1. Which of the following is a solution of the differential equation $\frac{d^2y}{dx^2} - 4y = 0$?

Circle the correct solution.

- $y = e^{-4x}$
- $y = e^{2x}$
- $y = e^{2x^2}$
- $y = \sin 2x$
- $y = 4x$
- $y = 2x^2$

2. When a child is born, his grandparents placed $10,000 in a savings account at 10% interest continuously compounded, to be withdrawn at age 20 to help pay for college. How much money is in the account at the time of maturity? Will this amount be enough to pay for college in 20 years? Why or why not (guess)?

3. The half-life of an isotope is 25 years. How long will it take 20 mg to decay to 2 mg?
4. Find the solution to the differential equation \(1 + x = 2xy', \ x > 0, \ y(1) = -2\).

5. A 175 pound body is found at a crime scene. The coroner finds the body temperature to be 70 degrees, normal body temperature is 98 degrees. The room temperature is set at 65 degrees. The cooling constant for humans that weigh between 150 and 190 pounds is \(-0.3\) degrees per hour. How long has the body been dead?

6. Solve the differential equation \(y' = 2 + 2x^2 + y + x^2y\).
7. A tank contains 1000 L of pure water. Brine that contains 0.05 kg of salt per liter of water enters the tank at a rate of 5 L/min. Brine that contains 0.04 kg of salt per liter of water enters the tank at a rate of 10 L/min. The solution is kept thoroughly mixed and drains from the tank at a rate of 15 L/min.
How much salt is in the tank after t minutes?
How much salt is in the tank after 10 minutes?

8. Solve the differential equation \( y' = xy \) with \( y_0 = 4 \).

9. The US population in 1980 was 260 million. The population in 1990 was 280 million. Predict the population in 2010.
When will the population exceed 350 million?
10. Find the orthogonal trajectories of the family of curves. $y = (x + k)^{-1}$

11. Use Euler's Method with step size 0.2 to estimate the value of $y(0.6)$ for the differential equation $\frac{dy}{dx} = 2x + y^2$ with $y(0) = 2$. 