AP CALCULUS AB • EXERCISE SHEET

1.9 Connecting Multiple Representations of Limits

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS algebra • graph • table • limit • approaches

Objective

Build the skills to answer exam questions on **connecting multiple representations of limits**.

You must be able to:

- find a limit from a graph, a table, or algebra
- cross-check that the three representations agree

1 Key knowledge and worked examples

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

■ Multiple representations

A limit can be found from a **graph** , a **table** , or **algebra** – and all three should give the same value. Cross-check when unsure.

■ Example

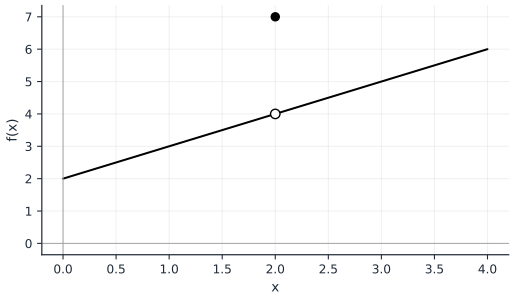
If algebra gives $\lim = 5$, the table trend is $\to 5$, and the graph approaches 5, the limit is 5.

■ Key knowledge: Connect algebra, graph and value

The formula for nearby inputs can determine the limit, while a separate point definition determines the actual value. A table should agree with that nearby formula.

■ Worked example: Connect algebra, graph and value

For $x \neq 2$, $(x^2 - 4)/(x - 2) = x + 2$. Nearby values therefore approach 4, and the graph follows the line $y = x + 2$ with a hole at $(2, 4)$. If a separate definition assigns $f(2) = 7$, the filled point is $(2, 7)$; that assignment changes continuity but not the limit.



2 Practice

2.1 Name three ways to find a limit. [1]

2.2 State what should be true across the representations. [1]

2.3 If algebra gives 5 and the table trend is 5, state the limit. [1]

3 Exam-style questions

3.1 A limit can be represented by [1]

☐ **A** only a graph
B a graph, table, or algebra
C only algebra
D none of these

3.2 The three representations of a limit should [1]

☐ **A** conflict
B all agree
C give different values
D be ignored

3.3 For a function, algebra gives $\lim = 4$, the table trend is $\to 4$, and the graph approaches 4.

(a) State the value from algebra. [1]

(b) State whether they agree. [1]

(c) State the limit. [1]

3.4 Let $g(x) = (x^2 - 9)/(x - 3)$ for $x \neq 3$ and $g(3) = 9$. (a) Find the limit at 3 by algebra. [2]

(b) State the open and filled point coordinates at $x = 3$ and decide whether g is continuous there. [2]

Solutions

Each answer shows the steps, then the **result**.

2.1

- from a graph, a table, or algebra

2.2

- they should all give the same value

2.3

- 5

3.1 B

- a graph, table, or algebra.

3.2 B

- all agree.

3.3

(a)

- 4

(b)

- yes

(c)

- 4

3.4

(a) For $x \neq 3$, $g(x) = x + 3$, so the limit is 6.

(b) Open point $(3, 6)$ and filled point $(3, 9)$; the value differs from the limit, so the function is not continuous.