1.10 Exploring Types of Discontinuities

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

KEY WORDS discontinuity • infinite discontinuity • jump discontinuity • removable discontinuity • jump

Objective

Build the skills to answer exam questions on **types of discontinuities**.

You must be able to:

- classify a **discontinuity** as removable, jump, or infinite

1 Key knowledge and worked examples

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

Three types of discontinuity

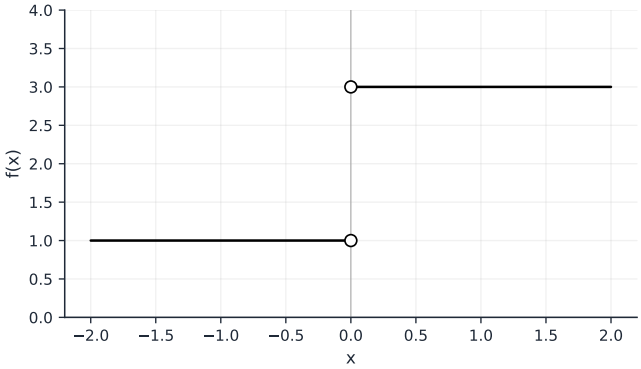
- **removable** (a **hole**): the limit exists but $\neq f(a)$, or $f(a)$ is undefined;
- **jump**: the left and right limits differ;
- **infinite**: a vertical asymptote (the function blows up).

Key knowledge: Distinguish discontinuity types

A removable discontinuity has an existing finite limit that can be supplied as the point value. A jump has unequal finite one-sided limits; an infinite discontinuity involves unbounded behaviour.

Worked example: Distinguish discontinuity types

A line with a missing point has a removable discontinuity. A graph approaching 1 on the left and 3 on the right has a jump; changing one point cannot make those limits agree. A graph of $1/x$ is unbounded near 0 and has an infinite discontinuity. Name the observed behaviour before proposing a repair.



2 Practice

2.1 Name the three types of discontinuity. [1]

2.2 State which type is a "hole". [1]

2.3 State which type occurs at a vertical asymptote. [2]

3 Exam-style questions

3.1 A discontinuity where the left and right limits differ is a [1]

- ☐ **A** removable discontinuity
- **B** jump discontinuity
- **C** infinite discontinuity
- **D** point of continuity

3.2 A hole in a graph is a [1]

- ☐ **A** jump discontinuity
- **B** removable discontinuity
- **C** infinite discontinuity
- **D** point of continuity

3.3 Classify each.

(a) A vertical asymptote. [1]

(b) A single missing point. [1]

(c) A step where the graph jumps. [1]

3.4 (a) For $f(x) = (x^2 - 4)/(x - 2)$, identify the discontinuity at 2 and give a point value that removes it. [2]

(b) A function approaches 1 from the left of 3 and 4 from the right. Classify the discontinuity and explain whether changing $f(3)$ can remove it. [2]