Answer all questions. Each question is worth 20 points. **LABEL EVERYTHING!!!**

1. Keynesian model with efficiency wage and sticky prices
   a. Draw IS-LM-FE, AS-AD, and labor market graphs. Label initial equilibrium points assuming the economy is initially at full employment.

   b. Taxes are lump sum and some agents are liquidity-constrained. Assume that there is a reduction in current taxes and an increase in future taxes such that the present value of taxes is unchanged. Use the graphs you drew in part (a) to illustrate the short-run effects on output, interest, prices, employment, and the wage. Label short-run equilibrium points with subscripts SR. Describe below why curves shift.

   c. Now, allow prices to adjust and use the same graph to illustrate the long-run effects of the shock. Assume the long-run has enough time pass for prices to adjust, but not enough for future taxes to rise. Describe below any shifts in curves.

   d. Write the expression for the government’s present value budget constraint. If agents were not liquidity constrained, explain how your answer would change if at all.
2. Classical model
   a. Draw IS-LM-FE, AS-AD, and labor market graphs. Label initial equilibrium points assuming the economy is initially at full employment.

   b. Assume that there is a decrease in current productivity which is expected to vanish before next period. Use the graphs you drew in part (a) to illustrate the effects on output, interest, prices, employment, and the wage. Label new equilibrium points. Describe below why curves shift.

   c. Assume that you are in charge of monetary policy in this country and that you do not want prices to change. How would you use monetary policy to keep prices from changing? Explain what would happen to the money supply and draw below on new IS-LM-FE and AS-AD graphs below.
3. Solow model: Let \( Y_t = AK_t^a(Q_tN_t)^{-a} \). Let \( d \) equal the rate of capital depreciation, \( q \) the rate of growth of labor efficiency (Q), and \( n \) the rate of growth of labor (N). Let small letters denote the value of the variable per efficiency unit of labor, that is \( y = Y/QN \).

a. Write and explain the equation which determines the equilibrium value of capital per efficiency unit of labor.

b. Write the expression for output per effective worker as a function of capital per effective worker. In a long-run equilibrium, how fast does output per effective worker \( (Y/QN) \) grow? How fast does output per worker \( (Y/N) \) grow? How fast does output \( (Y) \) grow?

c. Draw the Solow diagram for this model below and label the long-run equilibrium value for capital per efficiency unit of labor \( k^* \). Use your graph to find the new level of \( k^* \) when population growth falls. Label the new equilibrium value \( k^* \).

d. Hurricane Sandy destroyed some capital stock in the Northeast. Use a new graph of the Solow model to show how a reduction in \( k \) below \( k^* \) affects growth of \( k \). Explain how growth of per capita output is affected.
4. Distortionary taxation: This question asks you to consider the effect of the imposition of a future consumption tax to allow future government spending to rise. The agent’s budget constraint between current and future consumption is given by

\[ y - c + \frac{y^f - (1-t)c^f}{1+r} + a = 0, \]  

where \( t \) is the tax rate.

a. Solve the budget constraint for future consumption. Use your equation solution to determine the slope of the budget constraint? What is the value of the slope? Assume that the government raises the tax rate \( t \) rises) and offsets this with a future increase in government spending. Does the slope become steeper or flatter. Explain.

b. Use a graph of the household’s choice between future consumption and current consumption to analyze the effect of the tax increase on current and future consumption. Label equilibrium values for current and future consumption, and label intercepts of the budget constraint.

c. Discuss the income and substitution effects of the tax increase. Under the assumption that the substitution effect dominates the income effect, how is current consumption affected?

d. Use a Keynesian model with IS-LM-FE and AS-AD to illustrate the effect of the tax increase on equilibrium values for output, interest and prices in the short-run. Assume that the substitution effect dominates the income effect. Describe why curves shift and label both initial and new equilibrium points for the short run. [Do not add the long run.]
5. Monetary policy and inflation
   a. Assume that the monetary authority initially wants to create inflation of 1% each year, that is, have prices rise every year at this rate. Use the AS-AD graph for the monetary misperceptions model to show what this policy would look like in a long-run equilibrium when everyone anticipated the policy. Describe the behavior of the money supply, the price level, expected price level, and output in words.

   b. Draw a Phillips curve consistent with a 1% inflation rate and label the long-run values for inflation and the natural rate of unemployment? What is the expected rate of inflation in the long-run equilibrium?

   c. Now, assume that a new government is elected and that it believes that it can reduce unemployment at the cost of accepting a higher rate of inflation. Use AS-AD curves in the monetary misperceptions model to show how it would try to achieve this result and what the effect on money growth, inflation, and output would be in the short run (before inflationary expectations adjust) and in the long run (after inflationary expectations adjust).

   d. Illustrate your result in part c using the Phillips Curve you drew in part b. Label the equilibrium point achieved before expectations adjust 1 and the equilibrium afterwards 2. Explain below any curve shift.