1. Identify the order of the following differential equations and check the box(es) if they are linear, homogeneous, and/or constant coefficient.

   (a) $y''' + x^{y'} = y^x$

   Order: _____

   ☐ Linear

   ☐ Homogeneous

   ☐ Constant Coefficient

   (b) $y'' = y' + 4y$

   Order: _____

   ☐ Linear

   ☐ Homogeneous

   ☐ Constant Coefficient

   (c) $y' = e^{2x}y + \cos(x)$

   Order: _____

   ☐ Linear

   ☐ Homogeneous

   ☐ Constant Coefficient

   (d) $y' - e^{2x}y = 0$

   Order: _____

   ☐ Linear

   ☐ Homogeneous

   ☐ Constant Coefficient

2. As a skateboard rolls down a hill, it experiences two forces: gravitational force, given by $mg\sin(\theta)$, where θ is the slope angle relative to the horizontal, and friction, which is proportional to the speed of the skateboard, v. Find a differential equation which expresses the relationship between these quantities. (Hint: The net force F on the skateboard is mass times acceleration, $F = ma$, and acceleration is $a = \frac{dv}{dt}$, so what is the net force in terms of the two quantities acting on the skateboard?)

3. The half-life of a radioactive substance is 15 hours. Find a differential equation that its mass satisfies (in terms of hours t).

4. Verify that e^{e^x} satisfies the differential equation

$$e^{-x}y' - y = 0$$

The End.