ECON 331

ASSIGNMENT #4

Question 1

a)

```
> restart;
```

The demand function:

```
> Qd:= k*P^(-epsilon);
```

$$Qd := k\,P^{(-\varepsilon)}$$

Price elasticity of demand, 'ed':

```
> ed:= diff(Qd,P)*P/Qd;
```

$$ed := -\varepsilon$$

The supply function:

```
> Qs:= c*(P-To);
```

Price elasticity of supply, 'es':

```
> es:= diff(Qs,P)*P/Qs;
```

$$Qs := c\,(P - To)$$

$$es := \frac{P}{P - To}$$

b)

```
> F:= Qd=Qs:
> dP_dTo:=simplify(implicitdiff(F,P,To)):
> Diff(P,To) = dP_dTo;
```

$$\frac{\partial}{\partial To} P = \frac{c\,P}{k\,P^{(-\varepsilon)}\,\varepsilon + c\,P}$$

Note that 'P' is the **equilibrium** price here.

c)

The 'assume' command allows us to restrict the values of variables or parameters to specified intervals. The following restrictions are appropriate for the market model:

```
> assume(k>0):
> assume(epsilon>0):
> assume(c>0):
```

```
> assume(P>0):
```

These restrictions allow us to determine if $0 < \frac{\partial}{\partial To} P < 1$ by using the 'is' command:

```
>
>
```

$$0$$

```
> is(0<dP_dTo);
```

$$true$$

```
> is(dP_dTo<1);
```

$$true$$

d)

Since R = ToQs(P,To), where P is the **equilibrium** price and Qs is the **equilibrium** quantity, the total derivative of R with respect to To can be written as $Qs + To\left(\frac{\partial}{\partial To} Qs\right)$. Since $Qs = c(P - To)$; $\frac{\partial}{\partial To} Qs = c\left(\left(\frac{\partial}{\partial To} P\right) - 1\right)$. This allows us to express the total derivative of R with respect to To as a relatively simple function of the equilibrium price and the parameters of the model:

```
>
> dR_dTo:=Qs+To*c*(dP_dTo-1);
```

$$dR\_dTo := c\sim (P\sim - To) + To\, c\sim \left(\frac{c\sim P\sim}{k\sim P\sim^{(-\varepsilon\sim)} \varepsilon\sim + c\sim P\sim} - 1\right)$$

The tildes (**'~'**) attached to variables/parameters in the above expression is Maple's way of reminding us that we have restricted these values to certain intervals (part c).

QUESTION 2

a)

```
> restart;
> C:=1600+40*Q+(2/3)*Q^(3/2):
> AC:=expand(C/Q);
```

$$AC := \frac{1600}{Q} + 40 + \frac{2}{3}\sqrt{Q}$$

```
> MC:=diff(C,Q);
```

$$MC := 40 + \sqrt{Q}$$

b)

```
> P:=100+512*Q^(-1/2):
> TR:=expand(P*Q);
```

$$TR := 100\,Q + 512\,\sqrt{Q}$$

```
> MR:=diff(TR,Q);
```

$$MR := 100 + \frac{256}{\sqrt{Q}}$$

c)

```
> Q:=solve(MC=MR,Q);
```

$$Q := 4096$$

```
> pi=evalf(TR-C);
```

$$\pi = 1.021653333\ 10^{5}$$

```
>
```