MA126 Quiz 7

Name:

1) (8 pts) For what values of r does the function $y = e^{rx}$ satisfy the differential equation
$$2y'' + y' - y = 0 \quad ?$$

$$y = e^{rx}$$

$$y' = re^x \qquad y'' = r^2 e^{rx}$$

$$2y'' + y' - y = 2r^2 e^{rx} + re^{rx} - e^{rx}$$

$$= e^{rx}\left(2r^2 + r - 1\right) = 0$$

$\uparrow$ never zero

$\underbrace{\qquad}$ $\uparrow$ can only be zero if this is zero!

$$2r^2 + r - 1 = 0 \qquad (2r-1)(r+1) = 0 \qquad r = \tfrac{1}{2}, -1$$

2) (8 pts) Solve the differential equation
$$y' = \frac{y}{1+x^2}$$
(your answer can be an implicit function)

$$\frac{dy}{dx} = \frac{y}{1+x^2} \qquad \text{if } y \neq 0, \quad \frac{1}{y}\frac{dy}{dx} = \frac{1}{1+x^2}$$

In differential form,

$$\frac{dy}{y} = \frac{dx}{1+x^2} \qquad \text{integrate both sides:} \quad \int \frac{dy}{y} = \int \frac{dx}{1+x^2}$$

(OVER)

$$\ln |y| = \tan^{-1} x + C$$

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