

**Math 3740**

**EXAM 2**

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1. Consider the following nonhomogeneous linear differential equation

$$y^{(3)} - 2y^{(2)} + 2y' = e^x + 4.$$

(a) Find a general solution of this equation

(b) Find the solution of this equation with initial conditions

$$y(0) = 2, \quad y'(0) = 4, \quad y^{(2)}(0) = 1$$

2. Write the differential equation of the simple harmonic (oscillating) motion of a 2 kg mass on the end of the spring which is stretched 50 cm by a force of 4 N. This mass is set in motion with initial position  $x_0 = -1$  m and initial velocity 2 m/sec to the left. (a) Find solution of this equation in the form  $x(t) = C \cos(\omega t - \alpha)$ . (b) Find the amplitude, period and frequency of this motion.

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3. Use Gauss elimination to find all solutions of the following linear system system

$$\begin{aligned}x_1 + x_2 + 3x_4 &= 1 \\2x_1 + 3x_2 + x_3 &= 3 \\x_1 + 2x_2 + x_4 &= 2\end{aligned}$$

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4. State the definition of linear dependence of functions  $f, g$  and  $h$ . Are the following three functions linearly dependent on the real line

$$f(x) = 2, \quad g(x) = (\cos x)^2, \quad h(x) = x \quad ?$$

## Additional sample problems for the second midterm exam, 2016

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Similar problems will replace **problem 3** in the original sample 2nd midterm exam.

**3.** Transform the following differential equation into an equivalent system of first-order differential equations

$$x^{(3)} - x^{(2)} - 3x' + 5x = 2 \sin 4t$$

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**5.** Find general solution of the following linear system of differential equations

$$\begin{aligned}x_1' &= 4x_1 - x_2 \\x_2' &= 5x_1 + 2x_2\end{aligned}$$

satisfying the initial condition  $x_1(0) = 2, x_2(0) = 4$ .