1. *Suppose that the production function is* $Y = 9K^{0.5}N^{0.5}$. *With this production function, the marginal product of labor is* $MPL = 4.5K^{0.5}N^{-0.5}$. *The capital stock is K=25. The labor supply curve is* $LS = 100[(1-t)w]^2$, *where* w *is the real wage rate,* t *is the tax return on labor income, and hence* $(1-t)w$ *is the after-tax real wage rate.*

(a) *Assume that the tax rate on labor income* t, *equals zero. Find the equation of the labor demand curve. Calculate the equilibrium levels of the real wage and employment, the level of full employment output, and the total after-tax wage income of workers.*

$$w = MPL = \frac{22.5}{L^{0.5}}, \quad L = 100w^2$$

$$L = 225, \quad w = 1.5, \quad Y = 675$$

$$I_{\text{at}} = L \times (1-t)w = 337.5$$

(b) *Repeat part (a) under the assumption that the tax rate on labor income,* t, *equals* 0.6.

$$w = MPL = \frac{22.5}{L^{0.5}}, \quad L = 100[(1-t)w]^2$$

$$L = 90, \quad w = \frac{3\sqrt{10}}{4}, \quad Y = 135\sqrt{10}$$

$$I_{\text{at}} = L \times (1-t)w = 27\sqrt{10}$$

2. *Use the saving-investment diagram to analyze the following effect on national saving, investment, and the real interest rate. Explain your reasoning.*

"A large number of accessible oil deposits are discovered, which increases the expected future marginal product of oil rigs and pipelines. It also causes an increase in expected future income."

From the investment perspective, the increase in MPK^f will increase desired capital K_{t+1}. As $I_t = K_{t+1} - K_t - d$, so there is an increase in investment I_t, and this will cause the Investment curve to shift right.

From the saving perspective, the increase in expected future income will lower the household current saving ($S \downarrow$) and increase current consumption($C \uparrow$), which will increase aggregate consumption as well ($C^d \uparrow$). As $S^d = Y_t - C^d - G$, so the aggregate saving will be lower($S^d \downarrow$). This will cause the saving curve to shift left.

As the investment curve shifts right and saving curve shifts left, interest rate will increase.

3. *The money supply is $6,000,000. Currency held by the public is $2,000,000. The reserve-deposit ratio is 0.25. Banks do not hold excess reserves. Find deposits, bank reserves, the monetary base, and the money multiplier.*

$$D = M - C = 4 \times 10^6$$

$$R = D \times rr = 1 \times 10^6$$

$$B = R + C = 3 \times 10^6$$

$$m = \frac{M}{B} = \frac{C + D}{C + R} = 2$$

4. *An economy has a monetary base of 1000 $ 1 bills. Calculate the money supply in scenarios (a) - (d) and then answer part (e)*

(a). *All money is held as currency*

$$M = C + D, \quad B = C + R, \quad R = 0 \quad \Rightarrow \quad M = 1000$$

(b).*All money is held as demand deposits. Banks hold 100 percent of deposits as reserves*

$$B = C + R, \quad C = 0, \quad M = C + D, \quad R = D \times rr \quad \Rightarrow \quad M = 1000$$

(c).*All money is held as demand deposits. Banks hold 20 percent of deposits as reserves*

$$B = C + R, \quad C = 0$$

$$M = C + D = C + \frac{R}{rr} = 5000$$

(d). *people hold equal amounts of currency and demand deposits. Banks hold 20 percent of deposits as reserves*

$$B = C + R, \quad D = C, \quad R = D \times rr$$

$$M = C + D = 1666.67$$

(e). *The central bank decides to increase the money supply by 10 percent. In each of the for scenarios, how much should it increase the monetary base*

$$m = \frac{M}{B}, \quad r = \frac{10\%}{m}$$

$$m_a = 1, \quad r = 10\%$$

$$m_b = 1, \quad r = 10\%$$

$$m_c = 5, \quad r = 2\%$$

$$m_d = \frac{5}{3}, \quad r = 6\%$$