Math 221 **Project with Maple** **Due on Nov. 3, 2000**

Name:________________________________ Score:____________

Suggestions: To get started, go to my web site http://www.math.unl.edu/∼bdeng to get the ode sample file in Maple.

1 (a) Use Maple to find the exact solution to the logistic equation

$$\frac{dP(t)}{dt} = rP(t)(1 - \frac{P(t)}{K})$$

with $r > 0$ the intrinsic growth rate and $K > 0$ the carrying capacity.

(b) Plot the slope field for theequation with $r = 0.5$ and $K = 5$ together with solutions over the time interval $[0, 20]$ with distinct initial conditions $P(0) = 1, 2, 3, 4, 5, 6, 7, 8$.

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1 (a) Consider the equations of two competing species (Eq.(3) of page 493 of the hand-out supplement.)

$$\frac{dx}{dt} = x(1 - x - y)$$
$$\frac{dy}{dt} = y(0.75 - y - 0.5x).$$

(i) Plot the direction field similar to Figure 9.4.1. of the supplement.

(ii) Plot the direction field together with several solutions in one plot. Such a plot is referred to as a phase portrait of the equations. With the exception of the direction field, this plot should look like Figure 9.4.2 of the supplement.

(iii) Plot the solutions curves $x(t), y(t)$ verses the time t over the interval $[0, 20]$ with initial conditions $x(0) = 0.2, y(0) = 0.05$. You need to put these two curves in one plot similar to Figure 9.5.3.

(b) Consider equations of two competing species (Eq.(21) of page 496 of the supplement.)

$$\frac{dx}{dt} = x(1 - x - y)$$
$$\frac{dy}{dt} = y(0.5 - 0.25y - 0.75x).$$

Generate three plots exactly the same as those of (a)(i,ii,iii) above.

(c) Consider equations of one prey and one predator (Eq.(2) of page 505 of the supplement.)

$$\frac{dx}{dt} = x(1 - 0.5y)$$
$$\frac{dy}{dt} = y(-0.75 + 0.25x).$$

Generate three plots exactly the same as those of (a)(i,ii,iii) above.

END