Math 151 – Summary of Limit Notation/Meaning

- The statement $\lim_{x\to a} f(x) = L$ is read aloud as "The limit as x approaches a of the function $f(x)$ is L". It means that as the inputs we plug into $f(x)$ get closer and closer to the number a, the outputs get closer and closer to L.

- That statement doesn't quite make sense when the limit is infinite, so $\lim_{x\to a} f(x) = \infty$ means that as the inputs get closer and closer to a, the output just keeps growing without any sort of boundary.

- The statement $\lim_{x\to a^+} f(x) = L$ is read aloud as "The limit as x approaches a from the right of the function $f(x)$ is L". It means that as we plug in inputs that are GREATER THAN a but get closer and closer to a, the outputs get closer and closer to L.

- The statement $\lim_{x\to a^-} f(x) = L$ is read aloud as "The limit as x approaches a from the left of the function $f(x)$ is L". It means that as we plug in inputs that are LESS THAN a but get closer and closer to a, the outputs get closer and closer to L.

- The two limits $\lim_{x\to a^+} f(x) = L$ and $\lim_{x\to a^-} f(x) = L$ collectively are called the **one-sided limits** as x approaches a.

- FACT: The regular limit $\lim_{x\to a} f(x) = L$ fails to exist anytime the two one-sided limits are not the same. In fact, that's exactly what it means for a limit to not exist.