Classwork Thirty-Two: NAME:

Find the first 5 nonzero terms of a power series solution to

$$y'' = (cos\ x)y; \quad y(0) = 6; \quad y'(0) = 12.$$

Classwork Thirty-One: NAME:

Find a minimum value for the radius of convergence of a power series solution about $x_0 = 4$ to the differential equation

$(x^2 - 7x + 6)y'' - xy' + e^x y = 0.$

Classwork Thirty: NAME:

Use power series to find a solution to $xy' = (x+1)y$.

Find the first four nonzero terms, find a recurrence relation.

Then try to find the general terms of the power series and a closed form for the solution, from the power series.

HINT: $a_0 = 0$.

Classwork Twenty-Nine NAME:

Let $y = \sum_n a_n x^n$ be a power series solution to the differential equation

$$xy'' + y = 0; \quad y(0) = 0, \quad y'(0) = 1.$$

Find the first five nonzero terms of the series.

Classwork Twenty-Eight: NAME:

Find the power series expansion for $F(x) = \int \frac{ln\ (x+1)}{x}$.

Give the first four terms as well as the general formula.

Classwork Twenty-Seven: NAME:

Find the Taylor polynomial P_4 for a solution to the differential equation

$$y'' = y' + y\ cos\ x; \qquad y(0) = 1; \quad y'(0) = 2.$$

Classwork Twenty-Six: NAME:

Find the transfer $Y(s)$ and the solution $y(t)$ to the differential equation

$$y'' + 2y' + 5y = g(t); \qquad y(0) = 0; \quad y'(0) = 0$$

Express $Y(s)$ in terms of $G(s)$ and use convolution to express $y(t)$ in terms of $g(t)$–write out the integral.

Classwork Twenty-Five: NAME:

Find the convolution $sin\ t * sec\ t$ and observe that this is a solution to the differential equation $y'' + y = sec\ t$.

Classwork Twenty-Four: NAME:

Solve the differential equation

$$y'' + 4y = 6\delta(t-3)$$

with $y(0) = 2$ and $y'(0) = 0$.

Express the solution in terms of the step function $u(t-4)$ and also in two cases, where $t < 4$ and $t \geq 4$.

Classwork Twenty-Three: NAME:

Use Laplace Transforms to solve the differential equation

$$y' + 2y = 12u(t-4); \qquad y(0) = 20$$

Classwork Twenty-Two: NAME:

Find the Laplace Transform $F(s)$ when

$$f(t) = \begin{cases} 9, & \text{if } t < 3 \\ t^2, & \text{if } t \geq 3 \end{cases}$$

Classwork Twenty-One: NAME:

Use Laplace Transforms and Partial Fractions to solve

$$y'' + y = 2; \qquad y(0) = 0; \quad y'(0) = 4.$$

Classwork Twenty: NAME:

Find the function $g(t)$ which has Laplace Transform

$$G(s) = \frac{6s + 40}{s^2 + 8s + 25}$$

Classwork Nineteen: NAME:

Given that the Laplace Transform $F(s)$ of $f(t) = t^{\frac{1}{2}}$ is $F(s) = \frac{\sqrt{\pi}}{2} s^{-\frac{3}{2}}$.

Find the Laplace Transforms $G(s)$ and $H(s)$ for

(a) $g(t) = e^{3t} f(t) = t^{\frac{1}{2}} e^{3t}$; (b) $h(t) = t f(t) = t^{\frac{3}{2}}$.

Classwork Eighteen: NAME:

Use the definition of the Laplace Transform to determine $\mathcal{L}\{f\}$ for

$$f(t) = \begin{cases} 1, & 0 < t < 3 \\ 0, & t > 3 \end{cases}$$

Classwork Seventeen: NAME:

Use the elimination method to solve the following system.

$$x' = -3x + y; \qquad y' = x - 3y$$

Classwork Sixteen: NAME:

The motion of a spring is governed by the differential equation

$$x'' + 4x' + 5x = cos\ 2t.$$

Find the steady-state solution x_p.

Classwork Fifteen: NAME:

Find a second solution to the differential equation

$$y'' - tan\ x\ y' - sec^2\ x\ y = 0$$

given that $y_1 = sec\ x$ is a solution.

–Use Abel's Identity and Reduction of Order.

Classwork Fourteen: NAME:

Given the homogeneous solution $y_h = c_1 x + c_2 x^3$,

Find a particular solution y_p using Variation of Parameters:

$$y'' - \frac{3y'}{x} + \frac{3y}{x^2} = 2x$$

Classwork Thirteen: NAME:

Set up the particular solution y_p for the following differential equations but do not evaluate the constants. HINT: You need to find y_h to -check for matching.

$y'' - 3y' + 2y = x^2 e^x + e^{2x}\ cos\ 3x$

Classwork Twelve: NAME:

Use the Method of Undetermined Coefficients to solve the following problem with initial values $y(0) = 0$ and $y'(0) = 5$.

$y'' + 5y' + 6y = 3t$.

(HINT: $y_h = c_1 e^{-2t} + c_2 e^{-3t}$.)

Classwork Eleven: NAME:

Find the solution of the differential equation

$$y'' + 6y' + 13y = 0; \qquad y(0) = 5; \quad y'(0) = 1.$$

Classwork Ten: NAME:

Solve the linear second order differential equation

$y'' + 8y' + 15y = 0$ with initial values $y(0) = 2$ and $y'(0) = -2$.

Classwork Nine: NAME:

The population of alligators in Florida is currently estimated at one million. Suppose that the natural growth rate is 10%.

(a) Estimate the population in 10 years given exponential growth.

(b) Estimate the population in 10 years, given an annual "harvest" of 50,000 alligators.

(c) Find the limiting value for the alligator population if the equation is $P' = .1P - 2x10^{-7}P^2$ (in millions)

Classwork Eight: NAME:

A brine solution with concentration .05 kg/L flows at a constant rate of 6 L/min into a tank and the well-stirred solution flows out at the same rate.
The tank initially 50 L of a brine solution containing .5 kg of salt.
Find the mass $A(t)$ of salt in the tank after t minutes and also find the concentration of the solution after t minutes.
Do these have limiting values?

Classwork Seven: NAME:

Solve (implicitly) the homogeneous equation

$\frac{dy}{dx} = \frac{3y^2-2xy}{2xy-x^2}$

by first transforming to a separable equation. Simplify the answer.

Classwork Six: NAME:

Find the family of orthogonal trajectories to the curves $y = cx^2$. Sketch roughly.

Classwork Five: NAME:

Use the Test for Exactness to check the differential equation

$$(y^2 sec\ x\ tan\ x + 2)dx + (2y\ sec\ x - 3y^2)dy = 0$$

Then integrate to find the general (implicit) solution.

Finally, solve the initial value problem when $x_0 = 0$ and $y_0 = 2$.

Classwork Four: NAME:

1. Find the general (explicit) solution of the linear differential equation

$$dy/dt + 3y/t = 4/t$$

.

Then solve the initial value problem with $x(1) = 5$.

Classwork Three: NAME:

Use Euler's method with step size $h = .2$ to approximate $y(.6)$ in the initial value problem $dy/dx = 2x + y \qquad y(0) = 1$

Classwork Two: NAME:

1. Solve the differential equation $y' = y(y-2)(y-4)^2$ graphically:

(a) Find the constant solutions $y = c$.

(b) Find the intervals where y' is positive/negative and sketch the phase line.

(c) Find the limiting value L on each interval.

(d) Roughly sketch solution curves $y(0) = 1$, $y(0) = 3$, and $y(0) = 5$.

Classwork One: NAME:

1. (a) Verify that $y = x + 1 + Ce^x$ is a solution of $y' = -x + y$ for any C.

(b) Find the value of C if $y(0) = 4$.