

**MULTIPLE CHOICE (5 points each):** Write the letter of the alternative that *best* answers the question in the blank. Make sure you read all four alternatives before making your choice.

B 1. When  $f(k)$  is drawn on a graph with increases in  $k$  noted along the horizontal axis, the:

- (A) Graph is a straight line
- (B) Slope of the line eventually gets flatter and flatter
- (C) Slope of the line eventually becomes negative
- (D) Slope of the line eventually gets steeper and steeper

A 2. If a study by medical researchers found that brown sugar caused weight loss, then

- (A) The demand for white sugar decreases
- (B) The demand for white sugar increases
- (C) The quantity demanded of white sugar decreases
- (D) The quantity demanded of white sugar increases

C 3. A surplus exists in a market if

- (A) There is an excess demand for the good
- (B) The situation is such that the law of supply and demand would predict an increase in the price of the good from its current level price
- (C) The current price is above its equilibrium price
- (D) None of the above are correct

D 4. The Fed can increase the price level by conducting open market

- (A) Sales and raising the discount rate
- (B) Sales and lowering the discount rate
- (C) Purchases and raising the discount rate
- (D) Purchases and lowering the discount rate

B 5. Suppose that in a closed economy, GDP is equal to 11,000, taxes are equal to 1,500, consumption equals 7,500, and government purchases equal 2,000. What is private saving?

- (A) -500
- (B) 2,000
- (C) 1,500
- (D) 0

C 6. Given a nominal interest rate of 8 percent, in which case below would you earn the highest after-tax real interest rate?

- (A) Inflation is 5 percent; the tax rate is 20 percent
- (B) Inflation is 4 percent; the tax rate is 30 percent
- (C) Inflation is 3 percent; the tax rate is 40 percent
- (D) The after-tax real interest rate is the same for all of the above

B 7. According to monetary neutrality and the Fisher effect, an increase in the money supply growth rate eventually increases

- (A) Inflation, nominal interest rates, and real interest rates
- (B) Inflation and nominal interest rates, but does not change real interest rates
- (C) Inflation and real interest rates, but does not change nominal interest rates
- (D) Neither inflation, nominal interest rates, or real interest rates

D 8. Real GDP per person is \$20,000 in Jaredland, \$15,000 in Patrickland and \$5,000 in Alikland. Saving per person is 1,000 in all three countries. Other things equal, we would expect that

- (A) All three countries will grow at the same rate
- (B) Jaredland will grow the fastest
- (C) Patrickland will grow the fastest
- (D) Alikland will grow the fastest

B 9. Two economies are identical except that the level of capital per worker is higher in Highland than in Lowland. The production functions in both economies exhibit diminishing marginal product of capital. An extra unit of capital per worker increases output per worker:

- (A) More in Highland
- (B) More in Lowland
- (C) By the same amount in Highland and Lowland
- (D) In Highland, but not in Lowland

A 10. Which of the following is not implied by the quantity equation?

- (A) With constant money supply and velocity, an increase in output creates a proportional increase in the price level
- (B) With constant money supply and output, an increase in velocity creates an increase in the price level
- (C) If velocity is stable and money is neutral, an increase in the money supply creates a proportional increase in the price level
- (D) If velocity is stable, an increase in the money supply creates a proportional increase in nominal output

- \_\_C\_\_ 11. Investment per worker ( $i$ ) as a function of the saving ratio ( $s$ ) and output per worker ( $f(k)$ ) may be expressed as:
- (A)  $s + f(k)$
  - (B)  $s - f(k)$
  - (C)  $sf(k)$
  - (D)  $s / f(k)$
- \_\_D\_\_ 12. If the per worker production function is given by  $y = k^{1/2}$ , the saving ratio is 0.3, and the depreciation rate is 0.1, then the steady state ratio of capital to labor is:
- (A) 1
  - (B) 2
  - (C) 4
  - (D) 9
- \_\_B\_\_ 13. Starting from a steady state situation, if the saving rate increases, the rate of growth of capital per worker will:
- (A) Increase and continue to increase unabated
  - (B) Increase until the new steady state is reached
  - (C) Decrease until the new steady state is reached
  - (D) Decrease and continue to decrease unabated
- \_\_C\_\_ 14. The Golden Rule level of the steady state capital stock:
- (A) Will be reached automatically if the saving rate remains constant over a long period of time
  - (B) Will be reached automatically if each person saves enough to provide for his or her retirement
  - (C) Implies a choice of a particular saving rate
  - (D) Should be avoided by an enlightened government
- \_\_B\_\_ 15. If an economy with no population growth has a steady state MPK of 0.125, a depreciation rate of 0.1, and a saving rate of 0.225, then the steady state capital stock:
- (A) Is greater than the Golden Rule level
  - (B) Is less than the Golden Rule level
  - (C) Equals the Golden Rule level
  - (D) Could be either above or below the Golden Rule level
- \_\_D\_\_ 16. If an economy is in a steady state with no population growth and the capital stock is above the Golden Rule level and the saving rate falls:
- (A) Output, consumption, investment, and depreciation will all decrease
  - (B) Output and investment will decrease, and consumption and depreciation will increase

- (C) Output and investment will decrease, and consumption and depreciation will increase and then decrease but finally approach levels above their initial state
- (D) Output, depreciation, and investment will decrease, and consumption will increase and then decrease but finally approach levels above its initial state

C 17. In the Solow growth model of an economy with population growth, the break-even level of investment must do all of the following *except*:

- (A) Offset the depreciation of existing capital
- (B) Provide capital for new workers
- (C) Equal the MPK
- (D) Keep the level of capital per worker constant

B 18. The Solow growth model with population growth can explain::

- (A) Persistent growth in output per worker
- (B) Persistent growth in total output
- (C) Persistent growth in consumption per worker
- (D) Persistent growth in the saving rate

D 19. The manager of the bank where you work tells you that your bank has \$5 million in excess reserves. She also tells you that the bank has \$300 million in deposits and \$255 million dollars in loans. Given this information you find that the reserve requirement must be:

- (A) 50/255
- (B) 40/255
- (C) 50/300
- (D) 40/300

B 20. If velocity = 5, the price level = 1.5, and the real value of output is 2,500, then the quantity of money is:

- (A) 333.33
- (B) 750.00
- (C) 1,050.00
- (D) 8,333.33

## Numerical/Analytical Problems

1. Assume that a country's production function is  $Y = F(K, L) = K^{0.5}L^{0.5}$ .
- Show that this function exhibits constant returns to scale (CRS).

This is a Cobb-Douglas production function. Because the sum of the shares of capital and labor add up to 1, this function exhibits constant returns to scale. To show this, consider any  $\lambda > 0$ . Then:

$$F(\lambda K, \lambda L) = (\lambda K)^{1/2}(\lambda L)^{1/2} = \lambda^{1/2+1/2}K^{1/2}L^{1/2} = \lambda K^{1/2}L^{1/2} = \lambda F(K, L)$$

So, increasing all inputs by a factor  $\lambda > 0$  increases output in the same proportion. Therefore, the function exhibits constant returns to scale.

- What is the per-worker production function?

The per-worker production function is given by:

$$y \equiv \frac{Y}{L} = \frac{F(K, L)}{L} = \frac{K^{1/2}L^{1/2}}{L} = \frac{K^{1/2}L^{1/2}}{L^{1/2}L^{1/2}} = \left(\frac{K}{L}\right)^{1/2} \equiv k^{1/2}$$

- Assume that the country possesses 40,000 units of capital and 10,000 units of labor. What is  $Y$ ? What is labor productivity computed from the per-worker production function? Is this value the same as labor productivity computed from the aggregate production function?

With  $K = 40,000$  and  $L = 10,000$  then  $k = 40,000/10,000 = 4$ . So, labor productivity from the per worker production function is  $y = f(k) = 4^{1/2} = 2$ .

At the aggregate level,  $Y = (40,000)^{1/2}(10,000)^{1/2} = 20,000$ . So, labor productivity is  $Y/L = 2$ .

Labor productivity is the same, independently of how it is calculated.

- Assume that 10% of capital depreciates each year. What saving rate is necessary to make the given capital-labor ratio the steady-state level of capital per worker?

The steady-state condition is given by  $sf(k) = \delta k$ . With  $\delta = 0.1$  and  $k = 4$ , then it follows that  $s = 0.2$ .

- If the saving rate equals its steady-state level, what is consumption per worker?

Consumption per worker is given by  $c^* = (1-s)y^* = (1-s)f(k^*) = 0.8(2) = 1.6$

2. Suppose that two countries are exactly alike in every aspect, except that the citizens of country A have a higher saving rate than the citizens in country B.

a. Which country will have the higher level of output per worker in the steady state? Graph.

Country A will have the higher level of output per worker.  
This is easily seen in a graph. You should graph it yourselves.

b. Which country will have the faster rate of growth of output per worker in the steady state?

In the steady state, the growth rate of output per worker will be zero in both country A and country B.

3. It rains so much in the country of Tropicana that capital equipment rusts out (depreciates) at a much faster rate than it does in the country of Sahara. If the countries are otherwise identical, in which country will the Golden Rule level of capital per worker be higher? Graph.

The GR level of capital per worker will be higher in Sahara because, at the GR level,  $MPK = d$ . Since Sahara has a lower  $d$ , then it must be the case that, at the GR level, the  $MPK$  is higher for Sahara than for Tropicana. With a higher  $MPK$ , the GR level of capital per worker is higher for Sahara.

This is easily seen in a graph. You should graph it yourselves.