Show all work, including mental steps, in a clearly organized way that speaks for itself. Use 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. Keep answers EXACT (but give decimal approximations for interpretation). Indicate where technology is used and what type (Maple, GC).

1. $\dfrac{dy}{dx} + 2\,x\,y^2 = 0$, $soln: y = \dfrac{1}{C + x^2}$

   a) Verify that this y satisfies the given differential equation.
   b) Find the solution from this family which satisfies the initial condition $y(1) = 2$ and simplify your result.
   c) Is there an obvious "singular solution" missing from this family?
Organize your work as though you were playing professor. If you have an extra moment, does your solution to b) coincide with Maple's expression?

2. Write a differential equation that models the 1-dimensional motion situation:
"The time rate of change of the velocity of a freely falling object is proportional to the square of the velocity."
[Hint: Use the variable t for time and use d/dt derivative notation.]
Can we conclude anything about the sign of the constant of proportionality? [Hint: velocity can be positive or negative, i.e., up or down.]

► **solution**