шестиугольник
74. MEAN : среднее значение	69. PRIMARY : первичный	62. HORIZONTAL : горизонтальный
75. MEASURE : измерять, измерение	70. PRIME NUMBER : простое число	63. HUNDREDTHS : сотые
76. MEMBER : член, элемент	71. PROPORTION : соотношение, пропорция	64. HYPOTENUSE : гипотенуза
77. MIDDLE : середина, средний	72. RADICAL : радикал, корень, символ квадратного корня	65. INACCURATELY : неточно
78. MILE : миля	73. RANDOM : случайный, произвольный	66. INPUTTED : подставленный (в уравнение)
79. MILLION : миллион	74. RANGE : диапазон, область (множество) значений функции	67. INSCRIBED : вписанный
80. MINUTE : минута	75. RATIO : соотношение, отношение	68. INSTALLED : подставленный (в уравнение)
81. MULTIPLE : многочисленный	76. RATIONAL : рациональное	69. INTEGER : целое число
82. MULTIPLY : умножать	77. REGION : область	70. INTEGER -: целочисленный
83. NINTH : девятый	78. REVERSE : обратный, перевернутый	71. INTERCHANGING : взаимозаменяемые
84. NUMBER : число, номер, количество	79. SECTOR : сектор	72. INTERIOR : внутренний
85. NUMERICAL : числовой	80. SEQUENCE : последовательность	73. INTERSECT : пересекать
86. OPERATIONS : математические операции	81. SERIES : ряд (числовой ряд)	74. INTERSECTION : пересечение
87. ORDINARILY : обычным путем	82. SHIFT : сдвиг (по фазе), смещение, перенос (графика функции)	75. INVERSE : обратный (обратная функция)
88. OVER : свыше, сверх, больше	83. SIMILAR : подобный	76. INVERT : обращать функцию, выражение (математическая операция)
89. PAIR : пара	84. SPECIFIC : заданное значение (specific value)	77. IRRATIONALS : иррациональные (действительные) числа
90. PLANE : плоскость	85. SPECIFY : придать значение переменной величине, зафиксировать значение	78. ISOSCELES : равнобедренный
91. POINT : точка, указывать	86. SPHERE : сфера, шар	79. KILOLITER : килолитры
92. POSSIBILITY : вероятность, возможность	87. SUBSTITUTE : подставлять, заменитель	80. KILOMETER : километр
93. POUND : фунт	88. SUM : сумма, находить сумму	81. LATERAL : боковой, продольный, горизонтальный
94. POWER : степень	89. SUPPLEMENT : дополнительный	82. LEAGUE : лье
95. PROBABILITY : вероятность	90. SYMBOL : символ	83. LINEAR : линейный
96. PROBLEM : задача	91. TRANSFER : преобразовывать (преобразовать в безразмерную форму)	84. LITER : литр
97. PRODUCT : произведение, результат	92. TRANSFORM : преобразовать (уравнение, систему координат, единицы измерения)	85. MATH : математика
98. PRODUCTION : производство	93. UNIFORM : равномерный (равномерная сходимоссть)	86. MATHEMATICS : математика
99. PROPER : присущий, правильный	94. VALID : правильный	87. MEDIAN : медиана (геом), среднее значение (арифм)
100. PROPERTIES : свойства	95. VOLUME : объем	88. METER : метр
101. PROVIDED : при условии, если только; в том случае, если		89. METRIC : метрическое (пространство, в котором определено расстояние между точками)
102. PROVIDING : при условии, что		90. MIDPOINT : средняя точка
103. QUANTITY : количество		91. MILLIMETER : миллиметр
104. QUART : четверть галлона		92. MINUS : минус
105. QUARTER : четверть, четвертая часть		93. MONOMIAL : одночлен
106. RAISE : поднять, повышать		
107. RATE : ставка, частота, процент, коэффициент, норма		
108. REDUCE : уменьшать, сокращать		
109. RELATIVE : относительный		
110. REMAIN : оставаться		
111. REMAINDER : остаток, остаточный член		
112. REPLACE : заменять		

<p>113. RESPECTIVELY: соответственно 114. RESULT: результат 115. RISE: подъём, увеличение, возрастая, увеличиваться 116. ROOT: корень 117. ROUNDED: округленный 118. SAME: тот же самый 119. SCALE: масштаб 120. SCATTERED: рассеянный, разбросанный 121. SCATTERED SET: множество, состоящее только из изолированных точек 122. SECOND: секунда 123. SET: множество, задавать 124. SEVEN: семь 125. SEVENTEEN: семнадцать 126. SHADED: затушеванный, заштрихованный 127. SHAPED: имеющий определенную форму 128. SHILLING: шиллинг 129. SIDE: сторона 130. SIMPLIFY: упрощать 131. SIX: шесть 132. SIXTEEN: шестнадцать 133. SLOPE: наклон, угол наклона, тангенс угла наклона 134. SOLID: трехмерный 135. SOLUTION: решение 136. SOLVE: решать 137. SPACED: повторение с интервалами 138. SPEED: скорость 139. SPLIT: делить на части 140. SQUARE: квадрат, площадь, квадратный, возводить в квадрат 141. STANDARD: стандарт, стандартный 142. STATEMENT: утверждение 143. STEM: основа 144. SURFACE: поверхность 145. SYSTEM: система 146. TAIL: хвост, truncated tail of infinite series = отброшенная часть бесконечного ряда 147. TEMPERATURE: температура 148. TEN: десять 149. THIRD: третий 150. THIRTEEN: тринадцать 151. THIRTY: тридцать 152. THOUSAND: тысяча 153. THREE: три 154. TIMES: разы 155. TON: тонна 156. TOTAL: общее число 157. TWELVE: двенадцать 158. TWENTY: двадцать 159. TWICE: дважды 160. TWO: два 161. VALUE: значение, величина, показатель 162. WEIGH: взвешивать, весить 163. WEIGHT: вес, масса 164. WHOLE: весь, целый 165. WIDTH: ширина 166. YARD: ярд 167. ZERO: ноль</p>		<p>94. MULTIPLES: множители, кратные 95. NONADJACENT: несмежные 96. NONNEGATIVE: неотрицательный 97. NONZERO: ненулевое значение 98. NOTATION: обозначение 99. NUMERAL: числовой, цифровой 100. NUMERATOR: числитель 101. OBTUSE: тупой (угол) 102. ONE-DIMENSIONAL: одномерный 103. ONE-FIFTH: 1/5 104. ONE-FOURTH: 1/4 105. ONE-HALF: одна вторая 106. ONE-QUARTER: 1/4 107. ONE-SIXTH: 1/6 108. ONE-THIRD: 1/3 109. ONE-TWENTIETH: 1/20 110. OUNCE: унция 111. PARALLELOGRAM: параллелограмм 112. PARENTHESIS-PARENTHESES: круглая скобка-круглые скобки 113. PENTAGON: пентагон, пятиугольник 114. PERCENT: процент 115. PERCENTILE: процентильный или процентный 116. PERIMETER: периметр 117. PERPENDICULAR: перпендикулярный 118. PI: число пи (3.14...) 119. PINPOINT: точный 120. PLUG: подставлять (значение переменной в уравнение) 121. POLYGON: многоугольник 122. POLYNOMIAL: многочлен, полином 123. PYTHAGOREAN THEOREM: (теорема) Пифагора 124. PYTHAGOREAN TRIPLES: пифагорова тройка (числа, удовлетворяющие теореме Пифагора) 125. QUADRATIC: квадратный (многочлен, уравнение), квадратичный 126. QUADRATIC MEAN: среднеквадратичное значение 127. QUADRATICS: квадратные алгебраические выражения 128. QUADRILATERAL: четырехугольник 129. QUANTITATIVE: количественный 130. QUARTER-CIRCLE: четверть круга 131. QUOTIENT: частное, доля, коэффициент 132. RADIUS-RADII: радиус-радиусы 133. RATIONALS: рациональные (дробные) числа 134. REARRANGING: перестановка членов (в ряде, в уравнении) 135. RECIPROCAL: обратная величина 136. RECTANGLE: прямоугольник 137. RECTANGULAR: прямоугольный 138. REPETITION: повторение (математической операции) 139. RIDGE: ребро (геометрических фигур) 140. SCALED: умноженное на постоянное число 141. SCORE: результат, счет (в игре), два десятка 142. SEGMENT: отрезок, сегмент 143. SEMICIRCLE: полукруг 144. SIMPLIFY: упрощать</p>
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