

Notes 1.2 (Part 3)

Goal #1: Students will be able to identify vertical and horizontal asymptotes.

Goal #2: Students will be able to state the end behavior of a function using limit notation.

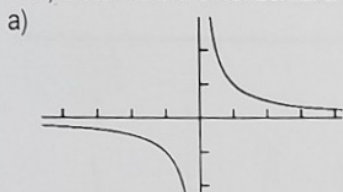
Goal #3: Students will be able to determine if a function is continuous or discontinuous & the type.

Asymptotes

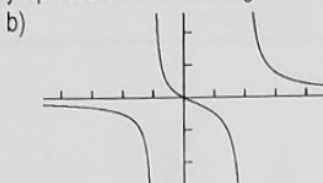
Vertical Asymptotes: The line $x=a$ is a vertical asymptote of a function $f(x)$ if the function does not cross as $x \rightarrow \infty$

Horizontal Asymptotes: The line $y=a$ is a horizontal asymptote of a function $f(x)$ if the function does not cross as $x \rightarrow \infty$

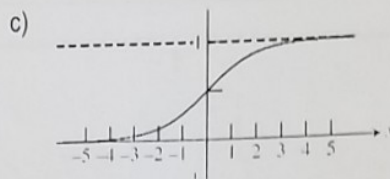
Ex1) Determine the horizontal and vertical asymptotes of the following functions:



Horizontal Asymptote: $y=0$
Vertical Asymptote(s): $x=0$

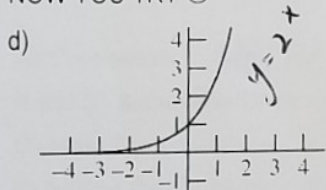


Horizontal Asymptote: $y=0$
Vertical Asymptote(s): $x=-1, x=2$

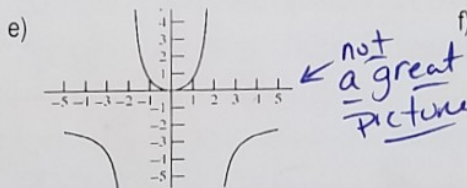


Horizontal Asymptotes: $y=0, y=1$
Vertical Asymptote(s): none

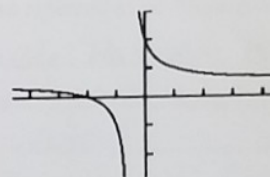
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Horizontal Asymptote: $y=0$
Vertical Asymptote(s): none



Horizontal Asymptote: $y=-1$
Vertical Asymptote(s): $x=-2, x=2$



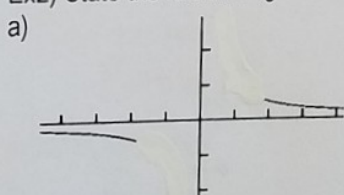
Horizontal Asymptote: $y=1/2$
Vertical Asymptote(s): $x=-1/2$

End Behavior

∞ **Left End Behavior (LEB):** The left end behavior of a graph of the function $f(x)$ describes the behavior of $f(x)$ as $x \rightarrow -\infty$

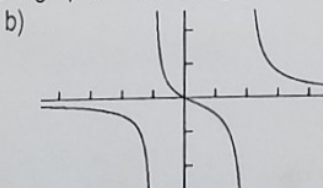
∞ **Right End Behavior (REB):** The right end behavior of a graph of the function $f(x)$ describes the behavior of $f(x)$ as $x \rightarrow \infty$

Ex2) State the left and right end behavior of the graphs below using limit notation:



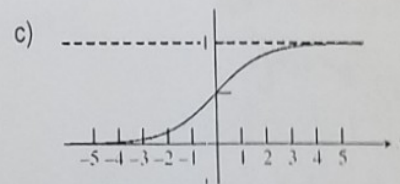
LEB: $\lim_{x \rightarrow -\infty} f(x) \rightarrow 0$

REB: $\lim_{x \rightarrow \infty} f(x) \rightarrow 0$



LEB: $\lim_{x \rightarrow -\infty} f(x) \rightarrow 0$

REB: $\lim_{x \rightarrow \infty} f(x) \rightarrow 0$



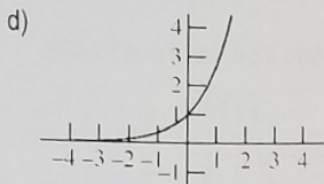
LEB: $\lim_{x \rightarrow -\infty} f(x) \rightarrow 0$

REB: $\lim_{x \rightarrow \infty} f(x) \rightarrow 1$

limit notation

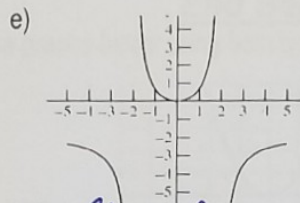
Right $\lim_{x \rightarrow \infty}$ really Big or $\lim_{x \rightarrow -\infty}$ really Small

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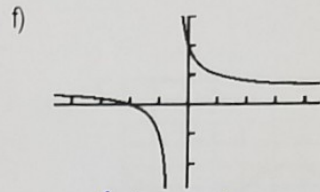
LEB: $\lim_{x \rightarrow 0} f(x) \rightarrow 0$

REB: $\lim_{x \rightarrow 0} f(x) \rightarrow \infty$



LEB: $\lim_{x \rightarrow 0} f(x) \rightarrow -1$

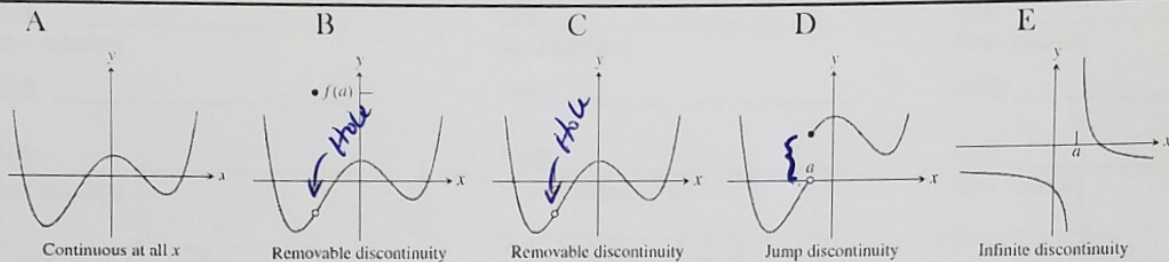
REB: $\lim_{x \rightarrow 0} f(x) \rightarrow -1$



LEB: $\lim_{x \rightarrow 0} f(x) \rightarrow \frac{1}{2}$

REB: $\lim_{x \rightarrow 0} f(x) \rightarrow \frac{1}{2}$

Discontinuity



NOTE: Jump and infinite discontinuities are also referred to as "Non-Removable"

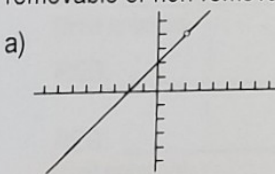
A) Continuous: No Breaks in graph every input possible has an output

B and C) Removable Discontinuity: [Holes] limit from left = limit from right.

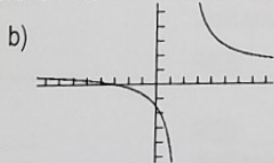
D) Jump Discontinuity: limit from left \neq limit from right

E) Infinite Discontinuity: Has a vertical asy.

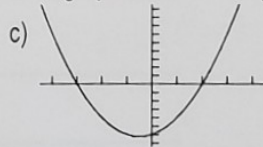
Ex3) Determine the continuity of each of the following functions. If the function is discontinuous state whether the discontinuity is removable or non-removable. If there is a non-removable discontinuity in the graph state if it has jump or infinite discontinuity.



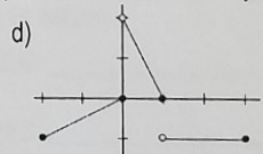
Not Continuous
Removable
[Hole]



Not Continuous
Infinite Disc.

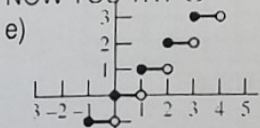


Continuous

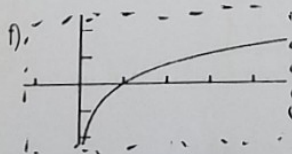


not continuous
jump Disc.

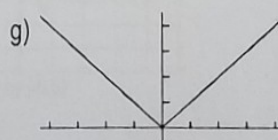
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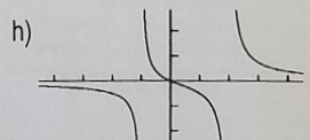
Not Continuous
jump



not continuous
Infinite



Continuous



Not Continuous
infinite