

Exercise walk-through

4.4.5

Transformation Composition

AQA · GCSE · Mathematics

28. Vectors and transformation geometry · Foundation

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With $a=(4,1)$ and $b=(1,3)$, $a+b=(5,4)$ and $2a-b=(7,-1)$. From $A=(1,2)$ to $B=(5,5)$, $AB=(4,3)$ and its length is 5. Write each 2D vector as a column with the horizontal component above the vertical component: the translation AB has top entry 4 and bottom entry 3. A negative horizontal entry moves left; a negative vertical entry moves down. Drawing b from the head of a gives the head-to-tail diagram for $a+b$. Subtracting b adds its opposite $-b$.

103. Combined isometries and invariants · Higher

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Apply each transformation to the current image in the stated order. Rotations, reflections and translations preserve lengths and angles, so their combinations also preserve them. Reflections reverse orientation; rotations and translations preserve it. Two reflections in parallel lines give a translation; in intersecting lines they give a rotation through twice the directed angle between the mirrors.

118. Tangents, chords and the alternate segment · Higher

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At contact T, the radius OT is perpendicular to the tangent: a non-perpendicular line through T would have a smaller centre-to-line distance than the radius and cut the circle twice. For tangents PA and PB, $OA=OB$, OP is shared and both contact angles are 90° . RHS makes OAP and OBP congruent, so $PA=PB$. For a centre perpendicular OM to chord AB, $OA=OB$ and OM is shared; RHS gives $AM=MB$. If $OA=5$ and $OM=3$, $AM=4$, hence $AB=8$. For a chord AB with minor central angle ϕ , triangle OAB has base angle $(180-\phi)/2$.

Exercises 2.1·2.3

2.1 (Higher) For $(3,2)$, reflect in y -axis then translate by $(2,1)$. Find final x .

2.2 (Higher) Reverse those operations on $(3,2)$. Find final x .

2.3 (Higher) Reflect in $x=0$ then $x=2$. Find the translation x -component.

3 Exam-style questions

Exercises 2.1·2.3

2.1 (Higher) For $(3,2)$, reflect in y -axis then translate by $(2,1)$. Find final x .

2.1 $-3+2=-1$.

2.2 (Higher) Reverse those operations on $(3,2)$. Find final x .

2.2 Translate gives $x=5$; reflect gives -5 .

2.3 (Higher) Reflect in $x=0$ then $x=2$. Find the translation x -component.

3 Exam-style questions

2.3 x becomes $-x$, then $4-(-x)=x+4$.

Exercise 3.1

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: Changing the order of transformations never changes the final image.

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3.1 False. Reflect $(3,2)$ in the y -axis then translate by $(2,1)$ to get $(-1,3)$. Translate first then reflect to get $(-5,3)$.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.