Population (contd)

Ex: A population of mice inhabit a field. Every month (month=30 days), every poir of mice produces a single mouse baby. Every day, local owls eats 15 mice.

Ques: what happens to population over time?

p(t) = population of mice at time t in months.

what is the initial population? what if p(0) = 600 mice? that if p(0) = 1000 mice?

p=0.5e-450 06

Aside

Let 17

every foir

products 10

products babies?

rouse babies?

reproduction

1=0.5(10) p-450

P-0.5p=-450

solve to find p(t)

solution

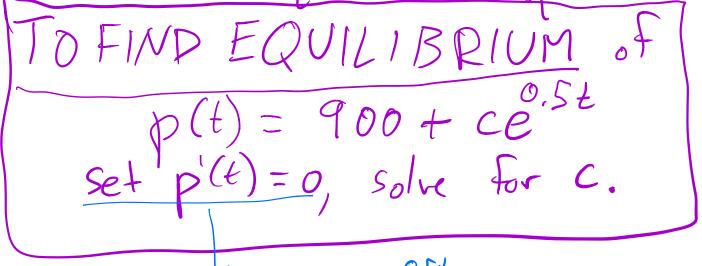
Owhat if p(o) = 600 mice? Owhat if p(o) = 1000 mice? Owhat if p(o) = 1000 mice?

5054. fok. 600 = 900 + Ce.S. (6)

-900 -900 + C·1

 $\begin{array}{c}
\text{p=u.p.} \\
\text{p=(900e^{0.5t} + C)e^{0.5t}} \\
\text{solution}
\end{array}$

DANS 1-300 = C $p(t) = 900 - 300e^{0.5t}$ population over the (Fp(0)=1000. 1000 = 900 + CE 1000 = 900 + C -900 _ 900 (100 = C p(t) = 900 + 100 e £ C=0 (t) = 900 + Ce t) = 900 + S t) = 900 we call this the equilibrium solution 450-45000



You take a hot cup of coffee outside in the middle of winter. What happens to the temperature T(t)

if outside temp = 500? 1st outside temp = 11° The change in temperature is related to the difference the temp of coffee and

The rate of change of temperature is proportional to the DIFFERENCE between the temperature T of the object and the temperature T_m of the environment (or medium)"

NEWTON'S LAW OF COOLING:

 $T' = -k(T - T_m)$

- T(t) is the temperature at time t
- T_m is the temperature of the medium (environment)
- k is a positive quantity, the temperature decay constant (depends on surface area of object and various properties of the environment)

 $\Gamma = T(t) = temp. of our object at time t.$ Tm= temp. of environment, This constant K= constant (temp decay comtent) =-K(T-Tm) unknown function is T(t)=

NEWTION'S LAW OF COOLING
You take a hot up of coffee outside in the middle of winter. What happens to the temperature T(t) of the coffee over time?

Does it continue to cool forever?

Does it cool more quickly if the temperature outside is 22*F (New York) or ~40*F (Alaska)?

"The rate of change of temperature is proportional to the DIFFERENCE between the temperature T of the object and the temperature T_m of the environment (or medium)"

NEWTON'S LAW OF COOLING:

- **EWTON'S LAW 0. 50-1

 * T(t) is the temperature at time t

 * T(t) is the temperature of the medium (environment)

 * K is a positive quantity, the temperature decay constant (depends on surface area of object and various properties of the environment)

 **Substitution* is $T = T_m + (T_0 T_m)e^{-kt}$

NOTE: If T_0 is the initial value of T, then the general solution is $T = T_m + (T_0 - T_m)e^{-t}$

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Resource on coffee temperatures: https://drittaway.coffee/temperature/ Example (update): An extra-hot cup of coffee at 180°F is carried outside in 22°F weather. After 5 minutes, the temperature of the coffee has dropped to 160°F. How long does it take the coffee to reach the perfect temperature of 130°F?

Example (OLD): A cup of coffee at 200°F is carried outside in 22°F weather. After 5 minutes, the temperature of the coffee has dropped to 120°F. How long does it take the coffee to reach 75°F?

Example (update): An extra-hot cup of coffee at 180°F. How long does it take the coffee to minutes, the emperature of 130°F?

The = 32° temp of environment (cursis: T(t))

T = 180 at t = 0, or T(0) = 180T = 160 t = 5 T(5) = 160STRATEGY (D plug in $T_m = 33$)

Follow this diff. equation (free that as constant)

T(t) = 170 (t) = 180

T = 180 at t = 0, or t = 0 (t) = 180

T = 160 t = 0 (t) = 180

T = 160 t = 0 (t) = 180

T = 160 t = 0 (t) = 180

T = 160 t = 0 (t) = 180

T = 160 t = 0 (t) = 180

T(t) = 160

Solve this diff. equation (free that as constant)

T(t) = 160 t = 0 (t) = 180