

# 4.9 Vector-Valued Functions

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ **Total: 9 marks**

**KEY WORDS** vector-valued function 向量值函数 • vector 向量 • parametric function 参数函数

## Objective

Build the skills to answer exam questions on **vector-valued functions**.

**You must be able to:**

- interpret a **vector-valued function** 向量值函数  $\vec{r}(t) = \langle x(t), y(t) \rangle$
- evaluate it at a value of  $t$

## 1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Vector-valued functions**

$\vec{r}(t) = \langle x(t), y(t) \rangle$  gives a **position vector** at each  $t$  — the same information as parametric motion, written as a vector.

■ **Example**

$\vec{r}(t) = \langle t, t^2 \rangle$ : at  $t = 2$ ,  $\vec{r}(2) = \langle 2, 4 \rangle$ .

## 2 Practice

**2.1** State what  $\vec{r}(t) = \langle x(t), y(t) \rangle$  gives. [1]

**2.2** For  $\vec{r}(t) = \langle 2t, t \rangle$ , find  $\vec{r}(3)$ . [2]

**2.3** State the connection between vector-valued and parametric functions. [1]

## 3 Exam-style questions

**3.1** A vector-valued function  $\vec{r}(t) = \langle x(t), y(t) \rangle$  describes [1]

- |   |   |
|---|---|
| A | B |
| C | D |
- A a single number  
B a position vector at each  $t$   
C a slope  
D an area

**3.2** For  $\vec{r}(t) = \langle t, 2t \rangle$ ,  $\vec{r}(1)$  equals [1]

- |   |   |
|---|---|
| A | B |
| C | D |
- A  $\langle 1, 2 \rangle$   
B  $\langle 2, 1 \rangle$   
C  $\langle 1, 1 \rangle$   
D  $\langle 2, 2 \rangle$

**3.3**  $\vec{r}(t) = \langle t + 1, 3t \rangle$ .

(a) Find  $\vec{r}(0)$ . [1]

(b) Find  $\vec{r}(2)$ . [1]

(c) State the  $x$ -component function. [1]