Sample Homework Questions to Accompany "A Classroom Experiment in Monetary Policy" by John Duffy and Brian C. Jenkins

Model overview:

1. **Demand.** The demand for real goods and services is given by the following *IS* equation:

$$y = 2 - r + \epsilon, \tag{1}$$

where y denotes the output gap, r denotes the real interest rate, and ϵ is an exogenous demand shock with a mean of zero. By assumption, the central bank can set r directly. All interest and inflation rates are expressed in percentages. That is, if the real interest rate is two percent, then $r = 2$.

2. **Supply.** The supply of goods and services is determined by the following *aggregate supply* or *Phillips curve* equation:

$$\pi = \pi^e + 0.25y, \tag{2}$$

where π is the inflation rate and π^e is the private sector's expectation of the inflation rate. Note that there are no exogenous shocks to the supply equation.

3. **Monetary policy.** The central bank wishes to stabilize the inflation rate around a target value π^T. The central bank incurs a cost when the inflation rate is different from the target. The cost to the central bank is reflected in the following *loss function*:

$$L(\pi) = (\pi - \pi^T)^2 \tag{3}$$

Answer the following:

1. (a) Suppose that the central bank has an inflation target of $\pi^T = 2.5$. Compute the loss L to the central bank when the actual inflation rate is 0, 1, 2.5, and 3. *You don't have to show your work.*

   (b) When $\pi^T = 2.5$, what is the value of π that minimizes the central bank's loss function given in equation (3)? *You don't have to show your work.*

2. (a) Rewrite the aggregate supply equation (2) to express the output gap y as a function of π and π^e. *You don't have to show your work.*

(b) Use your answer to part (a) to eliminate y from the IS equation (1) and solve for the real interest rate r as a function of π, π^e, and ϵ. *You don't have to show your work.*

(c) Suppose that the public expects that the inflation rate will equal the central bank's target (i.e., $\pi^e = \pi^T$). Use the equation for the real interest rate that you derived in 2(b) to compute the appropriate real interest rate for each combination of π^T, π^e, and ϵ.

$\boldsymbol{\pi^T}$	$\boldsymbol{\pi^e}$	$\boldsymbol{\epsilon}$	$\boldsymbol{r}$
2.5	2.5	0	
2.5	2.5	0.5	
2.5	2.5	1	
2.5	2.5	-0.5	
2.5	2.5	-1	

(d) Now, suppose that the public expects that the inflation rate will equal the central bank's target plus 1 percent. (i.e., $\pi^e = \pi^T + 1$). Use the equation for the real interest rate that you derived in 2(b) to compute the appropriate real interest rate for each combination of π^T, π^e, and ϵ.

$\boldsymbol{\pi^T}$	$\boldsymbol{\pi^e}$	$\boldsymbol{\epsilon}$	$\boldsymbol{r}$
2.5	3.5	0	
2.5	3.5	0.5	
2.5	3.5	1	
2.5	3.5	-0.5	
2.5	3.5	-1	

(e) Compare your answers to part (d) with your answers to part (c). How does the increase in the expected inflation rate affect the appropriate value of the real interest rate?