Foundation Check In - 9.03 Plane vector geometry

1. Write the vector  as a column vector.



1. Which of these diagrams represents ?

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |
|  |  |  |

1. Calculate .
2. If , what is  written as a column vector?
3.  and . Work out 
4. The vector  represents a journey that ends 5 km east and 7 km north from a starting point. Describe the journey that the vector  represents.
5. , ,  and . Show that ABCD is a quadrilateral.
6.  is parallel to . Show that the value of  is .
7. Find the value of  and .



1. Find the value of  and .



**Extension**

The quadrilateral in question 7 is a parallelogram. How can we show this using the four given vectors?

Is it also a rectangle? Draw it. Are you sure?

One way of testing if a parallelogram is a rectangle is to find the lengths of the inside diagonals from corner to corner; if they are equal in length it is a rectangle. What are the vectors of the inside diagonals  and? How could you work out how long these vectors are?

Answers

1. 
2. **B**
3. 
4. 
5. 
6. 5 km west, 7 km south
7. 

Alternatively, without drawing, we know that each vector represents a straight line.  so these vectors form a closed 4-sided shape. The shape is therefore a quadrilateral.

1. If  is parallel to , then  must be  multiplied by a value.

, so the value  is multiplied by –4. .

1. The top row gives  so . The bottom row gives  so .
2. The vector equation could be represented by the simultaneous equations



Solving these gives , .

**Extension**

The quadrilateral is a parallelogram, since opposite sides (AB and DC, and AD and BC) are parallel.

Drawing a diagram may not convince you about whether it is a rectangle: it looks quite ‘rectangle like’ (the inside angles are approximately 82 and 98 degrees).

The diagonals are  and . We can work out the lengths of these vectors by using Pythagoras’ theorem. The length of  is . The length of  is . Since the diagonals are not equal in length, this parallelogram cannot be a rectangle.

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| **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |  | **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |
| AO1 | 1 | Represent a 2-dimensional vector as a column vector |  |  |  |  | AO1 | 1 | Represent a 2-dimensional vector as a column vector |  |  |  |
| AO1 | 2 | Recognise representation of a column vector on a square grid |  |  |  |  | AO1 | 2 | Recognise representation of a column vector on a square grid |  |  |  |
| AO1 | 3 | Subtract column vectors |  |  |  |  | AO1 | 3 | Subtract column vectors |  |  |  |
| AO1 | 4 | Understand reverse vectors |  |  |  |  | AO1 | 4 | Understand reverse vectors |  |  |  |
| AO1 | 5 | Calculate with column vectors |  |  |  |  | AO1 | 5 | Calculate with column vectors |  |  |  |
| AO2 | 6 | Represent a 2-dimensional vector in a navigation context |  |  |  |  | AO2 | 6 | Represent a 2-dimensional vector in a navigation context |  |  |  |
| AO2 | 7 | Interpret column vectors |  |  |  |  | AO2 | 7 | Interpret column vectors |  |  |  |
| AO2 | 8 | Understand scalar multiplication of vectors |  |  |  |  | AO2 | 8 | Understand scalar multiplication of vectors |  |  |  |
| AO3 | 9 | Find two unknowns in a vector equation |  |  |  |  | AO3 | 9 | Find two unknowns in a vector equation |  |  |  |
| AO3 | 10 | Solve simultaneous equations in vector form |  |  |  |  | AO3 | 10 | Solve simultaneous equations in vector form |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| AO1 | 4 | Understand reverse vectors |  |  |  |  | AO1 | 4 | Understand reverse vectors |  |  |  |
| AO1 | 5 | Calculate with column vectors |  |  |  |  | AO1 | 5 | Calculate with column vectors |  |  |  |
| AO2 | 6 | Represent a 2-dimensional vector in a navigation context |  |  |  |  | AO2 | 6 | Represent a 2-dimensional vector in a navigation context |  |  |  |
| AO2 | 7 | Interpret column vectors |  |  |  |  | AO2 | 7 | Interpret column vectors |  |  |  |
| AO2 | 8 | Understand scalar multiplication of vectors |  |  |  |  | AO2 | 8 | Understand scalar multiplication of vectors |  |  |  |
| AO3 | 9 | Find two unknowns in a vector equation |  |  |  |  | AO3 | 9 | Find two unknowns in a vector equation |  |  |  |
| AO3 | 10 | Solve simultaneous equations in vector form |  |  |  |  | AO3 | 10 | Solve simultaneous equations in vector form |  |  |  |