True and False questions.

1. FALSE. Okun's law states a negative relationship between changes in the growth rate of output and changes in unemployment. Also accepted, though not strictly correct, was faster growth due to technical change. One would typically think that employment would rise with faster labor-augmenting technical change. You were punished for botching the definition of Okun's law.
2. FALSE. Use the sum of incomes definition of GDP. Wages paid to janitors are now paid to another company, thus no change in measured output.
3. FALSE. Only in a closed economy in equilibrium with G=T does S = I.
4. FALSE. Alternative policies include changing taxes or government expenditures. The government printing money also does not have an effect on output, as this new currency simply replaces old or is purchased with bank reserves.
5. FALSE. Either discuss the relationship between unemployment and inflation inherent in the Phillips curve or describe differences between actual inflation which shifts the LM curve left and expected inflation which shifts the LM curve right. Generous partial credit for close answers.
6. FALSE. Discuss the limitations of monetary policy, which include a bound on nominal interest rates at zero, the slope of the IS curve, and uncertainty over consumer behavior combined with implies that monetary policy is effective only with a lag of about 2 years.

Short questions.

1.

1987 -- 1 million computers @ $2,000 each + 200 Million Haircuts @ $10 each
1997 -- 4 million computers @ $1,000 each + 200 Million Haircuts @ $20 each
Assume no quality improvements (and implicitly no new goods).

(a) 3 points

1987 Nominal GDP = 1 million X $2,000 + 200 million X $10 each = **4 billion 1987$**
1997 Nominal GDP = 4 million X $1,000 + 200 million X $20 each = **8 billion 1997$**
% Change = 100

(b) 4 points

Using 1987 as the base year:

1987: Real GDP = 1 million X $2,000 + 200 million X $10 each = **4 billion 1987$**
1997: Real GDP = 4 million X $2,000 + 200 million X $10 each = **10 billion 1987$**

Percentage: (10 - 4) / 4 = 6/4 = 150%

Using 1997 as the base year

1987: Real GDP = 1 million X $1,000 + 200 million X $20 each = **5 billion 1997$**
1997: Real GDP = 4 million X $1,000 + 200 million X $20 each = **8 billion 1997$**

Percentage: (8 - 5) / 5 = 3/5 = 60%

(c) 4 points

GDP deflator = Nominal GDP / Real GDP

1987 Base Year

GDP Deflator in 1987 = 4 billion / 4 billion = 1
GDP Deflator in 1997 = 8 billion / 10 billion = 0.8
% change = -20%

1997 Base Year

GDP Deflator in 1987 = 4 billion / 5 billion = 0.8
GDP Deflator in 1997 = 8 billion / 8 billion = 1
% change = 0.2 / 0.8 = 25%

(d) 5 points

(b) and (c) are problematic because the answers you get for real GDP growth and the rate of inflation depend upon the base year chosen.

(e) 4 points

The puzzle is relevant to the US since computer prices are falling and the amount sold every year is increasing. This means that under these conditions the choice of a base year in the past will result in a different measured rate of inflation and growth. In particular, a distant base year causes measured real GDP to be higher and the GDP deflator to be lower (see table). This is relevant to the current US economy because we are currently at a time when there is very low measured inflation and robust growth. T

There has been some talk recently of a "New economy" or "New Paradigm" which claims that we can sustain a higher rate of growth without raising inflation. Parts (b) and (c) should suggest that this result may simply be a problem with the choice of base year.

	Real GDP	GDP Deflator
1987 Base	150%	-20%
1997 Base	60%	+25%

2.

(a) 7 points

Before News: PDV 1 year bond = **(P+I) / (1+0.05)**
After News: PDVnew 1 year bond = **(P+I) / (1+0.04)**

So the change in value is
(P+I) / (1+0.04) - (P+I) / (1+0.05) = (P+I) (1/1.04 - 1/1.05) = **(P+I) (1.05-1.04) / (1.04*1.05) = (P+I) * (0.00916)**

Which is about (P+I)(0.01).

In percentage terms,
(PDVnew - PDV) / PDV = [(P+I)(0.01)/(1.04*1.05)] / [(P+I) / (1+0.05)] = 0.01 / 1.04
which is **about 1%**.

(b) 7 points

PDV = c / (1+r) + c / $(1+r)^2$ + … = c / r

Before news: PDV = c / 0.05 = **20 c**
After news: PDVnew = c / 0.04 = **25 c**

So the change in value is 25c - 20c = **5c**

In percentage terns,
(PDVnew - PDV) / PDV = 5 c / 20 c = **25%**

(c) 6 points

The percentage change in the value of the bond or console is much greater for the infinitely-lived console in (b) than for the one year bond in (a). If monetary policy changes the rate of interest, we can expect the long lived instruments to be effected by a much greater extent.

For example, if investment is contingent on the value of some long lived project, then an *unexpected* fall in the interest rate will increase the value of that project much more than a short lived project. Investment spending on long term capital items will be affected to a greater degree.

Long Question

IS: Y=C+G+I

LM: $M^s=M^d$

C=20 + .5(Y-T); I=25- 200i; M=Y(.5-i)

(a) Construct the goods market equilibrium by substituting the expressions into the IS equation.

Y= 20 + .5(Y-T)+ 25- 200i +G

Note that a *balanced budget* means G=T, so G=T=20; also i=.05

$\Rightarrow$ Y= 20 + .5(Y-20)+ 25- 200· 0.05+20 $\Rightarrow$ **Y=90**;

Now look at the money market equilibrium: M= Y (.5-i). Substitute i=. 05 and Y=90

$\Rightarrow$ M= 90· (.5-.05) $\Rightarrow$ **M= 40.5**

(b) The government wants to increase its spending in order to achieve full employment Y=100, while expanding M so as to keep i=0.05. Taxes remain T=20. We substitute these into the IS equation and solve for the new G:

100= 20 + .5(100-20)+ 25- 200·0.05 +G $\Rightarrow$ **G=25.**

The government has to increase its spending by **ΔG=5**. The budget deficit is **G-T**= 25-20**=5.**

To keep the interest rate at i=0.05, M is increased to **M=**100(.5-.05)**=45**.

(c) Now we keep G=20 and reduce taxes instead, in order to achieve the same full employment Y=100. Assuming that the interest rate is still maintained at i=.05 (through monetary expansion), we solve the IS again, this time for the new T:

100= 20 + .5(100-T)+ 25- 200·0.05 +20 $\Rightarrow$ **T=10**; **ΔT=-10**; The budget deficit is **G-T=** 20-10**=10**.

The reduction in taxes needed to achieve full employment is larger than the required increase in government spending. Therefore the budget deficit in (*c*) is greater than in (*b*). The reason is that the marginal propensity to consume is less than 1. Lower taxes increase individuals' disposable income. They spend only some of that additional income, while saving the rest. An increase in government spending on the other hand, is entirely translated into an increase in spending. We do not know (without further information) which policy is better. While cutting taxes creates a larger deficit, low taxes may be desirable for other reasons.

Note: if we solve this question assuming that M=40.5 is held constant and i is allowed to vary then:

LM: $40.5=100(.5-i) \Rightarrow i= .095$ so:

IS: $100= 20 + .5(100-T)+ 25- 200\cdot.095 +20 \Rightarrow$ **T=-8**.

A negative tax means net transfer payments from the government to the consumers.

(d) Obtaining Y=100 with a balanced budget G=T (assuming i=.05):

$100= 20 + .5(100-G)+ 25- 200\cdot.05 +G \Rightarrow$ **G=T=30.**

We have to increase taxes and spending by **10**. Note that keeping a balanced budget requires a larger increase in spending than if we were allowed to create a deficit as in (*b*). The larger G is required in order to compensate for the negative effect of higher taxes on consumption.

Note: if we solve this question assuming that M=40.5 is held constant and i is allowed to vary then:

LM: $40.5=100(.5-i) \Rightarrow i= .095$ so:

IS: $100= 20 + .5(100-G)+ 25- 200\cdot.095 +G \Rightarrow$ **G=T=48**.

(e) Using monetary policy to obtain Y=100. G and T are kept at their original levels and we change M instead.

First use the IS equation to find what i is needed to get Y=100:

$100= 20 + .5(100-20)+ 25- 200\cdot i +20 \Rightarrow$ ***i*= .025**

Now use the LM equation to find what the money supply should be to achieve this interest rate in equilibrium, when Y=100.

$M=100(.5-.025) \Rightarrow$ **M=47.5**

(f) Substitute the new investment and consumption functions into the IS curve to find what the interest rate would have to be to achieve full employment (Y=100), given G=T=20:

$100= 15 + .5(100-20)+ 20- 200\cdot i +20 \Rightarrow$ ***i*= -.025**

We find that i should be negative. The (nominal) interest rate cannot be negative. If it is negative, then holding money gives a higher return (zero) than holding bonds (negative). Therefore nobody would want to hold bonds. The demand for bonds (zero) would be smaller then the supply of bonds. Thus the bonds market will not be in equilibrium. The price of bonds will fall, and interest rates will rise until equilibrium is restored.

As interest rates cannot be negative, monetary policy alone cannot achieve full employment. Increasing the supply of money would not suffice. This situation is known as a *liquidity trap*. Fiscal policy that would shift the IS curve upwards is needed as well.