## Exam II Problems for Ma 2212004 Fall.

## 1 Exam IIA

1. Consider the differential equation

$$
y^{\prime \prime}-3 y^{\prime}-4 y=3 e^{2 x}+2 \sin x-8 e^{-x}
$$

$1 \mathbf{a}(10 \mathrm{pts}$.$) Find the homogeneous solution of this equation.$
$1 \mathbf{b}$ (25 pts.) Find a particular solution of this equation.
$1 \mathbf{c}(10 \mathrm{pts}$.$) Give a general solution of this equation.$
2 Consider the differential equation

$$
\begin{equation*}
x^{2} y^{\prime \prime}-4 x y^{\prime}+6 y=x^{2} \ln x \quad x>0 \tag{*}
\end{equation*}
$$

2 a (10 pts.) Find two linearly independent solutions of the homogeneous equation corresponding to $(*)$.

2 b (10 pts.) Find the value of the Wronskian of the two linearly independent solutions you found in 2a.

2c (25 pts.) Find a particular solution to (*).
Note:

$$
\begin{aligned}
\int \frac{(\ln x)^{n}}{x} d x & =\frac{(\ln x)^{n+1}}{n+1}+C \\
\int \frac{\ln x}{x^{n}} d x & =-\left[\frac{\ln x}{(n-1) x^{n-1}}+\frac{1}{(n-1)^{2} x^{n-1}}\right]+C \quad n \neq 0,1
\end{aligned}
$$

2 d (10 pts.) Give a general solution to ( $*$ ) .

## 2 Exam IIB

1. Consider the differential equation

$$
y^{\prime \prime}+4 y^{\prime}-5 y=3 e^{2 x}+2 \cos x-8 e^{x}
$$

$1 \mathbf{a}(10 \mathrm{pts}$.$) Find the homogeneous solution of this equation.$
$1 \mathbf{b}$ (25 pts.) Find a particular solution of this equation.
$1 \mathbf{c}$ (10 pts.) Give a general solution of this equation.
2 Consider the differential equation

$$
\begin{equation*}
x^{2} y^{\prime \prime}-3 x y^{\prime}+3 y=x^{3} \ln x \quad x>0 \tag{*}
\end{equation*}
$$

2 a (10 pts.) Find two linearly independent solutions of the homogeneous equation corresponding to ( $*$ ).

2 b (10 pts.) Find the value of the Wronskian of the two linearly independent solutions you found in 2 a .

2c (25 pts.) Find a particular solution to (*).
Note:

$$
\begin{aligned}
\int \frac{(\ln x)^{n}}{x} d x & =\frac{(\ln x)^{n+1}}{n+1}+C \\
\int x^{n} \ln x d x & =\frac{1}{n+1} x^{n+1} \ln x-\frac{1}{(n+1)^{2}} x^{n+1}+C
\end{aligned}
$$

$2 \mathrm{~d}(10 \mathrm{pts}$.$) Give a general solution to (*)$.

