



4.2.8 Vectors

- 1) A game represents the position and movement of a character using 2D vectors.

The character's current position is:

$$p = (4, 3)$$

The character moves according to the movement vector:

$$m = (2, -1)$$

- a) Calculate the character's new position.

[1 mark]

- **(6,2);**

- b) The character's movement vector is multiplied by the scalar **3**. State what happens to the character's movement in terms of magnitude and direction.

[2 marks]

- **The magnitude/distance of the movement is tripled;**
 - **The direction of the movement remains the same;**
-

- 2) Two vectors are given:

$$a = (3, 2, 1)$$

$$b = (4, -1, 5)$$

Calculate the dot product $a \cdot b$

Show your working.

[2 marks]

- **$(3 \times 4) + (2 \times -1) + (1 \times 5);$**
 - **15;**
-

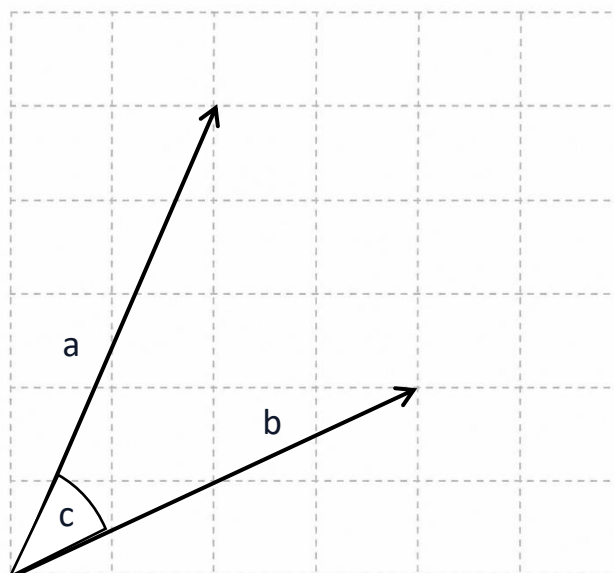




- 3) A game represents the position and movement of a character using 2D vectors.

Figure 1 shows two vectors **a** and **b** and the angle between them, **c**.

Figure 1



$$\mathbf{a} = (2, 5)$$

$$\mathbf{b} = (4, 2)$$

The magnitude of a vector, represented as an arrow, is the length of the arrow. The magnitude of vector **a** is 5 because $\sqrt{4^2 + 3^2} = 5$

- a) What is the magnitude of vector **b**?

[1 mark]

- $\sqrt{20}$ // $2\sqrt{5}$;

- b) Calculate the dot product of vectors **a** and **b**. You should show your working.

[2 marks]

- 18;

- c) Describe what will happen to the angle **c** and the magnitude of vector **a** when **a** is multiplied by the scalar 2.

[2 marks]

- The angle will still be the same; A. the direction will not change;
- The magnitude will be doubled;





- d) Describe what will happen to the angle c and the magnitude of vector $\mathbf{a}$ when $\mathbf{a}$ is multiplied by the scalar -1 .

[2 marks]

- The direction of $\mathbf{a}$ will be the opposite of its current direction;
 - The magnitude will still be the same;
-

- 4) Given the vectors in Figure 1:

Figure 1

$$\mathbf{u} = (2, 4)$$

$$\mathbf{v} = (8, 10)$$

$$\mathbf{w} = 0.25\mathbf{u} + 0.75\mathbf{v}$$

- a) Calculate $\mathbf{w}$.

[1 mark]

- $(6.5, 8.5)$;

- b) Explain why this is a convex combination.

[2 marks]

- Both scalars are non-negative;
 - The scalars add up to 1;
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