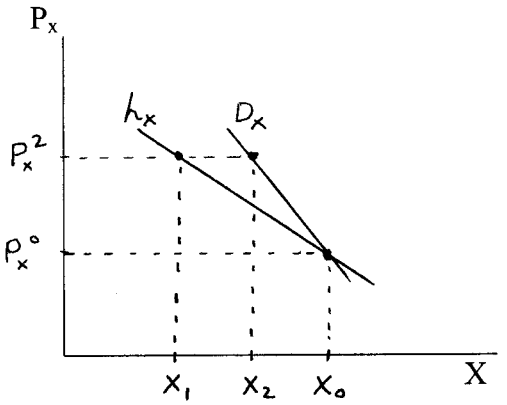
ECO 610
Final Exam
Fall 2002

1. (20 pts.) Illustrated below are Alfred's Marshallian and Hicksian demand curves for one of his two favorite commodities, good X. Unfortunately for Alfred, the price of X rises from P_x^0 to P_x^2. Carefully illustrate in the attached diagram the substitution and income effects of this increase in the price of X.



2. (10 pts.) Over a three-year period Mad Max exhibits the following consumption behavior:

	P_x	P_y	X	Y
Year 1	3	3	7	4
Year 2	4	2	6	6
Year 3	5	1	7	3

Is this behavior consistent with the strong axiom of revealed preference? Use the attached graph paper to illustrate your answer.

3. (20 pts.) Consider a constant-cost perfectly competitive industry. All firms have identical U-shaped average total cost curves. Initially the industry is in long-run equilibrium. Suddenly and unexpectedly, government imposes a large fixed license fee on all firms in the industry.
   a) How will this affect market price and output and each firm's output in the short run?

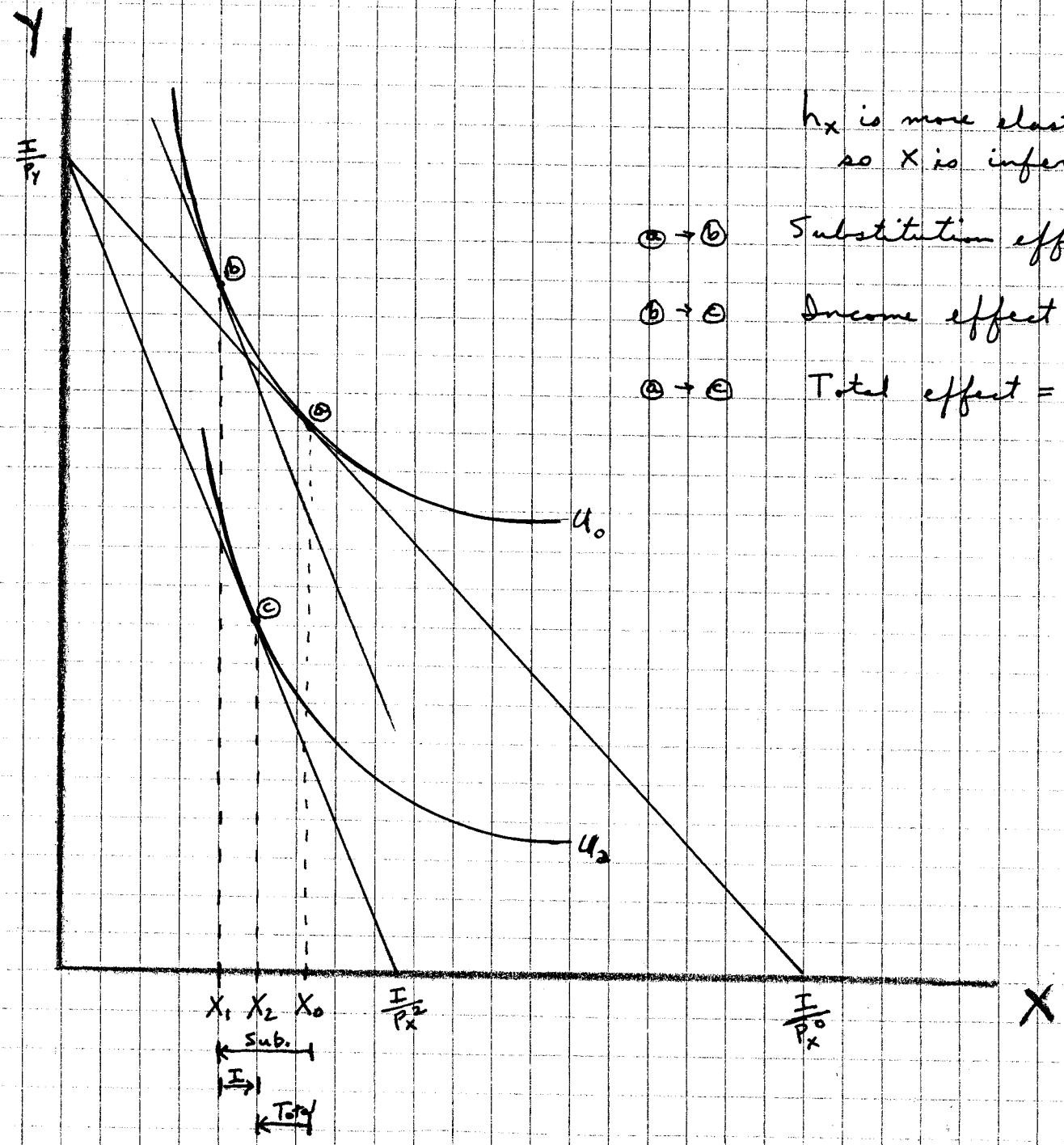
   Now suppose government announces that, in the future, every firm that wants to remain in this industry for the succeeding year must pay the fixed license fee on January 1 of that year. Firms that do not pay the annual fee will not be allowed to produce and sell the product.
   b) How will the equilibrium output of each firm be affected? Hint: draw the firm's short-run cost curves for the upcoming year.
   c) What will happen to the long-run equilibrium number of firms?
   d) What will happen to long-run equilibrium market price and output?

4. (10 pts.) Coal miners can dig two tons of coal per hour and coal sells for $20 per ton. There is only one coal mine in the area, and it faces a labor supply curve: $L = 50w$, where L is the number of miners and w is the wage rate. How many miners should the mine hire?

5. (20 pts.) Acme Pharmaceutical Company discovers a drug that cures the common cold. Acme has plants in both the United States and Europe and can manufacture the drug on either continent at a marginal cost of 10. Assume there are no fixed costs. In Europe, demand for the drug is $Q_E = 70 - P_E$, and in the U.S. demand for the drug is $Q_U = 110 - P_U$.
   a) If the firm can price discriminate between the two markets, what price and output should it set on each continent? Illustrate in the attached diagram.
   b) Suppose that because of arbitrage, price discrimination is not possible. If the firm can charge only a single price on both continents, what price and output should it set?
   c) Will the total consumer and producer surplus in both continents be higher with or without price discrimination? Illustrate in your diagrams.

6. (20 pts.) The production of gadgets is characterized by the following production function: $Q = 10K^{.5}L^{.5}$. The market-determined price of gadgets is P=$2, and the market-determined rental rate on capital is v=$12. In the short run, capital is fixed at $K_0=16$.
   a) If the market wage rate is w=$8, how much labor should the firm employ and how many gadgets should it produce?
   b) If the wage rate rises to w=$16, how much labor should the firm employ and how many gadgets should it produce?
   c) Illustrate your answers to (a) and (b) in the attached diagram. Are either of these input combinations on the firm's respective expansion paths for w=$8 and w=$16?

1.



h_x is more elastic than D_{x_1} so X is inferior.

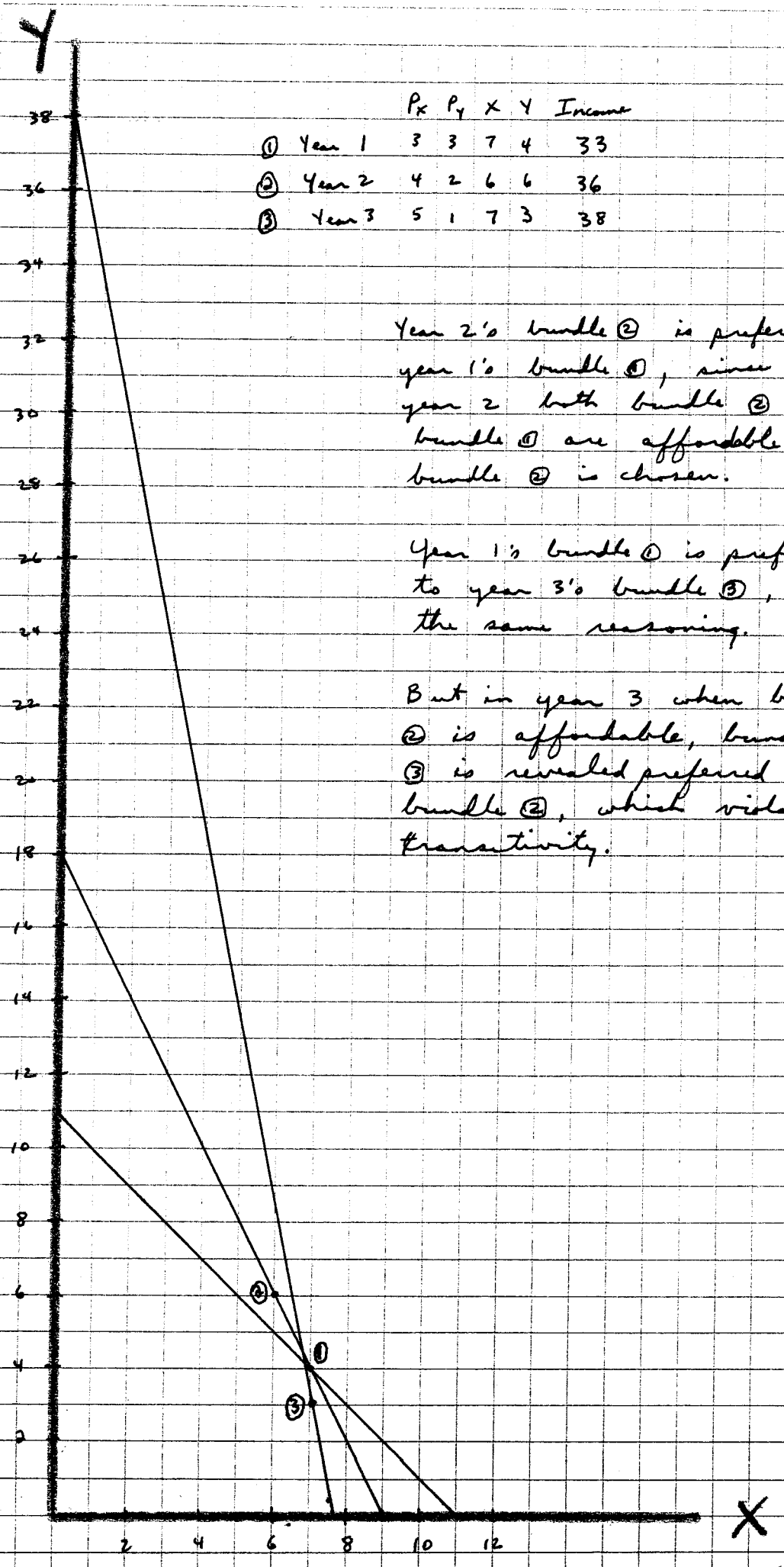
a → b Substitution effect = $X_0 \rightarrow X_1$

b → c Income effect = $X_1 \rightarrow X_2$

a → c Total effect = $X_0 \rightarrow X_2$

2.

		P_x	P_y	X	Y	Income
①	Year 1	3	3	7	4	33
②	Year 2	4	2	6	6	36
③	Year 3	5	1	7	3	38



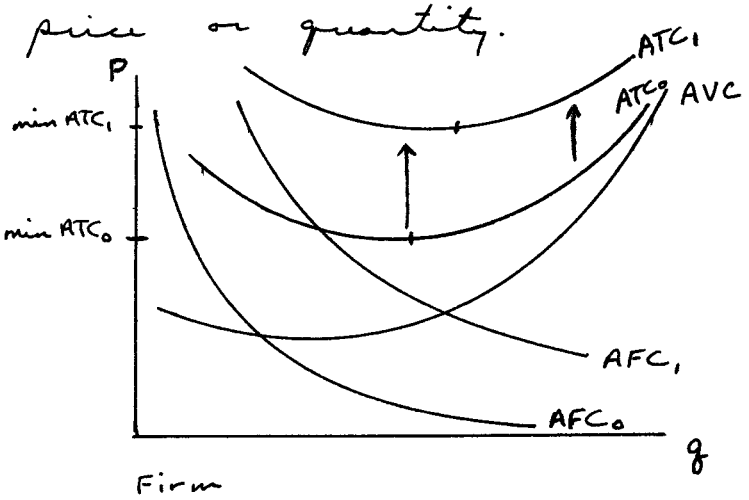
Year 2's bundle ② is preferred to year 1's bundle ①, since in year 2 both bundle ② and bundle ① are affordable, but bundle ② is chosen.

Year 1's bundle ① is preferred to year 3's bundle ③, by the same reasoning.

But in year 3 when bundle ② is affordable, bundle ③ is revealed preferred to bundle ②, which violates transitivity.

3. (a) a large, unexpected, fixed license fee will not change economic behavior. It simply results in a one-time windfall loss to the firms in the industry, and does not change firms' output decisions or market price or quantity.

(b)



Firm

Large fixed license fee that must be paid each year causes TFC to be bigger and for AFC to shift outward. The effect on SRATC is illustrated in the shift from ATC_0 to ATC_1. The minimum point on the firm's ATC curve shifts to the right, so in the new long-run equilibrium each firm will produce a greater output.

(c) Long-run equilibrium number of firms will decrease, because:

(d) equilibrium market price will rise and equilibrium quantity will fall. (Price rises because min ATC rises.)

4. Optimal employment of labor:

$\frac{dTR}{dL} = \frac{dTC}{dL}$, or in this case

$P_{coal} \cdot MP_L = \frac{d(w \cdot L)}{dL}$, where $L = 50w$ $\left(w = \frac{L}{50}\right)$

$(2)(20) = \frac{d(L^2/50)}{dL} = L/25$

$L = 1000$

5. (a) $Q_E = 70 - P_E$, $P_E = 70 - Q_E$ $\quad MC = 10$

$TR_E = 70 Q_E - Q_E^2$

$MR_E = 70 - 2Q_E = 10$

$Q_E = 30$, $P_E = 40$, $\pi_E = 900$

$Q_u = 110 - P_u$, $P_u = 110 - Q_u$

$MR_u = 110 - 2Q_u = 10$

$Q_u = 50$, $P_u = 60$, $\pi_u = 2500$

(b) $Q_T = Q_E + Q_u = 70 - P + 110 - P = 180 - 2P$

$P = 90 - \frac{Q}{2}$ $\quad TR = 90Q - \frac{Q^2}{2}$

$MR = 90 - Q = 10$, $Q_T = 80$, $P_T = 50$, $\pi_T = 3200$

(c) • Under price discrimination:

consumer's surplus in Europe = CS_E

$CS_E = \frac{1}{2}(70-40)(30) = 450$

$CS_u = \frac{1}{2}(110-60)(50) = 1250$

consumer's surplus + producer's surplus =

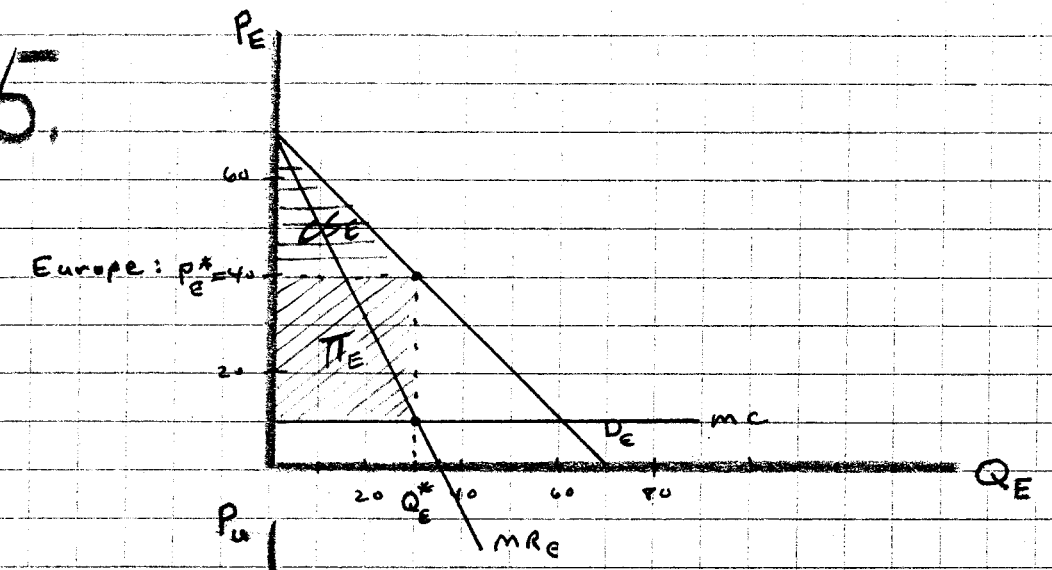
$450 + 1250 + 900 + 2500 = 5100$

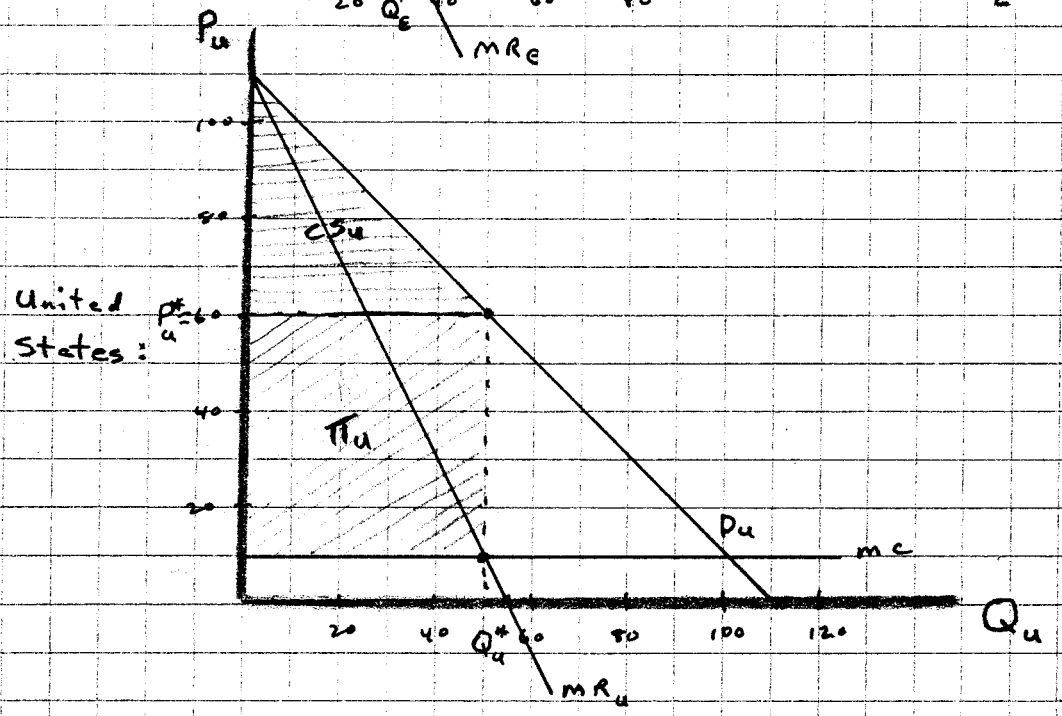
• With no price discrimination:

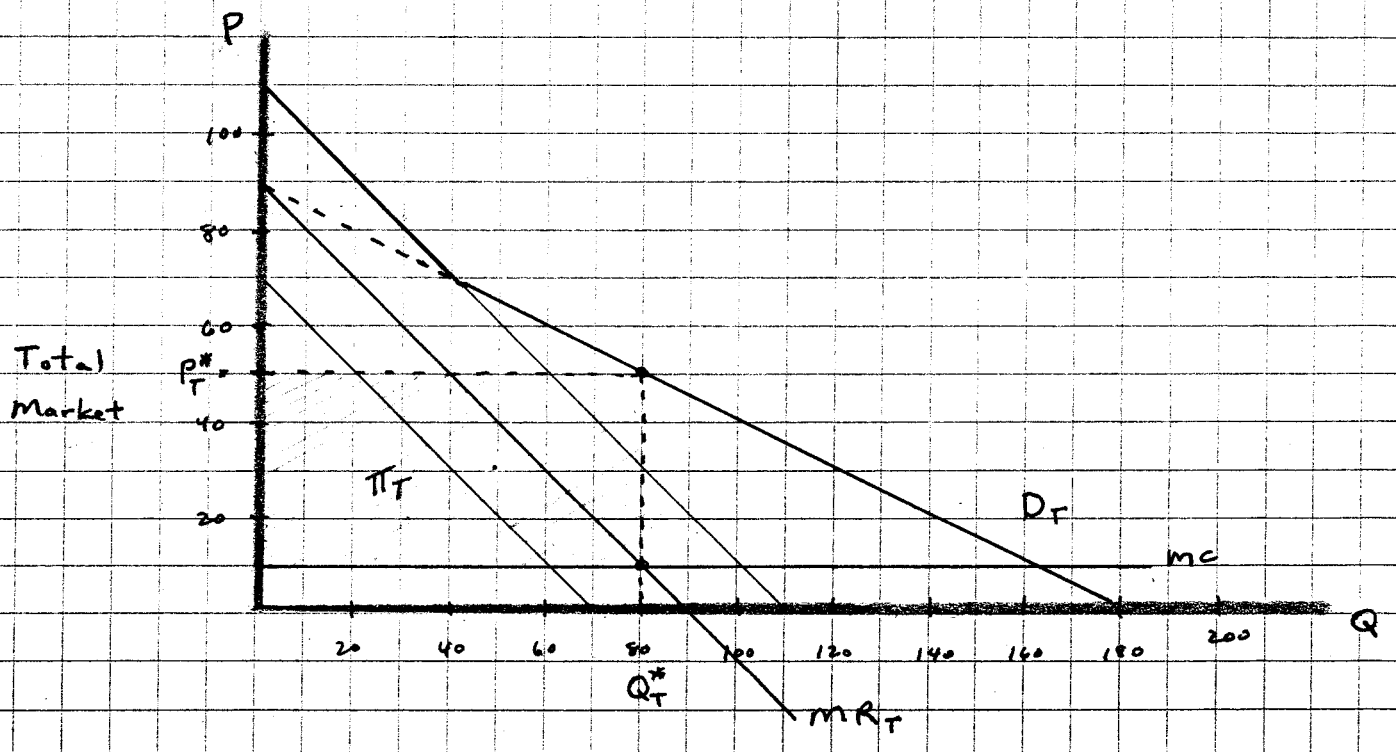
$CS_T = \frac{1}{2}(70-50)20 + \frac{1}{2}(110-50)60 = 2000$

$CS_T + \pi_T = 2000 + 3200 = 5200$

5.


P_E
60
CS_E
Europe: $p_E^* = 40$
π_E
20
D_E
mc
Q_E
20
Q_E^*
40
60
80
MR_E


P_u
100
80
CS_u
United States: $p_u^* = 60$
40
π_u
20
D_u
mc
Q_u
20
40
Q_u^*
60
80
100
120
MR_u


P
100
80
60
Total Market
$p_T^* =$
40
π_T
20
D_T
mc
Q
20
40
60
80
100
120
140
160
180
200
Q_T^*
MR_T

6. $Q = 10K^{1/2}L^{1/2}$, $P = 2$, $v = 12$, $K_0 = 16$

(a) employ labor up to point where $P \cdot MP_L = w$

if $w = 8$, $P \cdot 5K_0^{1/2}L^{-1/2} = w$

$(2)(5)(16)^{1/2}(L^{-1/2}) = 8$, $L^{1/2} = 5$, $L = 25$

$Q = 10(16)^{1/2}(25)^{1/2} = 200$

(b) if $w = 16$, $(2)(5)(16)^{1/2}(L^{-1/2}) = 16$

$L^{1/2} = 2.5$, $L = 6.25$

$Q = 10(16)^{1/2}(6.25)^{1/2} = 100$

(c) expansion path $\Rightarrow \frac{MP_L}{MP_K} = \frac{w}{v}$

$\frac{MP_L}{MP_K} = \frac{5K^{1/2}L^{-1/2}}{5K^{-1/2}L^{1/2}} = \frac{K}{L}$

if $w = 8$, and $v = 12$, $K = 16$, and $L = 25$:

$\frac{MP_L}{MP_K} = \frac{16}{25} \Leftrightarrow \frac{w}{v} = \frac{8}{12} = \frac{16}{24}$

so very close!

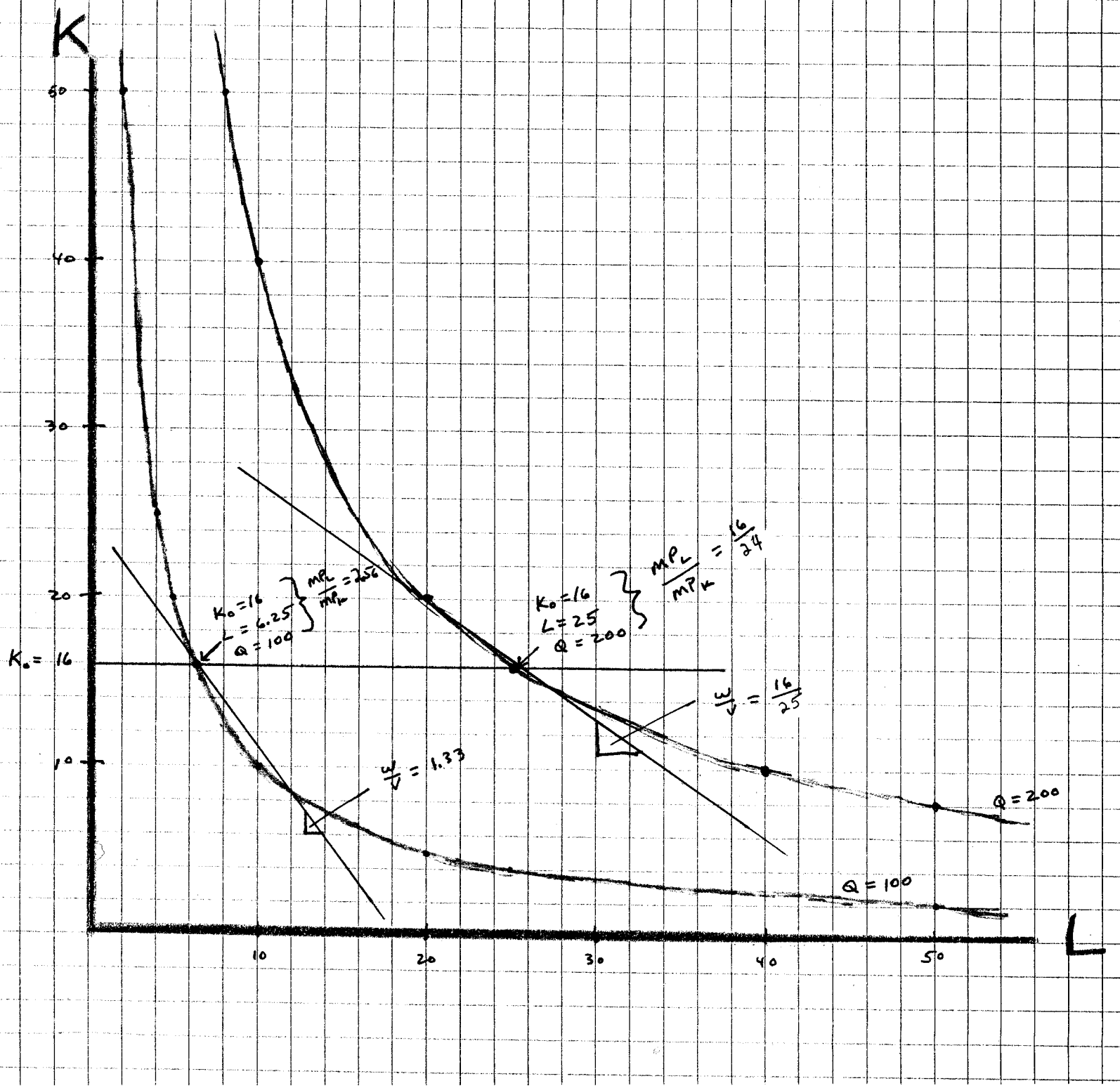
if $w = 16$, and $v = 12$, $K = 16$, and $L = 6.25$:

$\frac{MP_L}{MP_K} = \frac{16}{6.25} \Leftrightarrow \frac{w}{v} = \frac{16}{12}$

$2.56 \Leftrightarrow 1.33$

not close!

6.


K
50
40
30
20
$K_0 = 16$
10
$K_0 = 16$
$L = 6.25$
$Q = 100$
$\frac{MP_L}{MP_K} = 2.56$
$K_0 = 16$
$L = 25$
$Q = 200$
$\frac{MP_L}{MP_K} = \frac{16}{24}$
$\frac{w}{v} = \frac{16}{25}$
$\frac{w}{v} = 1.33$
$Q = 200$
$Q = 100$
10
20
30
40
50
L