Math 271 - Quiz #3 **Score:** _____ out of 10.

Name: key

Show all work clearly and in order. Please box your answers. 10 minutes.

1. (a) Find the explicit general solution for

$$x^2y' + xy = 1.$$

Standard Form: $y' + \frac{x}{x^2}y = \frac{1}{x^2}$

$y' + \underbrace{\frac{1}{x}}_{P(x)}y = \frac{1}{x^2}$

Integrating Factor: $e^{\int P(x)dx} = e^{\int \frac{1}{x}dx} = e^{\ln|x|} = |x|$

$= x$, if $x > 0$

Multiply: $x\left[y' + \frac{1}{x}y\right] = x\left[\frac{1}{x^2}\right]$

$\frac{d}{dx}[xy] = \frac{1}{x}$

Integrate: $xy = \int \frac{1}{x}dx$

$xy = \ln|x| + C$

$y = \frac{\ln|x|}{x} + \frac{C}{x}$

Since we assumed $x > 0$, you can even drop the $|\ |$ here.

Explicit Solution: $y = \frac{\ln(x)}{x} + \frac{C}{x}$

(b) Give the largest interval over which the general solution is defined. $(0, \infty)$

(c) Are there any transient terms in the general solution? If yes, what are they?

yes, $\frac{C}{x}$ AND $\frac{\ln(x)}{x}$

Note! $\lim_{x\to\infty} \frac{\ln(x)}{x} \overset{L'H}{=} \lim_{x\to\infty} \frac{(\frac{1}{x})}{1} = 0$