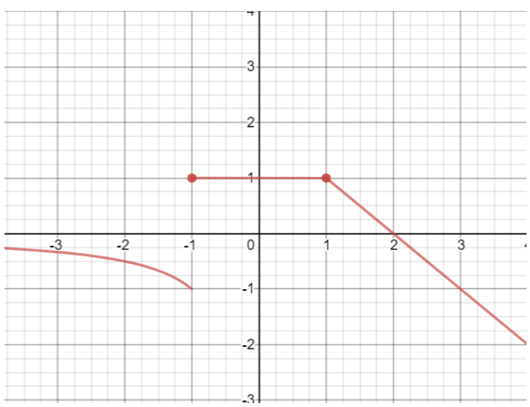
Math 111 — Quiz 3

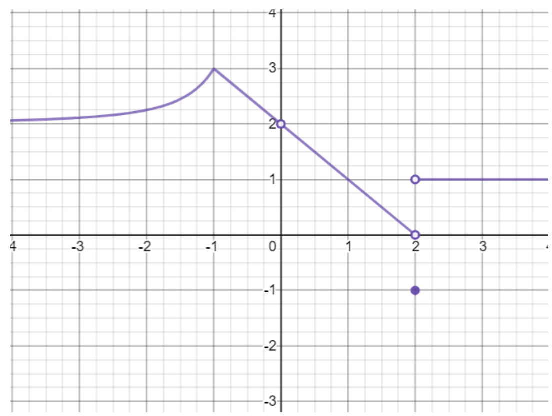
Topics: Week 3, §2.3, 2.5 – 2.6

Instructions. Read the problems carefully and show all work. A four function calculator $(+, -, \times, \div)$ is permitted. Your work should be your own: no other resources, including devices, notes, textbooks, or collaboration, are allowed.

Submission. You must submit this assessment in **PDF file format**. You may use this page or work on a separate sheet of paper. You must **clearly mark** where each question begins/ends and what your final answers are. Please write legibly — illegible answers will receive little to no credit.

1. (5 pts) Consider the graphs of $f(x)$ in red and $g(x)$ in blue below.





Determine the following limits, if they exist. If the limit is infinite, say so, and if it does not exist, write "DNE."

(a) $\lim_{x\to 0}\,[f(x)\cdot g(x)]$

(b) $\lim_{x\to 2}\,[f(x)+g(x)]$

(c) $\lim_{x\to -\infty}\left[\frac{f(x)}{g(x)}\right]$

(d) $\lim_{x\to \infty} f(x)$

(e) $\lim_{x\to -1^+}\sqrt{f(x)+g(x)}$

2. (2 pts) Identify all vertical and horizontal asymptotes (if any) from the graphs of $f(x)$ and $g(x)$ above.

(a) Asymptotes of $f(x)$:

(b) Asymptotes of $g(x)$:

3. (3 pts) This morning when I woke up, my car hood's temperature was 40 degrees Fahrenheit (°F). 8 hours later after a drive in the hot sunlight, my car hood was 165 °F. Let's use a continuous function $T(t)$ to model the temperature in °F of my car's hood at t hours after I woke up, so $T(0) = 40$ and $T(8) = 165$.

My favorite temperature for cooking eggs is *exactly* 150 °F. **Use the Intermediate Value Theorem** to justify that *at some time* in the 8 hours after waking up, I could cook a perfect egg on the hood of my car.

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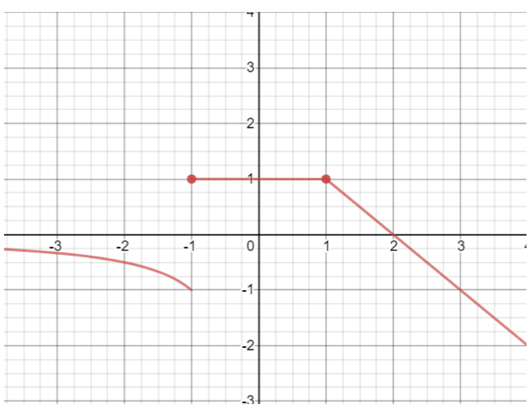

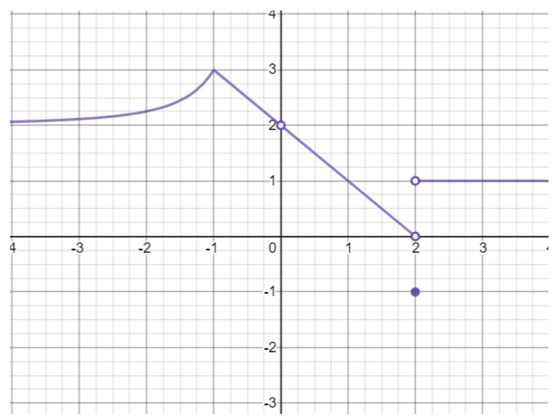

Determine the following limits, if they exist. If the limit is infinite, say so, and if it does not exist, write "DNE."

(a) $\lim_{x\to0}[f(x)\cdot g(x)] = \left(\lim_{x\to0} f(x)\right)\left(\lim_{x\to0} g(x)\right)$
$= 1 \cdot 2 = 2$

(b) $\lim_{x\to2}[f(x)+g(x)]$ DNE because $\lim_{x\to2} g(x)$ DNE

(c) $\lim_{x\to-\infty}\left[\frac{f(x)}{g(x)}\right] = \dfrac{\lim_{x\to-\infty} f(x)}{\lim_{x\to-\infty} g(x)} = \dfrac{0}{2} = 0$

(d) $\lim_{x\to\infty} f(x) = -\infty$

(e) $\lim_{x\to-1^+}\sqrt{f(x)+g(x)} = \sqrt{\lim_{x\to-1^+}(f(x)+g(x))}$
$= \sqrt{\left(\lim_{x\to-1^+} f(x)\right) + \left(\lim_{x\to-1^+} g(x)\right)}$
$= \sqrt{1+3} = \sqrt{4} = 2$

2. (2 pts) Identify all vertical and horizontal asymptotes (if any) from the graphs of $f(x)$ and $g(x)$ above.

(a) Asymptotes of $f(x)$: No vertical asymptotes
Horizontal asymptotes at $y=0$

(b) Asymptotes of $g(x)$: No VA
HA at $y=2$ and $y=1$

3. (3 pts) This morning when I woke up, my car hood's temperature was 40 degrees Fahrenheit (°F). 8 hours later after a drive in the hot sunlight, my car hood was 165 °F. Let's use a continuous function $T(t)$ to model the temperature in °F of my car's hood at t hours after I woke up, so $T(0) = 40$ and $T(8) = 165$.

My favorite temperature for cooking eggs is *exactly* 150 °F. **Use the Intermediate Value Theorem** to justify that *at some time* in the 8 hours after waking up, I could cook a perfect egg on the hood of my car.

IVT says that since $T(t)$ is continuous, $T(t)$ takes all values between $T(0) = 40$ and $T(8) = 165$ for t in $[0, 8]$.

Notice that $40 \leq 150 \leq 165$, so at some point t in $[0, 8]$, we get $T(t) = 150$, which is my preferred temp.