

ECON 201 – Problem Set 2

Full Solutions (Q14–15)

November 12, 2025

Q1. Nonlinear demand with tax (bicycles).

Solution. Linear case $Q_D = 500 - 5P$, $Q_S = 20P$: $P^* = 20$, $Q^* = 400$. With $t = 5$: $P_b = 24$, $P_s = 19$, $Q = 380$; CS falls from **16000** to **14440**, PS from **4000** to **3610**, $TR = 1900$, $DWL = 50$.

Nonlinear demand $Q_D = 1000 - 10P^2$: solve with $Q_S = 20P$. No tax: $1000 - 10P^2 = 20P \Rightarrow P^* = \frac{-2+\sqrt{404}}{2} \approx 9.0499$, $Q^* = 20P^* \approx 180.998$.

With $t = 5$: $Q_S = 20(P_b - 5)$, and $Q_D = 1000 - 10P_b^2$; equate to get $P_b = \frac{-2+\sqrt{444}}{2} \approx 9.5499$, hence $P_s \approx 4.5499$, $Q \approx 88.004$.

Consumer surplus = $\int_P^{10} (1000 - 10p^2) dp$, giving $CS_0 \approx 449.50$, $CS_1 \approx 236.83$. Producer surplus (supply through origin) = $\frac{1}{2}P_sQ$: $PS_0 \approx 819.50$, $PS_1 \approx 200.38$. Revenue ≈ 440.02 ; $DWL \approx 391.77$.

Q2. Subsidy vs tax (Chicago).

Solution. $Q_D = 300 - 3P$, $Q_S = -50 + 2P$. No policy: $300 - 3P = -50 + 2P \Rightarrow P^* = 70$, $Q^* = 90$.

Subsidy $s = 10$ to buyers: $Q_D = 300 - 3(P_s - 10) = 330 - 3P_s$. Equate with $Q_S = -50 + 2P_s$: $330 - 3P_s = -50 + 2P_s \Rightarrow P_s = 76$, $P_b = P_s - 10 = 66$, $Q = 102$. $CS = \frac{1}{2}(100 - 66)102 = 1734$, $PS = \frac{1}{2}(76 - 25)102 = 2601$, gov. outlay = $10 \cdot 102 = 1020$, $DWL = 60$.

Tax $t = 10$ on buyers: $Q_D = 300 - 3(P_s + 10) = 270 - 3P_s$. Equate: $270 - 3P_s = -50 + 2P_s \Rightarrow P_s = 64$, $P_b = P_s + 10 = 74$, $Q = 78$. $CS = \frac{1}{2}(100 - 74)78 = 1014$, $PS = \frac{1}{2}(64 - 25)78 = 1521$, revenue = $10 \cdot 78 = 780$, $DWL = 60$.