

Exercise walk-through

4.3.1

Geometry

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 $-b$.

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.

176. Vector geometry and midpoint arguments · Higher

Vector geometry and midpoint arguments · Higher

Let $OA=a$ and $OB=b$, with M midpoint of OA and N midpoint of OB . Then $OM=a/2$ and $ON=b/2$, so $MN=b/2-a/2=(b-a)/2=AB/2$. Thus MN is parallel to AB and half as long. For $a=(4,2), b=(2,6)$, $M=(2,1), N=(1,3)$, $AB=(-2,4)$ and $MN=(-1,2)$, verifying the general result. In parallelogram $OACB$ with $OC=a+b$, the midpoint of OC is $(a+b)/2$; the midpoint of AB is the same, so the diagonals bisect each other. If $AP=3AB/2$, P lies on line AB beyond B ; if $AP=AB/2$, P is its midpoint. A parallel vector at another location alone does not prove three specified points collinear.

Exercises 2.1·2.3

2.1 (Foundation) Find the area of a rectangle of sides 8 cm and 5 cm.

2.2 (Foundation) Find the area of a triangle of base 8 cm and height 5 cm.

2.3 (Foundation) Find the sum of interior angles of a pentagon in degrees.

Exercises 2.1·2.3

2.1 (Foundation) Find the area of a rectangle of sides 8 cm and 5 cm.

2.1 Rectangle area = $8 \times 5 = 40 \text{ cm}^2$.

2.2 (Foundation) Find the area of a triangle of base 8 cm and height 5 cm.

2.2 Triangle area = $8 \times 5 / 2 = 20 \text{ cm}^2$.

2.3 (Foundation) Find the sum of interior angles of a pentagon in degrees.

2.3 Interior-angle sum = $(5-2) \times 180 = 540^\circ$.

Exercises 2.4·3.1

2.4 (Higher) Two similar figures have length factor 3. Find the area factor.

2.5 (Higher) Two similar solids have length factor 3. Find the volume factor.

3 Exam-style questions

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: A triangle and rectangle with the same base and height have the same area.

Exercises 2.4·3.1

2.4 (Higher) Two similar figures have length factor 3. Find the area factor.

2.4 Area scales by the square of the length factor: $3^2=9$.

2.5 (Higher) Two similar solids have length factor 3. Find the volume factor.

3 Exam-style questions

2.5 Volume scales by the cube: $3^3=27$.

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: A triangle and rectangle with the same base and height have the same area.

3.1 False. Base 8 cm and perpendicular height 5 cm give rectangle area 40 cm^2 and triangle area 20 cm^2 .

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