EaD Comprehensive Lesson Plans

Strand:	Algebra	Sub-Strand:	Variables and Equations

BASIC 9

WEEKLY LESSON PLAN – WEEK 7

Content Standard:	B9.2.3.1 Demonstrate understanding of single variable linear inequalities with rational coefficients including: • solving inequalities • verifying • comparing • graphing

Indicator (s)	B9.2.3.1.1 Solve single variable linear inequalities with rational coefficients B9.2.3.1.2 Illustrate solution sets of linear inequalities on the number line.	**Performance Indicator;** Learners can graph linear inequalities on number line.

Week Ending	23-02-2024				
Class	B.S.9	**Class Size:**		**Duration:**	
Subject	Mathematics				
Reference	Mathematics Curriculum, Teachers Resource Pack, Learners Resource Pack				

Teaching / Learning Resources	Poster, Pictures, video	**Core Competencies:**	• Communication and collaboration • Critical Thinking and Problem solving • Personal Development • Creativity and Innovation

DAY/DATE	**PHASE 1 : STARTER**	**PHASE 2: MAIN**	**PHASE 3: REFLECTION**
MONDAY	Assist Learners to solve examples of inequalities by giving both inequality and interval notation forms of the solution.	1. Demonstrate on solving inequalities that involve rational expressions for the Learners to observe. 2. Assist Learners to identify linear inequalities and check solutions. 3. Discuss with the Learners about the applications of linear inequalities. The best way to define interval notation is the following table. There are three columns to the table. Each row contains an inequality, a graph representing the inequality and finally the interval notation for the given inequality.	Through questions and answers, conclude the lesson. **Exercise;** 1. Are x=−4 and x=6 solutions to 5x+7<22? 2. Solve and graph the solution set: 12x−2≥12(74x−9)+1. 3. Solve and graph the solution

Inequality	**Graph**	**Interval Notation**
a≤x≤b		[a,b]
a<x<b		(a,b)

$a\le x<b$		$[a,b)$
$a<x\le b$		$(a,b]$
$x>a$		(a,∞)
$x\ge a$		$[a,\infty)$
$x<b$		$(-\infty,b)$
$x\le b$		$(-\infty,b]$

Remember that a bracket, “[” or “]”, means that we include the endpoint while a parenthesis, “(” or “)”, means we don’t include the endpoint.

Now, with the first four inequalities in the table the interval notation is really nothing more than the graph without the number line on it. With the final four inequalities the interval notation is almost the graph, except we need to add in an appropriate infinity to make sure we get the correct portion of the number line. Also note that infinities NEVER get a bracket. They only get a parenthesis.

We need to give one final note on interval notation before moving on to solving inequalities. Always remember that when we are writing down an interval notation for an inequality that the number on the left must be the smaller of the two.

It’s now time to start thinking about solving linear inequalities. We will use the following set of facts in our solving of inequalities. Note that the facts are given for <. We can however, write down an equivalent set of facts for the remaining three inequalities.

1. If $a<b$ then $a+c<b+c$ and $a-c<b-c$ for any number c. In other words, we can add or subtract a number to both sides of the inequality and we don’t change the inequality itself.

2. If $a<b$ and $c>0$ then $ac<bc$ and $ac<bc$. So, provided c is a positive number we can multiply or divide both sides of an inequality by the number without changing the inequality.

3. If $a<b$ and $c<0$ then $ac>bc$ and $ac>bc$. In this case, unlike the previous fact, if cis negative we need to flip the direction of the inequality when we multiply or divide both sides by the inequality by c.

set: $10-5(2x+3)\le 25$.

		These are nearly the same facts that we used to solve linear equations. The only real exception is the third fact. This is the important fact as it is often the most misused and/or forgotten fact in solving inequalities. If you aren't sure that you believe that the sign of c matters for the second and third fact consider the following number example. −3<5−3<5 I hope that we would all agree that this is a true inequality. Now multiply both sides by 2 and by -2. −3<5−3<5−3(2)<5(2)−3(−2)>5(−2)−6<106>−10	
WEDNES DAY	Assist Learners to identify examples of rational inequality expressions.	1. Call individual Learners to the chalkboard to write an examples of a linear equality 2. Learners brainstorm to solve linear inequalities and express the solutions graphically on a number line and in interval notation. 3. Discuss with the Learners on how to solve compound linear inequalities and express the solutions graphically on a number line and in interval notation. ***How do you solve rational inequalities?*** To solve a rational inequality, use these steps: 1. If needed, move all the terms to one side of the inequality symbol, with zero on the other side. 2. If needed, combine all rational expressions into one polynomial fraction. 3. Factor the numerator and denominator completely. 4. Solve the factors for their zeroes; keep in mind that the denominator's zeroes would cause division by zero, so they cannot be included in your solution. 5. Use the zeroes to divide the number line into intervals. 6. Make a table of factors, showing where each factor is less than and greater than zero. 7. Multiply the factors' signs on each interval (that is, down the table's columns) to find the sign of the rational expression on that interval. 8. Select the intervals that match the inequality they gave you; remember to discard any endpoints that would cause division by zero. Let's see how these instructions work in practice: • **Solve the following:**	Through questions and answers, conclude the lesson. **Exercise;** 1. Solve and graph the solution set: −13<3x−7<17. 2. Solve and graph the solution set: 12x−2≥12 (74x−9)+1. 3. Solve and graph the solution set: 56≤13 (12x+4)<2. 4. Solve and graph the solution set: 4x+5≤−15 or 6x−11>7.

x2+3x+2/ x2−16≥0x2−16x2+3x+2≥0

They've already put this inequality into (one rational expression) with (zero) on the other side. So I can start with factoring everything:

This polynomial fraction will be zero wherever the numerator is zero, so I'll set the numerator equal to zero and solve:

$(x + 2)(x + 1) = 0$

$x + 2 = 0$ or $x + 1 = 0$

$x = -2$ or $x = -1$

The fraction will be undefined wherever the denominator is zero, so I'll set the denominator equal to zero and solve:

$(x + 4)(x - 4) = 0$

$x + 4 = 0$ or $x - 4 = 0$

$x = -4$ or $x = 4$

These four values, −4, −2, −1, and +4, divide the number line into five intervals, namely:

$(-\infty, -4)$

$(-4, -2)$

$(-2, -1)$

$(-1, 4)$

$(4, +\infty)$

I could use "test points" to find the solution to the inequality, by picking an *x*-value in each interval, plugging it into the original rational expression, simplifying to get a numerical answer, and then checking the sign, but that process gets long and annoying (and is prone to errors), so I'll use the easier and faster factor-table method instead.

My factor table looks like this:

<table>
<tr>
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<td></td>
<td>
<table>
<tr><td>$x+4$</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>$x+2$</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>$x+1$</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>$x-4$</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">$-\infty$ -4 -2 -1 4 $+\infty$</td></tr>
<tr><td>rational</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

My table has one row for each factor, a row for the number line, and a row for the rational expression. Each row is split into columns, with each column corresponding to one of the intervals on the number line.
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<td>FRIDAY</td>
<td>Demonstrate on Solving applications involving linear inequalities and interpret the results</td>
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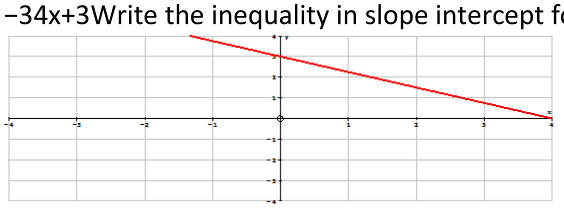
1. Assist Learners to solve applications involving linear inequalities and interpret the result.
2. Learners brainstorm to illustrate and explain the inequality signs.
3. Assist Learners to solve and graph linear inequalities on a cartesian plane.
Example A
Graph the inequality 3x+4y≤12.
3x+4y≤123x−3x+4y≤−3x+124y≤−3x+124y4≤−3x4+1244y4≤−3x4+1234y≤−34x+3Write the inequality in slope intercept form (y=mx+b).

The above graph represents the graph of the inequality before the solution set region is shaded. The line is a solid line because the inequality symbol is (≤). To determine whether to shade above the line or below the line, choose a point that is not on the line and test its coordinates in the original inequality. If the coordinates of the point satisfy the inequality, then the area above or below the line containing the point will be shaded. If the coordinates of the point do not satisfy the inequality, then the area above or below the line that does not contain the test point will be shaded.
The point (1, 1) is not on the graphed line. The point will be tested to determine if the coordinates satisfy the inequality.

3x+4y3(1)+4(1)3+47≤12≤12≤12≤12Substitute (1,1) for x and y of the original inequality.Evaluate the inequality.Is it true?
Yes, seven is less than 12. The point (1, 1) satisfies the inequality. Therefore, the solution set is all of the area below the line that contains the point (1, 1). The ordered pair that satisfies the inequality
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Learners in small groups to discuss , solve and graph linear inequalities on a number line.
Exercise;
Graph the following linear inequalities on a Cartesian plane.
1. 4x−2y>8
2. 4y−3x≤−8
3. x−y<−3
4. 3x+y>−1
5. x+3y≥9
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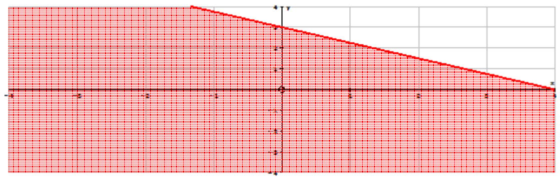
will lie within the shaded region.



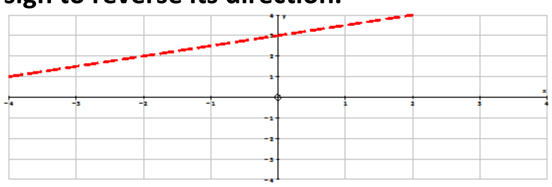
The solution set for the inequality is the entire shaded region shown in the graph. The solid line means that all of the points on the line will satisfy the inequality.

Example B

Graph the inequality 2x−4y<−12.

2x−4y<−122x−2x−4y<−2x−12−4y<−2x−12−4y−4<−2x−4−12−4−4y−4<−2x−4−12−3−4y > 12x+3Write the inequality in slope intercept form (y=mx+b).

The inequality was divided by negative 4 which caused the inequality sign to reverse its direction.

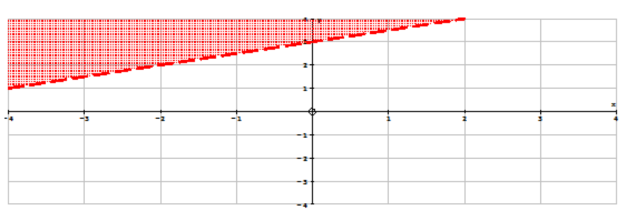


The above graph represents the graph of the inequality before the solution set region is shaded. The line is a dashed line because the inequality symbol is (<). To determine whether to shade above the line or below the line, choose a point that is not on the line and test its coordinates in the original inequality. If the coordinates of the point satisfy the inequality, then the area above or below the line containing the point will be shaded. If the coordinates of the point do not satisfy the inequality, then the area above or below the line that does not contain the test point will be shaded.

The point (1, 1) is not on the graphed line. The point will be tested to determine if the coordinates satisfy the inequality.

2x−4y2(1)−4(1)2−4−2<−12<−12<−12<−12Substitute (1,1) for 'x' and 'y' of the original inequality.Evaluate the inequality.Is it true?

No, negative two is greater than negative twelve. The point (1, 1) does not satisfy the inequality. Therefore, the solution set is all of the area above the line that does not contain the point (1, 1). The ordered pair does not satisfy the inequality and will not lie within the shaded region.



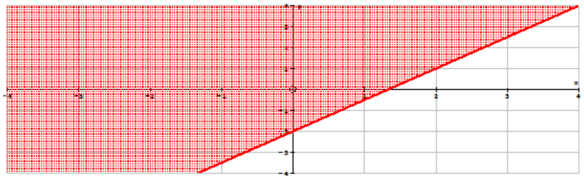
[Figure 6]

The solution set for the inequality is the entire shaded region shown in the graph. The dashed or dotted line means that none of the points on the line will satisfy the inequality.

Example C

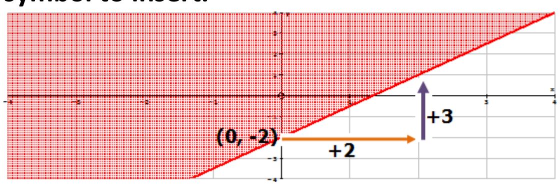
In this example, the graph of the inequality will be given and the task will be to determine the inequality that is modeled by the graph.

For the following, determine the inequality, in slope-intercept form, that is graphed.



[Figure 7]

This process is the same as determining the equation of the line that is graphed. The next step is then to decide the appropriate inequality symbol to insert.



[Figure 8]

Begin by determining the slope of the line. The slope of the line is determined by counting 2 units to the right and 3 units upward. The slope of the line for this graph is

m=riserun=32

The y−intercept for the line is (0, −2). The equation of the line in slope-intercept form is

y=32x−2

The solution set is found in the shaded region that is above the line. The line is a solid line. Therefore the inequality symbol that must be inserted is greater than or equal to. The inequality that is modeled by the above graph is:

y≥32x−2

Vocabulary

Inequality

> An ***inequality*** is a statement that shows a relationship between two expressions that are not always equal. An inequality is written using one of the following inequality symbols: greater than (>); less than (<); greater than or equal to (≥); less than or equal to (≤). The solution to an inequality is indicated by a shaded region that contains all the ordered pairs that satisfy the inequality.

Guided Practice

1. Without graphing, determine if each point is in the shaded region for

each inequality.

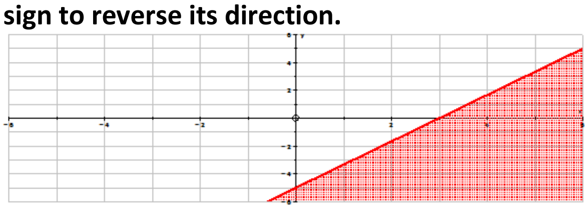
i) (2, –3) and 2y<−3x+1
ii) (–3, 5) and −3x>2y+6
2. Graph the following inequality: 5x−3y≥15
3. Determine the inequality that models the following graph:

Answers
1. If the point satisfies the inequality, then the point will lie within the shaded region. Substitute the coordinates of the point into the inequality and evaluate the inequality. If the solution is true, then the point is in the shaded area.

i) 2y2(−3)−6−6<−3x+1<−3(2)+1<−6+1<−5Substitute (2,−3) for x and y in the inequality.Evaluate the inequality.Is it true?
Yes, negative six is less than negative five. The point (2, –3) satisfies the inequality. The ordered pair will lie within the shaded region.

ii) −3x−3(−3)99>2y+6>2(5)+6>10+6>16Substitute (−3,5) for x and y in the inequality.Evaluate the inequality.Is it true?
No, nine is not greater than sixteen. The point (–3, 5) does not satisfy the inequality. The ordered pair does not satisfy the inequality and will not lie within the shaded region.

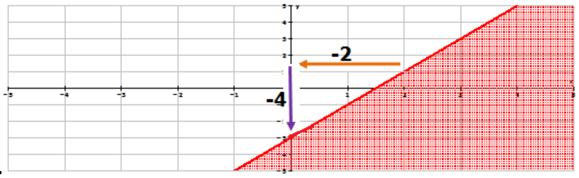
2. 5x−3y≥155x−5x−3y≥−5x+15−3y≥−5x+15−3y−3≥−5x−3+15−3−3y−3≥53 x+15−5−3y ≤ 53x−5Write the inequality in slope intercept form (y=mx+b).
The inequality was divided by negative 3 which caused the inequality sign to reverse its direction.



Is the graph of the inequality shaded correctly?
The point (1, 1) is not on the graphed line. The point will be tested to determine if the coordinates satisfy the inequality.

5x−3y5(1)−3(1)5−32≥15≥15≥15≥15Substitute (1,1) for x and y of the original inequality.Evaluate the inequality.Is it true?
No, two is not greater than or equal to fifteen. The point (1, 1) does not satisfy the inequality. The ordered pair does not satisfy the inequality and will not lie within the shaded region. Therefore, the

graph is shaded correctly.

3. 

Begin by determining the slope of the line. The slope of the line is determined by counting 2 units to the left and 4 units downward. The slope of the line for this graph is

$m=riserun=-4-2=2$

The y−intercept for the line is (0, −3). The equation of the line in slope-intercept form is $y=2x-3$

The solution set is found in the shaded region that is below the line. The line is a solid line. Therefore the inequality symbol that must be inserted is less than or equal to. The inequality that is modeled by the above graph is:

$y \leq 2x-3$

Summary

In this lesson you have learned to graph a linear inequality in two variables on a Cartesian plane. The solution set was all points in the area that was in the shaded region of the graph. To determine where the shaded area should be with respect to the line, a point that was not on the line was tested in the original inequality. If the point made the inequality true, then the area containing the point was shaded. If the point did not make the inequality true, then the tested point did not lie within the shaded region.

You also learned that the inequality symbol determined whether the line was dashed or solid. A dashed line was graphed for all inequalities that had a > symbol or a < symbol. The dashed line indicated that the points on the line did not satisfy the inequality. A solid line was graphed for all inequalities that had a ≥ symbol or a ≤symbol. The solid line indicated that the points on the line did satisfy the inequality.

In the last example, you learned to determine the inequality that was modeled by a given graph. The inequality was determined by calculating the slope and the y−intercept of the line in the same way that you would determine the linear equation for the graph of a straight line. The last step was to determine the inequality sign to be inserted.

Problem Set

Without graphing, determine if each point is in the shaded region for each inequality.

1. (2, 1) and $2x+y>5$
2. (−1, 3) and $2x-4y\leq-10$
3. (−5, −1) and $y>-2x+8$
4. (6, 2) and $2x+3y\geq-2$
5. (5, −6) and $2y<3x+3$

Name of Teacher: **School:** **District:**