$\boxed{/100}$

Show all work, including mental steps, in a clearly organized way that speaks for itself. User proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. [See long instructions on reverse].

① $x^2 \dfrac{dy}{dx} + (y+1) = 0$ is both separable and linear.

a) Find the general solution $(y = \cdots)$ by the separable technique.

b) Find the general solution $(y = \cdots)$ by the linear technique.
   (they should agree apart from constant redefinition)

c) Impose the initial condition $y(1) = 2$ on the general solution to find the IVP solution $(y = \cdots)$.

d) Check that your solution to part c) satisfies the original differential equation. If it does not, say so.

② The time rate of change of an alligator population P in a swamp is proportional to the square of P. The swamp contained a dozen alligators in 1988, two dozen in 1998. When will there be four dozen alligators in the swamp? What happens thereafter?
   Organize your work in the following steps:

a) State the differential equation and the mathematical conditions on P given in the word problem and state the first question asked by it in mathematical notation.

b) Solve the problem, answering the first question in a sentence. (Use dates.)

c) Make a rough graph of P versus time showing the 3 data points described in the problem (initial, intermediate, final) and what happens to P afterwards.

d) Answer "what happens thereafter" in words. (Use dates.)

e) Check that your solution to part b) satisfies your original differential equation. If it does not, say so.

If you have sufficient time during the test period, you may email your MAPLE worksheet check work for consideration for possible extra credit to jantzen@villanova.edu with subject: 2705 Test 1 Maple. This should not substitute for any hand work.