Math 128, Fall 2007
Quiz 6, Section A Name: _____

Show all work clearly and in order, and circle your final answers. Justify your answers algebraically whenever possible. Please write down all relevant mathematics. You have 20 minutes.

**1.** Write down the definition of the following improper integral. Then, determine whether the integral is convergent or divergent. If it is convergent, determine its value.

$$\int_0^\infty \frac{dx}{(2x+1)^2}$$

$$\begin{aligned}\int_0^\infty \frac{dx}{(2x+1)^2} &= \lim_{b\to\infty}\int_0^b \frac{dx}{(2x+1)^2} \\ &= \lim_{b\to\infty} -\frac{1}{2}\frac{1}{2x+1}\Big|_0^b \\ &= \lim_{b\to\infty} -\frac{1}{2}\frac{1}{2b+1} + \frac{1}{2} \\ &= \frac{1}{2}\end{aligned}$$

**2.** Determine whether the function $y = \frac{1}{2}\sin(\pi - x)$ is a solution to the differential equation:

$$y'' + y = 0$$

Justify your answer.

$y' = -\frac{1}{2}\cos(\pi - x)$, So $y'' = -\frac{1}{2}\sin(\pi - x)$ Therefore

$$y'' + y = -\frac{1}{2}\sin(\pi - x) + \frac{1}{2}\sin(\pi - x) = 0$$

Hence, $y = \frac{1}{2}\sin(\pi - x)$ is a solution to the given differntial equation.