Math 270 Day 4 Part 2

Section 2.2: Separable Differential Equations

What we'll go over today

- Solving simple calc. 1 differential equations of the form $\frac{d^n y}{dx^n} = f(x)$
- Solving separable differential equations

Solving simple calc. 1 differential equations of the form $\frac{d^n y}{dx^n} = f(x)$

To solve $\frac{d^n y}{dx^n} = f(x)$, just keep taking the antiderivative of both sides until you have solved for y

Solving simple calc. 1 differential equations of the form $\frac{d^n y}{dx^n} = f(x)$

<u>Ex 1</u>: Solve the IVP $\frac{dy}{dx} = 6x^2 - \cos x$, y(0) = 7

Solving simple calc. 1 differential equations of the form $\frac{d^n y}{dx^n} = f(x)$

<u>Ex 2</u>: Solve the IVP y'' = 8t - 3, y(1) = 5, y'(0) = 2

Solving Separable Differential Equations

A separable differential equation is a differential equation of the form

$$\frac{dy}{dx} = \left(\begin{array}{c} \text{stuff with} \\ \text{y's only} \end{array}\right) \left(\begin{array}{c} \text{stuff with} \\ \text{x's only} \end{array}\right)$$

To solve a separable DE...

- If the y' notation is used, switch it to $\frac{dy}{dx}$
- Move all *y* terms to the left side and move all *x* terms to the right (separate the variables)
- Integrate both sides (on the left side, pretend *y* is the independent variable)
- Solve for *y* if possible
- If the problem is an IVP, solve for the constant

Solving Separable Differential Equations

<u>Ex 3</u>: Solve the IVP $y' = -\frac{t}{y^2}$, y(1) = 3

Solving Separable Differential Equations

<u>Ex 4</u>: Solve the DE $\frac{dy}{dx} = x^2 y$

Solving Separable Differential Equations

<u>Ex 5 (Book Hw #20)</u>: Solve the IVP $x^2 \frac{dy}{dx} = \frac{4x^2 - x - 2}{(x+1)(y+1)}$, y(1) = 1

Solving Separable Differential Equations

<u>Ex 6</u>: Solve the DE $\frac{1}{y} dx - e^{y^2 - x} dy = 0$

Solving Separable Differential Equations

Justification