Math 234 B Discussion BD6 Quiz 2 **Name (Last,First):** Solutions

Compute the limit, if it exists. If it does not exist, write "DNE". In either case, include some steps to support your answer.

1.] (2 pts) $\lim_{x\to -0.5} 1-2x^2 = 1-2(-0.5)^2 = 1-2(0.25) = 1-0.5$
$= 0.5.$

2.] (2 pts) $\lim_{x\to -2} \frac{4-x^2}{x+2} = \lim_{x\to -2} \frac{(2+x)(2-x)}{x+2}$
$= \lim_{x\to -2} 2-x = 2-(-2) = 4.$

3.] (2 pts) $\lim_{x\to\infty} \frac{x^3+5}{9x-5x^3}$
$= \lim_{x\to\infty} \frac{x^3/x^3 + 5/x^3}{9x/x^3 - 5x^3/x^3} = \lim_{x\to\infty} \frac{1+5/x^3}{9/x^2-5} = \frac{1+0}{0-5} = -\frac{1}{5}.$

4.] (2 pts) $f(x) = \begin{cases} x^3 & \text{if } x<2 \\ 8 & \text{if } x\geq 2 \end{cases}$

a.) $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^-} x^3 = (2)^3 = 8.$

b.) $\lim_{x\to 2^+} f(x) = \lim_{x\to 2^+} 8 = 8.$

c.) $\lim_{x\to 2} f(x) = 8$, since the left and right handed limits both equal 8.

d.) Is $f(x)$ continuous at $x=2$? Why or why not?

Yes, since $\lim_{x\to 2} f(x) = f(2)$.

5.] (2 pts) Two species coexist in the same ecosystem. Species I has population $P(t)$ in t years, while Species II has population $Q(t)$, both in thousands, where P and Q are modeled by the functions

$$P(t) = \frac{30}{3+t} \qquad Q(t) = \frac{64}{4-t}$$

for all times $t\geq 0$ for which the respective *populations are not negative.*
What happens to $P(t)$ as t increases? (As always, justify your answer) (The population goes "extinct")

$\lim_{t\to\infty} \frac{30}{3+t} = 0$ since the limit of the numerator exists (not infinite) and the limit of the denominator is ∞.

What happens to $Q(t)$ as t increases? (Justify)

Note $t<4$ since $Q(4)$ is undefined and for $t>4$, $Q(t)$ is negative.

$\lim_{t\to 4^-} \frac{64}{4-t} = \infty$ since the limit of the numerator exists (not infinite) and is not zero, and the limit of the denominator is zero, and $4-t$ is positive for $t<4$.

(The population "explodes")