

SESSION 5: SOLVING EQUATIONS AND INEQUALITIES

KEY CONCEPTS:

- Literal equations (changing the subject of formulae)
- Linear inequalities
- Word problems

TERMINOLOGY

Literal equation: An equation which has different letters which represent variables

Inequality: A mathematical expression for comparing the size (magnitude) of a variable or variables

Linear inequality: A mathematical expression that is similar in form to a linear equation but may include the following signs:

Greater than and equal to: \geq

Greater than (not equal): $>$

Less than and equal to: \leq

Less than (not equal): $<$

X-PLANATION

Changing the subject of formulae

Literal equations are a way of showing the relationship between variables and are used as formula in every day calculations. However, the way the literal equation is written may not be in the form we require. We often need to rearrange a literal equation so that a particular variable is isolated on one side of the equation and set equal to an expression of the other variables on the other side of the equal sign. We call this process, changing the subject of the formula.

Step 1: Identify the variable that needs to be the subject of the formula

Step 2: Identify what operations involve this variable

Step 3: Perform the opposite operation to both sides of the equation

Start by adding or subtracting terms that do not include the variable

Divide or multiply both sides of the equation to isolate the variable

If the variable is squared, take the square root of both sides of the equation.

If the unknown variable is in the denominator, we multiply both sides by the lowest common denominator (LCD) and then continue to solve.

Linear Inequalities

We solve linear inequalities in the same way we solve linear equations, except that when multiplying or dividing both sides of an inequality by a negative number the sign changes from greater than to less than or from less than to greater than.

The solution to an inequality gives a set of numbers that satisfy the conditions of the inequality. The solution can be expressed in three ways:

- **An inequality**

We use the inequality signs to indicate all the values that form the solution:

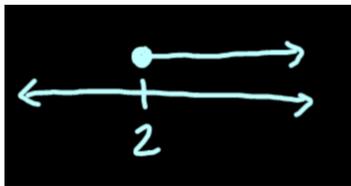
e.g greater than and equal to 2: $x \geq 2$

less than 2: $x < 2$

greater than and equal to 2 but less than and equal to 5: $2 \leq x \leq 5$

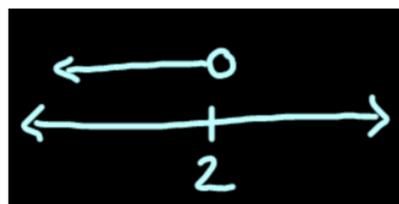
- **A number line**

We show the points included in the solution with a filled in circle and a solid line with an arrow above a number line. Eg: greater than and equal to 2:



If a point is not included, we draw a circle that is not filled in on the point followed by an arrow above a number line:

E.g. less than 2:



- **An interval**

We use square brackets separated by a semi-colon to include all real number values in a solution. This is called a closed interval.

e.g: greater than and equal to 2 but less than and equal to 5: $[2; 5]$

We use round bracket to show when a number is not included in the interval. We use the sign ∞ to represent infinity. We always use a round bracket with infinity because it is not a fixed number.

e.g greater than and equal to 2: $[2; \infty)$
less than 2: $(-\infty; 2)$

X-AMPLE QUESTIONS:

Question 1:

- (a) Solve for l : $P = VI$
- (b) Make m the subject of the formula: $E = mc^2$
- (c) Solve for t : $v = u + at$
- (d) Make f the subject of the formula:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

Question 2:

Solve the following linear inequalities:

a.)

$$\frac{4x - 2}{6} > 2x + 1$$

b.)

$$\frac{1 - a}{2} - \frac{2 - a}{3} \geq 1$$

c.) $-5 \leq 2k + 1 < 5$

Question 3:

a.) $\frac{7}{8}$ of a certain number is 5 more than $\frac{1}{3}$ of the number. Find the number.

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- b.) Three rulers and two pens have a total cost of R21,00. One ruler and one pen have a total cost of R8,00. How much does a ruler cost and how much does a pen cost?
- (c) A man runs to the bus stop and back in 15 minutes. His speed on the way to the bus stop is 5 km/h and his speed on the way back is 4 km/h. Find the distance to the bus stop.
- (d) Zanele and Piet skate towards each other on a straight path. They set off 20 km apart. Zanele skates at 15 km/h and Piet at 10 km/h. How far will Piet have skated when they reach each other?
- (e) When the price of chocolates is increased by R10, we can buy five fewer chocolates for R 300. What was the price of each chocolate before the price was increased?

Question 4:

- (a) Two jets are flying towards each other from airports that are 1 200 km apart. One jet is flying at 250 km/h and the other jet at 350 km/h. If they took off at the same time, how long will it take for the jets to pass each other?
- (b) Kadesh bought 20 shirts at a total cost of R 980. If the large shirts cost R 50 and the small shirts cost R 40. How many of each size did he buy?
- (c) The diagonal of a rectangle is 25 cm more than its width. The length of the rectangle is 17 cm more than its width. What are the dimensions of the rectangle?

