

# 1 Continuity and asymptotes – Part 2

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

## Vocabulary

Write each word three times.

| English            | Write it 3 times (English) |
|--------------------|----------------------------|
| continuous         | _____                      |
| vertical asymptote | _____                      |

## Recall

In Part A you met limits. Now use them to describe how smooth a graph is:

- Some graphs you can draw without lifting your pen.
- Others have jumps, holes, or shoot off to infinity.

Each idea has a worked example before the Practice.

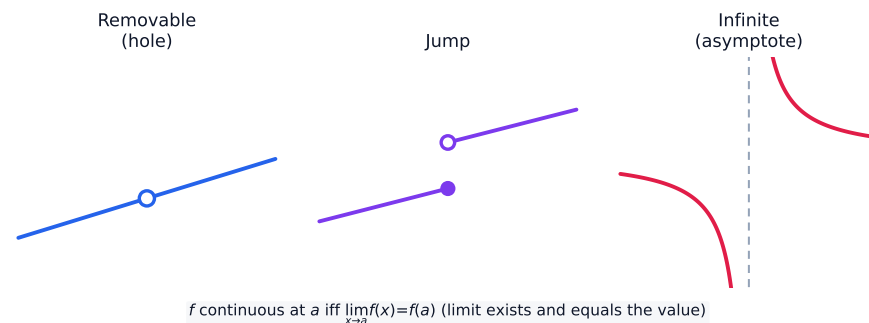
## New ideas

### ■ 1 Continuity

A function is **continuous** at a point if it has no break there – no hole, jump, or gap. A continuous graph can be drawn without lifting your pen.

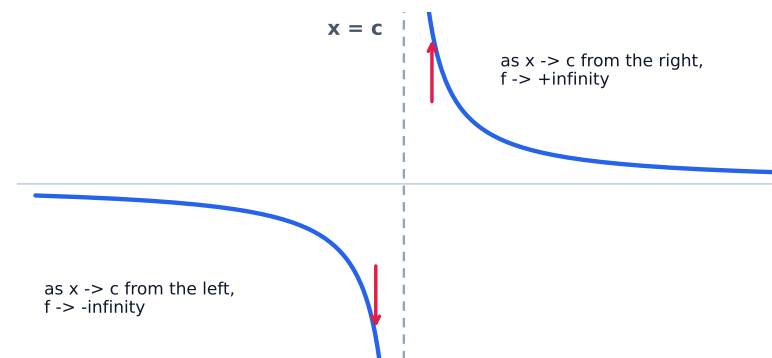
### ■ 2 Discontinuities

Where a graph breaks, it is **discontinuous**. The main kinds are a **hole**, a **jump**, and an **asymptote**.



### ■ 3 Vertical asymptotes

A **vertical asymptote** is a line the graph shoots up (or down) toward, without ever touching – it happens where the function blows up to infinity (like dividing by zero).



vertical asymptote  $x = c$  when  $\lim_{x \rightarrow c^+} f(x) = \pm\infty$  or  $\lim_{x \rightarrow c^-} f(x) = \pm\infty$

### ■ 4 Horizontal asymptotes

A **horizontal asymptote** is a value the graph levels off toward as  $x$  gets very large (or very negative).

**Watch out:** a graph can **cross** a horizontal asymptote but never crosses a **vertical** one – near a vertical asymptote the function races off to  $\pm\infty$  instead.

## Practice

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Try these in order. The methods are all above.

**2.1** State what it means for a function to be continuous at a point. [2]

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**2.2** Name three kinds of discontinuity. [3]

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**2.3** State what happens to a function near a vertical asymptote. [2]

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**2.4** State what a horizontal asymptote describes. [2]

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**2.5** For  $f(x) = \frac{1}{x-3}$ , state where the vertical asymptote is. [1]

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