Title: **Transformations, Vectors, Congruence and Similarity**

Key Knowledge/Prior Learning KS2/3 and Retrieval and Suggested Starters
• Identify, describe and construct congruent and similar shapes, including on co-ordinate axes, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)

KS4 National Curriculum – what students will be practicing
• Use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) • Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides including the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs • Apply and use the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures • Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representation of vectors • **Use vectors to construct geometric arguments and proofs** • **Describe the changes and invariance achieved by combinations of rotations, reflections and translations** •

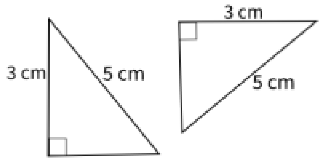
Specific Ambitious Knowledge

Key Vocabulary/Literacy Opportunities
• Congruent • Similar • Translation • Enlargement • Reflection • Rotation • Scale factor • Scalar • Proof • Invariance •

Key Formulae/Knowledge

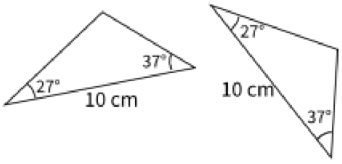
Conditions for congruency

To show that two triangles are congruent, you must **prove** one of the following four conditions are true:



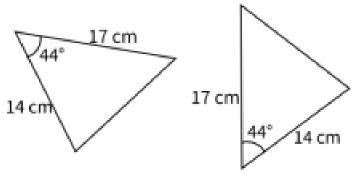
RHS (right-angle, hypotenuse, side)

- Both triangles have a right-angle.
- Both triangles have the same hypotenuse length.
- Have one other pair of sides which are equal



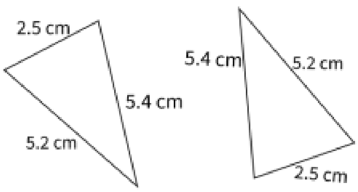
ASA (angle, side, angle)

- Two pairs of angles are equal.
- The side between the angles are the same.



SAS (side, angle, side)

- Two pairs of sides are equal.
- The angle between the pair of equal sides is the same.



SSS (side, side, side)

- All three pairs of sides are equal.

Two shapes are similar if they are the same shape but one may be an **enlargement** of the other.

Although lengths may differ for similar shapes, their **angles** are the same.
The following two shapes are similar:

To **add** and **subtract** vectors in **column vector** notation, we add each of the coordinate rows.

Suppose we had **vector** $\boldsymbol{a} = \begin{pmatrix} a_x \\ a_y \end{pmatrix}$ and **vector** $\boldsymbol{b} = \begin{pmatrix} b_x \\ b_y \end{pmatrix}$ then $\boldsymbol{a} + \boldsymbol{b} = \begin{pmatrix} a_x + b_x \\ a_y + b_y \end{pmatrix}$.

Similarly, for **subtraction**, $\boldsymbol{a} - \boldsymbol{b} = \begin{pmatrix} a_x - b_x \\ a_y - b_y \end{pmatrix}$.

Maths in Context (Historical, Real Life and Student Thinking Points)

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Projects/Enrichment/Investigations

- Vectors short problems
- **Vector Racer**
- **Vector Journeys**
- **Spotting the Loophole**