

ICNS 103

Hw1 solutions

1.

a. 1

b. does not exist

c. 3

2.

$$\begin{aligned}\lim_{x \rightarrow -2} (3x^3 - 4x^2 + 2x - 3) \\ &= 3(-2)^3 - 4(-2)^2 + 2(-2) - 3 \\ &= -24 - 16 - 4 - 3 \\ &= -47\end{aligned}$$

3.

$$\begin{aligned}\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x - 3} &= \lim_{x \rightarrow 3} \frac{(x-3)(x+2)}{x-3} \\ &= \lim_{x \rightarrow 3} (x+2) \\ &= 5\end{aligned}$$

4.

$$\lim_{x \rightarrow 0} \frac{x^2 - 2x}{x} = \lim_{x \rightarrow 0} \frac{x(x-2)}{x} = \lim_{x \rightarrow 0} (x-2) = -2$$

5.

a. 0

b. $-\infty$

c. does not exist

d. ∞

e. 2

f. 1

g. 1

6.

$$\lim_{x \rightarrow 0^-} \frac{6x}{x^4} = \lim_{x \rightarrow 0^-} \frac{6}{x^3} = -\infty \text{ since } x^3 \text{ is negative}$$

and close to 0 for $x \rightarrow 0^-$.

7.

$$\lim_{x \rightarrow \infty} \sqrt{x+10}$$

As x becomes very large, so does $x + 10$.

Because square roots of very large numbers are very large, $\lim_{x \rightarrow \infty} \sqrt{x+10} = \infty$.

8.

$$\lim_{x \rightarrow \infty} \frac{x+8}{x-3} = \lim_{x \rightarrow \infty} \frac{x}{x} = \lim_{x \rightarrow \infty} 1 = 1$$

9.

$$\lim_{x \rightarrow \infty} \frac{x^2-1}{x^3+4x-3} = \lim_{x \rightarrow \infty} \frac{x^2}{x^3} = \lim_{x \rightarrow \infty} \frac{1}{x} = 0$$

10.

$$\lim_{r \rightarrow \infty} \frac{r^3}{r^2+1} = \lim_{r \rightarrow \infty} \frac{r^3}{r^2} = \lim_{r \rightarrow \infty} r = \infty$$

11.

$$f(x) = \begin{cases} x & \text{if } x \leq 2 \\ -2 + 4x - x^2 & \text{if } x > 2 \end{cases}$$

a. $\lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^+} (-2 + 4x - x^2) = 2$

b. $\lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^-} x = 2$

c. $\lim_{x \rightarrow 2} f(x) = \lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^-} f(x) = 2$

d. $\lim_{x \rightarrow \infty} f(x) = \lim_{x \rightarrow \infty} (-2 + 4x - x^2) = -\infty$

e. $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow -\infty} x = -\infty$