Mathematical Reasoning: What's the Problem with Inequalities?

Resources

Tuesdays for Teachers
April 25, 2017

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Table of Contents

GEDTS® Mathematical Reasoning – High Impact Indicators 3

Symbols and Vocabulary 4

Math Translation Guide 5

Translating Words into Symbols 7

Commonly Used Words in Mathematics 8

Resources Referenced in the Presentation 9

GEDTS® Mathematical Reasoning – High Impact Indicators

Assessment Target	Indicators	What to look for in student work. The student can
A.3 **Write, manipulate, solve, and graph linear inequalities**	• A.3.a Solve linear inequalities in one variable with rational number coefficients. • A.3.b Identify or graph the solution to a one variable linear inequality on a number line. • A.3.c Solve real-world problems involving inequalities. • A.3.d Write linear inequalities in one variable to represent context.	• solved inequalities in one variable, using the standard algorithms. • solved a one-variable inequality and identified or created a graph on the number line of the solution. • analyzed the relationship between quantities in a real-world problem, and then created an inequality to model the problem situation. • analyzed the relationship between quantities in a real-world problem, and then solved the problem through algebraic reasoning.

Symbols and Vocabulary

Notation or Vocabulary	Definition
a > b	a is more than b
a ≥ b	a is at least b
a < b	a is less than b
a ≤ b	a is at most b or a is no more than b
a ≠ b	a is not equal to b
∞	Symbol for positive infinity - an abstract concept describing something without any bound or larger than any number.
Boundary point	A solution that makes the inequality true
Coefficient	4a > b – the number associated with the variable
Inclusive	a ≤ 6 – includes the number and is indicated on the number line with a closed circle
Exclusive	A < 6 – excludes the number and is indicated on the number line with an open circle
Solution Set	The range of values that make the inequality true

Math Translation Guide

The chart below gives you some of the terms that come up in a lot of word problems. Use them in order to translate or "set-up" word problems into equations.

English	Math	Example	Translation
What, a number	*x, n,* etc.	Three more than a number is 8.	$n + 3 = 8$
Equivalent, equals, is, was, has, costs	=	Danny **is** 16 years old. A CD **costs** 15 dollars.	$d = 16$ $c = 15$
Is greater than Is less than At least, minimum At most, maximum	> < ≥ ≤	Jenny **has more** money than Ben. Ashley's age **is less than** Nick's. There are **at least** 30 questions on the test. Sam can invite **a maximum** of 15 people to his party.	$j > b$ $a < n$ $t \geq 30$ $s \leq 15$
More, more than, greater, than, added to, total, sum, increased by, together	+	Kecia has 2 **more** video games than John. Kecia and John have a **total** of 11 video games.	$k = j + 2$ $k + j = 11$
Less than, smaller than, decreased by, difference, fewer	-	Jason has 3 **fewer** CDs than Carson. The **difference between** Jenny's and Ben's savings is $75.	$j = c - 3$ $j - b = 75$
Of, times, product of, twice, double, triple, half of, quarter of	x	Emma has **twice** as many books as Justin. Justin has **half** as many books as Emma.	$e = 2 \times j$ or $e = 2j$ $j = c \times ½$ or $j = e/2$
Divided by, per, for, out of, ratio of __ to __	|	Sophia has $1 **for** every $2 Daniel has. The **ratio of** Daniel's savings **to** Sophia's savings is 2 to 1.	$s = d \mid 2$ or $s = d/2$ $d/s = 2/1$

Example 1

Jennifer has 10 fewer DVDs than Brad.

Step 1: j (has) = b (fewer) – 10
Remember, the word "has" is an equal sign and the word "fewer" is a minus sign, so:
Step 2: $j = b - 10$

Example 1

Clay got 1- fewer votes than Kimberly. Reuben got three times as many votes as Clay. The three contestants received a total of 90 votes. Write an equation in one variable that can be used to solve for the number of votes Kimberly received.

Step 1: Pick which unknown will be represented by the variable. Since you're solving for Kimberly, let k be the number of votes Kimberly received.
Step 2: Represent the other two unknowns in terms of k. Clay got 10 fewer votes so it's k - 10 and Reuben got three times that so it's $3(k - 10)$.
Step 3: Set up the equation using all of the expressions to equal 90.

$$k + (k - 10) + 3(k - 10) = 90$$

Example 2

A school is having a special even to honor successful alumni. The event will cost $500, plus an additional $85 for each alum who is honored. Write an equation that best represents the number of alumni that can be honored.

Step 1: The amount the school can spend is equal to or less than $1,000, so it's $\leq 1{,}000$
Step 2: The event has a fixed cost of $500 and a variable of $85 per alum so it's $500 + 85a$.
Step 3: The equation then becomes $500 + 85a \leq 1{,}000$.

Example 3

A computer repair company charges $50 for a service call plus $25 for each hour of work. Write an equation that represents the relationship between the bill, b, for a service call, and the number of hours spent on the call, h.

Step 1: Some questions include a situation where there is more than one cost. One of them is fixed and one is variable. First identify the sum of the fixed and variable costs so b equals the total.
Step 2: Next, identify the fixed cost of 50 and the variable cost of $25h$ (25 x the number of hours).
Step 3: The equation then becomes $50 + 25h = b$.

Translating Words into Symbols

The sum of a number n and 5	$n + 5$
4 more than a number n	$4 + n$
13 less than a number n	$n - 13$
A number n subtracted from 5	$5 - n$
A number n increased by 8	$n + 8$
A number n decreased by 8	$n - 8$
Twice the number n	$2n$
The sum of 4 times a number n and 7	$4n + 7$
The product of n and m	nm
A number n divided by 5	$n/5$
The sum of p and q less the sum of n and m	$(p + q) - (n + m)$
9 divided by the number n	$9/n$
The quotient of a number n and 6	$n/6$
The ratio of two numbers n and m	n/m
Miles per hour	miles/hour
10% of a number n	$0.10n$
The sum of x and y is 6	$x + y = 6$
The sum of x and y is 3 more than twice the product	$x + y = 3 + 2xy$
The square of a number n	n^2
The square root of a number n	$\sqrt{n}$
The absolute value of a number n	$\lvert n \rvert$
The absolute value of the difference between x and y	$\lvert x - y \rvert$

Commonly Used Words in Mathematics

sum	The result of adding numbers
difference	The result of subtracting numbers
terms	Quantities that are added or subtracted In the expression $2x + 3 - 5y$, there are three terms: $2x$, 3, and $5y$.
product	The result of multiplying numbers
factors	Quantities that are multiplied In the expression $3m(a + b)$, there are two factors: $3m$ and $(a + b)$.
factor	The word factor is used in a few different ways including the example above. "n is a factor of a number" means n divides exactly into the number. "To factor" means to write a number as the product of its factors.
multiple of n	A number that is exactly divisible by n
quotient	The result of dividing two numbers In the division $x \div y = z$, x is the **dividend**, y is the **divisor**, and z is the **quotient**.
ratio	The quotient of two numbers The ratio of a to b is a/b.
natural numbers	The set of numbers used for counting: {1, 2, 3, 4, 5,…}
whole numbers	The natural numbers and zero: {0, 1, 2 , 3, 4,…}
integers	The set: {…,-3, -2, -1, 0, 1, 2, 3,…}
rational numbers	The set of all numbers which can be represented as a fraction using integers
irrational numbers	The set of numbers with non-repeating, non-terminating decimals
real numbers	The set of rational and irrational numbers
variable	A symbol (usually a letter) which stands for a number
literal part of a term	Non-numerical part of a term (for example, in the term 3xy, xy is the literal part of the term and 3 is called the **coefficient**)
like terms	Terms with identical literal parts

Resources Referenced in the Presentation

The following are the titles and urls of the websites and resources referenced in the presentation. They are listed in the order that they appeared.

Videos
How to Graph Inequalities for Middle School: Fractions & Other Math Tips

https://www.youtube.com/watch?v=PTDN-ApjzsM

How to Solve Inequalities
https://www.youtube.com/watch?v=wYEYeFGxHkI&t=57s

One-Variable Inequalities – Khan Academy
https://www.khanacademy.org/math/algebra/one-variable-linear-inequalities

Virtual Nerds: What is an Inequality? https://www.youtube.com/watch?v=wcBwdz-ZBaM

Math is Fun – Solving Inequalities
http://www.mathsisfun.com/algebra/inequality-solving.html

Very Basics of Graphing Inequalities (on a number line)
https://www.youtube.com/watch?v=nif2PKA9bXA

Solving and Graphing Inequalities (Excellent!)
https://www.youtube.com/watch?v=EE2qWIyjKD0

Math Dude Unit 1-4 –Solving Inequalities
https://www.youtube.com/watch?v=8hhewFQ_K0w

Lesson Plans
Solving Linear Inequalities – Event Planning
www.floridaipdae.org/index.cfm?fuseaction=resources.GEDAHS&cagiid=35103C4421814CCDCF2BF60B532270EE0718F330D6DCACE4E33EFA989573B6E6

Florida IPDAE – GED and AHS Lessons
Beginning Algebra – Lessons 14-15
http://www.floridaipdae.org/index.cfm?fuseaction=resources.GEDAHS&cagiid=DA077C783C76A85D93EE670F44851D4C70E44B31245B6D1B60A314A7FABD6FAE

Inequalities in the Real-World
https://betterlesson.com/lesson/592219/inequalities-in-the-real-world

Inequalities – Solving and Graphing
http://alex.state.al.us/lesson_view.php?id=29038

Number Line Maker

Graph Inequality on Number Line
http://www.mathwarehouse.com/number-lines/graph-inequality-on-number-line.php

Number Line Maker
http://www.mathwarehouse.com/number-lines/number-line-maker.php

Solving Inequalities
Cool Math – Inequalities
http://www.coolmath.com/algebra/07-solving-inequalities

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