3 Vectors and the scalar product – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	**中文**	**Write it 3 times** (English)		
vector	向量			
magnitude	模长			
unit vector	单位向量			
scalar product	数量积			
perpendicular	垂直			

Recall

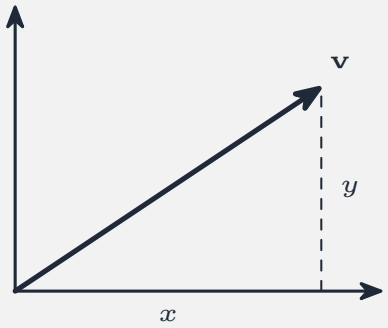
A **vector** 向量 has both size and direction. Pure 3 adds vectors in 3D and the scalar product.

New ideas

Read these first, then do the Practice.

■ 1 The magnitude of a vector

The **magnitude** 模长 (length) of a vector is found with Pythagoras:

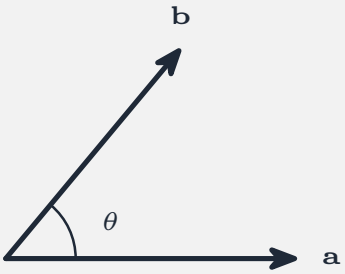


$$|\mathbf{v}| = \sqrt{x^2 + y^2}$$

$|\mathbf{v}| = \sqrt{x^2 + y^2 + z^2}$. A **unit vector** 单位向量 has magnitude 1.

■ 2 The scalar product

The **scalar product** 数量积 (dot product) is linked to the angle between two vectors:



$$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}|\,|\mathbf{b}| \cos\theta$$

$= 0$ if perpendicular

$\mathbf{a} \cdot \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$. If $\mathbf{a} \cdot \mathbf{b} = 0$, the vectors are **perpendicular** 垂直.

Watch out: the magnitude uses Pythagoras: $|\mathbf{v}| = \sqrt{x^2 + y^2 + z^2}$. The dot product $\mathbf{a}\cdot\mathbf{b} = 0$ means the vectors are *perpendicular*. To find the angle, use $\mathbf{a}\cdot\mathbf{b} = |\mathbf{a}||\mathbf{b}|\cos\theta$.

Practice

Try these in order.

3.6 Find the magnitude of the vector $3\mathbf{i} + 4\mathbf{j}$. [2]

3.7 What is the magnitude of a unit vector? [1]

3.8 Find $\mathbf{a} \cdot \mathbf{b}$ for $\mathbf{a} = (1, 2, 3)$ and $\mathbf{b} = (2, 0, 1)$. [2]

3.9 Two vectors have $\mathbf{a} \cdot \mathbf{b} = 0$. What does this tell you about them? [1]

3.10 Find the magnitude of $6\mathbf{i} + 8\mathbf{j}$. [1]

3.11 Challenge. Find the angle between $\mathbf{a} = (1, 0, 1)$ and $\mathbf{b} = (0, 1, 1)$, to the nearest degree. [3]