

1 What a limit is – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English

Write it 3 times (English)

limit

Recall

You have looked at graphs and how they behave:

- You can trace a curve and see where it is heading.
- Some graphs get closer and closer to a value without quite reaching it.
- You know how to put a number into a formula.

This sheet introduces the **limit** – the first big idea of calculus. Each idea has a worked example.

New ideas

■ 1 What a limit is

A **limit** is the value a function **approaches** as x gets close to some point. We write it

$$\lim_{x \rightarrow a} f(x).$$

It asks: as x heads toward a , what does $f(x)$ head toward?

■ 2 Finding a limit

If the function has no break at a , you can just substitute.

Worked example. $\lim_{x \rightarrow 2} (x^2 + 1) = 2^2 + 1 = 5.$

■ 3 A hole in the graph

A limit can exist even if the function has a **hole** at that point – the graph still heads toward a value from both sides.

■ 4 From both sides

The limit exists only if the function heads toward the **same** value from the left and from the right.

Watch out: the limit is about what $f(x)$ **approaches**, not necessarily the value at that exact point. A function can approach 5 even if, right at that point, it has a hole or a different value.

Practice

Try these in order. The methods are all above.

2.1 In words, state what $\lim_{x \rightarrow a} f(x)$ means. [2]

2.2 Find $\lim_{x \rightarrow 3} (x + 4)$. [2]

2.3 Find $\lim_{x \rightarrow 2} (x^2 - 1)$. [2]

2.4 State whether a limit can exist at a point where the graph has a hole. [1]

2.5 State the condition on the left and right sides for a limit to exist. [2]
