

Class 8: Wednesday September 17

Newton's Law Of Cooling

Does a hot cup of coffee cool down at a constant rate?

What assumption(s) can you make about the rate at which the coffee cools ?

Newton's Law of Cooling states that the rate of cooling is proportional to the difference between the object's temperature and the ambient temperature. Let C denote the temperature of the coffee (in $^{\circ}\text{F}$) and let C' be the rate at which it is cooling (in $^{\circ}\text{F}$ per minute.) If the temperature of the room is 70°F , Newton's Law of Cooling says:

$$C' \propto$$

Write an equation that relates C' and C . It will contains a constant of proportionality k .

When the coffee is at 180°F it is cooling at a rate of 9°F per minute. What is k ?

Write down an IVP model for the cooling coffee cup:

Solve your IVP model for the cooling coffee cup by using the method of separation of variables to obtain an expression for $C(t)$.

What is the expected steady state of your cooling model? Does your solution exhibit this behavior?