Improper Integrals[1]

1. Enter the following sequence of commands:

```
syms x
int(1/sqrt(x^6 + 1), 0, inf)  ..... Calculates symbolically
double(ans)  ..... Converts to a numeric format
quadl('1./sqrt(x.^6 + 1)', 0, inf)  ..... Calculates numerically
```

2. Use the commands above to evaluate the following integrals (you will encounter error messages in some of them):

   (a) $\int_0^\infty \frac{1}{x^{2/3}} dx$ (Use `1/x^(2/3).`)

   (b) $\int_1^\infty \frac{1}{x+1} dx$

   (c) $\int_1^\infty \frac{\ln x}{x^2}$ (Use `log` for natural logarithm.)

   (d) $\int_0^\infty \sin^2(x) dx$ (Use `(sin(x))^2 `)

3. Try to use MATLAB to evaluate the following functions using commands in #1:

   (a) $\int_{-1}^1 \frac{1}{x^2} dx$

   (b) $\int_0^1 \frac{1}{\sqrt{x}} dx$

4. What are some problems with calculating improper integrals numerically?

5. Try the following:

```
int(1/x^5, 1, inf)
int(sin(x^3)/x^5, 1, inf)
double(ans)
```

   Comparing the integrands of these two integrals, should the second one converge? Does the answer for the second integral make sense?

6. Prepare a brief (< 1 page) written report describing what happened and answering all the questions. Use complete sentences and standard mathematical notation. Writing quality will play a part in the grade.

This exercise explores improper integrals both symbolically and numerically. Evaluating improper integrals symbolically is precarious because it is hard for the computer to handle the symbol ∞ correctly. Evaluating numerically is also difficult because one cannot actually compute all the way to ∞, one must stop at some finite place.