

MAT 239 (Differential Equations) Prof. Swift
Worksheet 5. First Order ODEs, Inspection and Separation of Variables

1. Find the general solution to $\frac{dy}{dx} = 2y$, by inspection if possible.

$$y = C e^{2x}$$

2. Solve the initial value problem (IVP) $\frac{dy}{dx} = 2y$, $y(0) = 3$, by inspection if possible.

$$y = 3 e^{2x}$$

3. Find the solution to the IVP $\frac{dy}{dx} = \frac{1}{e^y}$, $y(0) = 0$, using separation of variables.
Find the interval of existence of the solution.

$$e^y dy = dx$$

$$\int e^y dy = \int dx$$

$$e^y = x + c$$

$$y = \ln(x + c)$$

$$0 = \ln(0 + c)$$

$$0 = \ln(c) \therefore e^0 = c, \underline{c = e^0 = 1}$$

$$\boxed{y = \ln(x + 1)}$$

Interval contains $x = 0$

solution is defined where $x + 1 > 0$

$$x > -1$$

Interval of existence is $(-1, \infty)$