

ENGR 213 sample final

Unless otherwise specified, the general explicit solution should be given.

1.

Solve the differential equation

$$t^2 \frac{dx}{dt} = xt - x^2$$

2.

Solve the differential equation

$$(xy - \sin(2x)) dx + \frac{x^2}{2} dy = 0$$

3.

Solve the differential equation

$$y' + y \cos x = \cos x$$

4.

Solve the initial value problem

$$\begin{cases} y'' - 2y' + y = 0 \\ y(0) = 1 \\ y'(0) = 3 \end{cases}$$

5.

Find all complex solutions of the equation

$$(z - 1)^4 = 16$$

6.

Solve the Bernoulli equation

$$y' + \frac{1}{x}y = xy^4$$

7.

Use undetermined coefficients to solve the differential equation

$$y'' + y = x \sin 2x$$

8.

Find the first five non-zero terms in the power series solution of

$$y'' - x^2 y = 0$$

by expanding around $x = 0$.

9.

Solve the system

$$\begin{cases} x' = 3x - y \\ y' = 3y - x \end{cases}$$

10.

Use variation of parameters to solve

$$y'' - y = e^{3x}$$
