Year 9 Equations and Inequalities – Revision Notes

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Year 9 · Maths · Equations, Formulae and Inequalities · Key ideas and worked examples

For grown-ups and learners: read each part and try the worked example. Then work through the sheets: Foundation, Developing, Challenge, then Mixed Practice to revise everything. Show your working: it earns marks in tests and helps you spot mistakes.

1. Formulae and changing the subject

A **formula** connects variables: the surface area of a cube with edge e is $S = 6e^2$. To make another letter the **subject**, undo the operations on it in reverse order, doing the same to both sides. Undo a square with a square root and a cube with a cube root: from $V = 4h^3$, $h^3 = V/4$, so $\mathbf{h = \sqrt[3]{(V/4)}}$.

Example: Make h the subject of $V = Ah/3$.
→ Undo the operations on h in reverse order
→ $h = 3V/A$
Answer: $h = 3V/A$

2. Solving equations

Clear brackets and fractions first. If the unknown is in the **denominator**, multiply both sides by it: $24/(x + 2) = 4$ gives $24 = 4(x + 2)$, so $x + 2 = 6$ and **$x = 4$**. To write an equation from words, choose a letter for the unknown, write each quantity in terms of it, and check your answer in the words.

Example: Solve $32/x + 8 = 12$.
→ Subtract 8: $32/x = 4$
→ Multiply by x: $32 = 4x$, so $x = 8$
Answer: $x = 8$

3. Simultaneous equations

The solution of two simultaneous equations is the **pair of values** that makes both true. To **eliminate** a letter, add or subtract the equations (multiply one first if needed). For $3x + 2y = 16$ and $x - 2y = 0$, adding gives $4x = 16$, so $x = 4$ and then $y = 2$. On a graph, the solution is the **point where the two lines cross**.

Example: Solve the simultaneous equations $x + 2y = 0$ and $4x - y = 27$.
→ Match the y terms, then eliminate y
→ $x = 6$; substitute to find $y = -3$
Answer: $x = 6$, $y = -3$

4. Inequalities

'At most 600' is ≤ 600 and 'more than 20' is > 20. Solve an inequality like an equation, but **reverse the sign** if you multiply or divide by a negative number: 7 − 2x > 13 gives −2x > 6, so **x < −3**. On a number line a filled circle means the end is included (≤, ≥) and an open circle means it is not (<, >).

Example: Solve the inequality $-4 \leq 2x + 4 < 4$.
→ Subtract 4 from all three parts: $-8 \leq 2x < 0$
→ Divide all three parts by 2: $-4 \leq x < 0$
Answer: $-4 \leq x < 0$

Think like a mathematician: test a few cases (**specialising**), look for the rule that always works (**generalising**), and explain why you are sure (**convincing**). When you check someone's working, say what is wrong and how to **improve** it.

Common mistakes: dividing before subtracting when changing the subject. Halving instead of square-rooting. Multiplying instead of dividing when x is in the denominator. Adding equations that have the same sign of y. Forgetting to reverse an inequality after dividing by a negative number.