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2023 GED CONFERENCE

Targeting Instruction Using Assessment Principles

New York, New York

July 18–20

GED TESTING SERVICE®

Greetings and Welcome!

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GED Testing Service

General Announcements

This presentation will be posted.

We will be stopping occasionally for questions, with a general Q&A afterward.

This is a math-centric presentation, but many of the principles apply generally to all content areas.

Questions before we begin?

Getting to Know You

Show of hands:

- Educators?
- New York?
- Comfortable teaching math?
- Attended a GED conference before?
- Attended a Tuesdays for Teachers session?

Today's Focus

GED is administered on a state-by-state basis, so there is some disparity and inconsistency in educators' knowledge about the test, and thus, how best to help their students.

This session will present information about the GED Mathematical Reasoning test that will help teachers to target their instruction in mathematics.

Importance of Mathematics

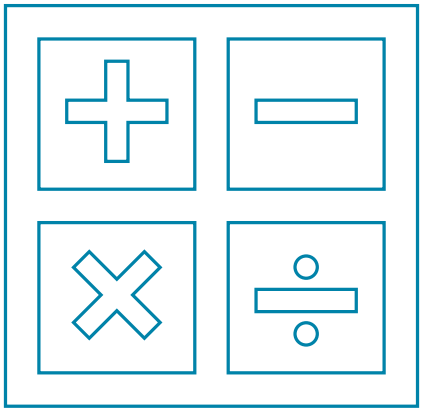
Over the past several years, GED Testing Service has tracked over 150,000 test takers who have passed the GED® test in 3 of the 4 subject areas.

Subject left to pass:

- 3% Science
- 5% Social Studies
- 12% RLA
- **80% Math**

What We Will Be Covering

- General background info
- Item/test development
- Skills assessed
- Test items
- Gaps in student skills and knowledge



- Resources for adult educators

Important Note

There are differences between the GED ***test*** and the instruction that takes place in the ***classroom***.

Just because a concept isn't included on the test, it does ***not*** mean it shouldn't be covered in the classroom.

Instruction does ***not*** need to strictly emulate the test.

What's the Best Instructional Strategy?

The one that works

for **YOUR** students

General Information and Test Development

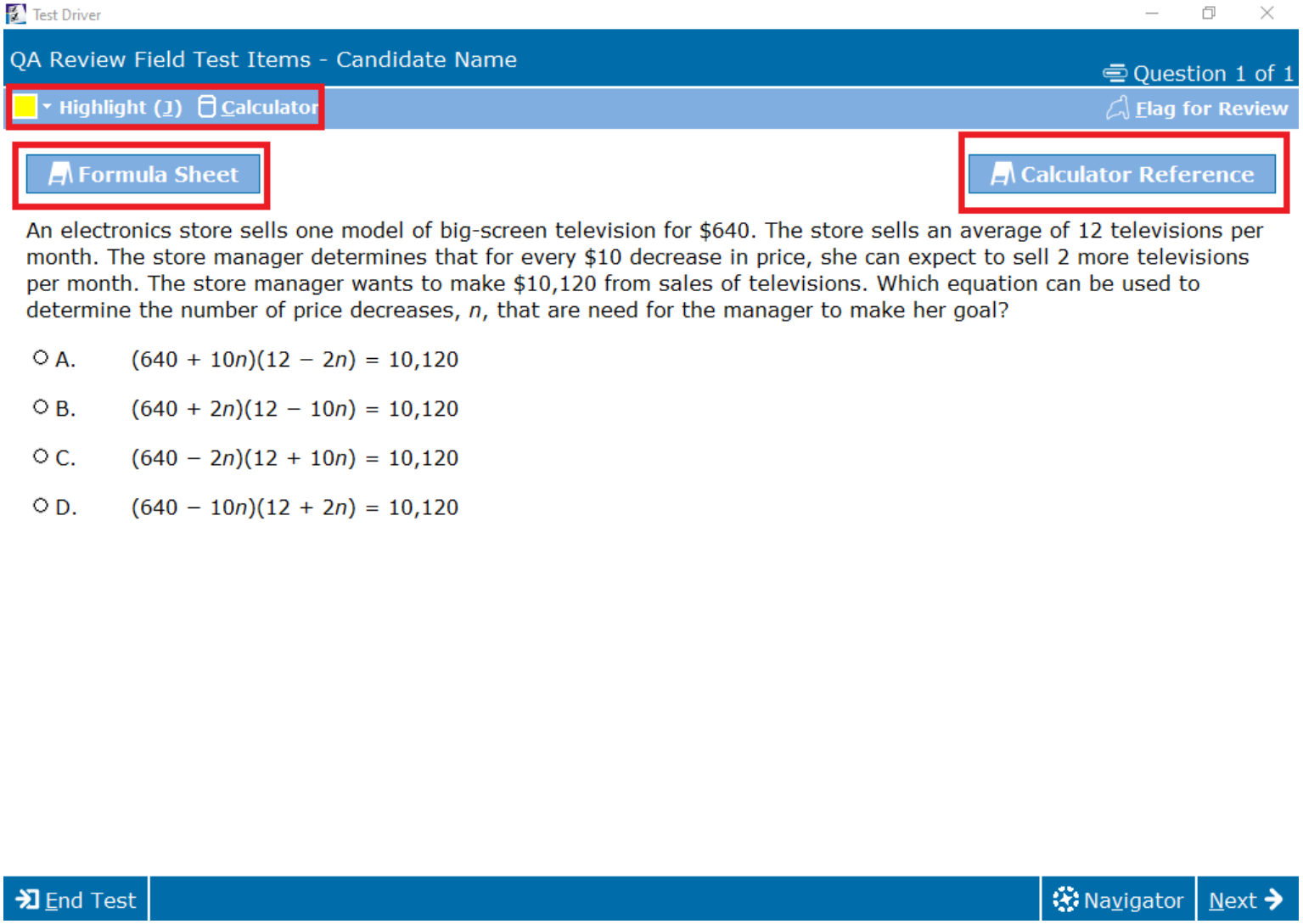
General Information

The GED test is given primarily at Pearson testing centers. It may be taken online at home via OnVUE.

The Mathematical Reasoning test includes a section of non-calculator items and a section of items where a calculator is available.

Test takers have a variety of testing tools to assist them during the math test.

Test-Taking Tools



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Formula Sheet (page 1)

Mathematics Formula Sheet

Area of a:

square	$A = s^2$
rectangle	$A = lw$
parallelogram	$A = bh$
triangle	$A = \frac{1}{2}bh$
trapezoid	$A = \frac{1}{2}h(b_1 + b_2)$
circle	$A = \pi r^2$

Perimeter of a:

square	$P = 4s$
rectangle	$P = 2l + 2w$
triangle	$P = s_1 + s_2 + s_3$
Circumference of a circle	$C = 2\pi r$ OR $C = \pi d$; $\pi \approx 3.14$

Surface area and volume of a:

rectangular prism	$SA = 2lw + 2lh + 2wh$	$V = lwh$
right prism	$SA = ph + 2B$	$V = Bh$
cylinder	$SA = 2\pi rh + 2\pi r^2$	$V = \pi r^2 h$
pyramid	$SA = \frac{1}{2}ps + B$	$V = \frac{1}{3}Bh$
cone	$SA = \pi rs + \pi r^2$	$V = \frac{1}{3}\pi r^2 h$
sphere	$SA = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$

Formula Sheet (page 2)

	(p = perimeter of base with area B; $\pi \approx 3.14$)
Data	
mean	mean is equal to the total of the values of a data set, divided by the number of elements in the data set
median	median is the middle value in an odd number of ordered values of a data set, or the mean of the two middle values in an even number of ordered values in a data set
Algebra	
slope of a line	$m = \frac{y_2 - y_1}{x_2 - x_1}$
slope-intercept form of the equation of a line	$y = mx + b$
point-slope form of the equation of a line	$y - y_1 = m(x - x_1)$
standard form of a quadratic equation	$y = ax^2 + bx + c$
quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Pythagorean theorem	$a^2 + b^2 = c^2$
simple interest	$I = Prt$ (I = interest, P = principal, r = rate, t = time)
distance formula	$d = rt$
total cost	total cost = (number of units) × (price per unit)

Item Development

The basis for item development is the Mathematical Reasoning indicators, which can be found in the ***Assessment Guide for Educators***.

Each indicator describes one or more mathematical skills.

Each test item is written to target *one* of the skills described by an indicator.

> **Q.1.a** Order fractions and decimals, including on a number line.

Item Development—Guiding Principles

Guiding principles for item development include:

- One item, one construct
- No extraneous information
- Distractors* reflect (most) common mistakes
- No ‘backwards’ assessment
- No testing of definitions or solution methods
- No ‘trick’ questions

*Incorrect answers

Field Test Analysis

New items are field tested, and afterward, are analyzed statistically. Each item is:

- Accepted,
- Rejected, or
- Revised and re-field tested

Accepted items are eligible for operational tests.

Rejected items are never heard from again.

This post-field test analysis also enables us to identify areas where test takers underperform.

Questions?

Assessment Targets and Indicators

Assessment Targets and Indicators

Assessment Target:

Q.1	**Apply number sense concepts, including ordering rational numbers, absolute value, multiples, factors, and exponents**

Assessment Targets and Indicators

Assessment Target with Indicators:

Q.1	**Apply number sense concepts, including ordering rational numbers, absolute value, multiples, factors, and exponents**
Q.1.a	Order fractions and decimals, including on a number line.
Q.1.b	Apply number properties involving multiples and factors, such as using the least common multiple, greatest common factor, or distributive property to rewrite numeric expressions.
Q.1.c	Apply rules of exponents in numerical expressions with rational exponents to write equivalent expressions with rational exponents.
Q.1.d	Identify absolute value or a rational number as its distance from 0 on the number line and determine the distance between two rational numbers on the number line, including using the absolute value of their difference.

Assessment Targets—Areas of Mathematics

Arithmetic:

- Number Sense
- Computation (including roots, percents, etc.)
- Geometric Measurement (2-D and 3-D)
- Data Displays
- Statistics/Probability

Assessment Targets—Areas of Mathematics

Algebraic:

- Algebraic Expressions
- Linear Equations
- Linear Inequalities
- Quadratic Equations
- Slope/Graphing
- Parallelism/Perpendicularity
- Functions

What's Not Assessed

If a concept is *not* described in the GED Mathematical Reasoning indicators, then it is *not* assessed on the GED Mathematical Reasoning test.

- Geometric proofs
- Trigonometry
- Exponential functions
- Two-variable inequalities
- Graphing quadratic equations
- Determining lines of best fit

Non-calculator Indicators

- **Q.1.a – Q.1.d** (number sense—ordering fractions and decimals, factors, multiples, exponents, distance on number lines)
- **Q.2.a – Q.2.d** (arithmetic computation—four basic operations, order of operations, squares, cubes, roots, undefined expressions)

- **NOT Q.2.e** (arithmetic word problems; calculator allowed)

Terminology

Basic rule: if a mathematical term is included in an indicator, test takers are expected to know it.

Caveat: definitions are *not* assessed on the GED Mathematical Reasoning test (e.g., “Which of these is the definition of a function?”).

Corollary: test takers are expected to *use* definitions in some items (e.g., “Which table represents a function?”).

Indicators—Multiple Skills

Q.1.a Order fractions and decimals, including on a number line.

What skills are included in this indicator?

- ordering fractions only (list)
- ordering decimals only (list)
- ordering fractions *and* decimals (list)
- ordering fractions only (number line*)
- ordering decimals only (number line*)
- ordering fractions *and* decimals (number line*)

*Requires knowing how to plot values on a number line

Can differentiate further: all positive; all negative; mix of both

Indicator Skills—Beyond the Literal

Q.1.a Order fractions and decimals, including on a number line.

We can also go beyond the *literal words* in the indicator to assess a skill.

Ordering is essentially a series of comparisons. We can therefore give *one* number (instead of several) and ask where it belongs in *comparison* to other numbers.

Indicator Skills—Further Examples

Q.1.a Order fractions and decimals, including on a number line.

Sample ‘comparison’ stems*:

- Between which pair of fractions should 4/7 be placed?
- Between which pair of decimals should 4/7 be placed?
- Between which pair of fractions should 0.38 be placed?

*the technical term for the actual question part of a test item

Implications for Educators

The skills assessed on the GED Mathematical Reasoning test are described in the indicators contained in the GED Assessment Targets.

The indicators do not describe *how* a skill is assessed, but if students know and understand a skill, their chances of success in solving test problems are high.

Many ‘introductory’ skills—i.e., converting a fraction to a decimal—are *not* assessed, but may require classroom instruction. This is where educator expertise is *critical*.

Types of Mathematical Reasoning Items

- Computational (arithmetic *and* algebraic)
  - Majority of items
- Translational (modeling, real-world problems)
- Analytical (interpret data displays, meaning of slope)
  - Extension of translation

NOTE: some items fall into multiple categories (i.e., real-world problems require both translation and computation)

Questions?

Mathematical Reasoning Items and Strategies

Computational Items

‘Computation’ does *not* just mean using the four basic operations to manipulate only numbers.

$$-0.62 + 3/8$$

‘Computation’ encompasses operations with arithmetic *and* algebraic terms, including the use of formulas, applying rules for exponents, working with data, statistics, and probability, etc.

- What is the area of a circle with a radius of 6 inches?
- Solve the equation: $-2x + 4 = -9x - 8$

Translational Items (Two types)

Modeling: creating or identifying a mathematical representation (equation, data display, algebraic graph, etc.) that models a given situation or other mathematical representation

> An oil storage tank has a capacity of 16,000 gallons and is filled using a pipe that carries 40 gallons of oil per minute. The tank currently holds 9,600 gallons of oil. Which equation can be used to determine the number of minutes, *m*, it will take to fill the tank to capacity?

Computation in context: solving a mathematical problem given a textual description (may include pictorial representations)

> An oil storage tank has a capacity of 16,000 gallons and is filled using a pipe that carries 40 gallons of oil per minute. The tank currently holds 9,600 gallons of oil. How many minutes will it take to fill the tank to capacity?

Close Reading

Close reading is an instructional strategy that is recommended for other content areas (RLA, Science, Social Studies).

Math is slightly different, as items typically require translation into ‘mathematical language’ (either explicitly written or internalized).

It is therefore necessary to adapt close reading strategies somewhat for mathematics.

Mathematical Language

No one ‘true’ definition

My definition: anything that describes mathematical quantities and/or relationships, usually going *beyond* simple text

Includes:

- Terminology (e.g., ‘polynomials’)
- Words with math-specific meanings (e.g., ‘product’)
- Symbols: single representations (*n*), or in combination

  ($y = 3x + 4$)
- Mathematical syntax rules (e.g., PEMDAS)

Adapting Close Reading for Mathematics

One suggested approach:

- Begin by reading the problem in order to *understand the task*—i.e., what are test takers being asked to do?

- Re-read to search out and identify information that:
  - describes quantities and their relationships
  - describes the required task in terms of those quantities

Mathematical Language—Sample Item

An oil storage tank has a capacity of 16,000 gallons and is filled using a pipe that carries 40 gallons of oil per minute. The tank currently holds 9,600 gallons of oil. How many minutes will it take to fill the tank to capacity?

Task: determine number of minutes

Information:

- total capacity
- current amount
- rate of fill

Mathematical language: how do I translate the text into mathematical quantities and relationships, and how do I use those relationships to complete the task?

Strategies for Educators

- Build recognition of required algorithms and fluency in performing computations.
- Use proficiency in numeric computation skills to build proficiency in algebraic computation, understanding the differences and relationship between the two.
- Build familiarity with, and proficiency in, interpreting text and translating to mathematical language (written or internalized), and then to applications of mathematical algorithms.

Questions?

Technology Enhanced Items

TEIs—General Information

Most items on the GED Mathematical Reasoning Test are multiple-choice (MC). However, there are some Technology-Enhanced Items (TEIs) on every test.

Types:

- Drag-and-drop
- Dropdown
- Fill-in-the-blank
- Hot spot

TEI's—Examples

QA Review Field Test Items - Candidate Name

Question 1 of 15 (1030122)

Highlight (J)

Flag for Review

Formula Sheet

Simplify.

$3 \times (8 - 4) + 6 \div 2 - 5$

Select...

Select...
-10
8
10
12
18

End Test

Test Driver

QA Review Field Test Items - Candidate Name

Question 9 of 15

Highlight (J) Calculator

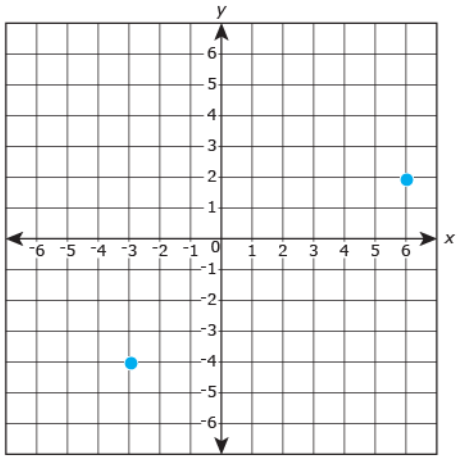
Flag for Review

Formula Sheet

Calculator Reference

Plot the points (-3, -4) and (6, 2) on the coordinate grid.

Click on the grid to plot the points.



End Test

Previous

Navigator

Next

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TEI's—Examples

Test Driver

QA Review Field Test Items - Candidate Name

Question 5 of 15

Highlight (J) Calculator

Flag for Review

Formula Sheet

Calculator Reference

Type your answer in the box. You may use numbers, a decimal point (.), and/or a negative sign (-) in your answer.

Solve for x.

$2x - 4 = -3x + 11$

$x =$ ☐

End Test

Test Driver

QA Review Field Test Items - Candidate Name

Question 15 of 15

Highlight (J) Calculator

Flag for Review

Formula Sheet

Calculator Reference

The table of values represents a function. Place an additional pair of values in the table so that it still represents a function.

Click on the numbers you want to select and drag them into the boxes.

x	y
−1	8
2	0
−2	−5
4	6
3	3

−2 −1 0 1 2 3

End Test | Previous | Navigator | Next

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2023 GED Conference Session

"Exploring Technology-Enhanced Items"

- Deep dive into TEIs
- All four content areas
- Presentation can be downloaded after conference

Gaps in Skills and Knowledge

Field Test Analysis (Slight Return)

New items are field tested, and afterward, are analyzed statistically. Each item is:

- Accepted,
- Rejected, or
- Revised and re-field tested

Accepted items are eligible for operational tests.

Rejected items are never heard from again.

This post-field test analysis also enables us to identify areas where test takers underperform.

Underperforming vs Difficulty

Some mathematical concepts, such as permutations and quadratic equations, are inherently more difficult. We *expect* test takers to perform less well on items assessing these concepts.

However, test takers tend to underperform on other concepts that are not as inherently difficult.

Areas of Skill and Knowledge Gaps

Mathematical Concepts:

- exponents/roots
- three-dimensional shapes
- (compound) probability
- algebraic computation
- inequalities
- slope/graphing

Mathematical Item Types:

- non-calculator items
- multiple responses

NOTE: There *is* overlap among many of these gaps.

Underperformance in Mathematical Concepts—Educator Strategies

Be aware of the problem

Identify where ‘problem’ concepts are related to other concepts (e.g., exponents → polynomials)

Leverage existing knowledge (e.g., equations → inequalities)

Underperformance in Mathematical Concepts—Educator Strategies

Practice using formulas (geometric measurement, slope)

Practice translating representations (equation → graph; words → symbols)

Build recognition and fluency

Underperformance in Mathematical Item Types—Educator Strategies

For concepts assessed by non-calculator indicators, practice with a calculator to increase comfort level, then move to practicing without a calculator

Make sure students understand that TE items can have more than one (correct) answer

Questions?

Session Survey

Your feedback is important. Please scan the QR code below to rate this session.

Thank you!

Communicate with GED Testing Service®
help@ged.com

Michael Bell – michael.bell@ged.com

Resources for Educators

Underperformance in Mathematical Reasoning

Tuesdays for Teachers (also other content areas)

“GED Knowledge & Skill Gaps—Mathematical Reasoning (Part One/Two)”

https://ged.com/educators_admins/teaching/professional_development/webinars

Some presentations can be found on YouTube

https://youtube.com/playlist?list=PLJ4lvP90ndyXDxVHLZ4hxacF0wlF-C2mc

2023 Conference: Higher Level Math Skills
(Ron Cruz Allen)

My Thanks….

….to Debi Faucette for providing many of these!

GED.com Links

- Computer Tutorial
- Calculator Tutorial
- Calculator Reference Sheet
- Formula Sheet
- Math Study Guide
- Calculator-Prohibited Indicators

https://ged.com/educators_admins/teaching/classroom_materials/

https://ged.com/educators_admins/teaching/teaching_resources

Assessment Guide for Educators:

https://ged.com/wp-content/uploads/assessment_guide_for_educators_all_subjects.pdf

GED.com Links

“Tips for Non-Calculator Math”

English:

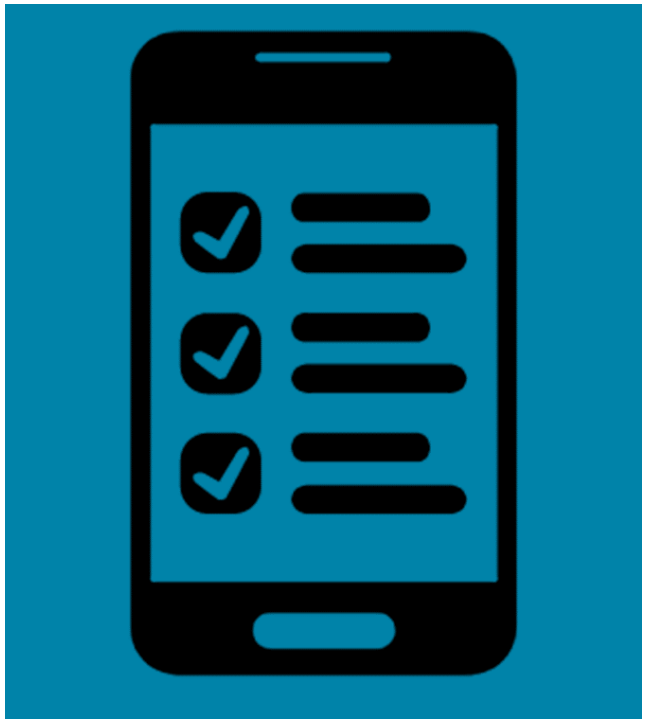
https://ged.com/wp-content/uploads/Tips-for-Non-calculator-math_EN.pdf

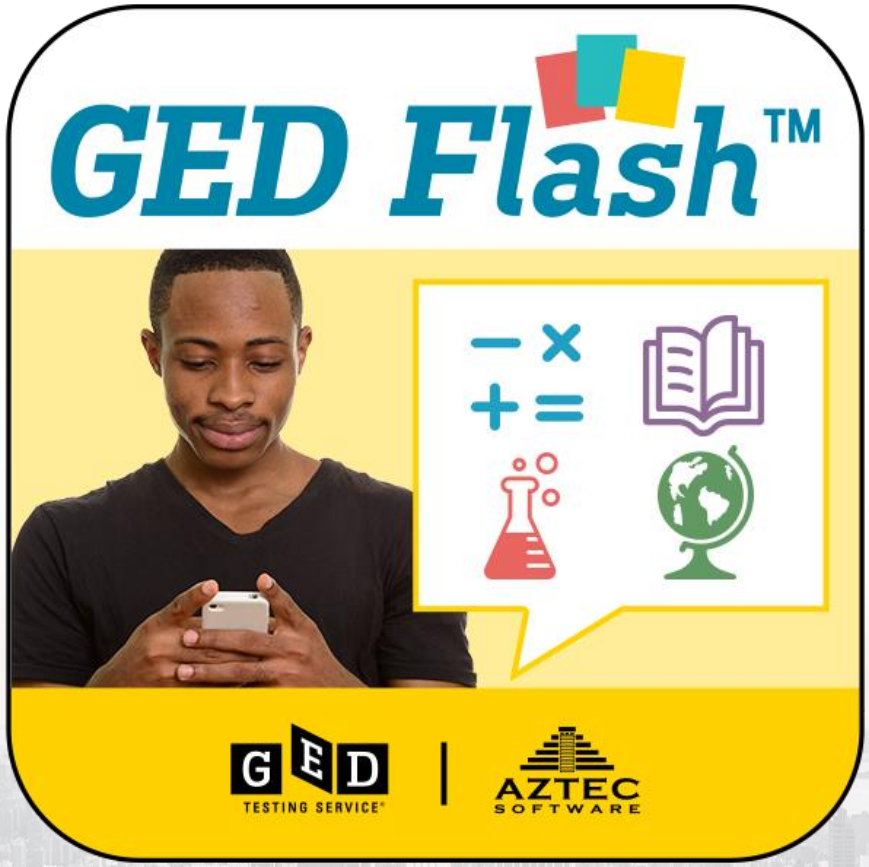
Spanish:

https://ged.com/wp-content/uploads/Tips-for-Non-calculator-math_ES.pdf

Other Instructional Resources

- Florida Literacy Math App
- Effortless Math
- IXL Learning
- GED Math Crash Course
- Math is Fun




GED Flash™
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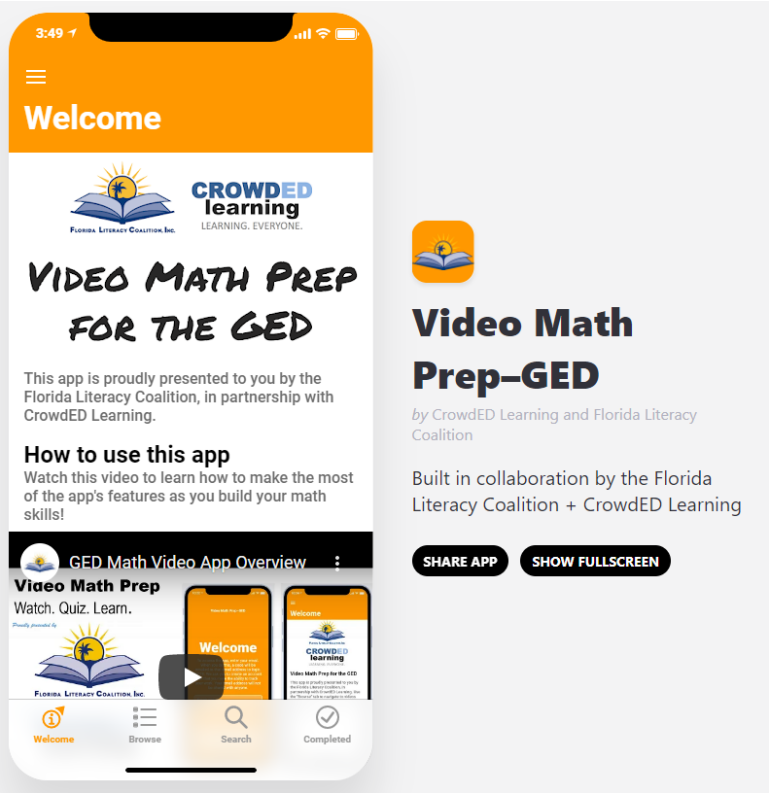
TESTING SERVICE
AZTEC
SOFTWARE

Florida Literacy Math App

Scan with camera to access app

https://floridaliteracy.org/mathvideos.html



FL Literacy Math App Tracking Sheet

https://gedmath.glideapp.io/

Florida Literacy Coalition, Inc.

FLC Math Tracking Sheet

This tracking sheet may help you as you explore all the video mini-lessons for the GED Math test. You can download/print this form and check the boxes next to the videos that you've watched.

It may be best if you watch the videos in order as they have been arranged with increasing difficulty and the skills will build as you go along.

As you explore the website you will notice that the videos are organized into 6 sections:

Foundations
Basic Math
Basic Algebra
Graphs and Functions
Geometry
Calculator/Reference Sheet

These sections are shown below. When you open each section you will find the videos organized into subsections shown here in blue.

Limited on time? If you're looking for the most important videos you may want to focus on the Basic Algebra and Graphs and Functions sections.

FOUNDATIONS

Place Value and Rounding

- ☐ Finding a number's place value
- ☐ Rounding whole numbers example 1
- ☐ Rounding whole numbers example 2
- ☐ Rounding to estimate difference
- ☐ Rounding decimals to the nearest tenth

Fraction Basics

- ☐ Numerator and denominator of a fraction
- ☐ Identifying fraction parts
- ☐ Proper and improper fractions
- ☐ Converting mixed numbers to improper fractions
- ☐ Mixed numbers: changing from an improper fraction
- ☐ Fractions in lowest terms
- ☐ Reciprocal of a mixed number
- ☐ Finding Common denominators

Decimal Basics

- ☐ Decimal place value
- ☐ Decimal to simplified fraction
- ☐ Fraction to decimal
- ☐ Converting percent to decimal and fraction

Identification

- ☐ Recognizing prime and composite numbers
- ☐ Identifying Rational Numbers
- ☐ Identifying parallel and perpendicular lines

Properties and Laws

- ☐ Properties of whole numbers
- ☐ Commutative property for addition
- ☐ Commutative law of addition
- ☐ Associative law of addition
- ☐ Associative property for multiplication
- ☐ Associative law of multiplication
- ☐ Commutative law of multiplication
- ☐ Ways to represent multiplication
- ☐ Identity Property
- ☐ Distributive Property 3
- ☐ Distributive law of multiplication
- ☐ Expressing division in multiple ways

BASIC MATH

Comparing Numbers

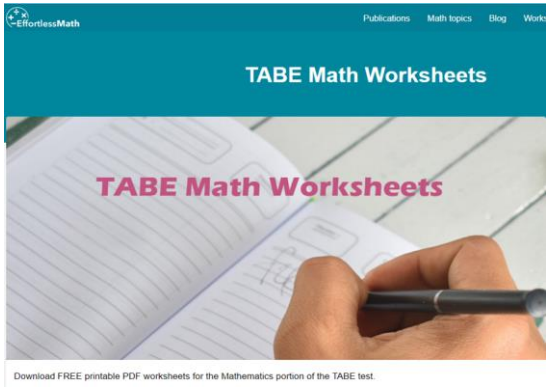
- ☐ Comparing whole numbers, place value
- ☐ Comparing decimals
- ☐ Comparing fractions
- ☐ Comparing fractions with different

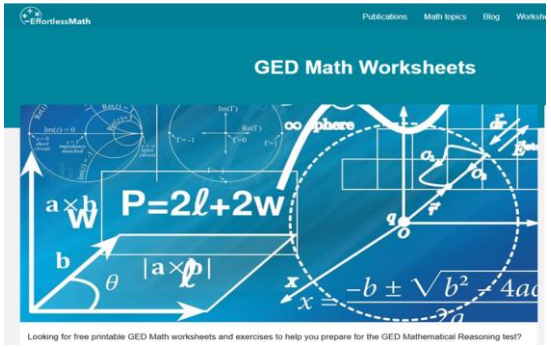
Effortless Math

This site contains free pdf worksheets for TABE and GED skills practice.

All worksheets contain answer keys so that students can self-check their work.

Effortless Math: We Help Students Learn to LOVE Mathematics





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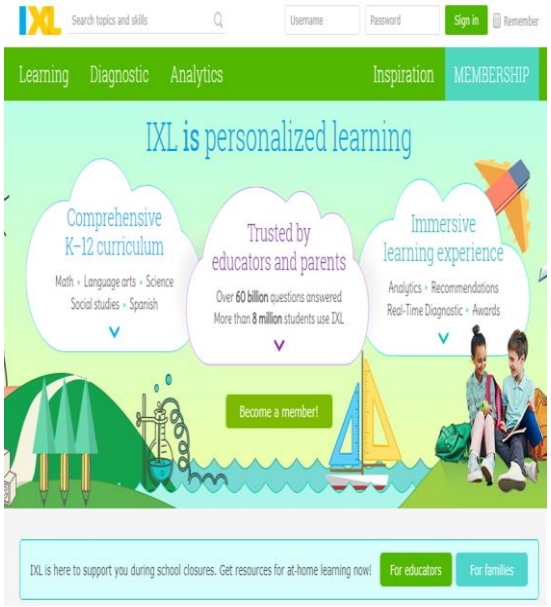
IXL Learning

Contains content for math (K-12), RLA (K-12), science (K-8), and social studies (K-8)

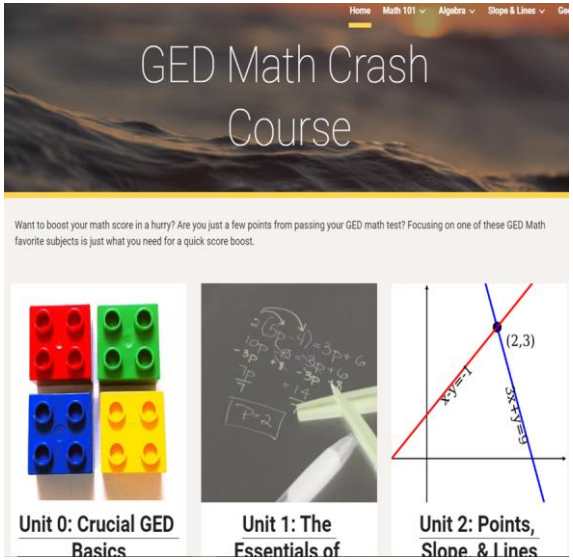
[IXL | Math, Language Arts, Science, Social Studies, and Spanish]



GED Math Crash Course

This site contains videos, notes, and practice problems for GED(R) prep students

Resources can be incorporated into a Google Classroom



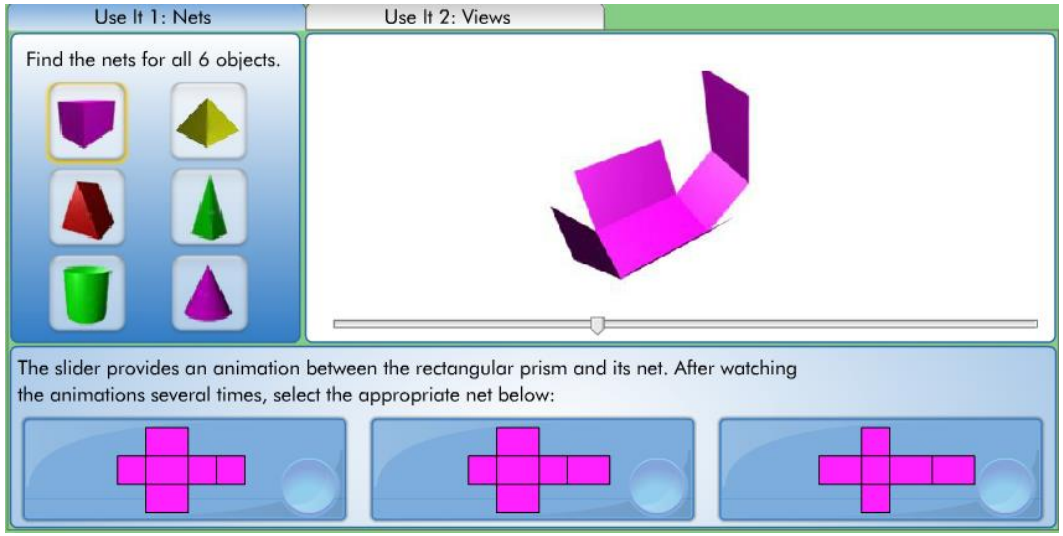
[Light & Salt Learning - 0: Crucial GED Basics (gedmathcrashcourse.com)]

Math is Fun

https://www.mathsisfun.com/geometry/

Using Nets to Find Surface Areas

Math Interactives



http://www.learnalberta.ca/content/mejhm/index.html?l=0&ID1=AB.MATH.JR.SHAP&ID2=AB.MATH.JR.SHAP.SURF&lesson=html/object_interactives/surfaceArea/use_it.html

Thank you!

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