



CALCULUS 1
FIRST PARTIAL
PROJECT

CONTINUITY AND DISCONTINUITY

Isabella de Anda A01023060

Mirna Dávila A01570133

A DISCONTINUITY, JUST AS ITS NAME IMPLIES, IS A POINT WHERE A MATHEMATICAL OBJECT IS DISCONTINUED.

ITS MAIN CHARACTERISTIC IS THAT IT HAS A LIMIT, AND THAT IT CAN BE FIXED BY RE-DEFINING THE FUNCTION.

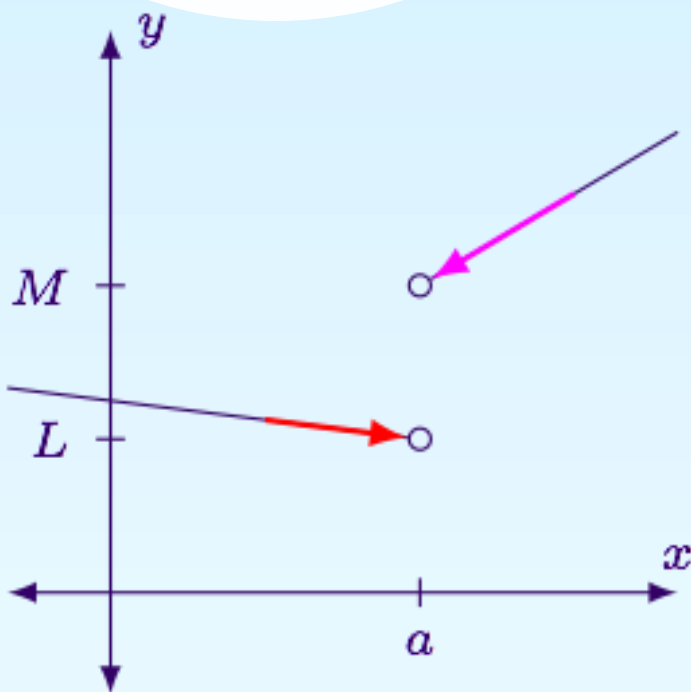
THERE ARE FOUR TYPES OF DISCONTINUITIES:

- JUMP DISCONTINUITIES
- INFINITE DISCONTINUITIES
- ENDPOINT DISCONTINUITIES
- MIXED

**WHAT IS A
DISCONTINUITY?**

JUMP DISCONTINUITY

THE JUMP DISCONTINUITY IS WHERE BOTH ONE SIDED LIMITS EXIST, BUT THEY BOTH HAVE DIFFERENT VALUES



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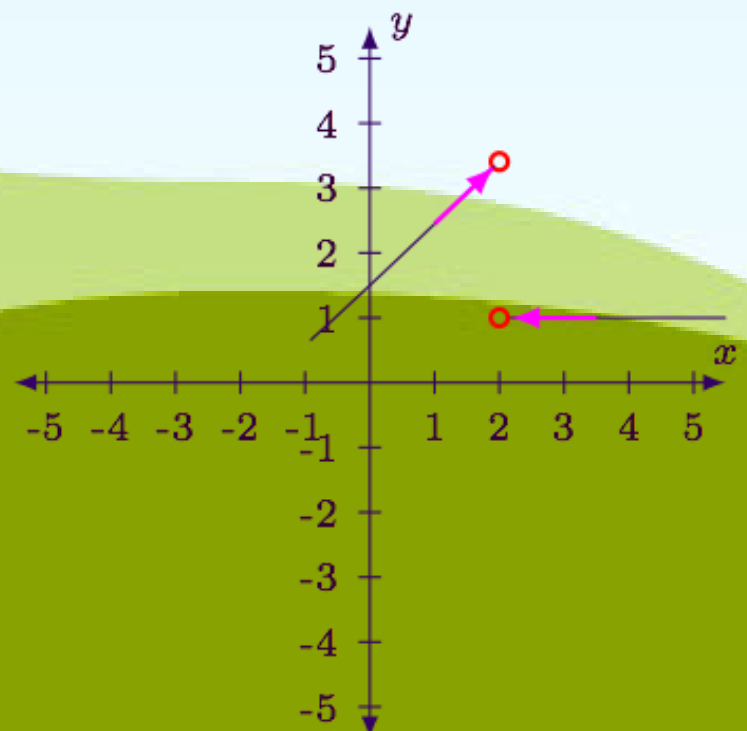
$$\lim_{x \rightarrow a^-} f(x) = L \quad \text{and} \quad \lim_{x \rightarrow a^+} f(x) = M$$

jump discontinuity at $x = a$

Example of a Jump Discontinuity

$$\lim_{x \rightarrow 2^-} f(x) = 3.5 \quad \text{and} \quad \lim_{x \rightarrow 2^+} f(x) = 1$$

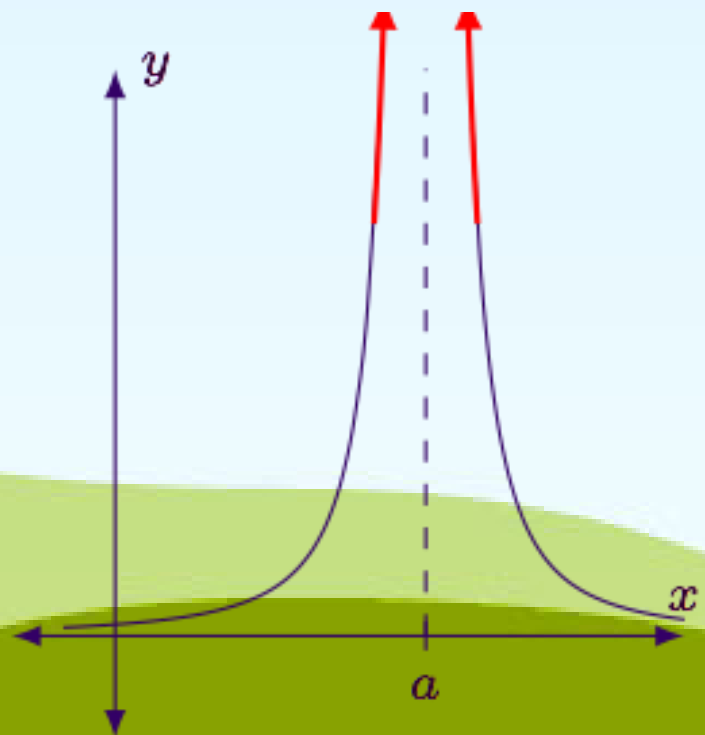
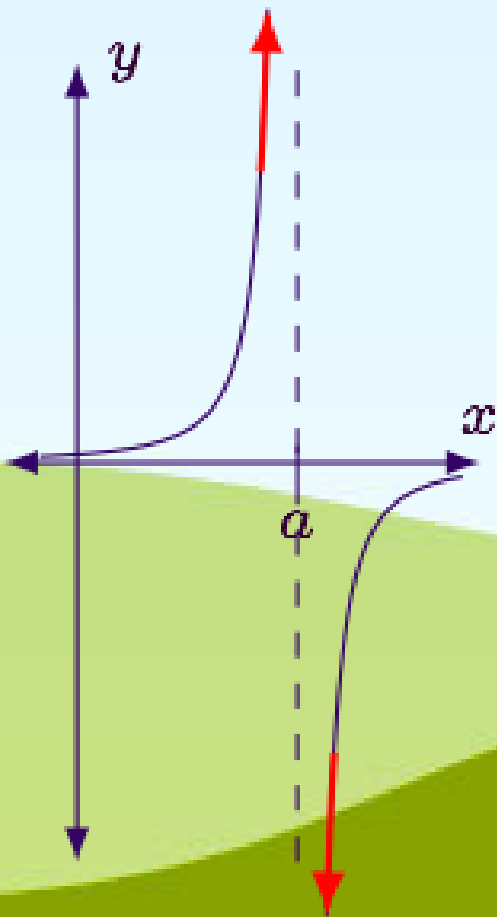
jump discontinuity at $x = 2$



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INFINITE DISCONTINUITY

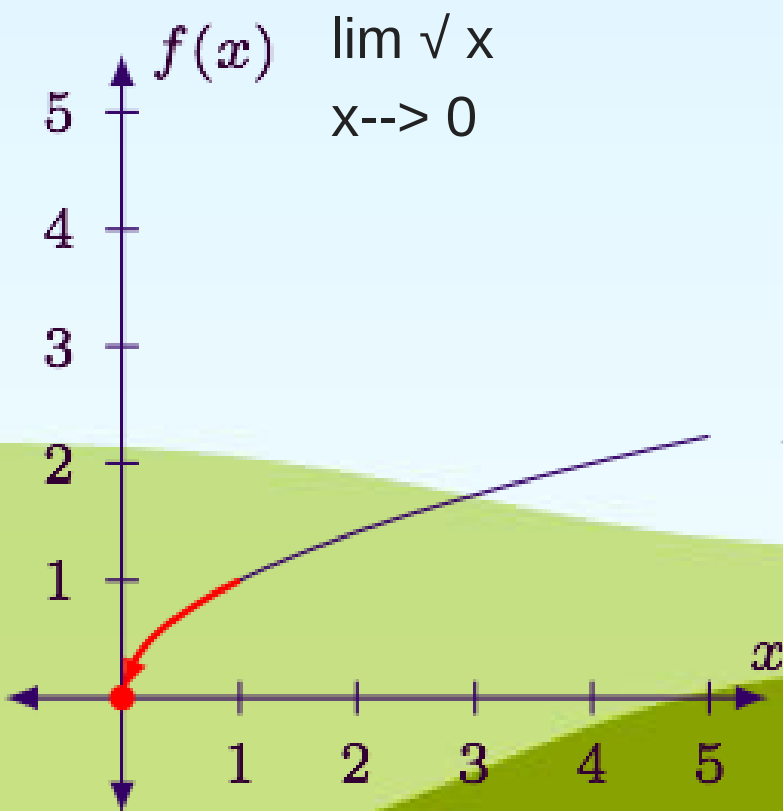
THE INFINITE DISCONTINUITY IS WHERE BOTH ONE SIDED LIMITS ARE INFINITE



BOTH GRAPHS HAVE INFINITE DISCONTINUITIES AT $x = a$

ENPOINT DISCONTINUITY

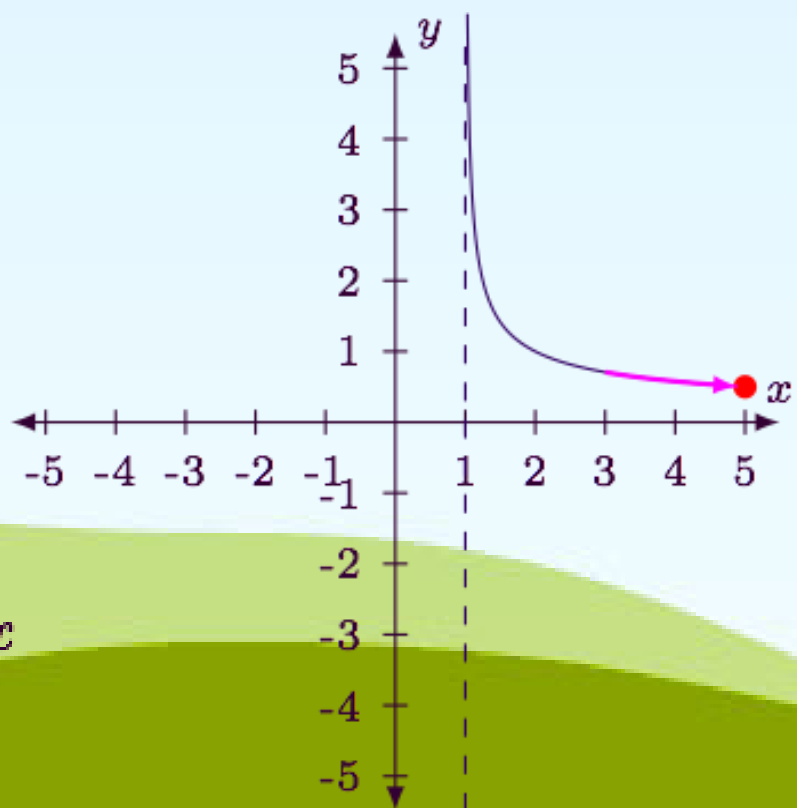
THE ENDPPOINT DISCONTINUITY IS WHEN ONLY ONE SIDED LIMIT EXISTS



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The function has an

endpoint discontinuity at $x = 0$ because only continuous from the right side and the endpoint has neither holes nor jumps.



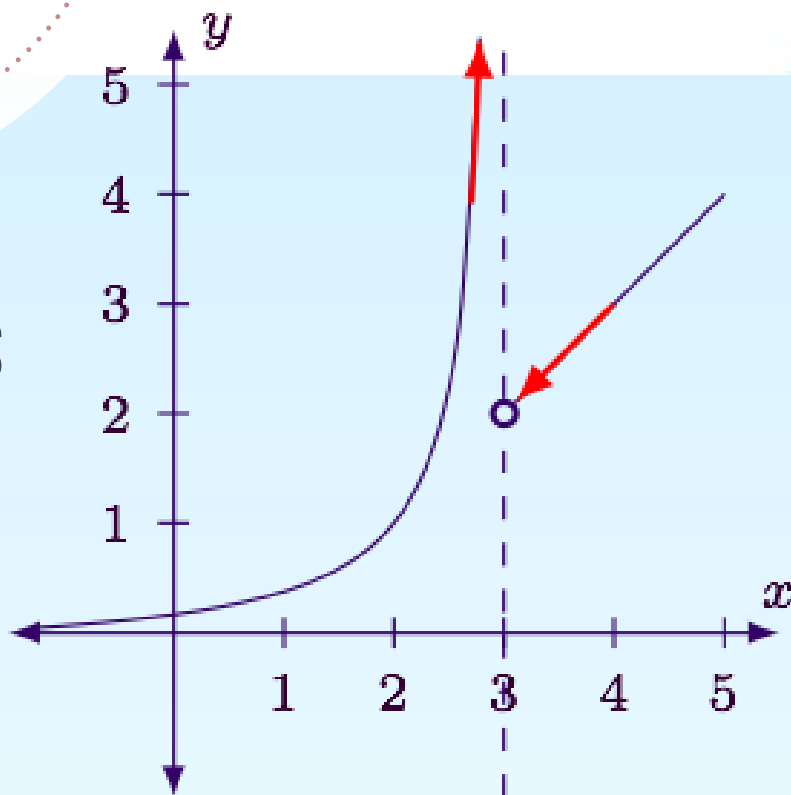
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The function has an

endpoint discontinuity at $x = 5$ since the function defined to the right of $x = 5$ is not defined

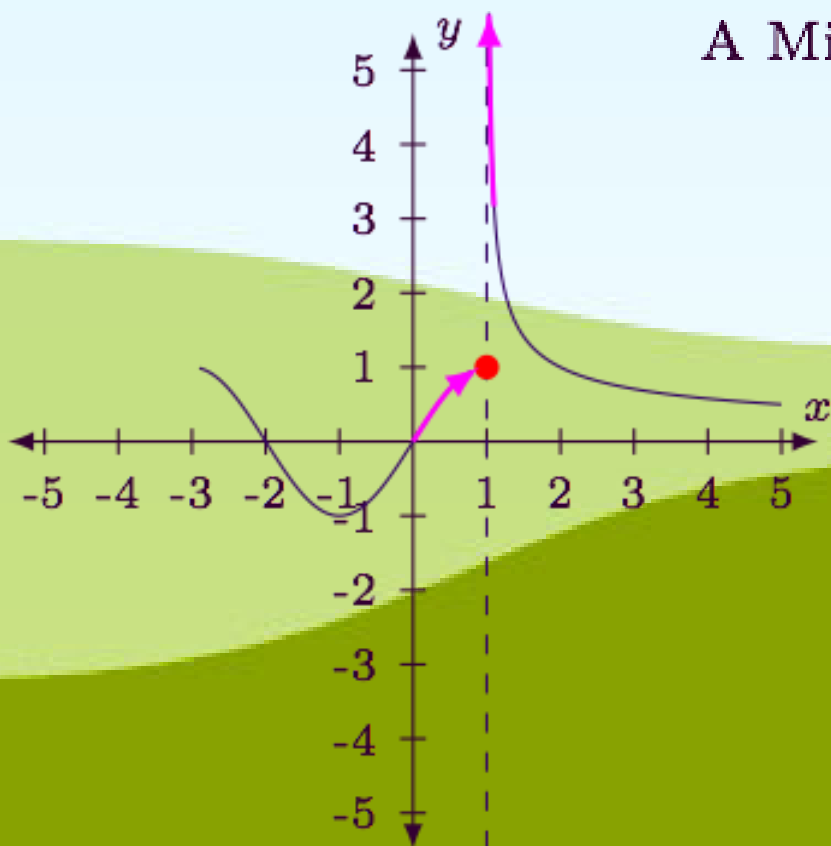
MIXED DISCONTINUITY

THE MIXED DISCONTINUITY IS WHEN AT LEAST ONE SIDED LIMIT DOES NOT EXIST



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A Mixed Discontinuity at $x=3$



$$\lim_{x \rightarrow 1^-} f(x) = 1 \quad \lim_{x \rightarrow 1^+} f(x) = \infty$$

$$\lim_{x \rightarrow 1} f(x) = 1$$

$$x \rightarrow 1$$

mixed discontinuity at $x = a$

REFERENCES

- MATH WAREHOUSE (N.D) WHAT ARE THE TYPES OF DISCONTINUITIES.

[HTTP://WWW.MATHWAREHOUSE.COM/CALCULUS/CONTINUITY/WHAT-ARE-TYPES-OF-DISCONTINUITIES.PHP](http://www.mathwarehouse.com/calculus/continuity/what-are-types-of-discontinuities.php)