1. Let

$$f(x) = \begin{cases} \tan\left(\frac{\pi}{4}x\right) & |x| < 1 \\ x^2 & |x| \geq 1. \end{cases}$$

a) Compute $\lim_{x\to 1^+} f(x)$.

b) Compute $\lim_{x\to 1^-} f(x)$.

c) Is $f(x)$ continuous at $x = 1$? Why or why not? Your answer must involve the definition of continuity.

d) Determine, by computing limits, whether or not $f(x)$ is continuous at $x = -1$. Again, you must explain clearly, using the definition, your rationale.

e) Sketch, by hand, the graph of $f(x)$ over the interval $-2 \leq x \leq 2$.

2. Compute $\lim\limits_{x\to -2^+} \dfrac{x^2+4}{x^3+8}$. Justify your answer using the allowed reasoning for infinite limits given in class.

3. Suppose $f(x) = \dfrac{(x-2)^2(x-1)}{\sqrt{x}}$. Compute $f'(x)$. Hint: first rewrite $f(x)$ in a way that makes it easy for you to find its derivative. Start by writing

$$\begin{aligned} f(x) &= \frac{(x-2)^2(x-1)}{\sqrt{x}} \\ &= \cdots \\ &= \cdots \end{aligned}$$

to rewrite $f(x)$. Note the mandatory presentation with the aligned equals signs. Then compute

$$\begin{aligned} f'(x) &= \frac{d}{dx}(\cdots) \\ &= \cdots \end{aligned}$$

where the first $(\cdots)$ is your rewritten version of $f(x)$. The same mandatory presentation style applies here, too.