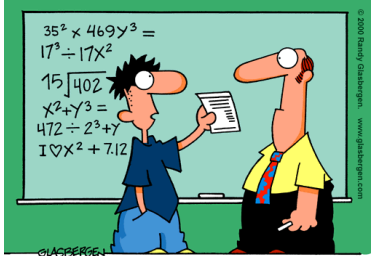


Math “Grab Bag”

Tips and Resources for the GED® Math Classroom

Tuesdays for Teachers
June 27, 2017

It Really Isn't Genetic



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Math Involves...

- Memory
- Language
- Sequencing
- Spatial ordering
- Critical thinking
- Good problem-solving strategies
- Number sense
- Reasoning
- Making connections

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In the Classroom, We Often...

- Make assumptions about the presence or absence of foundational skills
- Introduce new concepts too rapidly
- Insufficiently support explanations and activities
- Provide insufficient practice
- Focus on facts versus concepts
- Limit access to manipulatives
- Limit connection of skills to real-life situations

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Our Students Need...

A Balanced Mathematics Program

"WHERE" THE MATHEMATICS WORKS

Problem Solving

Communication & Procedures Skills

"HOW" THE MATHEMATICS WORKS

DOING MATHEMATICS

Conceptual Understanding

"WHAT" THE MATHEMATICS WORKS

Practice makes PERFECT

Fluency

CONSISTENCY IS

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What Are the Foundational (“Must-Haves”) in Mathematical Reasoning?

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Building Number Sense

Use a Number Line

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Students with Number Sense...

- Think and reason flexibly with numbers
- Use numbers to solve problems
- Spot unreasonable answers
- Understand how to put numbers together and take them apart
- Understand number relationships

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But they are just numbers...

Type of Number	Quick Description
Counting Numbers	{1, 2, 3, ...}
Whole Numbers	{0, 1, 2, 3, ...}
Integers	{..., -3, -2, -1, 0, 1, 2, 3, ...}
Rational Numbers	p/q – p and q are integers, q is not zero
Irrational Numbers	π – 3.14159265358979323856... cannot be written as a simple fraction $\sqrt{3}, \sqrt{99}$
Real Numbers	Rational and Irrational

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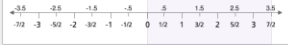
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Defining Numbers

Choose a Number Set:
☒ Counting ☒ Integers ☒ Rationals ☐ Real

Zoom



Rational numbers are numbers that can be written as the ratio of two integers.

Example: $5/2$ (2.5), $-1/4$ (-.25), etc.

Open Instructions

<https://unctv.pbslearningmedia.org/resource/mgbh.math.ns.numline/building-a-number-line/#.WU1B-IWcHnM>

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The Number Line

- Provides a model for basic operations for all rational numbers
- Is a spatial object
- Allows students to situate themselves spatially in mathematics
- Permits students to conceptualize mathematics

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Just a Sample

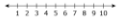
Common Core

Common Core

Julia wants to spend \$100 or less ordering shirts from an online company. The company charges a \$5 shipping fee for any order. The inequality $5 + 15n \leq 100$ represents the number of shirts, n , Julia can order from the online company. Graph all possible numbers of shirts that Julia can buy.

Click on the number line to plot the point(s).

(NOTE: To remove a point, place the arrow over the point and click the left mouse button.)

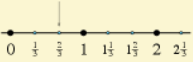


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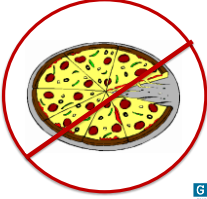
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Fractions

Students need to learn to *locate* a fraction on a number line.




Use the number line so students understand that fractions are numbers and not just part of a pizza.



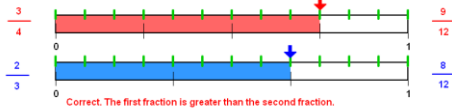
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Can Students Use a Number Line?

The fractions $\frac{3}{4}$ and $\frac{2}{3}$ are pictured with number lines below:




Correct. The first fraction is greater than the second fraction.

$\frac{3}{4} > \frac{2}{3}$

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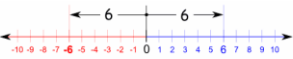
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Absolute Value

Absolute Value means how far a number is from 0.

- Remove any negative sign and think of all numbers as positive
- Recognize symbol used to represent absolute value

$|-5| = 5$
 $|7| = 7$




"6" is 6 away from zero, and "-6" is **also** 6 away from zero.

So the absolute value of 6 is 6, and the absolute value of -6 is also 6

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Inequalities

An inequality is a math statement that defines a range of values.

Jeffrey runs at least two miles every day.

On November 28, the temperature in North Pole, Alaska is expected to be greater than -4° and less than 9°

$T < 6$

<https://www.gedtestingervice.com/educators/exploring-the-2014-ged-test-webinar-archive>

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Operations with Positive and Negative Integers

$6 + (-2) = 4$

$(-8) - (-3) = -5$

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Data Displays

Dot plot and histogram showing data distribution.

Box plot showing the distribution of Length of Nails.

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Essential Skills for Box Plots

Arrange data in order
Find **median** for all data
Find median for lower quartile
Find median for upper quartile
Find the **range** of the extreme values

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Number Lines and the NFL

<https://unctv.pbslearningmedia.org/resource/mket-math-ns-ratnumbfootball/#.WU0tDGgrKUk>

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Resources

Helping with Math - Number Line Generator
<http://www.helpingwithmath.com/printables/others/NumberLineGenerator01.htm>

Math Warehouse – Number Line Graph Maker
<http://www.mathwarehouse.com/number-lines/number-line-maker.php>

Math is Fun – Number Lines (Inequalities, Operations, etc.)
<http://www.mathsisfun.com/number-line.html>

Annenberg Learner – Building the Number Line
http://www.learner.org/courses/learningmath/number/session1/part_c/index.html

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Order Matters

The Importance of Understanding the Order of Operations

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Why Bother?

Here is your problem: $4 + 2 \times 3 =$

Is the answer 18 or 10?

- Avoid confusion in how problems are solved
- Set up rules of precedence or rank of operations
- Is critical to simplifying and solving different algebra problems

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Answer the Why

Order of operations

Introduction of exponents

Order of operations with parentheses

Order of operations with division

Order of operations with multiplication

Order of operations with addition and subtraction

7 + 3 \times 5

$7 + 3 \times 5 =$

10×5

50

$7 + 3 \times 5$

$7 + 15$

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because two people interpreted it a different way or another

YouTube

<https://www.khanacademy.org/math/pre-algebra/pre-algebra-arith-prop/pre-algebra-order-of-operations/v/introduction-to-order-of-operations>

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Essential Understanding

- 1. Parentheses and Brackets**
from the inside out
- 2. Exponents**
of numbers or parentheses
- 3. Multiplication and Division**
in the order they appear.
- 4. Addition and Subtraction**
in the order they appear.

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Get Rid of Misconceptions about Order of Operations

Misconception 1 - All multiplication should happen before division.

Incorrect	Correct
$12 \div 3 \times 4$	$12 \div 3 \times 4$
$12 \div 12$	4×4
1	16

Misconception 2 - All addition comes before subtraction.


Incorrect	Correct
$4 + 10 - 5 + 8$	$4 + 10 - 5 + 8$
$14 - 13$	$14 - 5 = 9$
1	9 + 8
	17

Parenthesis
Exponents
Multiply / **D**ivide
Add + **S**ubtract

Remember: M/D have the same precedence. Evaluate as they appear from left to right. Same with A/S.

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Resources

Wyzant Resources – Lessons and Practice Problems


https://www.wyzant.com/resources/lessons/math/algebra/order_of_operations

Math is Fun – Sample problems

<http://www.mathsisfun.com/operation-order-pemdas.html>

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Percent Change

From Shopping to Identifying Trends

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FoxTrot

by Bill Amend

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Do your students know the vocabulary?

Ratio – a comparison between two different values

Percent of change – ratio of the amount of change to the original amount

Percent increase – how much original amount increases

Percent decrease – how much original amount decreases

percent change = $\frac{\text{amount of change}}{\text{original amount}}$


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What do students need to know?

- An understanding of percent
- Part and whole
- Increase
- Decrease
- Original number
- Difference between percentage of and percent of change

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Do they understand increase vs. decrease?

- If you buy a brand new car for \$15,999, drive it off the lot, and get into an accident, the car will be worth \$11,499. Does the car's value increase or decrease?
- The temperature at sunrise is 71 degrees Fahrenheit . At noon, the temperature is 84 degrees Fahrenheit. At sunset, it is 69 degrees Fahrenheit. Has the temperature had an increase or decrease from sunrise to sunset?
- A scuba diver jumps off a dive boat into the water and descends 30 feet below sea level. He rises 10 feet to swim above a coral head, then swims back down 8 feet to the top of a submerged wreck. Has his depth shown an increase or decrease from his initial descent?


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Percent of Increase

- Tips
- Sales Tax
- Increase in Population




To calculate percent of increase

$$\text{percent change} = \frac{\text{amount of increase}}{\text{original amount}}$$

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Calculating a Percent of Increase

In 1981, there were 25 endangered and threatened species of reptiles in the U. S. In 2015, there were 45 species. By what percent did the number of these reptile species change from 1981 to 2016?

80%

=


20

25

Is the amount of change an increase or a decrease? (increase)
What is the amount of change from 1981 to 2015? (45 - 25 = 20)
What is the original amount? (25)
Divide the amount of change by the original amount (20/25 = .8)
Write the quotient as a percent (.8 = 80% increase)

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Calculating a Percent of Increase

198,000 people attended a concert in 2007. The number of attendees increase by 12% from 2007 to 2017. How many attendees attended in 2017?

Attendees in 2017

=

Attendees in 2007


+

Amount of increase

= 198,000 + 12% x 198,000 (Substitute)
= 198,000 + 0.2 x 198,000 (write percent as a decimal)
= 221,760 (Evaluate)


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Percent of Decrease

- Discounts
- Sales
- Reduction in Population



To calculate percent of decrease


percent change =

amount of decrease

original amount

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Calculating a Percent of Decrease

A stock was worth \$18.00 a share in 2000. In 2016, the same stock was worth \$7.60 a share. What was the percent of change?

58%

=


10.40

18.00

Is the amount of change an increase or a decrease? (decrease)
What is the amount of change from 200 to 2016? (\$10.40)
What is the original amount? (\$18.00)
Divide the amount of change by the original amount (10.40/18)
Write the quotient as a percent (.57777 . . . = 58% decrease)

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Common Errors

- Using the wrong base when calculating change
- Not being able to differentiate between a quantity change and a percentage change
- Incorrectly changing a decimal to a percent
- Confusing "percentage of" situations with percent increase/decrease situations
- Not reading the situation (word problem) carefully

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Resources

Art of Problem Solving: Percent Increase and Decrease Part 1
https://www.youtube.com/watch?v=vTPQV_M6tfl
Art of Problem Solving: Percent Increase and Decrease Part 1
<https://www.youtube.com/watch?v=TbUlfWJ9Ohw>
How to Find the Percent Change Increase: The Easy Way
<https://www.youtube.com/watch?v=YWOeN7hDD3E>
How To Find Percent Change Decrease: The Easy Way
<https://www.youtube.com/watch?v=fwhZ8lTiReY>

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Exponents and Roots

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Do your students know the vocabulary?

Exponents

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← Exponent (or power)

← Base

Roots

Root index → 3

Radical sign → $\sqrt{}$

Radicand → 27

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Rules of Exponents Made Easier

0:38 / 4:55



The Math Dude – Law of Exponents - <https://www.youtube.com/watch?v=g4bKGsC2bY>

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Rules of Exponents

	Rule	Example
1	$x^1 = x$	$5^1 = 5$
2	$x^0 = 1$	$5^0 = 1$
3	$x^{-1} = \frac{1}{x^1}$	$5^{-1} = \frac{1}{5}$
4	$(x^m)(x^n) = x^{m+n}$	$(x^2)(x^3) = x^{2+3} = x^5$
5	$\frac{x^m}{x^n} = x^{m-n}$	$\frac{x^3}{x^2} = x^{3-2} = x^1$
6	$(x^m)^n = x^{m(n)}$	$(x^3)^2 = x^{(3)(2)} = x^6$
7	$(xy)^n = x^ny^n$	$(xy)^3 = x^3y^3$
8	$(\frac{x}{y})^n = \frac{x^n}{y^n}$	$(\frac{x}{y})^3 = \frac{x^3}{y^3}$
9	$x^{-n} = \frac{1}{x^n}$	$x^{-2} = \frac{1}{x^2}$

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Squares and Square Roots of Positive Rational Numbers

Recommendations for Test-Takers

- Memorize the first 12 perfect squares (1, 4, 9, ..., 144)
- Understand inverse relationships between pairs of squares and square roots ($12^2 = \sqrt{144}$ and $\sqrt{144} = 12$)
- Understand difference in squaring a negative number and the negative of a square number, i.e., $(-3)^2 = 9$ and $-(-3)^2 = -9$
- Practice computing with square and square roots that include fractions and decimals

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Max the
RADICAL

Simplifying Radical Expressions

- $\sqrt{9}$
- Find the prime factors = $\sqrt{3 \cdot 3}$
- Bring any pairs outside the radical = 3

$$\frac{\sqrt{9xy^2}}{\sqrt{3 \cdot 3 \cdot x \cdot y \cdot y}}$$
$$3y\sqrt{x}$$

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Why do students need to know this?

Mathematical Reasoning - Candidate Name

Question 1 of 10

Previous

Next

4 Formula Sheet

Type your answer in the box. You may use numbers, symbols, and/or text in your answer.
An expression is shown.
$$\sqrt{13} + \sqrt{2}$$

Simplify the expression completely. Leave your answer in radical form.
(NOTE: Click the symbol selector when you need to enter the radical sign.)

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Next

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Resources

Math is Fun – Explanations and sample questions
<https://www.mathsisfun.com/exponent.html>

The Math Dude – Law of Exponents -
<https://www.youtube.com/watch?v=g4bKGsC2IoY>

Khan Academy – Intro to Exponents
<https://www.khanacademy.org/math/pre-algebra/pre-algebra-exponents-radicals/pre-algebra-exponents/v/introduction-to-exponents>

Learning Upgrade – Exponent Rules
https://www.youtube.com/watch?v=VQsQj1Q_CMQ

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Last, but not least

The incredible zero

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The Incredible Zero

- It is unique in representing nothingness.
- As a placeholder it gives our number system its power.
- It acquires different meaning based on its location. Think 30 versus 3,000.




The Origin of the Number Zero

<http://www.smithsonianmag.com/history/origin-number-zero-180953392/#qagAYjydW3RXhkh.99>

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Properties of Zero

Property	Example
$a + 0 = a$	$4 + 0 = 4$
$a - 0 = a$	$4 - 0 = 4$
$a \times 0 = 0$	$6 \times 0 = 0$
$0 / a = 0$	$0/3 = 0$
$a / 0 = \text{undefined (dividing by zero is undefined)}$	$7/0 = \text{undefined}$
$0^a = 0$ (a is positive)	$0^4 = 0$

<http://www.mathsisfun.com/numbers/zero.html>

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Resources


Math is Fun – Properties of Zero
<http://www.mathsisfun.com/numbers/zero.html>

Math is Fun – Dividing by Zero
<https://www.mathsisfun.com/numbers/dividing-by-zero.html>

Khan Academy – Why Dividing by Zero is Undefined
<https://www.khanacademy.org/math/algebra/introduction-to-algebra/division-by-zero/v/why-dividing-by-zero-is-undefined>

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Final Thoughts


- Help students build their number sense
- Include opportunities for students to work together
- Provide plenty of practice with real-life situations included
- Set high expectations

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Tuesdays for Teachers




Next Tuesdays for Teachers – August 22, 2017

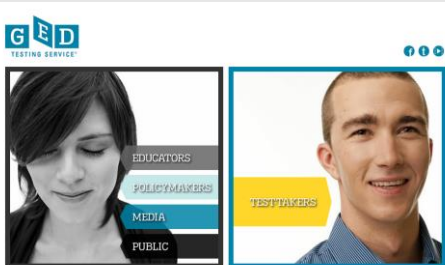
- More content-based information
- More strategies and activities
- More resources

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Contact Us:

Daphne Atkinson,
daphne.atkinson@gedtestingservice.com
Debi Faucette,
debi.faucette@gedtestingservice.com
communications@gedtestingservice.com

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