ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2015
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FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

(1)b.	(2)d.	(3)a.	(4)a.	(5)d.	(6)c.	(7)b.	(8)d.	(9)c.	(10)c.
(11)c.	(12)a.	(13)c.	(14)c.	(15)b.	(16)d.	(17)b.	(18)c.	(19)d.	(20)d.

II. Short answer

(1) a. elastic b. decrease c. 6%
d. decrease e. 2%.

(2) a. 8 thousand pounds b. excess supply c. 6 thousand pounds
d. increase e. \$15 thousand f. decrease
g. \$18 thousand h. \$3 thousand.

(3) a. MR = 15 – 2Q
b. MR is straight line with P-intercept = \$15, slope = -2/thousand
c. \$11 d. 4 thousand e. \$4 thousand
f. \$9 g. 6 thousand h. \$0 thousand.

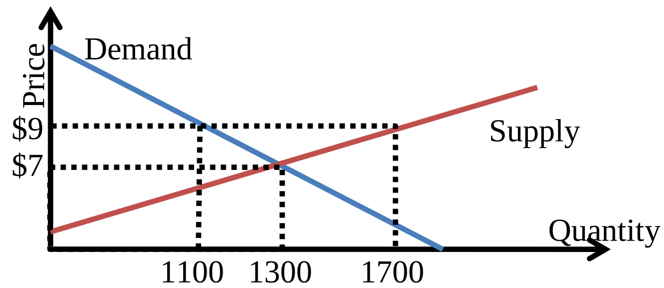
III. Problems

(1) a. Equation for budget line: $4\ q_1 + 2\ q_2 = 50$.
b. $MRS = MU_2/MU_1 = 3\ (q_1\text{-}5)\ /\ (2q_2)$.
c. Solve $MRS = p_2/p_1 = 2/4$ jointly with equation for budget line to get $q_1{}^* = 8$, $q_2{}^* = 9$.

(2) a. $\%\Delta q^{tot} = \varepsilon \times 10\% = -8\%$, Quantity demanded decreases by 8%.
b. $\varepsilon^{comp} = \varepsilon + S\eta = -0.8 + 0.05(0.4) = -0.78$.
$\%\Delta q^{sub} = \varepsilon^{comp} \times 10\% = -7.8\%$, Quantity demanded decreases by 7.8%.

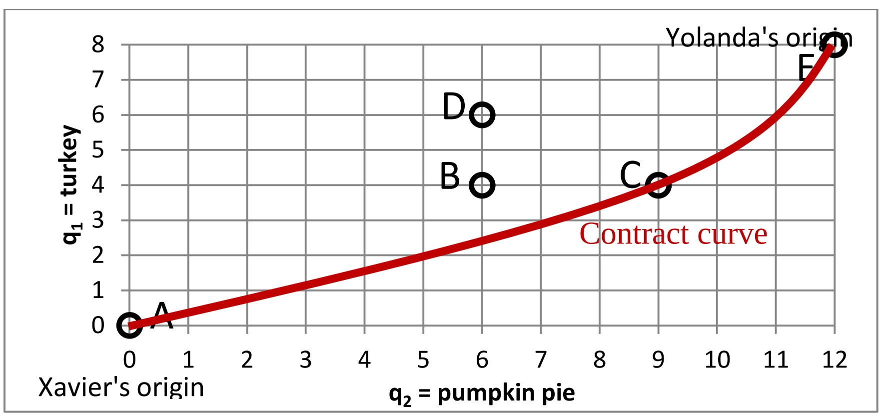
(3) a. $MP_1 = 6\, x_1^{-3/5}\, x_2^{4/5}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.
b. $MRSP = MP_2/MP_1 = \frac{12\ x_1^{2/5} x_2^{-1/5}}{6\ x_1^{-3/5} x_2^{4/5}} = \frac{2\,x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.
c. Check returns to scale:
$f(ax_1, ax_2) = 15\ (ax_1)^{2/5}\ (ax_2)^{4/5} = a^{2/5}\ a^{4/5}\ 15\ x_1^{2/5} x_2^{4/5} = a^{6/5}\ q > aq$, for a>1.
So this production function has INCREASING returns to scale.

(4) a. Set $Q_D = Q_S$ and solve to get $P^* = \$7$ and $Q^* = 1300$.
b. At $P = \$9$, $Q_D = 1100$ and $Q_S = 1700$. So the country will <u>export 600 units</u>.



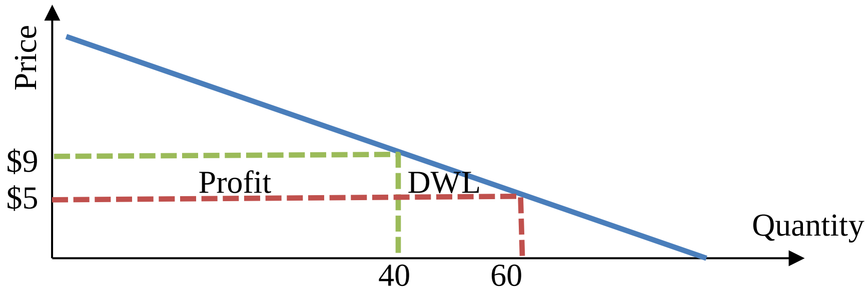
c. Consumer surplus decreases by \$2400, the area of the smaller trapezoid.
d. Producer surplus increases by \$3000, the area of the larger trapezoid.
e. The country as a whole gains \$3000 - \$2400 = \$600.

(5) Note that Xavier's $MRS_X = 3q_1 / q_2$ and Yolanda's $MRS_Y = q_1 / q_2$.
a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Yolanda has everything, so she cannot be made better off. Xavier has nothing, so he cannot be made better off without taking some of Yolanda's turkey or pumpkin pie, which would make Yolanda worse off.
b. **No**, B is not Pareto-efficient, because $MRS_X = 2 \neq MRS_Y = 2/3$.
c. **Yes**, C is Pareto-efficient, because $MRS_X = 4/3 = MRS_Y$.
d. **No,** D is not Pareto-efficient, because $MRS_X = 3 \neq MRS_Y = 1/3$.
e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Xavier has everything, so he cannot be made better off. Yolanda has nothing, so she cannot be made better off without taking some of Xavier's turkey or pumpkin pie, which would make Xavier worse off.
f.



(6) a. $Rev_1 = P\, q_1 = \mathbf{17q_1 - (q_1^2/5) - (q_1 q_2/5)}$ **.**
b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{17 - 2q_1/5 - q_2/5}$ **.**
c. Set $MR_1 = MC = \$5$ and solve to get $\mathbf{q_1^* = 30 - q_2/2}$ **.**
d. Since $q_1^* = q_2^*$, $q_1^* = 30 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 20} = q_2^*$.
e. $Q = q_1^* + q_2^* = \mathbf{40}$. Substituting into demand equation: $P^* = 17 - (40/5) =$ **\$9.**
f. Total revenue = $P^* \times Q^*$ = \$360. Total cost = $AC \times Q^*$ = \$200. Total profit = total revenue – total cost = **\$160.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting MC = \$5 = P = 17 – (Q/5) and solving to get

Q = 60. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=40 to the efficient quantity = 60. This is the area of a triangle, equal to **$40**.



(7) a. Set $P_D = P_S$ and solve to get Q** = 1000, P = $6.
b. $MSC = P_S + MEC = 2 + (Q/100)$.
c. Set $MSC = P_D$ and solve to get Q* = 600.
d. DWL = (1/2) × (1000-600) × (12-6) = $1200.
e. Pigou tax rate = MEC(600) = $4.

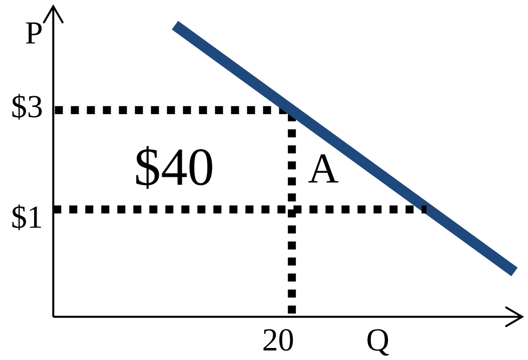
(8) [This question assumes ridiculously small dollar values, just to make calculations easier.]
a. E(I) = (0.80 × 9) + (0.20 × 4) = $8 .
b. $E(U) = (0.80 \times 9^{1/2}) + (0.20 \times 4^{1/2}) = 2.8$ utils.
c. Set $U(I) = I^{1/2} = 2.8$ and solve to get I* = $7.84 .
d. Willing to pay $9 - $7.84 = $1.16 .
e. 0.20 × $5 = $1 .

(9) a. $P_D = 70 + EL = 470 – 0.2 Q$.
b. MC = EL = 400 – 0.2 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: $P_D > MC$ for all values of Q.
d. AC = 400 – 0.1 Q.
e. Set $P_D = AC$ and solve to get Q = 700. P = AC = $330.

IV. Critical thinking

(1) Non-profit organizations may focus on the public good, but they still must minimize their losses. Thus they are motivated to use **market-segmenting price discrimination** to minimize losses. This means that they follow the same pricing rule as profit-making firms: $P_i = \frac{MC}{1+(1/\varepsilon_i)}$, where ε_i denotes the elasticity of demand by the ith market segment. So if students and senior citizens have **greater elasticity of demand** (that is, if they are more sensitive to the price) than other customers, then these organizations will give these groups discount prices.

(2) The graph below shows the consumer's demand curve. The gain in consumer surplus from the reduction in price from $3 to $1 equals ($3-$1)×20 = $40 plus the area of triangle A. Thus the gain in consumer surplus is necessarily greater than $40. Therefore the consumer would prefer the reduction in price to an increase in income of $40.



Version B

I. Multiple choice

(1)c. (2)a. (3)b. (4)b. (5)b. (6)a. (7)d. (8)a. (9)d. (10)c.
(11)e. (12)a. (13)e. (14)c. (15)c. (16)a. (17)a. (18)b. (19)a. (20)a.

II. Short answer

(1) a. inelastic   b. increase   c. 4%
d. decrease   e. 1%.

(2) a. 4 thousand pounds   b. excess demand   c. 9 thousand pounds
d. decrease   e. $21 thousand   f. decrease
g. $6 thousand   h. $27 thousand.

(3) a. MR = 16 – 2Q
b. MR is straight line with P-intercept = $16, slope = -2/thousand
c. $10   d. 6 thousand   e. $12 thousand
f. $6   g. 10 thousand   h. $0 thousand.

III. Problems

(1) a. Equation for budget line: $10\ q_1 + 5\ q_2 = 150$.
b. $MRS = MU_2/MU_1 = 2\ (q_1\text{-}5) / (3q_2)$.
c. Solve $MRS = p_2/p_1 = 5/10$ jointly with equation for budget line to get $q_1^* = 11$, $q_2^* = 8$.

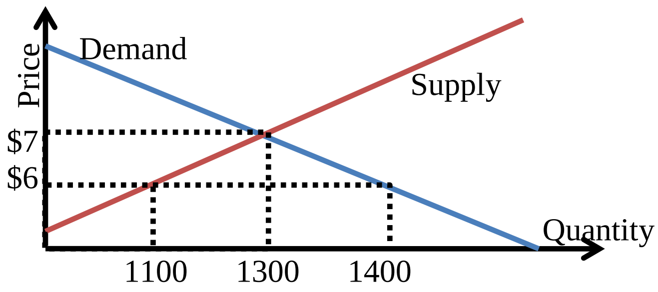
(2) a. $\%\Delta q^{tot} = \varepsilon \times 10\% = -7\%$, Quantity demanded decreases by 7%.
b. $\varepsilon^{comp} = \varepsilon + S\eta = -0.7 + 0.2(0.8) = -0.54$.
$\%\Delta q^{sub} = \varepsilon^{comp} \times 10\% = -5.4\%$, Quantity demanded decreases by 5.4%.

(3) a. $MP_1 = 3\ x_1^{-3/4}\ x_2^{3/4}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.
b. $MRSP = MP_2/MP_1 = \frac{9\ x_1^{1/4} x_2^{-1/4}}{3\ x_1^{-3/4} x_2^{3/4}} = \frac{3\ x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.
c. Check returns to scale:
$f(ax_1, ax_2) = 12\ (ax_1)^{1/4}\ (ax_2)^{3/4} = a^{1/4}\ a^{3/4}\ 12\ x_1^{1/4} x_2^{3/4} = aq$.

So this production function has CONSTANT returns to scale.

(4) a. Set $Q_D = Q_S$ and solve to get $P^* = \$7$ and $Q^* = 1300$.

b. At $P = \$6$, $Q_D = 1400$ and $Q_S = 1100$. So the country will <u>import 300 units</u>.



c. Consumer surplus increases by \$1350, the area of the larger trapezoid.

d. Producer surplus decreases by \$1200, the area of the smaller trapezoid.

e. The country as a whole gains \$1350 - \$1200 = \$150.

(5) Note that Xavier's $MRS_X = q_1 / q_2$ and Yolanda's $MRS_Y = 2q_1 / q_2$.

a. **No**, A is not Pareto-efficient, because $MRS_X = 1/3 \neq MRS_Y = 2$.

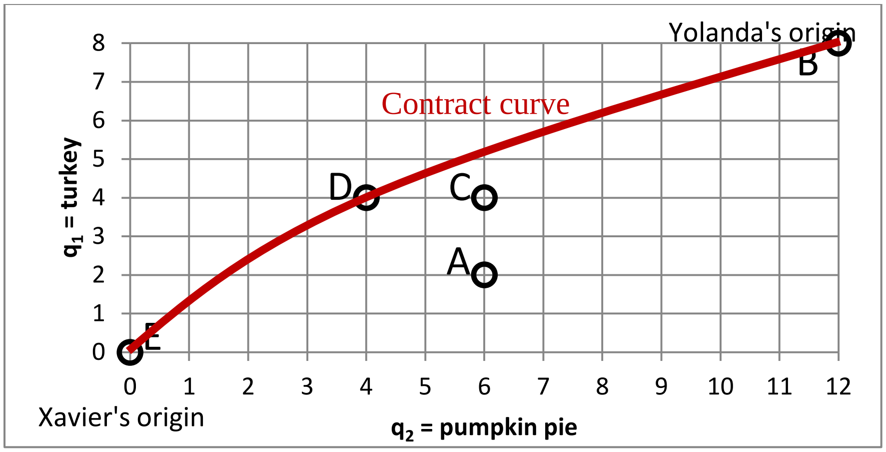
b. **Yes,** B is Pareto-efficient, because no one can be made better off without someone else being made worse off. Xavier has everything, so he cannot be made better off. Yolanda has nothing, so she cannot be made better off without taking some of Xavier's turkey or pumpkin pie, which would make Xavier worse off.

c. **No,** C is not Pareto-efficient, because $MRS_X = 2/3 \neq MRS_Y = 4/3$.

d. **Yes**, D is Pareto-efficient, because $MRS_X = 1 = MRS_Y$.

e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Yolanda has everything, so she cannot be made better off. Xavier has nothing, so he cannot be made better off without taking some of Yolanda's turkey or pumpkin pie, which would make Yolanda worse off.

f.



(6) a. $Rev_1 = P\,q_1 = \mathbf{15q_1 - (q_1^2/10) - (q_1 q_2/10)}$ **.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{15 - 2q_1/10 - q_2/10}$ **.**

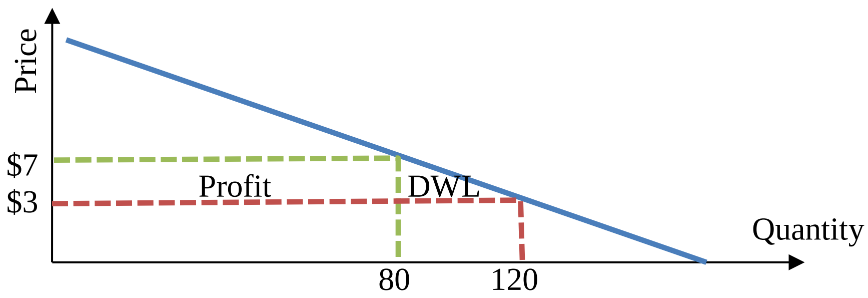
c. Set $MR_1 = MC = \$2$ and solve to get $\mathbf{q_1^* = 60 - q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 60 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 40} = q_2^*$.

e. $Q = q_1^* + q_2^* = \mathbf{80}$. Substituting into demand equation: $P^* = 14 - (80/10) = \mathbf{\$7.}$

f. Total revenue = P* × Q* = \$560. Total cost = AC × Q* = \$240. Total profit = total revenue – total cost = **\$320.**

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting MC = \$3 = P = 15 – (Q/10) and solving to get Q = 120. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=80 to the efficient quantity = 120. This is the area of a triangle, equal to **\$80**.



(7) a. Set $P_D = P_S$ and solve to get Q** = 800, P = \$5.
b. MSB = P_D + MEB = 18 – (Q/100).
c. Set MSB = P_S and solve to get Q* = 1200.
d. DWL = (1/2) × (1200-800) × (10-5) = \$1000.
e. Pigou tax rate = MEB(1200) = \$3.

(8) [This question assumes ridiculously small dollar values, just to make calculations easier.]
a. E(I) = (0.80 × 16) + (0.20 × 4) = \$13.60 .
b. E(U) = $(0.80 \times 16^{1/2}) + (0.20 \times 4^{1/2})$ = 3.6 utils.
c. Set $U(I) = I^{1/2} = 3.6$ and solve to get I* = \$12.96 .
d. Willing to pay \$16 - \$12.96 = \$3.04.
e. 0.20 × \$12 = \$2.40 .

(9) a. P_D = 60 + EL = 560 – 0.2 Q.
b. MC = EL = 500 – 0.2 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.
d. AC = 500 – 0.1 Q.
e. Set P_D = AC and solve to get Q = 600. P = AC = \$440.

IV. Critical thinking
Same as Version A.

Version C

I. Multiple choice
(1)d. (2)c. (3)c. (4)c. (5)a. (6)b. (7)a. (8)b. (9)b. (10)d.
(11)a. (12)b. (13)d. (14)b. (15)d. (16)b. (17)c. (18)a. (19)b. (20)b.

II. Short answer

(1) a. inelastic b. decrease c. 3%
d. increase e. 2%.

(2) a. increase b. \$10 per pound c. increase
d. \$20 thousand e. decrease f. \$32 thousand
g. \$6 per permit h. \$12 thousand.

(3) a. MR = 13 –Q
b. MR is straight line with P-intercept = \$13, slope = -1/thousand
c. \$9 d. 8 thousand e. \$8 thousand
f. \$7 g. 12 thousand h. \$0 thousand.

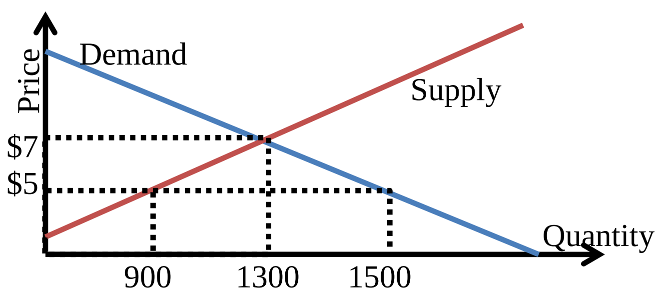
III. Problems

(1) a. Equation for budget line: $4\ q_1 + 3\ q_2 = 85$.
b. $MRS = MU_2/MU_1 = 3\ q_1 / (2(q_2-5))$.
c. Solve $MRS = p_2/p_1 = 2/4$ jointly with equation for budget line to get $q_1^* = 15$, $q_2^* = 10$.

(2) a. $\%\Delta q^{tot} = \varepsilon \times 10\% = -9\%$, Quantity demanded decreases by 9%.
b. $\varepsilon^{comp} = \varepsilon + S\eta = -0.9 + 0.1(0.6) = -0.84$.
$\%\Delta q^{sub} = \varepsilon^{comp} \times 10\% = -8.4\%$, Quantity demanded decreases by 8.4%.

(3) a. $MP_1 = 3\ x_1^{-4/5}\ x_2^{3/5}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.
b. $MRSP = MP_2/MP_1 = \frac{9\ x_1^{1/5} x_2^{-2/5}}{3\ x_1^{-4/5} x_2^{3/5}} = \frac{3\ x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.
c. Check returns to scale:
$f(ax_1, ax_2) = 15\ (ax_1)^{1/5}\ (ax_2)^{3/5} = a^{1/5}\ a^{3/5}\ 15\ x_1^{1/5} x_2^{3/5} = a^{4/5}\ q < aq$, for a>1.
So this production function has DECREASING returns to scale.

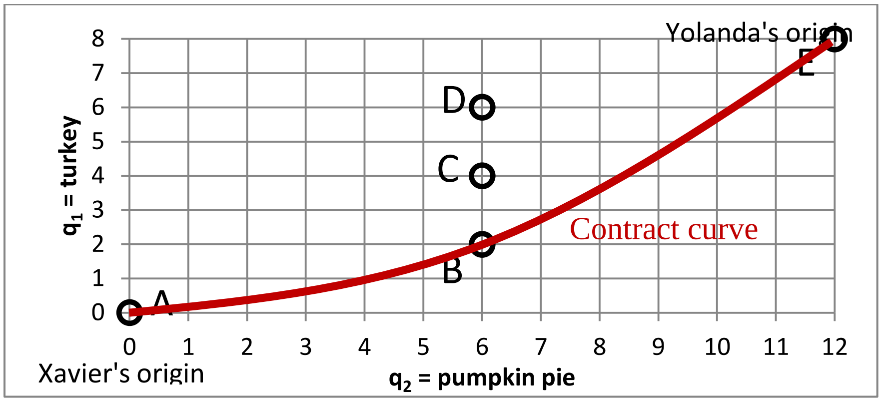
(4) a. Set $Q_D = Q_S$ and solve to get $P^* = \$7$ and $Q^* = 1300$.
b. At $P = \$5$, $Q_D = 1500$ and $Q_S = 900$. So the country will import 600 units.



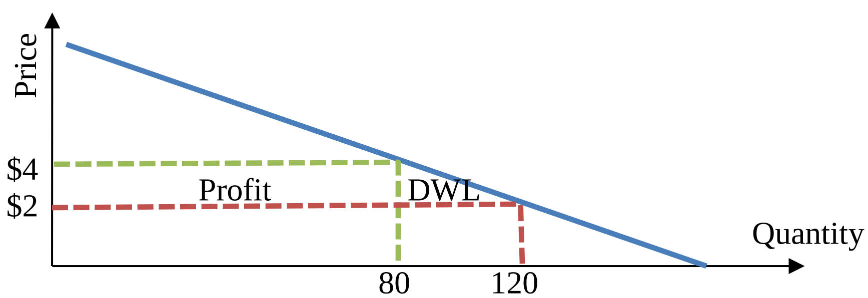
c. Consumer surplus increases by \$2800, the area of the larger trapezoid.
d. Producer surplus decreases by \$2200, the area of the smaller trapezoid.
e. The country as a whole gains \$2800 - \$2200 = \$600.

(5) Note that Xavier's $MRS_X = 3q_1 / q_2$ and Yolanda's $MRS_Y = q_1 / q_2$.
a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Yolanda has everything, so she cannot be made better off. Xavier

has nothing, so he cannot be made better off without taking some of Yolanda's turkey or pumpkin pie, which would make Yolanda worse off.
b. **Yes**, B is Pareto-efficient, because $MRS_X = 1 = MRS_Y$.
c. **No**, C is not Pareto-efficient, because $MRS_X = 2 \neq MRS_Y = 2/3$.
d. **No,** D is not Pareto-efficient, because $MRS_X = 3 \neq MRS_Y = 1/3$.
e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Xavier has everything, so he cannot be made better off. Yolanda has nothing, so she cannot be made better off without taking some of Xavier's turkey or pumpkin pie, which would make Xavier worse off.
f.



(6) a. $Rev_1 = P\, q_1 = \mathbf{8q_1 - (q_1^2/20) - (q_1 q_2/20)}$ **.**
b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{8 - 2q_1/20 - q_2/20}$ **.**
c. Set $MR_1 = MC = \$2$ and solve to get $\mathbf{q_1^* = 60 - q_2/2}$ **.**
d. Since $q_1^* = q_2^*$, $q_1^* = 60 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 40} = q_2^*$.
e. $Q = q_1^* + q_2^* =$ **80**. Substituting into demand equation: $P^* = 8 - (80/20) =$ **$4.**
f. Total revenue = $P^* \times Q^*$ = $320. Total cost = $AC \times Q^*$ = $160. Total profit = total revenue – total cost = **$160.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting MC = $2 = P = 8 – (Q/20) and solving to get Q = 120. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=80 to the efficient quantity = 120. This is the area of a triangle, equal to **$40**.



(7) a. Set $P_D = P_S$ and solve to get Q** = 1200, P = $6.
b. $MSC = P_S + MEC = 4 + (Q/200)$.

c. Set MSC = P_D and solve to get Q* = 800.
d. DWL = (1/2) × (1200-800) × (10-6) = $800.
e. Pigou tax rate = MEC(800) = $3.

(8) [This question assumes ridiculously small dollar values, just to make calculations easier.]
a. E(I) = (0.90 × 9) + (0.10 × 1) = $8.20 .
b. E(U) = $(0.90 \times 9^{1/2}) + (0.10 \times 1^{1/2})$ = 2.8 utils.
c. Set U(I) = $I^{1/2}$ = 2.8 and solve to get I* = $7.84 .
d. Willing to pay $9 - $7.84 = $1.16 .
e. 0.10 × $8 = $0.80 .

(9) a. P_D = 40 + EL = 340 – 0.2 Q.
b. MC = EL = 300 – 0.2 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.
d. AC = 300 – 0.1 Q.
e. Set P_D = AC and solve to get Q = 400. P = AC = $260.

IV. Critical thinking
Same as Version A.

[end of answer key]