Arc Length and Improper Integrals

1. Write an integral that gives the length of one arch of the sine curve (so from $x = 0$ to $x = \pi$).

2. (a) Does $\displaystyle\int_1^\infty \frac{1}{x^2}\,dx$ converge or diverge? If it converges, evaluate it.

   (b) Does $\displaystyle\int_1^\infty \frac{1}{x}\,dx$ converge or diverge? If it converges, evaluate it.

3. Using #2, can you conclude anything about whether the following integrals converge or diverge? (Try to figure this out without evaluating the integrals!)

(a) $\int_1^\infty \frac{1}{x^3}\,dx$?

(b) $\int_1^\infty \frac{1}{x^{1/2}}\,dx$?

(c) $\int_1^\infty \frac{1}{x^{3/2}}\,dx$?