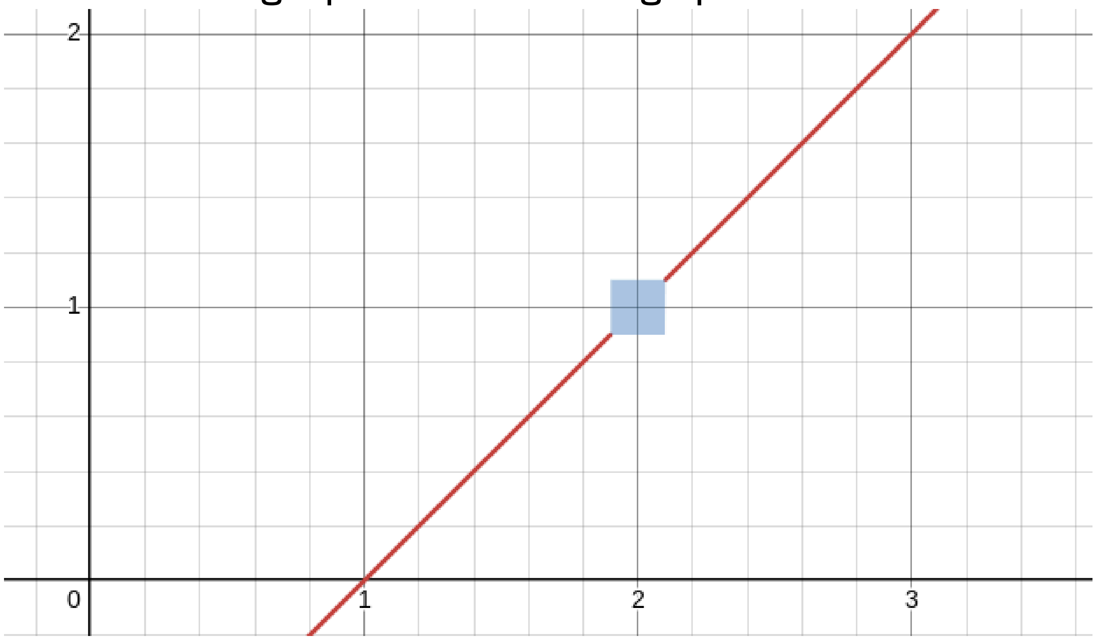
Calculus 2.2 Key Points

Limits:
Limits tell us what value a function approaches near a point

Take a look at this graph with a missing spot in the middle:



Even though we don't know the actual value of the function at $x = 2$, we can see that the y-value gets closer to 1 from both sides as x approaches 2 from both sides

More formally, this can be written as $\lim_{x \to 2} f(x) = 1$

(Read as "The limit of $f(x)$ as x approaches 2 is equal to 1")

If a function only approaches a value from one side, then it can be denoted like:

$\lim_{x \to 2^+} f(x) = 1$ (The graph approaches a value from the right)

or

$\lim_{x \to 2^-} f(x) = 1$ (The graph approaches a value from the left)

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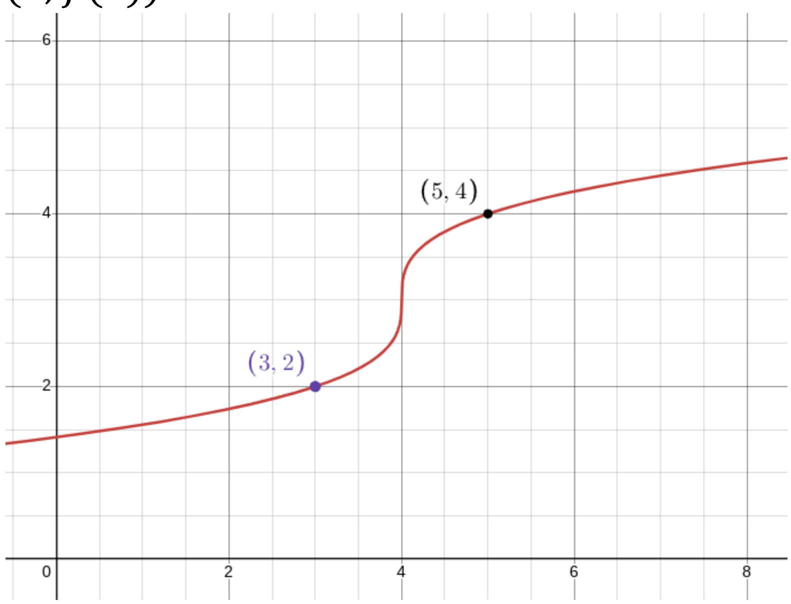
Continuity:

3 conditions for continuity:

- $\lim_{x \to a} f(x)$ exists
- $f(a)$ exists
- $\lim_{x \to a} f(x) = f(a)$

Intermediate Value Theorem:

Take a continuous function that passes through two points, $(a, f(a))$ and $(b, f(b))$



In this case, we'll say that $a = 3$, $f(a) = 2$, $b = 5$, and $f(b) = 4$

The intermediate value theorem tells us that the function must pass through every point between $f(a)$ and $f(b)$
And we see that between $x = 3$ and $x = 5$ the function must pass through every y-value between 2 and 4 to be continuous and go from $(3, 2)$ to $(5, 4)$

Note: The function <u>must</u> be continuous for this theorem to be true