Linear Inequations

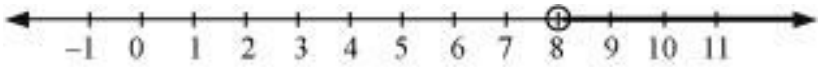
- Two real numbers or two algebraic expressions related by the symbol '<', '>', '≤' or '≥' form an inequality.

Note: Inequalities involving '<' or '>'are strict inequalities whereas inequalities involving '≤' or '≥' are slack inequalities.

Example: $6 < 26$, $3 < z + 1 \leq 22$, $27 \geq s \geq 16$, $p + t > 100$

- Any **solution of an inequality in one variable** is a value of the variable that makes it a true statement.
- The set of numbers consisting of all the solutions of an inequality is known as the **solution set** of the inequality.
- The rules that need to be followed to solve an inequality are:
    - Equal numbers may be added to (or subtracted from) both sides of an inequality without affecting the sign of the inequality.
    - Both sides of an inequality can be multiplied (or divided) with the same positive number. However, when both sides are multiplied or divided by a negative number, then the sign of the inequality is reversed.
- To represent $x \leq a$ (or $x \geq a$) on a number line, encircle the number a, and darken the line to the left (or the right) of a.

Example:
Show the graph of the solution of the inequality $5(x - 3) > 2x + 9$ on number line.
Solution:
$5(x - 3) > 2x + 9$
$\Rightarrow 5x - 15 > 2x + 9$
$\Rightarrow 5x - 15 - 2x > 2x + 9 - 2x$
$\Rightarrow 3x - 15 > 9$
$\Rightarrow 3x > 9 + 15$
$\Rightarrow 3x > 24$
$\Rightarrow x > 8$
Thus, the solution of the given inequality can be represented on the number line as shown below.



- The solution set might be taken from real numbers or whole numbers or integers or any other set of numbers. The set from which the values of the variables (involved in the inequation) are chosen is called the **replacement set**. We may take any set as the replacement set. For example, **N**, **Z**, $\{-4, -3, -2\}$ can be taken as the replacement set.