Ryan Goh
BU ID: U12345678
Disc. Section:
B8 Friday 12:10-1:10

Sample Homework for
1.1. #3 and 1.2 #3

1.1.3 Consider the model $\frac{dP}{dt} = 0.4P(1 - P/230)$

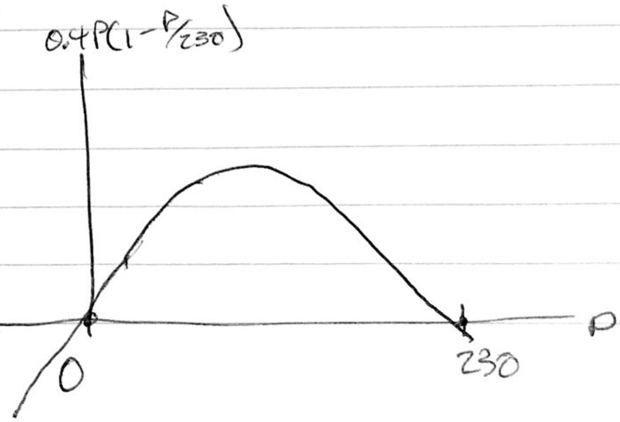
a) We see that $\frac{dP}{dt} = 0$ when $0.4P(1-P/230) = 0$, that is when either $P = 0$ or $1 - P/230 = 0$

This last equality implies $P = 230$. Hence the equilibrium values of the population are $P = 0$ and $P = 230$

b) We see that
$0.4P(1-P/230) > 0$ for $0 < P < 230$
and
$0.4P(1-P/230) < 0$ for either $P > 230$ or $P < 0$
the latter of which is unphysical (population can't be negative)

Hence $\frac{dP}{dt} > 0$, and thus the population is increasing for all values P with $0 < P < 230$.

c) In a similar way, the population is decreasing when $\frac{dP}{dt} < 0$, or equivalently, when $P > 230$



1.2.3) First note that, by the chain-rule $\frac{d}{dt}(e^{t^3}) = 3t^2 \cdot e^{t^3}$, hence if $y(t)=e^{t^3}$ and we want $\frac{dy}{dt} = f(t,y)$, we need a function f satisfying $f(t,y(t)) = 3t^2 e^{t^3} = 3t^2 \cdot y(t)$.

Hence we choose $\underline{f(t,y) = 3t^2 \cdot y}$, and conclude $y(t) = e^{t^3}$ solves $\frac{dy}{dt} = f(t,y)$.