MATH 396 PROBLEMS 1
REVIEW PROBLEMS

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Regular problems:

1. Investigate the existence and convergence of the following (Lebesgue) integral:

\[
\int_{-\infty}^{\infty} \frac{xdx}{(1 + x^2)^2 \sqrt{|x - 1|}}
\]

2. Solve: \( y'' + y' + y = x \).

3. Solve: \( y' = \frac{y+1}{x+2} + 1 \).

4. Can the following functions be the characteristics of a differential equation

\[ y' = f(x, y) \]

where \( f \) is continuous and \( \frac{\partial f}{\partial y} \) exists and is continuous everywhere?

(a) \( y = x + c \)

(b) \( y = cx + 1 \).
Challenge problem:

5. Compute:

\[ \int_{[0,1]^n} \max(x_1, \ldots, x_n) \, dx_1 \ldots dx_n. \]