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Solving linear inequalities in one variable

At first glance, it seems that dividing both sides by a will solve the problem. BUT ... We just don't know if a is a positive value or a negative value. If a is positive, our solution of x > 6 will be true. But if a is negative, we need to reverse the direction of the inequality, and the solution is x < 6. Since we do not know the value of a, we cannot state a solution to this problem. Therefore, there is NO SOLUTION! 1 6.1 Solving Linear Inequalities in One VariableA linear inequality in one variable is an inequality which can be put into the form ax + b > c where a, b, and c are real numbers. Note that the “>” can be replaced by □, 4 2x – 2 < 6x – 5 can be written – 4x + (– 2) < – 5. 6x + 1 □ 3(x – 5) can be written 6x + 1 □ – 15. 2 6.1 Solving Linear Inequalities in One VariableThe solution set for an inequality can be expressed in two ways. Example: Express the solution set of x < 3 in two ways. Open circle indicate that the number is not included in the solution set. 1. Set-builder notation: {x | x < 3} 2. Graph on the real line: 1 2 3 4 -4 -3 -2 -1 Example: Express the solution set of x ≥ 4 in two ways. Closed circle indicate that the number is included in the solution set. 1. Set-builder notation: {x | x ≥ 4} • 2. Graph on the real line: 1 2 3 4 -4 -3 -2 -1 3 6.1 Solving Linear Inequalities in One VariableA solution of an inequality in one variable is a number which, when substituted for the variable, results in a true inequality. Examples: Are any of the values of x given below solutions of 2x > 5? ? ? x = 2 2(2) > 5 4 > 5 False 2 is not a solution. ? ? x = 2.6 2(2.6) > 5 5.2 > 5 True 2.6 is a solution. ? ? x = 3 2(3) > 5 6 > 5 True 3 is a solution. ? ? x = 1.5 2(1.5) > 5 3 > 5 False 1.5 is not a solution. The solution set of an inequality is the set of all solutions. 4 6.1 Solving Linear Inequalities in One VariableThe graph of a linear inequality in one variable is the graph on the real number line of all solutions of the inequality. Verbal Phrase Inequality Graph All real numbers less than 2 x < 2 All real numbers greater than -1 x > -1 All real numbers less than or equal to 4 x < 4 All real numbers greater than or equal to -3 x > -3 5 6.1 Solving Linear Inequalities in One VariableAddition and Subtraction Properties If a > b and c is a real number, then a > b, a + c > b + c, and a – c > b – c have the same solution set. If a < b and c is a real number, then a < b, a + c < b + c, and a – c < b – c have the same solution set. Example: Solve x – 4 > 7. + 4 x – > 7 Add 4 to each side of the inequality. x > 11 {x | x > 11} Set-builder notation. 6 6.1 Solving Linear Inequalities in One VariableExample: Solve 3x ≥ 2x + 5. 3x ≥ 2x + 5 – 2x Subtract 2x from each side. x ≥ 5 {x | x ≥ 5} Set-builder notation. 7 6.1 Solving Linear Inequalities in One VariableMultiplication and Division Properties If c > 0 the inequalities a > b, ac > bc, and > have the same solution set. If c < 0 the inequalities a > b, ac < bc, and < have the same solution set. Example: Solve 4x ≥ 12. 4x ≥ 12 Divide by 4. x ≥ 3 4 is greater than 0, so the inequality sign remains the same. 8 6.1 Solving Linear Inequalities in One VariableExample: Solve (– 3) Multiply by – 3. – 3 is less than 0, so the inequality sign changes. 9 6.1 Solving Linear Inequalities in One VariableExample: Solve x + 5 < 9x + 1. – 8x + 5 < 1 Subtract 9x from both sides. – 8x < – 4 Subtract 5 from both sides. Divide both sides by – 8 and simplify. x > Inequality sign changes because of division by a negative number. Solution set in set-builder notation. 10 6.1 Solving Linear Inequalities in One VariableExample: Solve Subtract from both sides. Add 2 to both sides. Multiply both sides by 5. • 20 30 40 50 60 -20 -10 10 Solution set as a graph. 11 6.2 Problem Solving Example: A cell phone company offers its customers a rate of $89 per month for 350 minutes, or a rate of $40 per month plus $0.50 for each minute used. How many minutes per month can a customer who chooses the second plan use before the charges exceed those of the first plan? Let x = the number of minutes used. Solve the inequality 0.50x + 40 ≥ 89 . 0.50x ≥ 49 Subtract 40. x ≥ 24.5 Divide by 0.5. The customer can use up to 24.5 minutes per month before the cost of the second plan exceeds the cost of the first plan. 12 6.3 Compound InequalitiesA compound inequality is formed by joining two inequalities with “and” or “or.” 13 6.3 Compound InequalitiesExample: Solve x + 2 < 5 and 2x – 6 > – 8. Solve the first inequality. Solve the second inequality. x + 2 < 5 2x – 6 > – 8 x < 3 Subtract 2. 2x > – 2 Add 6. {x | x < 3} Solution set x > – 1 Divide by 2. {x | x > –1} Solution set The solution set of the “and” compound inequality is the intersection of the two solution sets. 1 2 3 4 -4 -3 -2 -1 14 6.3 Compound InequalitiesWhen solving compound inequalities, it is possible to work with both inequalities at once. This inequality means 11 < 6x + 5 and 6x + 5 < 29. Example: Solve 11 < 6x + 5 < 29. 6 < 6x < 24 Subtract 5 from each of the three parts. 1 < x < 4 Divide 6 into each of the three parts. Solution set. 1 2 3 4 -4 -3 -2 -1 15 6.3 Compound InequalitiesExample: Solve Subtract 6 from each part. Multiply each part by – 2. Multiplication by a negative number changes the inequality sign for each part. • • Solution set. 1 2 3 4 -4 -3 -2 -1 16 6.3 Compound InequalitiesExample: Solve x + 5 > 6 or 2x < – 4. Solve the first inequality. Solve the second inequality. x + 5 > 6 2x < – 4 x > 1 x < – 2 { x | x > 1} { x | x < – 2} Solution set Solution set Since the inequalities are joined by “or” the solution set is the union of the solution sets. 1 2 3 4 -4 -3 -2 -1 17 6.4 Absolute Value and InequalitiesThere are 4 types of absolute value inequalities and equivalent inequalities |x| < a |x| > a 18 6.4 Absolute Value and InequalitiesTranslating Absolute Value Inequalities The inequality |ax + b| < c is equivalent to -c < ax + b < c The inequality |ax + b| > c is equivalent to ax + b < -c or ax + b > c 19 6.4 Absolute Value and InequalitiesExample Solve |x - 4| < 3 -3 < x - 4 < 3 1 < x < 7 The solution set is {x| 1 < x < 7} and the interval is (1, 7) º º 1 2 3 4 -4 -3 -2 -1 20 6.4 Absolute Value and InequalitiesExample Solve |4x - 1| < 9 -9 ≤ 4x - 1 ≤ 9 -8 ≤ 4x ≤ 10 -2 ≤ x ≤ 5/2 The interval solution is [-2, 5/2] □ □ 1 2 3 4 -4 -3 -2 -1 21 6.4 Absolute Value and InequalitiesSolve |x| > a Solve |x + 1| > 2 x + 1 < -2 or x + 1 > 2 x < -3 or x > 1 The solution interval is (-∞, -3) U (1, ∞) º º 1 2 3 4 -4 -3 -2 -1 22 6.4 Absolute Value and InequalitiesSolve |x| ≥ a Solve |2x - 8| ≥ 4 2x – 8 ≤ -4 or 2x - 8 ≥ 4 2x ≤ 4 or 2x ≥ 12 x ≤ 2 or x ≥ 6 The solution interval is (-∞, 2] U [6, ∞) • • 1 2 3 4 -4 -3 -2 -1 23 6.5 Linear Inequalities A linear inequality in two variables can be written in any one of these forms: Ax + By < C Ax + By > C Ax + By ≤ C Ax + By ≥ C An ordered pair (x, y) is a solution of the linear inequality if the inequality is TRUE when x and y are substituted into the inequality. 24 6.5 Linear Inequalities Which ordered pair is a solution of5x - 2y ≤ 6? (0, -3) (5, 5) (1, -2) (3, 3) ANSWER: A. (0, -3) 25 6.5 Linear Inequalities The graph of a linear inequality is the set of all points in a coordinate plane that represent solutions of the inequality. We represent the boundary line of the inequality by drawing the function represented in the inequality. 26 6.5 Linear Inequalities The boundary line will be a:Solid line when ≤ and ≥ are used. Dashed line when < and > are used. Our graph will be shaded on one side of the boundary line to show where the solutions of the inequality are located. 27 6.5 Linear Inequalities Here are some steps to help graph linear inequalities: Graph the boundary line for the inequality. Remember: ≤ and ≥ will use a solid curve. < and > will use a dashed curve. Test a point NOT on the boundary line to determine which side of the line includes the solutions. (The origin is always an easy point to test, but make sure your line does not pass through the origin) If your test point is a solution (makes a TRUE statement), shade THAT side of the boundary line. If your test points is NOT a solution (makes a FALSE statement), shade the opposite side of the boundary line. 28 6.5 Linear Inequalities Graph the inequality x ≤ 4 in a coordinate plane Decide whether to use a solid or dashed line. Use (0, 0) as a test point. Shade where the solutions will be. y x 5 -5 29 6.5 Linear Inequalities Graph y > x + 2 in a coordinate plane.Sketch the boundary line of the graph. Solid or dashed line? Use (0, 0) as a test point. Shade where the solutions are. y x 5 -5 30 6.5 Linear Inequalities Graph y > -½x - 2 in a coordinate plane.Sketch the boundary line of the graph. Solid or dashed line? Use (0, 0) as a test point. Shade where the solutions are. y x 5 -5 31 6.5 Linear Inequalities Graph 3x - 4y > 12 in a coordinate plane.Sketch the boundary line of the graph. Find the x- and y-intercepts and plot them. Solid or dashed line? Use (0, 0) as a test point. Shade where the solutions are. y x 5 -5 32 Example 4: Using a new Test PointGraph y < 2/5x in a coordinate plane. Sketch the boundary line of the graph. Find the x- and y-intercept and plot them. Both are the origin! Use the line’s slope to graph another point. Solid or dashed line? Use a test point OTHER than the origin. Shade where the solutions are. y x 5 -5 Are you ready to dive into our solving inequalities unit? Let's do a very quick review of inequality basics that you probably first learned about in second grade. Always remember that inequalities do not have just one solution. There are always multiple solutions! Think about the following inequality: We could replace x with 4 because 4 is less than 5. We could replace x with 2 because 2 is less than 5. We could even replace x with -3 because -3 is less than 5. We could go on forever, so as you can see there are many many solutions to this inequality! Let's take a look at the inequality symbols and their meanings again. When you graph inequalities that have only one variable, we use a number line. We will use open and closed circles and arrows pointing to the left or right to graph our answers.An open circle on the graph indicates less than (). A closed circle on the graph represents less than or equal to (). Take a look at the models below. x is greater than 5. I use an open circle on 5, since x is NOT equal to 5. Then I draw an arrow to the right to indicate that x can be any number greater than 5. x is less than -3. I use an open circle on -3 since x is NOT equal to -3. Then I draw an arrow to the left to indicate that x can be any number less than -3. x is greater than OR equal to -2. I use a closed circle on -2 since x is also equal to -2. Then draw an arrow to the right to indicate that x can be any number greater than -2. x is less than OR equal to 10. I use a closed circle on 10 since x is also equal to 10. Then draw an arrow to the left to indicate that x can be any number less than 10. Ok... enough review. Let's solve a few inequalities. You are going to solve inequalities using the exact same rules that you used when solving equations. Let's quickly review those rules: Rules for Solving Inequalities Whatever you do to one side of the inequality, you must do to the other side.Always get rid of the constant first and then any coefficients last.If you have fractions, get rid of the fractions first and then proceed with solving the inequality. Did you notice that you took the exact same steps that you would've taken in order to solve a regular equation? The only difference was that you had a less than sign instead of an equal sign. Now that was pretty easy!The next example is similar to example 1, but I would like to show you how to reverse your answer to make it easier to read and graph. Don't be afraid to do this if your variable ends up the right hand side of the inequality. Example 2: Reversing the Inequality Symbol Ok... The first two examples should have been pretty easy since you are a superstar at solving equations. Luckily there's only one trick that you have to remember when solving inequalities and that is: Whenever you multiply or divide by a negative number, you must reverse the sign! I knew you were going to ask "Why?" And.... you should be asking why. It's important to understand these rules. Sometimes, the best explanations are through examples. Let's take a look. See What Happens..... 3 < 5 3 is less than 5 is a true statement.**I know that I can keep my inequality balanced by multiplying or dividing every term by the same number, so.... let's multiply every term by -1.(-1)(3) < (-1)(5)-3 < -5 Now we have -3 is less than -5. Is that a true statement?No, -3 is greater than -5, so in order to make it a true statement, we must reverse the sign.-3 > -5 This works with any true statement as long as you multiply or divide by a negative number. Go ahead, try another one. Write a true statement, and then divide by -2.Ok... let's look at a few examples. Our next example revisits how to solve equations and/or inequalities with variables on both sides. Example 3: Variables on Both Sides and Dividing By a Negative Number Let's take a look at how our new rule applies to solving equations. Pay special attention to the part where we divide by negative 1. Our last example revisits how to solve equations and/or inequalities with fractions. I hope you remember the trick. Example 4: Working with Fractions Now are you ready for a few on your own? Click here to move onto Solving Inequalities Practice Problems. Home > Inequalities > Inequalities in One Variable solving linear inequalities in one variable worksheet. solving linear inequalities in one variable worksheet pdf. solving linear inequalities in one variable calculator. solving linear inequalities in one variable ppt. solving linear inequalities in one variable involving absolute value. solving linear inequalities in one variable gizmo answers. solving linear inequalities in one variable pdf. solving linear inequalities in one variable lesson plan

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