GED Math Graphics: Illustrated Guide to Self Confidence

www.gedmathgraphics.net

Teacher Notes

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Using the Math Guide

If your educational program serves disadvantaged students within the resource constraints typical of a nonprofit agency, then full a scale high school curriculum with college prep extras may not be a realistic goal. You simply may not have enough class time or certified teachers.

So first of all be very clear on how much specifically ***math*** instructional time you will actually have with each student, and aim for learning goals that the student can realistically reach within your time constraints. Success on the GED may be an appropriate aspiration for many of your students. If so, the test preparation approach outlined in the Math Guide is designed for you.

Target: GED Math Success

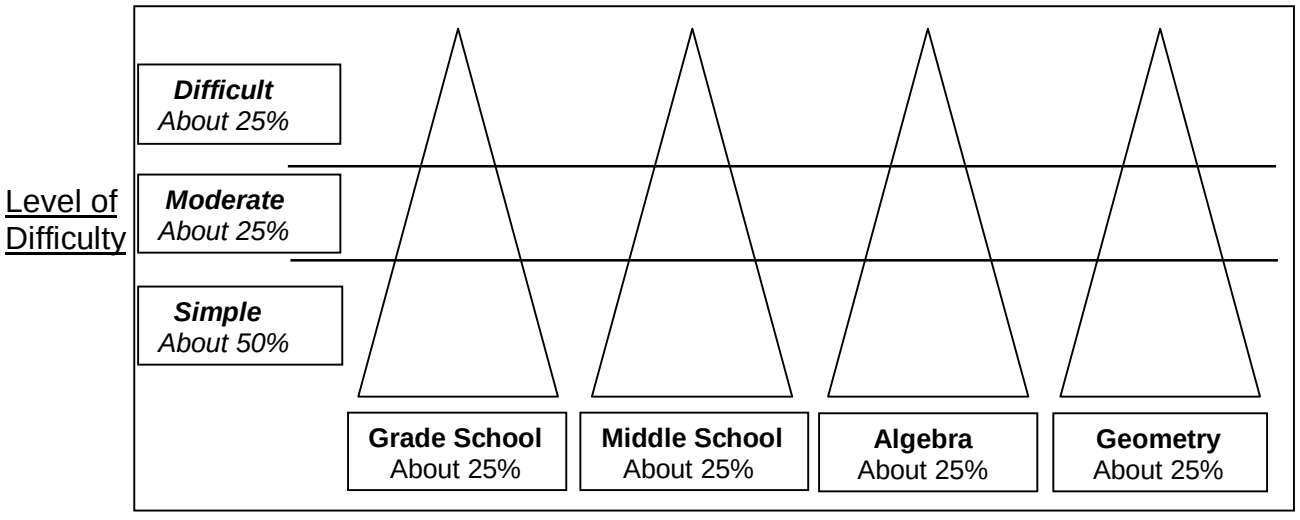
The Math Guide outlines a realistic and practical road map to success on the GED math exam. That means using available class time as efficiently as possible to assure the "magic number" of at least 30 correct answers (60% or more) on 50 test questions.

To assure this outcome, solid grounding in the skills and "Typical GED Questions" presented in the Math Guide is more important than total mastery of every possible topic and nuance that just might appear on a few test questions. Since a fairly narrow range of fundamentals appears repeatedly in a variety of questions, insure that your instructional focus reflects the test itself.

Look First at the Exam

Consider the exam's content overview, as outlined in the introduction of a typical GED text. With the labels for math content and question type somewhat freely translated, you find:

GED Math Questions by Subject and Level of Difficulty



This graphic depicts four subject areas, each with a roughly equal number of test questions. Overall, about 25% of all exam questions are relatively difficult, leaving about 75% relatively simple or only moderately difficult. But since these accessible 75% of total test questions are spread evenly across the whole exam, you can't afford over or under emphasis on any one part.

Strategy for Success

You need a **plan** for success: ***what*** to accomplish, linked to ***how*** to get there. Based on a minimum goal of 60% correct answers, you need to assure that students are prepared for almost all of the simple questions and over half of the moderately difficult ones.

Key Issue: Student Turnover

A common obstacle in nonprofit educational programs is the continual coming and going of students, many of whom do not stay long enough to complete a lengthy program. If frequent changes in your class list sometimes evoke the transience of a subway car as much as the continuity of a school, you must drive instruction quickly toward a tangible achievement before students depart. To do that, keep it positive, keep it fun, and above all ***keep it moving!***

Don't Get Mired in Needless Detail

You need to cover the full range of chapter headings, but not in excruciating detail. Just grinding away exhaustively on the elementary and middle school material is not likely to prove very productive. Even if you should get to full mastery, that is still only the ***first 50%*** of the test.

A more productive approach starts not in the front of the text but in the back. Look in the Contents of your GED text for the number of pages devoted to the ***second 50%*** of test questions—algebra and geometry. Then, how many pages address all the rest—the first 50% of the test? Typically, you find nearly 200 pages first, with just over 100 pages last. In other words, to achieve a balance with the actual number of test questions, you would need to weed out almost half of the first part of the book. Think about ***that*** before you just dive in on page one!

Before you lavish precious class time on such topics as common denominators, fraction-decimal equivalents, number sequences and patterns, or simplifying $\sqrt{27}$, you are well advised to scan a few practice tests. Are these topics actually tested consistently? Your students may already be frustrated from past struggles with them, so really—how much class time and effort (pain and suffering???!!!) are you willing to devote to a few test questions that you seldom find?

Be Sure to Include the Easy Pickings

Better to base a comprehensive plan on the actual test. Many algebra and geometry questions are actually quite easy, especially with the Math Guide's simplified approach. When combined with a confident grasp of elementary and middle school essentials, the basics in Units 3 and 4 are often enough to assure a passing score of 60% on a practice exam—all you really need.

A Realistic Basis for Success

The idea is to get to successful completion before students depart. All test questions have the same point value, so why pound away on the hard ones? Slip past difficult, lightly tested topics in favor of some of the surprisingly easy and more numerous problems in algebra and geometry.

Start serious planning with two or three GED practice tests from various sources. Scan each question, and look for a skill or "Typical Question" in the Math Guide that fits fairly closely. You will probably find that about 90% or even more of the test's 50 questions require thorough familiarity with a Math Guide skill, or may even closely resemble a "Typical Question." Look closely at this material, focus on it exclusively and teach it thoroughly. Again, it's all you need!

Engagement Builds Confidence

The patterns your find in this way are very useful to guide your instructional time and emphasis. But if ***what*** you teach is important, ***how*** you teach is even more so. You must build students' confidence, and for that they need encouragement and must experience success.

Start out with encouragement, and never let up. Students must continually hear positive messages such as, "This is stuff everybody does, and you will too. Don't worry, we'll just keep going, you will get it and it will all happen." *Such empathetic support is fundamental!*

But beyond verbal encouragement, you need to involve students quickly in something they can actually ***do*** without a lot of preliminaries. Show them how a key concept translates to success on simple problems, but don't expect total mastery the first time. Don't rush to the next topic—come back again to revisit familiar skills and use them to tackle increasingly complex problems.

The Math Guide's concept-based graphics support this approach. Students need to internalize the story lines on a few key graphics, so introduce Top 10 Charts early and keep the Concept Charts readily at hand. Not always the centerpiece of every lesson, the right chart is often useful when students are uncertain during a class exercise and need an on-the-spot refresher.

Such "teachable moments" must be seized quickly before attention wanes, and at such times a targeted graphic is worth its weight in gold. Accessed quickly when needed, it can head off self-doubt and frustration in support of engaging yet focused and briskly paced class exercises.

Take Discontinuity in Stride

Developed in the context of high student turnover as discussed above, the Math Guide's approach adapts to discontinuities that might derail a more conventional program. To overcome spotty attendance and variations in learning patterns, emphasize familiar skills in a range of applications and settings. Select practice material in the text, but keep the class format varied with manipulatives, activities, games and a range of supplements as well.

Avoid lockstep lessons. It often doesn't work to stay with one topic until everybody "gets it."

(1.) First, "everybody" is not in the class consistently, and
(2.) It takes repetition to gain a comfort level, and really "own" important new concepts.

So emphasize engagement and self confidence over thoroughness, and don't press for mastery the first time. It's OK when some students miss some classes—recycle to familiar skills, and apply them in ways that gradually extend the scope and complexity of new problems.

Ideal Schedules and Real-World Adjustments

An ideal class schedule might place a group of students with comparable skill levels in a math class for one hour per day, five days per week, for up to six months or even longer. In this scenario, virtually every student of average or even low-average functioning would be expected to pass a practice test and succeed on the GED math exam.

However, nontraditional programs may find difficulties in adopting this ideal pattern. Perhaps your program experiences rapid turnover, with some clients leaving before their full enrollment time has elapsed. In such cases you may want some students to take the exam as soon as possible, without necessarily teaching through the whole textbook from the first page to the last.

Or the frequent arrival of new students may translate to new demands on chronically over-stretched teaching schedules. In any case, when students seem confident with the skills and "Typical Questions" in each new part of the Math Guide, it's time for a unit assessment.

Summary of Units and Unit Assessments

Unit 1 of the Math Guide selects a relatively few but fundamentally important skills. Review the charts to assure conceptual understanding, but beware of over-doing potentially boring drills. Instead, be ready for that point in a class exercise when students actually need a specific skill to solve a word problem. That's the "teachable moment," when you pull out the now-familiar skill chart and focus on using it. This approach can engage students more effectively than drills.

To review and assess Unit 1 skills in number operations, use chapter review sections on whole number and decimal word problems that you will find at the beginning of the GED text. The presentation at this level is relatively simple, but the mathematical thinking and approach to problem solving found here are important for the entire GED test. This is the place to start building students' confidence in sound problem solving techniques.

Unit 1 also touches on fraction skills, but you might skip the text's chapter test on fractions. Though key fraction skills are often integrated within GED test problems, stand-alone fraction problems are relatively lightly tested.

Therefore there is no great need to set up a test on fractions as a prerequisite to Unit 2. Rather, introduce students to fractions and measurements in class exercises with manipulatives, then apply the skills as required in specific problems as they come up—see for example Unit 2, p. 10.

Unit 2 incorporates middle school math skills, particularly ratio, proportion and percent. The text's chapter review on data analysis and probability is an excellent review for these topics and indeed the entire first half of GED material, because it uses graphs and tables to present basic middle school concepts in a variety of ways—just as students will encounter on the test itself.

Success on the chapter review includes the ability to solve most problems with understanding—***and*** the confidence to use guessing strategies on the really difficult questions without obsessing on them. When students can do that, they are ready to go on to pick the "low hanging fruit" in algebra and geometry, where the same test taking strategy will apply.

Unit 3 is basic geometry, with conceptual content quite similar to the corresponding chapter in a GED text. "Typical Questions" are often relatively easy to master, since few require thorough familiarity with earlier material. Thus the chapter review test from the text can be a confidence builder, and success is a signal to go on to algebra.

Unit 4 is the algebra component, though some problems go back to integrate geometry as well. Your GED text's chapter review(s) for algebra can represent a good assessment for Unit 4, with the caveat that some advanced material may seldom if ever appear on practice tests.

It's probably a good idea to compare practice tests and textbook material once again, before beginning to plan instruction on the algebra unit. You may want remove lightly tested items including quadratic equations and trigonometry from your Unit 4 assessment. Alternatively, you might leave them in as examples of problems that are safely skipped over in a successful test taking approach. See further comments in the Unit 4 notes, below.

Setting the Test Date

When students do well on unit assessments, it may be time to try a practice GED math test. Administer it under actual test conditions: two timed tests of 45 minutes each, one part with a calculator, one part without, and only one piece of scrap paper.

A score of 60% might be a minimum for the actual test, though 70% seems preferable if additional teaching time allows. But in addition to test readiness alone, a number of other factors may influence the decision to proceed to testing.

In some cases you may be rushing to complete instruction before students leave the program, so you want to get them into testing while you still have them.

But in other circumstances good reasons to hold students for added learning time can include:

- The student may be responsible for other program components, perhaps treatment goals or family responsibilities. These obligations may take priority over GED testing.

- Morale and cohesion among a class group may be adversely affected when a "chosen few" are sent for the test while others must stay behind.

- When staff escort time or availability of transportation to the testing site is limited, individual students may need to be aggregated in relatively large batches of test takers.

- An important part of GED programs can be self responsible use of answer keys to review each incorrect answer and learn the correct way to solve the problem. Prospective test takers may need to do this mostly on their own, particularly if teacher time available for individual tutoring is constrained due to the needs of the majority of students.

- Spoon feeding must end, as students develop test taking strategies to skip hard questions, focus on what they ***do*** know, and then come back to make good guesses on the rest. It may take extended study time and a few more practice tests to gain this facility, but the effort is a necessary and important part of test preparation.

- The student's own confidence and understanding may be strengthened by tutoring his or her peers. In some programs such assistance to others may be part of a service obligation. In any case, when individuals are compatible with one another the activity can not only be quite effective for the learner but solidify understanding for the tutor as well.

- In other cases, full mastery of all GED math topics, including those covered only lightly or not at all in the Math Guide, may be required by the program or sought by the student. This is the time to review the full GED text, and possibly even introduce college basic skills texts and material such as the charts and worksheets in Post-GED Math.

Unit 1 Teaching Notes

Several *key skills in number operations* are addressed in the graphics of Unit 1. These are essential prerequisites to success, but your challenge is to *go beyond the infamous "drill and kill" approach* to teaching them.

Instead, involve students in an interactive process, based on *solving word problems such as those found in the text's beginning chapters on whole numbers and decimals.* As they work to their own solutions, support purpose and confidence at teachable moments with a well chosen Math Guide graphic—from Unit 1, from the Top 10 Charts, or perhaps from the Concept Charts.

"Typical Questions" versus Word Problems

Throughout Units 1-4, and highlighted separately in Test Review - Typical Questions, the Math Guide presents models for several key test items. Though good as confidence builders, the "Typical Questions" differ importantly from the majority of test items. So as you approach these special cases, keep in mind both their advantages and limitations.

On the positive side, the "Typical Questions" are easily teachable. They are fairly simple, and often don't require much in common with the rest of the test. Because each is quite likely to represent one of 30 correct answers needed to pass the test, you can truthfully encourage students as they "get" one of them. "Great job—one down, 29 to go!"

But "cookie cutter" tools won't be enough for the whole job. Students who can do no more than recognize model questions and duplicate familiar solutions are not well prepared for the test.

Rather, the most important point about "Typical Questions" is that students need to recognize and answer these and other easy problems with speed and confidence. The overall testing challenge is to dispose of such questions quickly, attack the moderately difficult ones with sound technique, and still have sufficient time to crack the rest with appropriate test taking strategies and purposeful guessing.

Word Problems

Well over half of test items are word problems. Emphasis shifts from "bite size" reproduction to increasing complexity. Rote skill drills or model solutions—even when learned successfully—will not be sufficient. Thus an important purpose of Unit 1 is to begin building higher level skills in problem solving and test taking.

Look ahead now, to scan the "Typical GED Questions" in Unit 2. Although these graphics address a few common problem types with highly teachable rubrics for successful solutions, the actual test questions take many forms.

A familiar problem type may appear repeatedly, but often with variations in question format, such as the need to read a graph to find a proportion or percent question. Added complexity also comes with potentially confusing extra data, an added skill requirement such as rounding or estimation, or with two steps needed instead of just one.

Therefore, success with word problems seldom comes by recognizing specific question types and knowing the steps to answer them. *Students must consistently follow a logical thinking process to choose familiar skills and apply them appropriately in a wide range of new situations.*

This process is best learned by doing. Start at the beginning of the text, with group exercises focused on word problems with whole numbers and decimals. Encourage individual work on one problem at a time, and review solutions right away to be sure everyone is on the right track.

Introduce the logical outline in the Word Problem chart as a good beginning in many situations. Using the procedural outline in the chart, guide students beyond rote and impulse and toward a take-charge orientation. Even when problems are easy at first, emphasize the logic of actually thinking them through rather than jumping too quickly at "the answer."

As problems get more difficult, requiring multiple skills and/or steps, students may need to overcome anxiety-driven impulses toward blind guessing. This all-too-familiar mode is painful to watch. Even before students finish reading the problem they may grab the first numbers they see, sometimes including extra data they don't actually need.

In such situations, students need reassurance and "hand holding." Your most useful role is much more like a coach than a drill master. You need to find ways to break tension and relieve anxiety. Then when students calm down a little, open them again to logic based thinking.

Try a Joke

So be empathetic, and try a little humor. This is a good place for your favorite logic jokes—in any case here are a couple of very old riddles that often work for me. Before long, everyone in my class can recognize them by the first couple of words and repeat the punch lines in unison.

It's a familiar ritual that seldom fails to draw wry smiles. And the message often works: "Just calm down and really read the problem again. It's not nearly as complicated as you thought!"

Why not try the two logic riddles below, to help you empathize with how your students might feel at times when they anxiously grasp at some "answer" without really knowing why. Pretend that you don't know the answer (even if you already do) and pay attention to your feelings as your brain races frantically to somehow come up with a solution to each crazy situation.

This is the way students feel just before you hear ***"I hate math!!!"*** Some may burst out with it, but it's even worse if held in and not addressed.

Your job as math coach is to calm them down and get them back on track. So try whatever you think might work, including these riddles if they fit your personal style.

Logic riddle #1

Railroad crossing without any cars,

How do you spell it without any R's?

Solution

Did you think about this one first without peeking? Did your brain race over all those R's and cars?

Go back to the Word Problem chart, where it asks: "What's the question?"

That would be: how do you spell "it"? So of course the answer is simply "i,t."

Logic riddle # 2

As I was going to St. Ives,

I met a man with seven wives.

Each wife had seven sacks,

Each sack had seven cats,

Each cat had seven kits.

Kits, cats, sacks, and wives,

How many were going to St. Ives?

Solution

Did you mentally grab a calculator and madly pile up multiples of seven? A lot of extra data…….

If you read the problem carefully, the answer is easy. Only one was going, the rest stayed behind!

Test Taking Strategies

It is a good idea to take students through most of the word problems in the text, not only for practice in a wide variety of problem types but also to insure that they are using appropriate strategies for choosing and checking answers. Repeated practice is typically needed, to overcome the tendency of clinging to the first "answer" found rather than examining it critically or weighing potential alternatives.

Just as you do not over-drill skills but have key charts ready when needed, it also works to show students in the context of a specific problem how checking their answer pays. They need to practice guessing even on problems they are not sure of, by such tactics as guess-and-check, estimating correct answers and/or eliminating choices that seem incorrect.

On problems solved without calculators, watch for students doing multi-digit multiplication and division on scratch paper. This is a red flag, because most GED problems are structured with built in factors that allow easy cancellations. Such quick solutions are not to be passed up!

Thus students need to recognize their hand calculations as signals that they have missed an easy cancellation, or may need to re-read the problem and use correct numbers. This is not supposed to be hard. Set up the whole problem as a big fraction, just like the examples in the "Typical Problems" or the game on p. 11 below, and an easy answer almost always appears.

Fractions and Measurement

Fractions are often imbedded within larger word problems, particularly in cases where the use of a calculator is allowed. For example, see Unit 2, page 10. Students who are not confident with fraction calculations can use the calculator to turn the fraction into a decimal (punch in the top number, the "divided by" key, the bottom number, and the equal sign). With all numbers in the problem expressed as decimals, the student can often use the calculator to find or guess intelligently at the answer.

Briefly introduce fraction concepts in class exercises with manipulatives, but you need not spend a lot of drill time on the Unit 1 graphics that illustrate isolated fraction skills. This is simply because few of these skills actually show up as separate problems on practice tests.

The skills are important of course, but more typically are tested in the context of word problems such as those of Unit 2, where the need to use fractions may be just one part of a larger problem, such as measurement, ratio or proportion.

So wait until you are into a lesson in Unit 2, and then be ready for the right "teachable moment" to bring out a fraction poster. In Unit 1 are just some of the fraction posters that I developed from time to time for structured lessons, but now use mainly for on-the-spot review.

Just be aware as you plan your lessons on fractions that students seem to take to manipulatives and The Master Ruler much more readily than a textbook or chart. Another thing to try is a novel web based learning activity.

At www.rickyspears.com/rulergame you will find a very useful interactive teaching tool. Try to find internet access for pairs of students to compete for the best score and then advance the level, as in a video game. They typically enjoy the friendly competition, so it's a painless and effective way to impart most of the fraction and measurement skills they will need for the GED.

Unit 2 Teaching Notes

Unit 2 is the beating heart of the approach advocated in the Math Guide. A continuation of the introductory Top 10 Charts, its *purpose* is to give the student *confidence* in a complex of related skills and strategies needed to answer an *important "critical mass" of test questions*—word problems touching on various aspects of ratio, proportion, or percent.

This is not a blueprint for detailed mastery, skill by skill or brick by brick. Rather, involve students quickly in something they can actually ***do*** without a lot of preliminaries, and show them that what they are learning translates to success on actual test questions.

Build up their confidence with the charts and basic-level problems, then progress to more complex skill requirements on the familiar models. Several variations on this basic pattern are detailed on p. 12, below. *Catch the spirit and have fun—it works!*

Whole Number Skills and Cancelling – pp. 3-6

Math facts and cancelling are fundamental skills because they apply in a very wide range of GED problems. But to build interest and self-confidence for students, ***avoid drills!***

This is "Math Lite," where fun helps more than pressure. Student success depends on building number sense—eventually. Meanwhile, let them use a calculator and refer to the times table if they need to. Skills in both math facts and problem solving proficiency will grow with time, and with active engagement in class exercises—much more effectively than grinding away on drills.

Build on Everyday Use of Coins – p. 3

Cancellation opportunities involving multiples of 5, 10, 25 and 50 often come up in problems with 100 in the denominator: percent and percent change—see examples on pp. 13 and 17.

Point out to students that cancellations like these are typical in the GED section where calculators are not provided. Build their self confidence in these types of solutions with knowledge of coin combinations such as those below.

Quarters:	25 x 2 = 50	25 x 3 = 75	25 x 4 = 100	
Dimes:	10 x 2 = 20	10 x 5 = 50	10 x 10 = 100	
Nickels:	5 x 2 = 10	5 x 5 = 25	5 x 10 = 50	5 x 20 = 100

I like to keep small plastic bags handy, with separate supplies of quarters, dimes, and nickels. Pose problems where the need to cancel factors of 5 and 10 comes up, then point to a chart (page 3, or a larger display) and spread out the coins for a hands-on review.

Point out that every number with 0 or 5 as the last digit has a certain number of nickels in it (is a factor of 5.) Let them use a calculator but coax them to do without it—while you use this opportunity to kid around: “Come on, you really knew this all the time—right???”

Make It a Game – Factors on p. 4

It’s useful to devise warm-ups such as games and competitions. In my favorite format, students go in groups of two or more to chalk boards and work the same challenge together. They look at each other’s work, and typically find the interaction stimulating and fun.

I like to randomly choose products from the times table, for complex multiplication/division. For example, “What is 14 times 45 times 63, divided by 27 times 42 times 15?”

If you have beginning level English Language Learners (ELLs) in your class, just write on the board so any who might need to can copy. The specific numbers don’t matter, just sprinkle in plenty of common factors for cancelling.

Post a large size times table and let them refer to it as they need to. Driven by the desire to finish first, they will quickly learn to do without it.

The same dynamic will discourage the calculator, too. The point is that it’s easier to cancel common factors than to punch in all those numbers on a calculator. The cancellers will usually beat the punchers, and everyone will have fun watching.

The problem and solution, simple but not necessarily a whole number, will look like this:

$$\text{Start: } \frac{14 \times 45 \times 63}{27 \times 42 \times 15} \qquad \text{Finish: } \frac{\cancel{7} \times \cancel{2} \quad \cancel{5} \times \cancel{9} \quad 7 \times \cancel{9}}{\cancel{14} \times \cancel{45} \times \cancel{63}} \quad \cancel{3} \times \cancel{3}$$

$$\frac{\cancel{27} \times \cancel{42} \times \cancel{15}}{\cancel{9} \times \cancel{3} \quad \cancel{6} \times \cancel{7} \quad 3 \times \cancel{5}} \quad \cancel{2} \times \cancel{3} \qquad = \frac{7}{3} \text{ (Prime factors left over)}$$

On Motivation—Proportion Exercises, p. 9

Motivation and success are all about building a student's confidence and sense of mastery. Proportion problems are ideal for this purpose: easy and fun for both teacher and student.

The goal is to get the individual to the point of "Hey, I can ***do*** this!"

Go around the group in turn, to engage each student in an active learning process. Pique a specific interest, then pose an individualized problem from lived experience, such as:

- Basketball (the example in the Math Guide), or
- Take other scenarios from a student's focus in real time—
  something he or she is doing or thinking about right at the moment.

Examples:

Based on chatting with them or just watching what they are doing, seek to engage them with:

- Baseball

  "You're a hitter? If you get 3 hits in 5 at-bats, how many hits will you get in 25 at-bats?"

- Eating Pizza

  "Like pizza? If you eat 3 slices in 5 seconds, how many slices can you eat in 25 seconds?"
  (Make this a little crazy, and have fun. Get them to laugh and work the problem aloud.)

- Hot Dog Eating Contest

  Set this one up with overblown dramatics. "You are competing at the big eating contest.
  The long table is piled with hot dogs. Everyone is lined up, out to win. Ready, set, go!
  If you eat 3 hot dogs in 5 seconds, how many hot dogs can you eat in 25 seconds?"

  The idea here is to loosen them up, get them into a spirit of fun. Use comic gestures too!

- Parenting

  Was the student's child up last night crying? Be empathetic, but capture the moment:
  "If your child cries 3 times in 5 nights, how many times will that be in 25 nights?", or,
  "If your child forgot lunch 3 times in 5 days, how many times is that in 25 days?"

- Off-Task Behavior

  If a student is spinning a pencil or braiding a friend's hair (happened with me!), you don't need to revert to strict classroom management and demand order. Why resurrect old baggage from former school conflicts?

  With a small group, you can simply capture the moment:

  "If you spin a pencil 3 times in 5 seconds, how many times will you spin it in 25 seconds?"
  "If you can make 3 braids in 5 minutes, how many braids can you make in 25 minutes?"

Set Up Cancelling as Part of the Solution

Have factor sets like these ready, so you can rattle off whacky problems spontaneously:

- If 2 (whats) in 9 (somethings), then how many (whats) in 27 (somethings)?
- If 3 (whats) in 7 (somethings), then how many (whats) in 21 (somethings)?
- If 3 (whats) in 8 (somethings), then how many (whats) in 32 (somethings)?
- If 4 (whats) in 7 (somethings), then how many (whats) in 56 (somethings)

More Complicated Proportion Problems, p. 10

Make sure that students understand the full range of proportion problems in the text, starting with simple ones and building toward those with added complexity—such as fraction and rounding as illustrated on p. 10.

But don't rely only on the text, use other sources too. It often works to make up problems for the class, and then get students into the act, as well. Let them ham it up—they will love it!

Percent, pp. 11-15

After students are confident with proportions, percent problems are a short next step. The charts, pp. 11-12, lead to simple problems, p. 13. As with proportions, start with simple percent problems in the text and then include more complexity, as on pp. 14-15.

Percent Change, pp. 16-17

The final topic before a first-half review is percent increase and decrease. The charts are very clear; be sure the students have enough practice with these problems so they are confident with the specific approaches needed for ratio, proportion, percent and percent change.

Use a variety of resources and formats—the text as well as other sources—in which the charts are not a primary teaching tool but are used as review or problem solving aids. Don't try to be the center of every lesson—also have students work in small groups and teach each other.

Mid Term Review

This is the point to insure confidence and understanding of elementary and middle school material. Use the word problems in the text's chapter on data analysis and probability, which typically require the correct interpretation of tables and graphs before applying skills and techniques presented in Units 1 and 2.

With experience and confidence in such problems, students are well prepared to move ahead with geometry and algebra. Have them work with each other, and monitor their thinking to be sure they fully understand the questions and are using a full range of problem solving strategies, including cancelling, estimation and guess-and-check.

Unit 3 Teaching Notes

Geometry should be begun with a group of students who have successfully mastered Units 1 and 2. If separate classes have not yet been formed, they should be at this point.

This is because students who are confident with middle school material (Units 1 and 2) can quickly grasp and apply the charts of Unit 3. These "Typical GED Questions" appear frequently on the actual test, and in a form that is often remarkably similar to the Math Guide charts.

The visual nature of geometry lends itself to making Unit 3's charts a centerpiece of class discussion. As students explain the charts to the class and to one another in small groups, most quickly grasp key concepts in a way that allows them to answer textbook questions successfully.

In working through the text's problems in this unit, do not hesitate to encourage students as they add to their ability to answer items that are virtually certain to appear on the GED. Each one brings them one step closer to the "magic number" of 30 correct answers needed to pass!

The main exception to this generalization is the group of similar triangle problems. While not "cookie cutter solutions," these are really just one more set of proportions, as in Unit 2. The charts on pages 15-17 will help most students make the necessary connection.

Note that the Math Guide covers most GED geometry questions, but omits discussion of the criteria for proving congruent triangles. This subject is rarely covered on practice tests, and represents another example of a question that a student should skip or attempt to guess if encountered. If time allows at the end of the program, gaps such as these might potentially be addressed with additional instruction.

Unit 4 Teaching Notes

As students start Unit 4, most will be looking forward to success on the exam. They may be hoping they will pass, but still wondering at some level if they really can.

At every point in GED learning, they need reassurance: "This is stuff everybody does, and you will too. Don't worry, we'll just keep going, you will get it and it will all happen."

Signed Numbers, pp. 3-6

Such encouragement may be particularly important as students begin signed numbers—or more likely revisit them with apprehension due to frustrating experiences in the past. If they were drilled by rote before, there may well be barriers of confusion and frustration to overcome.

So be sure to use the manipulative approach outlined on page 3. Have those bottle caps marked and ready, and be sure all students get a thorough chance not only to use them but to explain how they work. Make up and discuss humorous scenarios such as gambling in a casino, or using a credit card and the paying bills—what's the balance now?

It is important establish a clear link to using a number line. My favorite pathway is the thermometer on page 4 (later the Y axis on a graph.) Here, the class can discuss walking over a frozen lake, using a freezing point of zero degrees Celsius. As the temperature rises and falls from positive to negative and back again, be careful not to fall through the ice!

Once students are on firm ground with signed numbers on the thermometer, it's important to establish clarity on the rules for multiplication and division. The charts on pp. 5-6 spell out what they need to know. This content needs to be thoroughly worked and explained by the students themselves—not drilled in by rote.

Students have probably seen such material before, but this is the time for classroom exercises to let them explain and solidify their understanding. Confusion here will inevitably lead to complications later.

Solving Equations, pp.7-10

The above comments apply equally well to insuring that students understand and have fully internalized the skills needed to solve simple linear equations. Students have almost certainly seen such basics before, but now they must really own (internalize) the concepts and apply correct procedures automatically in textbook problems. Let them draw the diagrams on the board, work simple examples in class and explain them to each other.

Students don't really need to master every possible topic and nuance in advanced algebra just to pass the GED, but it is vital to be really solid on the Math Guide's basics, including how to solve simple equations. To paraphrase Willie Sutton, that's where the problems are.

Using Formulas, pp. 11-15

Here is another set of confidence builders. Though not always "cookie cutter" solutions, these pages are an introduction to some predictable problems that students will learn to solve consistently, given a little guidance through standard textbook examples. These are just too easy to pass up, in their quest for the "magic number" of 30 correct answers on the test.

Point on a Grid, pp. 16-17

Here is one more model question that appears on almost every practice test—one more step toward the "magic 30." Once again, students may have seen and used coordinate graphs before, but probably need to draw and explain them again as they follow the model on page 16.

Deep understanding here will help them answer not only the "cookie cutter" model on page 17, but to understand several other graph-based questions as well. Bottom line: this question is predictable and easy, so they can't afford to skip it.

Slope, p. 18-19

Using the coordinate plane is very important for problems with slope. The conceptual basis for calculating the slope of a line on a grid is much easier than the textbook formula for most students to understand, and is usually sufficient for most slope problems.

Counting spaces on the plane can be helpful for other problems, too, so be sure students really grasp the concept. Let them draw the plane in class and explain it to one another.

Show students how to draw a right triangle on the grid and count the lengths of the vertical and horizontal legs. The slope is simply the ratio of these—it's really easy once you show them how, and that way you don't need to grapple with the potentially confusing formula.

The downside to ignoring the formula is of course that students won't know how to handle a "point-slope" question involving the equation **y** = *m***x** + **b**. But before you spend a lot of time worrying about this omission, look through some practice GED tests to see whether you can actually find such a problem.

You will probably find that this level of algebra is tested lightly if at all. Particularly if you need to complete a batch of students before they leave or you must turn your attention to a new in-coming class, there's very little risk in telling students to simply guess on a question like this, if in fact they should actually encounter one.

Point in an Equation, p. 20

Another very predictable question involves solving for a variable in a linear equation. The chart on p. 20 illustrates two possible variations, which should be supplemented with review of text materials. Give students plenty of practice here, because they will most likely see this type of problem on the test.

Algebra Puzzles, p. 21-22

The test will include at least one word problem requiring the student to write and solve a linear equation with one variable. The "Typical Problems" on p. 22 are representative, but certainly not "cookie cutter" replicas of the potential range of such algebra puzzles. The chances of more than one are high, so it's important to insure that students are comfortable with using algebraic thinking to set up the necessary equation and then solve it to answer the question as asked.

The latter point is important. Suppose the student goes through a whole problem to correctly find, for example, that X = 6. However, if the test question is written so that the correct answer is actually "X + 3" then the student will be correct in filling in the bubble for "9" and wrong for "6." And that little trap is often there!

So be sure to spend enough group class time with examples from text resources, and some fun time letting students get comfortable with crazy examples including those they might make up themselves. Their feelings of confidence and mastery from these sessions will help them a lot with the approach they need for the overall test.

Calling a Halt to Algebra

By the time you finish Unit 4, students will not have completed all the text material. But they will be prepared to tackle a practice test and score at least 60-70%, so it's time to let them try.

A point worth noting is that the nature of the math curriculum has begun to change here. As algebra becomes more logical-sequential, conceptually focused graphics may become less helpful. But never mind, students have come far enough and need not press on.

But of course if you are really sure you have enough time without losing anybody, you might elect to go further. In any case, I usually do not teach the trigonometric ratios or quadratic equations, because these topics are represented lightly if at all in practice GED tests.

Sometimes, however, you may see a practice test question on solving and/or factoring `a quadratic equation. The Math Guide skips this topic, but if there's time after students seem ready for the test, you might show them how to use guess-and-check in this case.

Success on the GED Math Test

A key resource for test preparation is Test Review - Typical Questions. Summarized in the table below, these questions are well worth thorough study. Test takers can expect to encounter very familiar versions—or even close copies—of most of them. In other words over half of the "magic 30" questions needed to pass are quite predictable, and several are just plain easy.

Summary of Typical Questions –
Milestones Toward the "Magic 30"

Number of Problems	Unit	Page	Problem Title
1	1	13	Mean and Median
2		14	Perfect Squares
3		19	Scientific Notation
4	2	6	Cancel Ratios – Probability***
5		9 and 10	Proportions – with and without a calculator***
6		13-14-15	Percents – with and without a calculator***
7		17	Percent Change – increase and decrease
8	3	4 or 5	Complementary or Supplementary Angles (not both on the same test)
9		8	Parallel Lines with Angles – Find the Missing Angle
10		10	Special Triangles – Find the Missing Angle
11		13	Recognize the 3-4-5 Right Triangle (or variations—6-8-10, or 60-80-100)
12		16	Solve Similar Triangles (variation of proportion problems)
13	4	11	Perimeter
14		12 or 13	Subtract the Smaller Area - #1 and/or #2
15		14 or 15	Volume and/or Interest with Consistent Units
16		17	Find a Point on a Coordinate Grid
17		19	Slopes – Smart Guesses
18		20	Find a Point in an Equation***
19		22	Solve Algebra Puzzles***

*** The most common problems. Each test will almost certainly have at least two of each.

The Next Level – Word Problems

Most tests will include about 20 or more "Typical Questions." Beyond this easy start will be another 15-20 word problems that students find relatively straightforward, based on practice in class with text material. That leaves 15—or often fewer—for intelligent guessing strategies. Note that a confident, well focused student can skip the hard ones and still pass comfortably.

Final Lap in the Race – The Coach's Words for Test Takers

Don't just do questions one by one, from start to finish. Instead, have a plan. Answer the "sure things" and "probables" first. That means you should skip over the hard ones at first. Above all, don't squander precious time working in circles on a hard question, and forget about the last ones. There are always a few easy questions tucked in before the end, so be sure to get them!

After going through all questions the first time, come back for the ones you were not sure of. Use your strategies—guess and check, or estimate. Eliminate the obvious wrong answers, to raise your odds of a correct response with a smart guess among the fewer choices remaining. And remember there's no penalty for wrong answers, so be sure to answer them all!