Connections (day 1)

Graph 1-3 $y = g(x)$

Breaks — 2. m can't be det.
1. limit D.N.E. but one-sided limits exist
3. Not continuous (jump discontinuity)

} piece-wise functions

Holes — 2. m can't be det.
1. limit exist
3. not continuous (removable discontinuity)

} functions where factoring removes div by zero

Vertical Asymptotes — m can't be det
limit D.N.E but may $= \pm\infty$ based on one-sided
not continuous (infinite discontinuity)

} functions where lim num $= (\# \neq 0)$, lim den $= 0$

Oscillations — m can't be det
limit D.N.E
not continuous

Corners — m can't be det
limit exists
continuous

If $\lim_{x \to c} g(x) = +\infty$ or $-\infty$ then there is a vert. asymptote @ $x = c$.

However, if $\lim_{x \to c} g(x)$ D.N.E., one-sided limits may still equal $+\infty$ or $-\infty$. If $\lim_{x \to c^+} f(x) = +\infty$ or $-\infty$ or if $\lim_{x \to c^-} g(x) = +\infty$ or $-\infty$ then there is a vert asym. @ $x = c$.

3 types of behavior associated w/ non-existence of a limit.

1. $g(x)$ approaches a different # from right and left side (Break)

2. $g(x)$ increases $+\infty$ or decreases $-\infty$ w/o bound (vert. asymptotes)

3. $g(x)$ oscillates

More on vert. Asymptotes (* Ask them to hypothesize after Limit prob. of $\frac{0}{0}$ WS)

If the lim of the den = 0 but the lim of num ≠ 0 then limit D.N.E. but, lim may equal

① $+\infty$

② $-\infty$

③ $+\infty$ from one side and/or $-\infty$ from other side

Example

$\lim_{x \to 2} \frac{3}{x-2}$

Num. $\lim_{x \to 2} 3 = 3$

Den. $\lim_{x \to 2} x-2 = 0$

* HW - P. 121-122 #15-27 odd

Another ex. $\lim_{x \to 1} \frac{x^2-4x+3}{x^2-2x+1}$

Calculators allowed: graph function

Calculators not allowed: pick # to left → 1.9 | 2 | 2.1 ← pick # to right

plug #'s into factored form

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So, $\lim_{x \to 2^-} \frac{3}{x-2} = -\infty$ and $\lim_{x \to 2^+} \frac{3}{x-2} = +\infty$ and $\lim_{x \to 2} \frac{3}{x-2}$ D.N.E.