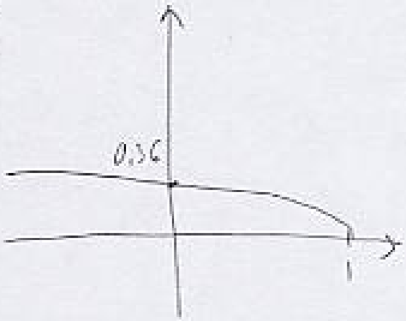
**Fall '04/MAT 250/Worksheet 1** **Name:** Solution *Show all your work.*

**1.** (7pts) Investigate the behavior of the function $f(x) = (1-x)^{\frac{1}{x}}$ when $x \to 0$.
a) What appears to be the limit of $f(x)$ when $x \to 0$?
b) Use $x$'s closer and closer to 0 to find the limit accurate to six decimal points. Write the table of values here.

a)




Limit appears to be somewhere around 0.36, according to using the trace feature

b)

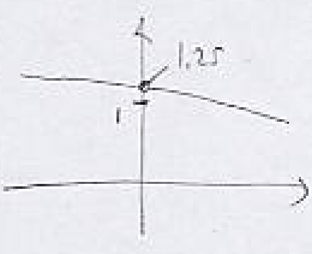
| $x$ | $f(x)$ |
|---|---|
| $10^{-4}$ | 0.367861 |
| $10^{-5}$ | 0.367878 |
| $10^{-6}$ | 0.367879 |
| $10^{-7}$ | 0.367879 |

$\left.\begin{matrix} 10^{-6} \\ 10^{-7} \end{matrix}\right\}$ six digits appear to have stabilized

Limit is 0.367879 to six digits

**2.** (8pts) Investigate the behavior of the function $f(x) = \dfrac{5(\sqrt{x^5+4}-2)}{x^5}$ when $x \to 0$.
a) What appears to be the limit of $f(x)$ when $x \to 0$?
b) Compute the values of $f(x)$ for $x = 10^{-4}, 10^{-5}, \ldots, 10^{-8}$. Write the table of values here. What appears to be the limit now?
c) Explain why a) and b) apparently give different answers. (Hint: enter $1 + 10^{-14} - 1$ in your calculator. Is the answer what you expect? What is happening?)

a)




Trace gives limit 1.25.

b)

| $x$ | $f(x)$ |
|---|---|
| $10^{-4}$ | 0 |
| $10^{-5}$ | 0 |
| $10^{-6}$ | 0 |
| $10^{-7}$ | 0 |
| $10^{-8}$ | 0 |

Limit appears to be 0?

c) The answer in a) is more accurate. In b) limitations of the calculator kick in. Since it keeps only about 14 significant digits, computations in b) give us, for example:

$$\frac{5(\sqrt{(10^{-4})^5+4}-2)}{(10^{-4})^5} = \frac{5(\sqrt{\underbrace{10^{-20}+4}_{\text{calculator treats as 4, since it truncates beyond 14 significant digits}}}-2)}{10^{-20}}$$

$$= \frac{5(\sqrt{4}-2)}{10^{-20}} = 0$$