

# 1.14 Connecting Infinite Limits and Vertical Asymptotes

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 9 marks

## Objective

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Build the skills to answer exam questions on **connecting infinite limits and vertical asymptotes**.

You must be able to:

- relate an **infinite limit** 无穷极限 at  $a$  to a **vertical asymptote** 垂直渐近线  $x = a$

## 1 Worked examples

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

### ■ Infinite limits

If  $f(x) \rightarrow \pm\infty$  as  $x \rightarrow a$ , the line  $x = a$  is a **vertical asymptote**. This happens where the denominator  $\rightarrow 0$  but the numerator does not.

### ■ Example

$f(x) = \frac{1}{x-2}$  has a vertical asymptote at  $x = 2$ ; as  $x \rightarrow 2^+$ ,  $f(x) \rightarrow +\infty$ .

## 2 Practice

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2.1 State what an infinite limit at  $a$  indicates. [1]

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2.2 For  $f(x) = \frac{1}{x}$ , state the vertical asymptote. [1]

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2.3 State where a rational function has a vertical asymptote. [2]

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### 3 Exam-style questions

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3.1 If  $\lim_{x \rightarrow a} f(x) = \infty$ , then  $x = a$  is a [1]

- A horizontal asymptote
  - B vertical asymptote
  - C hole
  - D root
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3.2  $f(x) = \frac{1}{x-2}$  has a vertical asymptote at [1]

- A  $x = 0$
  - B  $x = 2$
  - C  $y = 2$
  - D  $x = -2$
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3.3  $f(x) = \frac{1}{x-5}$ .

- (a) Where is the denominator 0? [1]
- (b) State the vertical asymptote. [1]
- (c) State the behaviour of  $\lim_{x \rightarrow 5^+} f(x)$ . [1]

### 4 Go further

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- work through the **1.14 Connecting Infinite Limits and Vertical Asymptotes** lesson on the **Learn** page;
- read the **Limits and Continuity** section of the AP Calculus AB handout on the **Know** page.

## Solutions

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**2.1** the graph has a vertical asymptote there.

**2.2**  $x = 0$ .

**2.3** where the denominator is 0 but the numerator is not.

**3.1** B.

**3.2** B.

**3.3** (a)  $x = 5$ . (b)  $x = 5$ . (c)  $+\infty$ .