GED® Knowledge & Skill Gaps
Mathematical Reasoning

Session 2

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Greetings and welcome!

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General Announcements

This presentation will be posted

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

There's a lot of examples in this presentation; answers are included at the end

Questions before we begin?

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Today's Focus

Some students have gaps in the knowledge and skills that they need to succeed on the GED® Mathematical Reasoning test.

Students may need more instruction and practice in these areas during test preparation.

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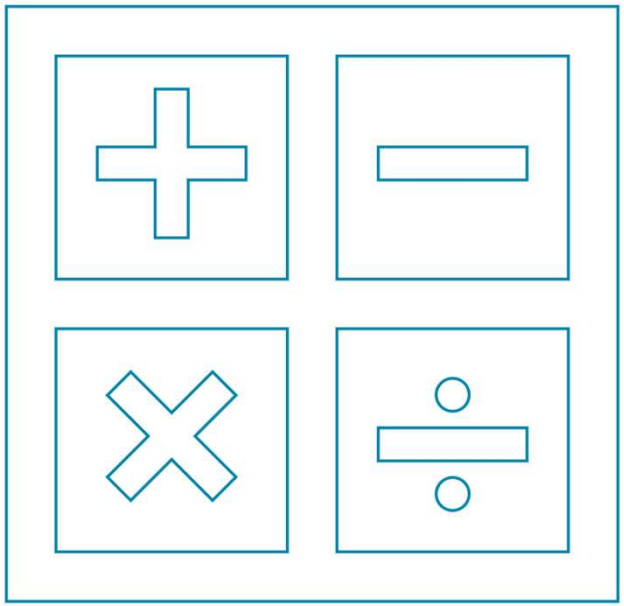
What we will be covering

- How skill/knowledge gaps are identified
- Specific skills and GED® indicators where students and test takers have the *most* difficulty
- Possible reasons *why* students and test takers are having difficulty
- What educators can do to address these gaps



What we won't be covering

Test takers tend to underperform on some items simply because the concepts they assess are more difficult.

In other words, we *expect* the items to be difficult because the concepts are difficult (e.g., permutations and quadratic equations).

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

{*ABC, ACB, BAC, BCA, CAB, CBA*}

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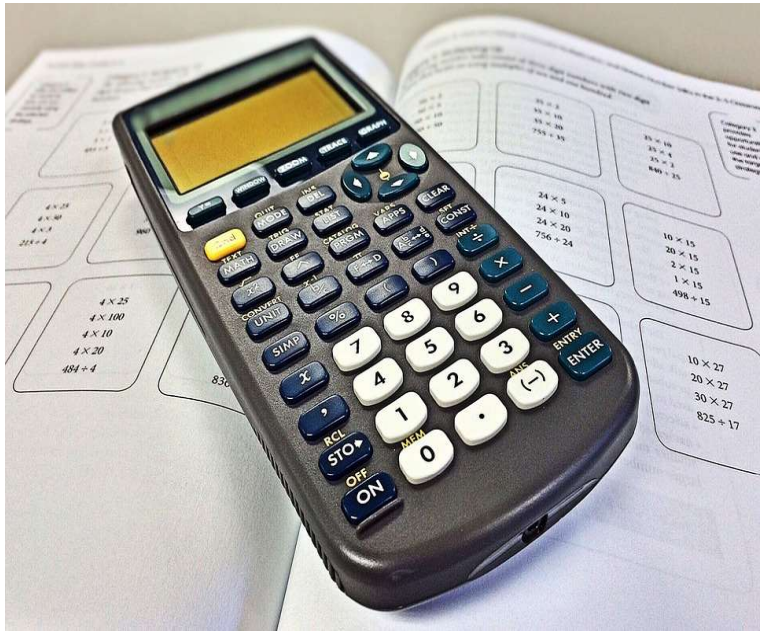
Data Summary: Passed 3 of 4 Subjects

Over the past two years, GED Testing Service has tracked 77,000 test takers who have passed the GED® test in 3 of the 4 subject areas.

Subject left to pass:

- 2% Science
- 5% Social Studies
- 11% RLA
- **82% Math**



Identifying Skill and Knowledge Gaps

Item development

The basis for item development is the GED® assessment targets (indicators), which can be found on GED.com in the ***Assessment Guide for Educators***.

Each indicator describes one or more 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

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Assessment Targets and Indicators

GED® *Assessment Guide for Educators*

- https://ged.com/wp-content/uploads/assessment_guide_for_educators_all_subjects.pdf
- **Math Guide**: pages 17 – 72
- **Math Assessment Targets** (Indicators): pages 23 – 26

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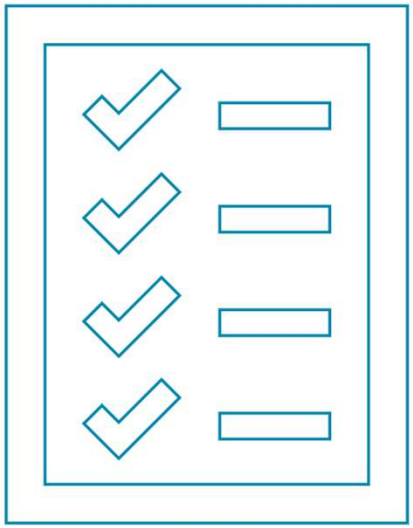
Analysis of test items

Test items are developed and field-tested (embedded in operational tests).

Items are analyzed statistically, *and* for content issues.

Knowledge and skill gaps are identified through this statistical analysis.



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Areas of Knowledge and Skill Gaps

Session 1:

- non-calculator items
- exponents/roots
- three-dimensional shapes
- (compound) probability

Session 2:

- algebraic computation
- inequalities
- slope/graphing
- multiple answers

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

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Questions?
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Gap 5: Algebraic Computation

Gap 5: Algebraic computation

Indicators:

- A.1.a (factoring, computing w/linear expressions)
- A.1.d (computing w/polynomials)
- A.1.f (factoring polynomials)

Skills:

- add/subtract
- multiply/divide
- multiple operations
- factor (Greatest Common Factor, trinomials)

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Gap 5: Algebraic computation (types)

Linear expressions:

- one or two variables
- not multiplied together
- no exponents
- Example: $4x + 8y - 8$

Polynomials:

- no limit on number of variables
- may have exponents
- variables may be multiplied together
- Examples: $4x + 8y^3$
  $8xy - 8$

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Gap 5: Algebraic computation (examples)

Linear expressions

Subtract: $(2x - 3) - (6x - 8)$
(A.1.a)

Multiply: $(5x - 3y)(2x + y)$
(A.1.a)

Simplify: $2(3x - y) - (x + 4y)$
(A.1.a)

Factor: $6x + 10y$
(A.1.a)

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Gap 5: Algebraic computation (examples)

Polynomials

Subtract: $(3x^2 - 4y^2) - (4x^2 - 9y)$
(A.1.d)

Multiply: $-5xy(xy^2 - 6x^2y^2)$
(A.1.d)

Factor: $6x^3y^2 + 10xy^4$
(A.1.f)

Factor: $3x^2 - 8x - 35$
(A.1.f)

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Gap 5: Algebraic computation (strategies)

Practice with simple one-operation problems, then with more complex problems.

Understand the different mechanics in computing with integers vs. computing with exponents.

Understand the relationship between multiplying and factoring expressions (distributive property and FOIL).

Make connections to concepts of exponents and how those relate to algebraic computation.

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Gap 6: Inequalities

Gap 6: Inequalities

Test takers do well on items assessing equations (A.2), but less so on items assessing inequalities (A.3.a – A.3.d), even though nearly all the concepts are identical:

- solving (equations and inequalities) algebraically
- using algebraic reasoning to solve contextual problems
- writing equations and inequalities

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Gap 6: Inequalities

Differences between equations and inequalities:

- understanding the meaning of inequality (not *specifically* assessed, but used in writing inequalities and in algebraic reasoning)
- knowing/understanding the vocabulary of inequality (less than, more than, etc.)
- knowing when to switch direction of the inequality symbol when solving inequalities
- identifying the graph of a one-variable inequality

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Gap 6: Inequalities (examples)

Solve the inequality for x: $-4x + 12 < -8$

(A.3.a)

Which number line represents the solution to the inequality $-4x + 14 < 2x - 10$?

(A.3.b)

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Gap 6: Inequalities (examples)

Sarah has a budget of $500 to buy team jerseys. The vendor charges a fee of $100 and $30 per jersey. How many jerseys can Sarah buy?

(A.3.c)

Sarah has a budget of $500 to buy team jerseys. The vendor charges a fee of $100 and $30 per jersey. Which inequality can be used to determine how many jerseys, x, Sarah can buy?

(A.3.d)

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Gap 6: Inequalities (strategies)

Know and understand the meaning and vocabulary of inequality.

Understand how the meaning and vocabulary of inequality relate to symbolic and contextual representations.

Make clear the connections, similarities, and differences between solving equations and solving inequalities.

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Gap 7: Slope/ Graphing

Gap 7: Slope/graphing

Indicators:

- A.5.b (calculate slope from a table, graph, or equation)
- A.5.d (graph a two-variable equation)

Related indicators:

- A.5.b (interpret unit rate as slope)
- A.6.a – A.6.c* (writing equations from points and/or slope; working with parallel and perpendicular slopes)

*difficult indicators, but still an "area of knowledge and skill gap"

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Gap 7: Slope/graphing (examples)

The table displays the coordinates of several points on a line. What is the slope of the line represented by the table?

x	*y*
1	-9
3	-6
5	-3

(A.5.b)

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Gap 7: Slope/graphing (examples)

What is the slope of the equation $3x - 9y = 2$?

(A.5.b)

Which graph represents the equation $8x - 4y = 24$?

(A.5.d)

Which graph represents the equation $y = 3x - 4$?

(A.5.d)

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Gap 7: Slope/graphing (strategies)

Practice using the slope formula (tables and graphs).

Understand how slope is represented in an equation and how it is manifested on a graph (including meaning on data and algebraic graphs).

Practice manipulating equations from standard form to slope-intercept form (and vice versa).

Make sure students are fluent in computing with integers.

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Questions?

Gap 8: Multiple Answers (TE Items)

Gap 8: Multiple answers—TE items

Most items on the GED® Mathematical Reasoning test are multiple choice (MC) and have only one correct answer. But the test also contains technology-enhanced (TE) items, including fill-in-the-blank, drag-and-drop, hot spot, and dropdown formats.

Most TE items have only one correct answer. However, a TE item *may* have more than one correct answer. Some test forms will have no items of this type; others will have one, or in rare cases, two.

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Gap 8: Multiple answers—TE items (item characteristics)

Two types:

- More than one correct answer is possible, but test takers are asked to select *only* one.
- Test takers are asked to select *all* correct answers.

Items with multiple answers may assess any indicator that supports the format—however, not all indicators are appropriate to this type of TE item.

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Gap 8: Multiple answers—TE items (examples)

The table of values does not represent a function.

Click on a pair of values that could be removed from the table so that it represents a function.

x	*y*
1	5
0	-2
4	0
1	-8
-3	-3

(A.7.b)

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Gap 8: Multiple answers—TE items (examples)

The table of values does not represent a function.

Click on a pair of values that could be removed from the table so that it represents a function.

x	*y*
1	5
0	-2
4	0
1	-8
-3	-3

OR

x	*y*
1	5
0	-2
4	0
1	-8
-3	-3

(A.7.b)

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Gap 8: Multiple answers—TE items (examples)

The pairs of numbers represent the slopes of lines on a coordinate grid. Click on the pair or pairs that represent perpendicular slopes.

0 and 1	1/3 and -3
-1 and 1	-1/2 and -2

(A.6.c)

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Gap 8: Multiple answers—TE items (examples)

The pairs of numbers represent the slopes of lines on a coordinate grid. Click on the pair or pairs that represent perpendicular slopes.

0 and 1	1/3 and -3
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(A.6.c)

CORRECT

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Gap 8: Multiple answers—TE items (examples)

The pairs of numbers represent the slopes of lines on a coordinate grid. Click on the pair or pairs that represent perpendicular slopes.

0 and 1	1/3 and -3
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(A.6.c)

INCORRECT

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Gap 8: Multiple answers—TE items (strategies)

Understand that a math problem or test item doesn't *always* have *only one* correct answer.

Analyze each answer choice/possible answer.

Focus on the mathematics of the item, and what task the item involves.

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Questions?


Q&A

Thank you!

Communicate with GED Testing Service®
help@ged.com

Michael Bell – michael.bell@ged.com

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Answers to Examples

Gap 5: Algebraic computation (examples)

Subtract: $(2x - 3) - (6x - 8)$

(A.1.a)

$-4x + 5$

Multiply: $(5x - 3y)(2x + y)$

(A.1.a)

$10x^2 - xy - 3y^2$

Simplify: $2(3x - y) - (x + 4y)$

(A.1.a)

$5x - 6y$

Factor: $6x + 10y$

(A.1.a)

$2(3x + 5y)$

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Gap 5: Algebraic computation (examples)

Subtract: $(3x^2 - 4y^2) - (4x^2 - 9y)$
(A.1.d)

$-x^2 - 4y^2 + 9y$

Multiply: $-5xy(xy^2 - 6x^2y^2)$
(A.1.d)

$-5x^2y^3 + 30x^3y^3)$

Factor: $6x^3y^2 + 10xy^4$
(A.1.f)

$2xy^2(3x^2 + 5y^2)$

Factor: $3x^2 - 8x - 35$
(A.1.f)

$(3x + 7)(x - 5)$

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Solve the inequality for x: $-4x + 12 < -8$

(A.3.a)

$x > 5$

Which number line represents the solution to the inequality $-4x + 14 < 2x - 10$?

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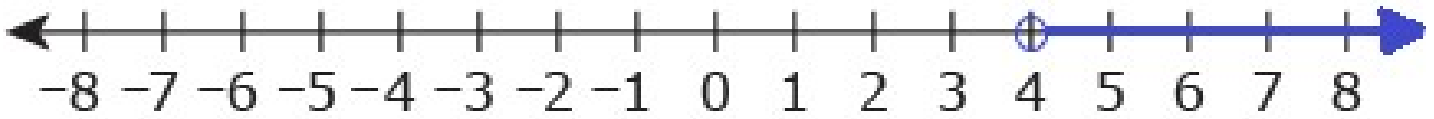

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13

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(A.3.d)

$500 > 100 + 30x$

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Gap 7: Slope/graphing (examples)

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(A.5.b)

$\frac{3}{2}$

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What is the slope of the equation $3x - 9y = 2$?

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$$\frac{1}{3}$$

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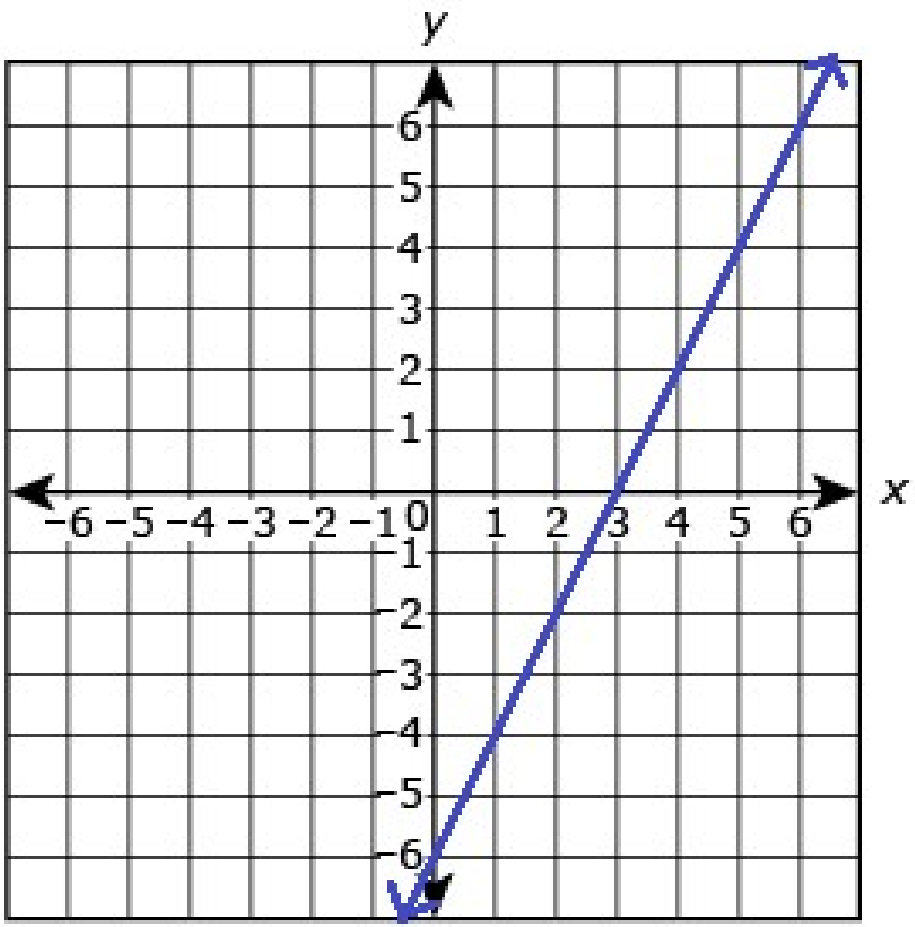

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Gap 7: Slope/graphing (examples)

Which graph represents the equation $y = 3x - 4$?

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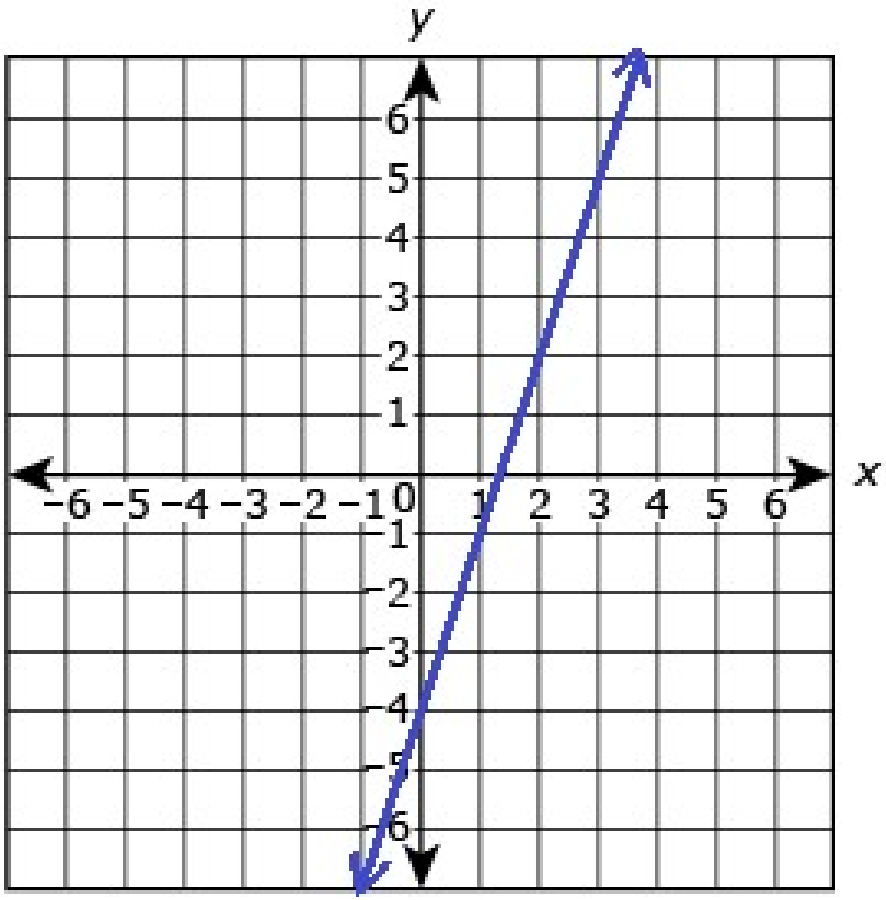

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CORRECT

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INCORRECT

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