ECON-UA-12-SECTION-002
INTERMEDIATE MACROECONOMICS
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DEPARTMENT OF ECONOMICS
NEW YORK UNIVERSITY
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Supplemental Problem Set 1
Complete before June 5 (but do not turn in)

Prepare answers to the following for Wednesday class. Supplemental problem sets resemble exam questions. Answers will be posted on NYU Classes on June 5 after class.

A. Math Review: the calculus

a. If $y = f(x) = x^{1/2}(2x+1)^{1/2}$, find dy/dx.

b. If $y = f(x) = \frac{3x^{1/3}}{(3x+3)^{1/3}}$, find dy/dx.

c. If $y = f(x) = \ln(x^{1/3})$, find dy/dx.

d. If $y = f(x) = e^{3x}$, find dy/dx.

e. If $y = f(x) = \frac{x^{1/2}}{\ln x^{1/2}}$, find dy/dx.

f. If $z = f(x) = x^{1/3}.e^{x^{1/3}}$, find dy/dx.

g. If $w(t) = 7e^{-rx(t)^2}$, find the growth rate of w.

h. Let $Y = AK^{1/2}L^{1/2}$, where Y, A, K, L are all functions of time (note: we could write the production function as $Y(t) = A(t)(K(t))^{1/2}(L(t))^{1/2}$ but this would involve too much notation). Log differentiate with respect to time to find the growth rate of Y in terms of the growth rate of A, K and L.

B. Questions from Chapters 1 and 2:

2. Explain, if and how, the following items are included in the calculation of GDP:

a. Changes in business inventories

b. Fees earned by real estate agents while selling existing homes

c. Social security checks issued by the government

d. The building of a new bridge by the US Army Corps of engineers

e. Interest that families pay on their home mortgage

3. Suppose an appliance store buys a refrigerator from the manufacturer on Dec. 15, 2016 paying $600. On Jan. 15, 2017 a consumer buys that same refrigerator paying $1000.

a. What is the contribution to GDP of the appliance store's transaction in 2016 and which category in the national income accounts is it listed under? Explain.

b. What is the contribution to GDP of the consumer's transaction in 2017 and which category in the national income accounts is it listed under? Explain.

C. Questions from Chapter 8:

4. Suppose the aggregate production function is $Y = K^{\alpha}L^{1-\alpha}$ where $0 < \alpha < 1$.

a. Show that the aggregate production has constant returns to scale.

b. Find the intensive form of the production function, $y = f(k)$, where $y \equiv Y/L$ and $k \equiv K/L$.

c. Find the marginal product of labor ($MPL \equiv \frac{\partial Y}{\partial L}$) and describe in words how K and L affect the MPL.

d. Find the marginal product of capital ($MPK \equiv \frac{\partial Y}{\partial K}$) and describe in words how K and L affect the MPK.

e. Find the marginal product of capital per worker ($MPk \equiv \frac{\partial y}{\partial k}$) and describe in words how K and L affect the MPk.

f. Show that $MPK = MPk$.

g. Calculate the labor share of GDP$= (W/P) * L/Y$ where the real wage, W/P, equals the MPL in competitive equilibrium, so $W/P = MPL$.

h. Calculate the capital share of GDP $= (R/P) * K/Y$ where the real rental price on capital, R/P, equals the MPK in competitive equilibrium, so $R/P = MPK$.

i. Suppose $\alpha = 1/3$. If in a given year population growth is 3% and the capital stock grows 6%, use the growth trick to show that output grows 4% and output per worker grows 1%.

D. Problem and Applications from Chapter 8 in Mankiw:

5. Chapter 8 Problem 2

6. Chapter 8 Problem 5 - a,b,c.

7. **True, False, Uncertain and Explain** all credit depends on your explanation. Assess the truth, falsity or uncertainty of following statement which was taken from a politician's speech not long ago: "Devoting a larger share of national output to investment would help restore rapid productivity growth and rising living standards." [Hint: use the Solow model but first, define productivity, then define living standards].