Review

Directions: Use a calculator for problems 1-12. Do not use a calculator for problem 13.

1. Find $f(2)$ if $f(x)$ is the solution to the differential equation $\frac{dy}{dx} = \frac{\sin x}{x}$ with the initial condition that $f(1) = 5$.

2. Find $f(6)$ if $f(x)$ is the solution to the differential equation $\frac{dy}{dx} = e^{-x^2}$ with the initial condition that $f(3) = \pi$.

3. Find $f(\pi)$ if $f(x)$ is the solution to the differential equation $\frac{dy}{dx} = \frac{2}{\ln x}$ with the initial condition that $f(2) = 3$.

4. A metal plate has been heated to 50 degrees Celsius. It is then placed in an oven that is set to 250 degrees Celsius and heats to a temperature of 100 degrees Celsius after 8 minutes. How much longer will it take to heat up to 200 degrees Celsius?

5. A can of coke is 70 degrees Fahrenheit. It is placed into a freezer set at 20 degrees Fahrenheit. After 20 minutes, the temperature is 40 degrees Fahrenheit. It is known that coke will freeze at 30 degrees Fahrenheit and at that temperature the can will explode in the freezer. After how many more minutes will the can explode?

6. A metal pan is removed from an oven and placed on the counter in a 70 degree Fahrenheit room. As it is removed from the oven it is measured to have a temperature of 200 degrees Fahrenheit. If it takes 14 minutes to cool to a temperature of 120 degrees Fahrenheit, how much longer will it take to cool to 76 degrees Fahrenheit?

7. Three thousand dollars is invested in an account that earns 2.36% interest compounded quarterly. How much money is in the account after 3 years? Round to the nearest cent.

8. Two thousand dollars is invested in an account that earns 1.55% interest compounded monthly. How much money is in the account after 5 years? Round to the nearest cent.

9. Four hundred dollars is invested in an account that earns 3.24% interest compounded continuously. How much money is in the account after 6 years? Round to the nearest cent.

10. The half-life of iodine-131 is approximately 8 days. A particular sample weighs 40 mg. After how many days will the sample weigh 3 mg?

11. Titanium-44 decays according to the differential equation $\frac{dy}{dt} = -0.011002y$ where t is measured in years. What is the half-life of titanium-44? A particular sample of titanium-44 has a weight of 125 mg. After how many years will it weigh 33 mg?

12. Plutonium-236 decays according to the differential equation $\frac{dy}{dt} = -0.2425287y$ where t is measured in years. What is the half-life of plutonium-236? How long would a particular sample take to decay to 22% of its original value?

13. Solve each of the following differential equations and state the interval of validity for each:

a. $\frac{dy}{dx} = 3x^2 - 2x - 1$ and $y(2) = 3$.

b. $\frac{dy}{dx} = \cos 2x$ and $y = 3$ when $x = \frac{\pi}{4}$.

c. $\frac{dr}{dt} = \frac{1}{t-2} + \frac{1}{t}$ and $r = 5$ when $t = 1$.

d. $\frac{dz}{dx} = \frac{5x+2}{\sqrt[3]{x}}$ and $z(1) = 2$.

e. $\frac{dy}{dx} = \sec^2 x - x$ and $y(0) = 3$.

f. $\frac{dA}{dt} = \frac{2}{1+t^2}$ and $t = 1$ when $A = \pi$.

g. $\frac{dy}{dx} = \frac{2x}{\sqrt{1-x^4}}$ and $x = 0$ when $y = 3$

h. $\frac{dy}{dx} = \frac{1}{xy}$ and $y(1) = 2$

i. $\frac{dy}{dt} = e^{y+t}$ and $y = 1$ when $t = 0$

j. $\frac{dy}{dx} = xe^{x^2 - \ln(y^2)}$.and $x = 0$ when $y = 1$

k. $\frac{dy}{dx} = \frac{\sin x \cos x \cos^2 y}{\sin y}$ and $y\left(\frac{\pi}{4}\right) = 0$

l. $\frac{dy}{dx} = \frac{x+1}{y}$ and $y(0) = -2$

m. $\frac{dy}{dx} = \frac{y+3}{x-2}$ and $y = 1$ when $x = 3$

n. $\frac{dy}{dx} = \frac{x^2-1}{y-2}$ and $y = -4$ when $x = 3$