**ECO 244: Applied Mathematics II**

**Final Exam Sample Questions**

1. Solve the following differential equations:
2. $\frac{f^{'}\left(x\right)-2f(x)}{x}=\frac{1}{x}$ ; $f\left(0\right)=3$
3. $dx=5xdt-3dt$ ; $x\left(2\right)=1$
4. Consider Market A, which has the following demand and supply functions:

$Q\_{d}=9-2P+3\frac{dP}{dt} $ and $Q\_{s}=-2+P$

1. Assuming that the rate of change in price overtime is directly proportional to excess demand, find the time path $P(t)$.
2. What is the intertemporal equilibrium price?
3. What is the market equilibrium price?
4. Is the price model $P(t)$ dynamically stable if $P\left(0\right)=5$?
5. **You are working in the marketing department of a computer software company. Your marketing team determines that a maximum of 30,000 units of a new product can be sold in a year. You hypothesize that the rate of growth of sales** $\left(\frac{dx}{dt}\right)$ **is proportional to the difference between the maximum sales and the current sales** $(x)$**.**

**Use the given information to form a differential equation. Solve for the time path** $x(t)$**, if initial sales was 2000 units.**

1. **Suppose the refugee population of a certain country is growing at the rate of 2% per year.** $x\_{0}$ **is the initial size of the refugee population.**
2. **Construct a difference equation to portray the refugee population growth between two years.**
3. **Calculate the size of the population after 4 years, if** $x\_{0}=100$
4. **Consider the demand and supply functions of Market B:**

$$Q\_{dt}=80-0.4P\_{t}$$

$$Q\_{st}=-10+0.2P\_{t-1}$$

**Since Market B is an agricultural market, production is lagged by one time period, for which current period’s market supply are based on the preceding period’s prices.**

1. **Determine the market price time path function** $P\_{t}$**.**
2. **What is the intertemporal equilibrium price?**
3. **Use the price time path function derived in (a) to sketch a Cobweb diagram. Discuss whether the oscillation is explosive (divergent), damped (convergent) or uniform.**

**\*\*RED indicates very very important!**

1. (a) If the initial value$ y\_{0}=1$, graphically illustrate the time path of $y\_{t}$.

$$∆y\_{t}=0.02y\_{t}$$

 (b) Circle the correct attribute in relation to the time path graph you constructed above:-

* Divergent / Convergent / Uniform (neither convergent or divergent)
* Oscillatory / Non-oscillatory
* Increasing at an increasing rate / Decreasing at a decreasing rate / Increasing at a decreasing rate / Decreasing at an increasing rate
* Dynamically Stable / Dynamically unstable
1. Graphically illustrate the time path of $y\_{t}$. Include a detailed explanation on the pattern of the time path.
2. $y\_{t+1}=\frac{3}{4}y\_{t} ; y\_{0}=100$
3. $x\_{t+1}-x\_{t}=3x\_{t}+4 ; x\_{0}=2$

Linear programming problems can be found in this link with solutions. Scroll down at the bottom of the webpage, and visit pages 1, 2 and 3.

<http://www.purplemath.com/modules/linprog.htm>