Learning Enhancement Team

University of East Anglia
STUDENT SUPPORT SERVICE

Worksheet: Homogeneous Second Order Differential Equations

This worksheet has questions on homogeneous second order differential equations. Before attempting the questions below, you could read the study guide: *Homogeneous Second Order Differential Equations*.

Homogeneous Second Order Differential Equations study guide

Model Answers to this worksheet

1. Which of these second order ordinary differential equations are homogeneous?

a. $\frac{d^2y}{dx^2}+\frac{dy}{dx}+xy=0$ b. $\frac{d^2y}{dx^2}+3x\frac{dy}{dx}=x$ c. $y''+2y=0$

d. $\frac{d^2y}{dx^2}=\cos(x)y$ e. $y''+y'=4x$ f. $\frac{d^2y}{dx^2}+y=4$

2. Are the following second order ordinary differential equations homogeneous? If you decide that any are **not** homogeneous, explain **why** they are not homogeneous.

a. $y''+x^2y'+y=0$ b. $x\frac{dy}{dx}=\frac{d^2y}{dx^2}+1$ c. $3y''+x=y'-1$

3. Find the **general solution** to the following second order ordinary differential equations:

a. $y''-3y'+2y=0$ b. $y''+4y'+4y=0$ c. $\frac{d^2y}{dx^2}-8\frac{dy}{dx}+20y=0$

4. Find the **particular solution** to the following homogeneous second order ordinary differential equations:

a. $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=0$ with the initial conditions $y(0)=0$ and $y'(0)=1$

b. $y''+6y'+9y=0$ with the boundary conditions $y(0)=0$ and $y(1)=2$