

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** 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** $\langle 1, 2 \rangle$
- **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]

Solutions

2.1 a position vector for each value of t .

2.2 $\vec{r}(3) = \langle 6, 3 \rangle$.

2.3 they carry the same information — the components $x(t)$, $y(t)$ are the parametric equations.

3.1 B.

3.2 A.

3.3 (a) $\langle 1, 0 \rangle$. (b) $\langle 3, 6 \rangle$. (c) $x(t) = t + 1$.