

## §7.3: Separable Differential Equations

### Key Points:

- A **separable differential equation** is a differential equation that can be written in the form

$$f(y) \cdot \frac{dy}{dx} = g(x).$$

- To solve a separable differential equation:
  1. Separate the variables
  2. Integrate both sides (Remember  $+ C!!!$ )
  3. Solve for  $y$  (if possible)
  4. Use the initial condition to find  $C$ .
- Other notes:

### Examples:

1. Solve the differential equation  $\frac{dy}{dx} = -2y$  if  $y(0) = 1$ .

2. Solve the differential equation  $\frac{dx}{dt} + x = 1$  if  $x(1) = 0.1$ .

3. Solve the differential equation  $\frac{du}{dt} = u + ut^2$  if  $u(0) = 5$ .

4. Solve the differential equation  $\frac{dy}{dx} = xe^y$  if  $y(0) = 0$ .

5. Solve the differential equation  $\frac{ds}{d\theta} = -s^2 \tan \theta$  if  $s(0) = 2$ .

6. Find an equation of the curve that passes through the point  $(0, 1)$  and whose slope at  $(x, y)$  is  $xy$ .

7. Solve the differential equation  $y' = x + y$  by making the change of variable  $u = x + y$ .

8. A tank contains 20 kg of salt dissolved in 5000 L of water. Brine that contains 0.03 kg of salt per liter of water enters the tank at a rate of 25 L/min. The solution is kept thoroughly mixed and drains from the tank at the same rate. How much salt remains in the tank after half an hour?