Math 7B - Week 9

Name: _____

Section Number: _____

1 Solve the following pure-time initial value problem $\frac{dN}{dt} = \sqrt{t+9}$ where $N(0) = 20$.

2a Solve the autonomous differential equation $\frac{dy}{dx} = y + 1$.

2b Solve the autonomous initial value problem $\frac{dy}{dx} = y^2 + y$ where $y(0) = 1$.

3. Solve the separable differential equation $\frac{dy}{dx} = 2xe^{-y}$.

4. Solve the following separable differential equations with their initial values.

   (a) $y' = 6y^2x$ where $y(1) = \dfrac{1}{25}$

   (b) $\dfrac{dy}{dt} = e^{y-t}\sec(y)(1+t^2)$ where $y(0) = 0$.

5. Suppose that an object has a temperature T and is brought into a room that is kept at a constant temperature T_a. Newton's law of cooling states that the rate of temperature change of the object is proportional to the difference between the temperature of the object and the surrounding medium.

   (a) Denote the temperature at time t by $T(t)$.

   $$\frac{dT}{dt} = k(T_a - T)$$

   Derive the solution to the differential equation, assuming that at time $t = 0$, the temperature of the object is $T = T_0$.