Section 31.6:

Friday, February 9, 2018 10:30 AM

3 c) for cooling, we found

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

$$\Rightarrow \quad T = T_{room} + (T_{init} - T_{room})e^{-kt}$$

how does this change if a cold object is warming up in a room instead

$\frac{dT}{dt}$ is positive (objects temp is increasing)

but $T - T_{room}$ is negative (the object is cooler than the room)

so $\frac{dT}{dt}$ and $(T - T_{room})$ still have opposite signs

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

d) find k using the information about $-100°C$

$$T = T_{room} + (T_{init} - T_{room})e^{-kt}$$

$$-100 = 20 + (-200 - 20)\, e^{-k \cdot 1}$$

$$-120 = -220\, e^{-k}$$

$$\frac{120}{220} = e^{-k}$$

$$\ln\left(\frac{120}{220}\right) = -k$$

$$k = -\ln\left(\frac{120}{220}\right)$$

$$\approx 0.606136$$

do not round here!

now, find t

$$T = T_{room} + (T_{init} - T_{room})\, e^{-kt}$$

$$0 = 20 + (-200 - 20)\, e^{-0.606136t}$$

$$-20 = -220\, e^{-0.606136t}$$

$$\frac{20}{220} = e^{-0.606136t}$$

$$\ln\left(\frac{20}{220}\right) = -0.606136t$$

$$t = \frac{\ln(20/220)}{-0.606136}$$

$\approx$ 3.956 days

$\approx$ 4 days