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Quiz n^o 1 (20 minutes)

Show your work and justify your answers. Calculators, notes, cell phones, books are not allowed. Please do not use red or pink ink. Maximum: 20 points

Exercise 1 (4+3+3 points) .

The liquid base of an ice cream at initial temperature of 30° C is placed in a freezer with constant temperature -20° C. Assume that Newton's law of cooling applies with transmission factor $k = 0.5 \text{ hours}^{-1}$.

(a) Write an initial value problem (IVP) that models the temperature of the liquid as a function of time.

(b) Solve the IVP and determine a formula for the temperature of the liquid as a function of time.

(c) Suppose the ice cream is ready when it reaches the temperature of 0° C. How long will it take to be ready? (*Leave your answer in term of ln*)

Exercise 2 (3+2+5 points) . The differential equation

$$\frac{dy}{dt} = e^{y^2} - 1$$

is of the form $\frac{dy}{dt} = f(y)$ with $f(y) = e^{y^2} - 1$

(a) Sketch the graph of $f(y)$ versus y

(b) Determine the equilibrium point(s).

(c) Draw the phase line and classify the equilibrium point(s) as asymptotically stable, unstable, or semistable. Sketch graphs of solutions in the ty -plane on either sides of each equilibrium point.