

## Practice Quiz 2 MATH 2280, ORDINARY DIFFERENTIAL EQUATIONS, FALL 2023

NAME: Solutions

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**Problem 1. Section 2.2g** (10 points) Determine if the following differential equation is or is not directly integrable.

$$x^2 \frac{d^2 y}{dx^2} = 1$$

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**Solution:**

Since we can write

$$\frac{d^2 y}{dx^2} = \frac{1}{x^2} = f(x)$$

with  $f$  not depending on  $y$ , the DE is directly integrable

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**Problem 2. Section 2.4c** (10 points) Solve the following initial value problem (using the indefinite integral). Also, state the largest interval over which the solution is valid (i.e., the maximum possible interval of interest).

$$\frac{dy}{dx} = \frac{x-1}{1+x}$$

with  $y(0) = 8$ .

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**Solution:**

We can integrate both sides

$$\begin{aligned} \Rightarrow y(x) &= \int \frac{x-1}{1+x} dx \\ &= \int \frac{1+x-2}{1+x} dx \\ &= \int \frac{(1+x)}{(1+x)} dx - \int \frac{2}{1+x} dx \\ &= \int dx - 2 \ln|1+x| \\ &= x - 2 \ln|1+x| + C \end{aligned}$$

So,  $y(x) = x - 2 \ln|1+x| + C$  is the general solution and

$$\begin{aligned} y(0) &= 0 - 2 \ln|1+0| + C \\ &= 2 \ln(1) + C \\ &= 0 + C = 8 \Rightarrow C = 8 \end{aligned}$$

Then  $y(x) = x - 2 \ln|1+x| + 8$