Name: ______________________ Math 211 Quiz 10

Section: 322 ☐ 323 ☐ Dec 6, 2012

1. (10 pts) The demand function for an electronics company's car stereos is $D(q) = 2 - q$ and the supply function is $S(q) = q^2$, where q is measured in thousands.
a. At what price is the market for the stereos in equilibrium?
b. What is the maximum total surplus?

a. $D(q) = S(q) \Rightarrow 2 - q = q^2 \Rightarrow q^2 + q - 2 = 0 \Rightarrow (q+2)(q-1) = 0$

$\Rightarrow \boxed{q = 1}$ or $\cancel{q = -2}$ $(q \geq 0)$

$D(1) = 1 \Rightarrow$ at price $\boxed{P = 1}$ the market is in equilibrium.

b. $\int_0^1 (2-q) - (q^2)\, dq = \int_0^1 2 - q - q^2\, dq = \left[2q - \frac{q^2}{2} - \frac{q^3}{3}\right]_0^1$

$= 2 - \frac{1}{2} - \frac{1}{3} = 2 - \frac{5}{6} = \boxed{\frac{7}{6}}$

2. (10 pts) A retiree is paid \$1500 per month by an annuity. If the income is invested in an account that earns 5% interest compounded continuously.
a. What is the future value of the income after ten years?
b. What is the present value of the income over a ten-year period?

a. $FV = e^{+0.05 \cdot 10} \int_0^{10} 1500\, e^{-0.05t}\, dt = e^{+0.5}\, 1500 \int_0^{10} e^{-0.05t}\, dt$

$= e^{+0.5}\, 1500 \left[\frac{e^{-0.05t}}{-0.05}\right]_0^{10} = e^{+0.5}\, 1500 \left[\frac{e^{-0.5}}{-0.05} - \frac{1}{-0.05}\right]$

$= e^{+0.5} \frac{1500}{0.05}\left(1 - e^{-0.5}\right) = \boxed{e^{+0.5}\, 30000\left(1 - e^{-0.5}\right)} = 30000\left(e^{0.5} - 1\right)$

b. $PV = \boxed{30000\left(1 - e^{-0.5}\right)}$