Economics 101b; Mock Exam

1. Today it appears that because of the computer revolution the rate of growth of the efficiency of labor in the United States has more than doubled, from 1.0 percent per year before 1995 to about 3.0 percent per year since. Suppose this increase were to be permanent. And suppose the rate of labor force growth were to remain constant at 1 percent per year, the depreciation rate were to remain constant at 3 percent per year, and the American savings rate (plus foreign capital invested in America) were to remain constant at 20 percent per year.

Assume that the efficiency of labor in the U.S. in 2004 is $17,500 per year, and that the diminishing-returns-to-capital parameter α is 1/2.

a. What is the change in the steady-state capital-output ratio because of this acceleration in efficiency-of-labor growth? What is the new steady-state capital-output ratio?
b. How would such a permanent acceleration in the rate of growth of the efficiency of labor change your forecast of the level of output per worker in 2040?
c. How would your answers to a and b be different if a were 1/3? If it were 2/3?
d. How much does your answer to (b) depend on the approximation that countries converge to their steady-state growth paths rapidly? How valid is this approximation in this instance?

2. Consider the Solow growth model, in which output per worker along the steady-state growth path is given by:

$$\frac{Y_t}{L_t} = \left(\left(\frac{K}{Y} \right)^* \right)^{\left(\frac{\alpha}{1-\alpha} \right)} \times E_t$$

where the steady-state capital-output ratio (K/Y)* is given by:

$$\left(\frac{K}{Y} \right)^* = \frac{s}{n + g + \delta}$$

where the diminishing-returns-to-scale parameter in the production function is α, and where s is the economy's savings-investment rate, n is the labor force growth rate, δ is the depreciation rate, and g is the proportional rate of growth of the efficiency of labor E_t.

a. Suppose that we have two economies A and B, identical save that in economy A the efficiency of labor is twice that of economy B. What is the ratio of their steady-state output per worker levels?
b. Suppose that we have two economies A and B, identical save that in economy A the capital-output ratio is twice that of economy B. Write an equation for how the ratio of their steady-state output per worker levels varies depends on the value of the production function parameter α.
c. Suppose that we have a labor force growth rate of 2% per year, a depreciation rate of 4% per year, a rate of growth of the efficiency of labor of 2% per year, and a savings rate of 20% of GDP. What is the steady-state capital-output ratio? Suppose that the efficiency of labor is currently $20,000 per year and the economy is on its steady-state growth path. What is the economy's level of output per worker if the diminishing-returns-to-capital parameter α is 1/2?
d. With the same parameter values as (c), what is the proportional reduction in the steady-state level of output per worker that would be generated by a reduction in the savings rate from 20% to 16%?

3. In Taiwan today, the (real) savings rate is about 32 percent of output, the average rate of increase in the efficiency of labor is 3 percent per year, the average rate of population growth is about 1 percent per year, and the depreciation rate is about 4 percent per year.

(1) Suppose that Taiwan is able to maintain these investment, population growth, depreciation, and labor efficiency growth rates far into the future. What is its balanced-growth capital-output ratio?

(2) Suppose that the parameter α in the production function $Y/L = E \times (K/L)^{\alpha}$ is 1/3. What is the level of output per worker on the balanced-growth path (that is, what is output per worker as a function of the efficiency of labor E and of the parameters of the model)?

(3) What will the long-run rate of growth of total GDP be in the steady state?

(4) What will the long-run rate of growth of GDP per worker be in steady state?