

- You can take as long as you like to complete this gateway.
- To pass this gateway you must get 4 of the 5 problems *COMPLETELY* correct.
- If your previous gateway was number  $k$ , please make sure this is gateway  $k + 1$ .
- If the first gateway you pass is number  $n$  then your score for gateways will be  $20 - n$ .
- **Circle your final answers; that is what I will grade.**
- **No calculators, books, or notes allowed!!**

1. Find the following limits:

(a)  $\lim_{x \rightarrow \infty} \ln \left( \frac{x}{x^2 + 1} \right)$

(b)  $\lim_{x \rightarrow -\infty} \tan^{-1} x$

2. Find the derivatives of the following functions (don't simplify your answers):

(a)  $f(x) = \frac{x^2 \sqrt[3]{x^4}}{x^{\frac{2}{3}}}$

(b)  $f(x) = \sec(\ln(x^2 + 1))$

(c)  $f(x) = \sin^{-1}(e^{x^2-5}) + 1007$