## August 16 Math 2306 sec. 51 Fall 2021

## Section 1: Concepts and Terminology

Suppose $y=\phi(x)$ is a differentiable function. We know that $d y / d x=\phi^{\prime}(x)$ is another (related) function.

For example, if $y=\cos (2 x)$, then $y$ is differentiable on $(-\infty, \infty)$. In fact,

$$
\frac{d y}{d x}=-2 \sin (2 x)
$$

Even $d y / d x$ is differentiable with $d^{2} y / d x^{2}=-4 \cos (2 x)$.

equation true.

Note that $\frac{d^{2} y}{d x^{2}}+4 y=0$.
we can verify.
we had. $\frac{d^{2} y}{d x^{2}}=-4 \cos (2 x)$
If we plus that int the left

$$
\begin{gathered}
\frac{d^{2} y}{d x^{2}}+4 y \\
-4 \cos (2 x)+4 \cos (2 x)=0
\end{gathered}
$$

## A differential equation

The equation

$$
\frac{d^{2} y}{d x^{2}}+4 y=0
$$

is an example of a differential equation.

Questions: If we only started with the equation, how could we determine that $\cos (2 x)$ satisfies it? Also, is $\cos (2 x)$ the only possible function that $y$ could be?

7 yes

## Definition

A Differential Equation is an equation containing the derivative(s) of one or more dependent variables, with respect to one or more indendent variables.

Solving a differential equation refers to determining the dependent variable(s)-as function(s).

Independent Variable: will appear as one that derivatives are taken with respect to.

Dependent Variable: will appear as one that derivatives are taken of.


## Independent and Dependent Variables

Often, the derivatives indicate which variable is whiah:


