

Exercise walk-through

4.4.1

**Vectors**

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AQA · GCSE · Mathematics

## 28. Vectors and transformation geometry · Foundation

### Vectors and transformation geometry · Foundation

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  $-b$ .

## 118. Tangents, chords and the alternate segment · Higher

### Tangents, chords and the alternate segment · Higher

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  $90^\circ$ . 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  $\phi$ , triangle OAB has base angle  $(180-\phi)/2$ .

## 174. Vector geometry and midpoint arguments · Higher

### Vector geometry and midpoint arguments · Higher

Add/subtract components and multiply a vector by a scalar. Position vectors locate points from one origin; displacement  $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$  joins two points. A scalar multiple gives parallel directions; to establish collinearity, also connect the displacements to a common point. Midpoints average position vectors. Give a chain of vector equalities with clear start and end points.

## Exercises 2.1·2.3

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**2.1** (Foundation) Find the x-component of  $(4,1)+(1,3)$ .

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**2.2** (Foundation) Find the magnitude of  $(4,3)$ .

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**2.3** (Foundation) Find the y-component of  $(4,1)+(1,3)$ .

**3 Exam-style questions**

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## Exercises 2.1·2.3

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**2.1** (Foundation) Find the x-component of  $(4,1)+(1,3)$ .

**2.1** Add the x-components:  $4+1=5$ .

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**2.2** (Foundation) Find the magnitude of  $(4,3)$ .

**2.2** Magnitude= $\sqrt{4^2+3^2}=5$ .

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**2.3** (Foundation) Find the y-component of  $(4,1)+(1,3)$ .

## 3 Exam-style questions

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**2.3** Add the y-components:  $1+3=4$ .

## Exercise 3.1

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**3.1** Decide whether this claim is true. Justify with a concrete calculation or counterexample:  $AB$  and  $BA$  always have the same components.

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**3.1** Decide whether this claim is true. Justify with a concrete calculation or counterexample:  $\overrightarrow{AB}$  and  $\overrightarrow{BA}$  always have the same components.

**3.1** False.  $A=(1,2)$ ,  $B=(5,5)$  give  $\overrightarrow{AB}=(4,3)$  and  $\overrightarrow{BA}=(-4,-3)$ . Reversing direction negates the vector.

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