

Important Concepts . . .

# Preview Review



**Mathematics Grade 9 TEACHER KEY**  
**W2 - Lesson 8: Linear Inequalities**

## Important Concepts of Grade 9 Mathematics

W1 - Lesson 1 .....	Powers
W1 - Lesson 2 .....	Exponents
W1 - Lesson 3 .....	Rational Numbers
W1 - Lesson 4 .....	Order of Operations
W1 - Lesson 5 .....	Square Roots of Rational Numbers
W1 - Review	
W1 - Quiz	
W2 - Lesson 6 .....	Graphing Linear Relations
W2 - Lesson 7 .....	Solving Linear Relations
W2 - Lesson 8 .....	Linear Inequalities
W2 - Lesson 9 .....	Polynomials
W2 - Lesson 10 .....	Surface Area of 3D Objects
W2 - Review	
W2 - Quiz	
W3 - Lesson 11 .....	Properties of Circles
W3 - Lesson 12 .....	Polygons and Scale Diagrams
W3 - Lesson 13 .....	Rotational Symmetry
W3 - Lesson 14 .....	Representing Data
W3 - Lesson 15 .....	Probability
W3 - Review	
W3 - Quiz	

## Materials Required

Paper  
Pencil  
Graph Paper  
Calculator

**No Textbook  
Required**

**This is a stand-  
alone course.**

### Mathematics Grade 9

Version 6

Preview/Review W2 - Lesson 8

ISBN: 978-1-927090-00-8

**Publisher: Alberta Distance Learning Centre**

**Written by: Lenee Fyfe**

**Reviewed by: Danielle Winter**

**Project Coordinator: Danielle Winter**

**Preview/Review Publishing Coordinating Team: Julie Reschke**



Alberta Distance Learning Centre has an Internet site that you may find useful. The address is as follows: <http://www.adlc.ca>

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

### ALL RIGHTS RESERVED

Copyright © 2011, by Alberta Distance Learning Centre, 4601-63 Avenue, Barrhead, Alberta, Canada, T7N 1P4. Additional copies may be obtained from Alberta Distance Learning Centre.

No part of this courseware may be reproduced or transmitted in any form, electronic or mechanical, including photocopying (unless otherwise indicated), recording, or any information storage and retrieval system, without the written permission of Alberta Distance Learning Centre.

Every effort has been made both to provide proper acknowledgement of the original source and to comply with copyright law. If cases are identified where this effort has been unsuccessful, please notify Alberta Distance Learning Centre so that appropriate corrective action can be taken.

**IT IS STRICTLY PROHIBITED TO COPY ANY PART OF THESE MATERIALS UNDER THE TERMS OF A LICENCE FROM A COLLECTIVE OR A LICENSING BODY.**

# Preview/Review Concepts for Grade Nine Mathematics

## Teacher Key



***W2 – Lesson 8:***

***Linear Inequalities***

# OBJECTIVES

By the end of this lesson, you will be able to:

- Determine if a rational number is a possible solution for a given inequality.
- Solve linear inequalities and problems involving linear inequalities.
- Graph the solution of a linear inequality on a number line.
- Verify the solution of an inequality.

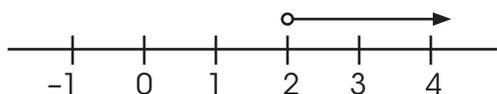
## GLOSSARY

**Inequality:** A way of representing an expression where one value is greater than, less than or equal to another value. Examples of an inequality:  
 $x \geq 5$ ,  $-7 \leq y$ ,  $n > 0.6$ ,  $R < -3.5$ .

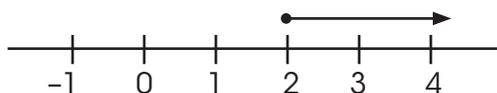
**Solution of an Inequality:** A value or a set of values that satisfy an inequality.

**Boundary Point:** Separates the values greater than the unknown from the values less than the unknown.

An open circle shows that the boundary point is not included in the solution.



A closed circle shows that the boundary point is included in the solution.



## W2 – Lesson 8: Linear Inequalities

### Materials required:

- Paper, Pencil, Graph Paper, and Calculator

### Part 1: Representing Inequalities

An inequality is an expression where one value is greater than, less than or equal to another value.

The symbols used for inequality are:

- $>$  means 'greater than'
- $<$  means 'less than'
- $\geq$  means 'greater than or equal to'
- $\leq$  means 'less than or equal to'

To read an inequality:

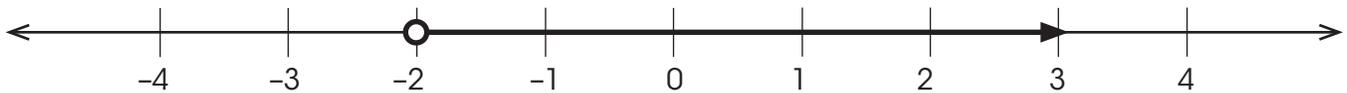
- $x > y$       $x$  is greater than  $y$
- $x < y$       $x$  is less than  $y$
- $x \geq y$       $x$  is greater than or equal to  $y$
- $x \leq y$       $x$  is less than or equal to  $y$
- $x \neq y$       $x$  is not equal to  $y$

For example,  $x < -5$  is read as:  $x$  is less than  $-5$ .

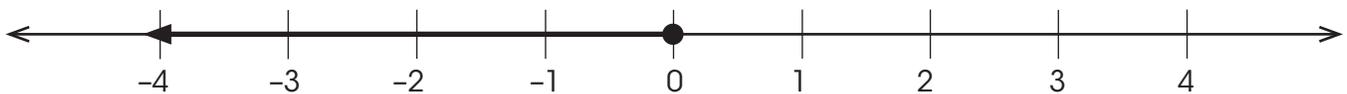
It means that the unknown value,  $x$ , is less than  $-5$ . Possibilities include  $-6, -7, -8, -9 \dots$

### Example 1

An inequality can be represented graphically.



In the above the line segment, the beginning at  $-2$  is an open circle. This represents  $>$  and means  $2$  is **not** a possible solution for this equation. Only values greater than  $-2$  satisfy the equation.



In the above line segment, the beginning at  $0$  is coloured in, depicting a closed circle. This represents  $\leq$  and means  $0$  **is** a possible solution for this equation. Zero and values less than  $0$  satisfy the equation.

### Practice Questions

1. Insert the correct equation or inequality beside its corresponding graph.

$m \geq 4$        $m > 4$        $x = 4$        $4 \geq y$        $4 > y$

$m > 4$	
$4 \geq y$	
$4 > y$	
$x = 4$	
$m \geq 4$	



## Part 2: Solving Inequalities

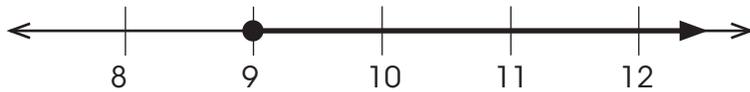
Solving an inequality is very similar to solving an equation. The purpose is to isolate the variable to solve for a solution.

### Example 1

$$6y \geq 54$$

$$\frac{6y}{6} \geq \frac{54}{6}$$

$$y \geq 9$$

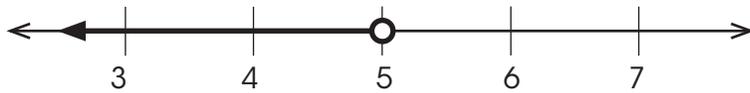


### Example 2

$$x + 4 < 9$$

$$x + 4 - 4 < 9 - 4$$

$$x < 5$$



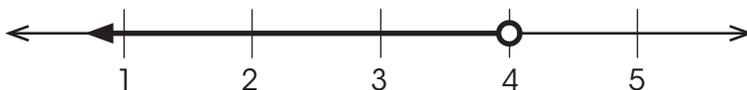
### Part 3: Solving Inequalities by Multiplying or Dividing by a Negative Number

#### Example 1

When each side of the inequality is multiplied or divided by a negative number, the inequality sign must be reversed in order for it to be true.

$$\begin{array}{l}
 -3x > -12 \\
 \frac{-3x}{-3} < \frac{-12}{-3} \\
 x < 4
 \end{array}$$

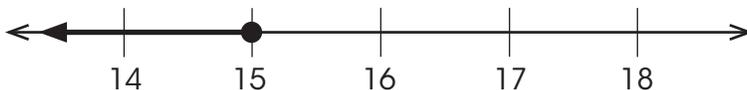
Note: Because the inequality is divided by a negative number, the inequality symbol is reversed.



#### Example 2

$$\begin{array}{l}
 -n \geq -15 \\
 -n \times -1 \geq -15 \times -1 \\
 n \leq 15
 \end{array}$$

Note: Because the inequality is multiplied by a negative number, the inequality symbol is reversed.



The solution of an inequality can contain many values. The solution will be the value or the set of values that satisfy the inequality.

In the first example, where  $x < 4$ , possible solutions include:

- 3, 2, 1, 0, -1 . . .  
 2.05, 3.99, 0.007,  $\frac{1}{2}$ ,  $-\frac{3}{4}$ ,  $-\frac{5}{12}$

In the second example, where  $n > 15$ , possible solutions include:

- 15, 16, 17, 18, 19, 20 . . .  
 742, 1000, 15.7, 16.359

## Part 4: Solving Multi-Step Inequalities

To solve inequalities involving addition, subtraction, multiplication and division, work to isolate the variable, remembering to reverse the inequality sign when multiplying or dividing by a negative number.

### Example 1

$$4m - 18 < 36$$

$$4m - 18 + 18 < 36 + 18$$

$$4m < 44$$

$$\frac{4m}{4} < \frac{44}{4}$$

$$m < 11$$

### Example 2

$$-7p + 2 > -3p + 22$$

$$-7p + 2 - 2 > -3p + 22 - 2$$

$$-7p > -3p + 20$$

$$-7p + 3p > -3p + 3p + 20$$

$$-4p > 20$$

$$\frac{-4p}{-4} < \frac{20}{-4}$$

$$p < -5$$

Remember to reverse the inequality symbol when multiplying or dividing by a negative number.

### Practice Questions

1. Solve the following inequalities. Graph the inequality for b and c.

a.  $6x < 2x + 30$

$$6x - 2x < 2x - 2x + 30$$

$$4x < 30$$

$$\frac{4x}{4} < \frac{30}{4}$$

$$x < 7.5$$

b.  $-12x + 15 > 19 - 4x$

$$-12x + 15 - 15 > 19 - 15 - 4x$$

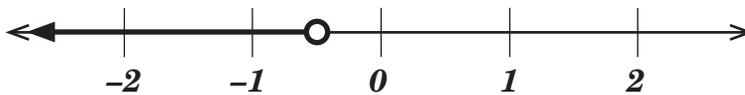
$$-12x > 4 - 4x$$

$$-12x + 4x > -4x + 4x + 4$$

$$-8x > 4$$

$$\frac{8x}{-8} < \frac{4}{-8}$$

$$x < -0.5$$



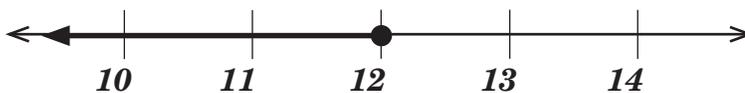
c.  $3x - 6 \leq 30$

$$3x - 6 + 6 \leq 30 + 6$$

$$3x \leq 36$$

$$\frac{3x}{3} \leq \frac{36}{3}$$

$$x \leq 12$$



d.  $6x + 5 \geq 2x - 15$

$$6x + 5 - 5 \geq 2x - 15 - 5$$

$$6x \geq 2x - 10$$

$$6x - 2x \geq 2x - 10 - 2x$$

$$4x \geq -10$$

$$x \geq -\frac{10}{4} = -2\frac{1}{2} \text{ or } -2.5$$

2. Give 3 possible solutions that satisfy the following inequalities.

a.  $p \geq 6$  **6, 7, 8, 9, 6.02, 1000, etc**

b.  $2 \leq b$  **2, 1, 0, -1, -10, -1000, 1.5 etc**

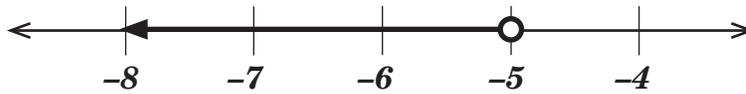
c.  $r > 3.05$  **3.06, 3.07, 4, 5, 10, 100, 1000, etc**



4. Solve and graph the following inequalities.

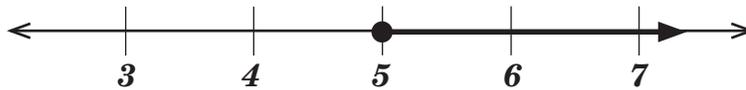
a.  $-7x + 2 > -3x + 22$

$$\begin{aligned} -7x + 2 - 2 &> -3x + 22 - 2 \\ -7x + 3x &> -3x + 3x + 20 \\ -4x &> 20 \\ x &< -5 \end{aligned}$$



b.  $4x + 7 \leq 7x - 8$

$$\begin{aligned} 4x + 7 + 8 &\leq 7x - 8 + 8 \\ 4x - 4x + 15 &\leq 7x - 4x \\ 15 &\leq 3x \\ 5 &\leq x \end{aligned}$$



c.  $3x - 4 \geq 6x + 11$

$$3x - 4 + 4 \geq 6x + 11 + 4$$

$$3x - 6x \geq 6x - 6x + 15$$

$$-3x \geq 15$$

$$x \leq -5$$



d.  $-6x + 5 \geq 29$

$$-6x + 5 - 5 \geq 29 - 5$$

$$-6x \geq 24$$

$$x \leq -4$$









