Intermediate Microeconomics: Old Exams

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These notes were created for my "Intermediate Microeconomics" course at Loyola Marymount.

Contents

Part I
Old Exams

1 Some Old Exam Questions

Caveat

These questions were taken from my old exams from similar courses. Please note that these questions are not necessarily exhaustive of the material that might be covered on an exam. Please also refer to the **key topics** of each chapter and the **exercises for each chapter**.

Question C.1: Fill in the blanks:

a. An ordinary good is one for which demand ___________ when ___________ increases.

b. If $(4, 0) \succ (2, 2)$ and $(0, 4) \succ (2, 2)$, then preferences are not ___________.

Question C.2: Fill in the blanks:

a. If a consumer is a borrower and the interest rate ___________, they will always remain a borrower.

b. A good is inferior. If ___________ decreases then demand will ___________.

c. The ___________ measures the slope of indifference curves.

Question C.3: Fill in the blanks:

a. If a consumer is a net buyer of some good, then their gross demand is ___________ than their endowment for that good.

b. If an increase in income causes demand for a good to fall, the good is called ___________.

c. A consumer who prefers $(1, 2)$ to $(2, 3)$ has preferences that are not ___________.

Question C.4: Fill in the blanks:

a. A normal good is one for which demand ___________ as income increases.

b. A person is a net borrower. If the interest rate ___________, they will remain a net borrower and be strictly better off.

c. A consumer who strictly prefers both bundles $(2, 0)$ and $(0, 2)$ to $(1, 1)$ has preferences that are not ___________.

Question C.5: Fill in the blanks:

a. An inferior good is one where demand ___________ when ___________ increases.

b. If a consumer can compare every pair of bundles and state a preference or indifference, their preferences are ___________.

Question C.6: Fill in the blanks:

a. A Giffen good is one for which demand ___________ as its own price increases.

b. When someone prefers to have less of a good, their preferences are not ___________.

Question C.7: Consider the following preference relation on the set $\{a, b, c\}$:

$$a \succsim a, b \succsim b, c \succsim c, a \succsim b, b \succsim a, a \succsim c, b \succsim c$$

a. Is it complete?

b. Write the indifference relation.

c. Write the strict preference relation.

d. Write the preferences in chain notation.

e. Write a utility function that represents these preferences.

Question C.8: Consider the following preference relation on the set $\{a, b, c\}$:

$$a \succsim a, b \succsim b, c \succsim c, a \succsim b, b \succsim c, a \succsim c$$

a. Is it complete?

b. Write the strict preference relation $\succ$.

c. Write the indifference relation $\sim$

d. Write the preferences in chain notation.

e. Write any utility function that represents these preferences.

Question C.9:

A person's utility is $U(x_1, x_2) = x_1 x_2$. Prices are p_1, p_2 and they have income m.

a. Write down the equation for their budget line.

b. What is the slope of the budget line?

c. What is the slope of their indifference curve at the point $(3, 2)$.

d. Write down an equation that implies that the slope of the budget equation is the same as their indifference curve at the point (x_1, x_2). (Hint: This is the "Tangency" condition.)

e. What is their Marshallian demand for x_1 and x_2?

f. If $p_1 = 2$ and $p_2 = 1$, and $m = 20$ what bundle is optimal?

g. As income goes up, what happens to their demand for x_1? Is x_1 a normal good or inferior good?

h. As the price p_2 goes up, what happens to demand for x_1? Is x_1 a compliment, substitute or neither for x_2?

Question C.10: Suppose someone's utility is $u(x_1, x_2) = 5ln(x_1) + x_2$. Prices are p_1 and p_2.

a. What is the slope of this person's indifference curve at the point (x_1, x_2).

b. What is the slope of the budget line?

c. What is the consumer's demand for x_1 and x_2 when $p_1 = 1$, $p_2 = 1$ and $m = 10$?

d. *More Challenging:* Suppose $p_2 = 2$ and we observe they buy $x_1 = 1$ and spend the rest of their money on x_2. Determine what p_1 must be.

Question C.11: A consumer's demands are $x_1 = \frac{1}{2}\frac{m}{p_1}$ $x_2 = \frac{1}{2}\frac{m}{p_2}$ and their income is m. Price are p_1 and p_2, respectively.

a. What is their budget equation when $m = 1200$, $p_1 = 100$, and $p_2 = 100$?

b. How much x_1, x_2 do they demand when $m = 1200$, $p_1 = 100$, and $p_2 = 100$?

c. The price of x_1 increases to $p_1 = 300$ what is their change in demand for x_1 (the total effect)?

d. How much money would they need to afford the old bundle at the new prices? Call this $\tilde{m}$.

e. What bundle would they choose with the prices $p_1 = 300, p_2 = 100$ and income $\tilde{m}$?

f. Of the total change in demand due to the substitution effect and how much is due to the income effect?

Question C.12: A consumer will earn $m_1 = 200$ this month and $m = 600$ next month. Let c_1 and c_2 be their consumption in months 1 and 2.

a. Suppose the interest rate is $r = \frac{1}{2}$. How much can they consume in month 1 if they consume nothing in month 2? How much can they consume in month 2 if they consume nothing in month 1?

b. Sketch their intertemporal budget line (label intercepts and slope).

c. If their utility is $U(c_1, c_2) = c_1 c_2$, what is their optimal bundle of (c_1, c_2)?

d. Are they a borrower or a saver?

e. If the interest rate decreases, are they better-off, worse-off, or can you not tell?

Question C.13: A consumer has utility

$$U(x_1, x_2) = \min\Big\{x_1, \frac{1}{4}x_2\Big\},$$

a. Write their budget equation.

b. Derive the Marshallian demand for x_1. That is, what is their optimal choice of x_1 as a function of p_1, p_2, m

c. Sketch the Engel curve for x_1 when $p_1 = 4$, $p_2 = 1$.

Question C.14: A consumer's utility for consumption today (c_1) and next year (c_2) is

$$u(c_1, c_2) = \min\{c_1, c_2\},$$

They will receive incomes $m_1 = 600$, $m_2 = 1500$, and the interest rate is r.

a. Write the intertemporal budget equation.

b. What is the optimal bundle of (c_1, c_2) for them when $r = 0.25$?

c. Is the consumer a borrower or saver when $r = 0.25$?

d. If r decreases to 0.1, is the consumer a borrower or saver?

Question C.15: A consumer has utility

$$U(x_1, x_2) = x_1 + x_2,$$

with $p_1 = 4$, $p_2 = 2$, and $m = 20$.

a. Write the budget constraint.

b. What is the slope of the indifference curves?

c. What is the optimal bundle for the consumer?

d. If $p_2 = 5$ what is the optimal bundle?

e. How much income $\tilde{m}$ would the consumer need to buy the old bundle (from when $p_2 = 2$) at the new prices?

f. How much of the change from (b) to (c) is due to the substitution effect?

Question C.16: A consumer has utility

$$U(x_1, x_2) = x_1 x_2,$$

an endowment of $(\omega_1, \omega_2) = (10, 0)$, and faces prices $p_1 = p_2 = 1$.

a. Write the budget equation.

b. What is the marginal rate of substitution?

c. What is the demand for x_1?

d. Is the consumer a net buyer or seller of x_1?

Question C.17: A consumer has

$$u(x_1, x_2) = \min\left\{\frac{1}{3}x_1, x_2\right\},$$

Suppose $p_1 = 1$, $p_2 = 6$, and $m = 900$.

a. Write the equation for the budget line.

b. What is the consumer's demand for x_2?

c. If p_2 changes to 12, what is the total effect of the change in demand for x_2?

d. how much of the change in demand for x_2 is due to the substitution effect? How much is due to the income effect?

Question C.18: A consumer with endowment $(\omega_1, \omega_2) = (5, 5)$ has utility

$$u(x_1, x_2) = x_1 + x_2,$$

with $p_1 = 2$ and $p_2 = 4$.

a. Write the budget equation.

b. What is the optimal bundle?

c. In (b), is the consumer a net buyer, or net seller of x_1?

d. If p_1 decreases to 1, is the consumer a buyer or seller of x_1?

Question C.19: A consumer has utility

$$U(x_1, x_2) = \min\{x_1, 2x_2\},$$

with income m and prices p_1, p_2.

a. Write the budget line.

b. What is the "no waste condition" for this consumer?

c. Derive the Marshallian demands for x_1 and x_2.

Concept Check: Fill-in-the-Blank

Question C.20
Fill in all blanks:

a. For a firm, profit maximization implies ___________ minimization.

b. If a firm doubles its inputs but output increases by less than double, its production function has ___________ returns to scale.

c. A monopolist can never be profit-maximizing if demand is ___________.

Equilibrium Problems

Question C.21
Suppose the demand for a good is given by $Q_d = 200 - 40p$ and market supply is $Q_s = 10p$.

a. What is the equilibrium price and quantity in the market?

b. What is the price elasticity of demand at the equilibrium price?

c. What is the equilibrium price and quantity with a quantity tax of $t = \frac{5}{2}$?

d. What is the dead-weight loss associated with this tax?

Question C.22
Suppose market demand is $Q_d = 300 - 2p$ and market supply is $Q_s = p$

a. What is the equilibrium price and quantity in this market?

b. What is the price elasticity of demand at the equilibrium price?

c. If the price rises by 1%, approximately how does quantity demanded change?

d. What are the equilibrium price and quantity if a quantity tax $t = 75$ is imposed?

e. What is the dead-weight loss from this tax?

Question C.23
Demand and supply for a good are $Q_d = 81 - p$ and $Q_s = 8p$.

a. Find the equilibrium price and quantity.

b. Compute the elasticity of demand at the equilibrium price. Is demand elastic, inelastic, or unit-elastic?

c. If a $t = 9$ per-unit tax is imposed, what is the new equilibrium quantity?

d. How much more do consumers pay per unit and how much less do producers receive?

e. Calculate the associated dead-weight loss.

Question C.24
Demand is $Q_d = 1000 - 8p$ and supply is $Q_s = 2p$.

a. Find the equilibrium price and quantity.

b. What is consumer surplus in equilibrium?

c. If the government levies a $50 tax, what is the new equilibrium quantity?

d. Compute the dead-weight loss.

e. *Challenge:* Which tax rate maximizes government revenue?

Cost-Minimization Problems

Question C.25
A firm produces output y with $f(x_1, x_2) = x_1^{1/3} x_2^{1/3}$.

a. Suppose $w_1 = 1$ and $w_2 = 1$. Find the conditional demands for x_1, x_2.

b. Find the cost function.

c. If x_2 is fixed in the short run at $x_2 = 1$, what is the short-run cost of producing y?

d. If the output price is $p = 300$, how much does the firm produce in the short run?

Question C.26
Production function $f(x_1, x_2) = x_1^{1/3} x_2^{1/3}$ with $w_1 = 4,\ w_2 = 1$.

a. Does the production function exhibit increasing, decreasing, or constant returns to scale?

b. Find the conditional factor demands.

c. Derive the cost function $c(y)$.

d. If the firm is a price-taker and the output price is $p = 600$, write the firm's profit function.

e. What output does the firm choose at $p = 600$?

Question C.27
A firm with $f(x_1, x_2) = x_1^{1/2} x_2^{1/2}$ faces $w_1 = 4,\ w_2 = 1$.

a. Does this production function have increasing, decreasing, or constant returns to scale?

b. Write an expression for the slope of the isoquants.

c. What is the slope of its isocosts?

d. Find the cost-minimizing (x_1, x_2) for output y.

e. Derive the cost function $c(y)$.

Question C.28
A firm with $f(x_1, x_2) = x_1^{1/2} x_2^{1/2}$ faces $w_1 = \frac{1}{2},\ w_2 = \frac{1}{2}$.

a. What is the marginal product of x_1? Does the firm exhibit diminishing marginal product for x_1?

b. Find the conditional factor demands for output y.

c. Derive the cost function $c(y)$.

Cournot (and Monopoly) Problems

Question C.29
Suppose market demand $q = 1000 - 10p$ and firms have cost function $c(q) = 10q$.

a. Derive the inverse demand function.

b. For a monopolist, write the profit function.

c. Find the monopolist's optimal quantity and price.

d. If there are two firms competeing in cournot competition, write firm 1's profit.

e. Derive firm 1's best response.

f. Leveraging symmetry, find the Nash equilibrium quantities.

g. What are market quantity and price in equilibrium?

Question C.30
Two firms have cost $c(q) = 5q$ and face inverse demand $p = 29 - Q$.

a. Write firm 1's profit function as a function of q_1, q_2.

b. Find firm 1's best response function.

c. Leverage symmetry to determine the Nash equilibrium.

Question C.31
A monopolist has cost $c(y) = 2y^2 + 400y + 10$ and demand is $q(p) = 1000 - p$.

a. Does this function have decreasing, increasing, or contant, marginal cost?

b. Write profit as a function of y.

c. Find the profit-maximizing y and the price.

d. Show that demand is elastic at that price.

Question C.32
Suppose demand is $Q = 3000 - p$ and firms have zero costs $c(q) = 0$.

a. Suppose there is one firm in the market (a monopolist) write the profit function.

b. What quantity maximizes profit for this monopolist?

c. With two firms producing q_1, q_2 and comepeting in cournot competition, write firm 1's profit.

d. Derive firm 1's best response function.

e. Find Nash equilibrium quantities (leverage symmetry).

Question C.33
Suppose demand is $q = 1000 - 10p$ and each firm has cost function $c(q) = 10q$.

a. What is the inverse demand?

b. Suppose there is one firm in the market (a monopolist) write the profit function.

c. Find the monopolist's optimal q and p?

d. Now suppose there are two firms comepeting in Cournot competition, write firm 1's profit.

e. Derive firm 1's best response.

f. Leverage symmetry to find the Nash equilibrium.

Question C.34
Suppose demand is $Q = 500 - p$ and firms have cost $c(q) = 200q$.

a. What is the inverse demand?

b. Suppose there is one firm in the market (a monopolist) write the profit function.

c. Find the monopolist's optimal q and p?

d. Now suppose there are two firms comepeting in Cournot competition, write firm 1's profit.

e. Derive firm 1's best response.

f. Leverage symmetry to find the Nash equilibrium.

A Few Additional Problems

Question C.35 A monopolist serves types of consumers with inverse demand functions:

$$p_A = 120 - 3q_A, \qquad p_B = 96 - 3q_B,$$

where q_A and q_B are the quantities sold to groups A and B, respectively. Cost is $C(q) = 12q$.

a. Find the profit-maximizing quantities q_A^*, q_B^* and corresponding prices p_A^*, p_B^*.

b. Compute the resulting maximum profit.

Question C.36 A monopolist sells two goods to two consumers with the following willingess to pay. The monopolist has zero cost.

	Good 1	Good 2
Consumer A	30	10
Consumer B	10	30

a. If the monopolist sets separate prices for good 1 and good 2 find the prices it should set to maximize profit and compute that profit.

b. If the monopolist sells only the bundle, find the price it should choose to maximize profit and compute that profit.

c. Which strategy yields the higher profit?

Question C.37 A firm is a price taker and faces a market price $p = 50$. Suppose their short run cost is $c_{sr}(q) = 20q + q^2 + 80$ and their long run cost is $c_{lr}(q) = 10q + q^2$.

a. In the short run find the profit-maximizing output and the profit.

b. In the long run find the profit-maximizing output and profit.

c. Explain briefly (one sentence) why long-run profit differs from short-run profit.

1.1 Solutions

Solution C.1

a. decreases, price

b. convex

Solution C.2

a. Decreases

b. income, increase

c. MRS (Marginal Rate of Substitution)

Solution C.3

a. More

b. Inferior

c. Monotonic

Solution C.4

a. increases

b. decreases

c. convex

Solution C.5

a. decreases, income

b. complete

Solution C.6

a. increases

b. monotonic

Solution C.7

a. yes

b. $a \sim a, b \sim b, c \sim c, a \sim b$

c. $a \succ c, b \succ c$

d. $a \sim b \succ c$

e. For example, $u(a) = 2, u(b) = 2, u(c) = 0$

Solution C.8

a. yes

b. $a \succ b, a \succ c, b \succ c$

c. $a \sim a, b \sim b, c \sim c$

d. $a \succ b \succ c$

e. For example, $u(a) = 3, u(b) = 2, u(c) = 1$

Solution C.9

a. $p_1x_1 + p_2x_2 = m$

b. $-\frac{p_1}{p_2}$

c. $-\frac{2}{3}$

d. $-\frac{x_2}{x_1} = -\frac{p_1}{p_2}$

e. $x_1 = \frac{\frac{1}{2}m}{p_1}, x_2 = \frac{\frac{1}{2}m}{p_2}$

f. $(5, 10)$

g. Normal

h. Neither

Solution C.10

a. $-\frac{5}{x_1}$

b. $-\frac{p_1}{p_2}$

c. $x_1 = 5, x_2 = 5$

d. $p_1 = 10$

Solution C.11

a. $100x_1 + 100x_2 = 1200$

b. $(6, 6)$

c. Decreases by 4 to $x_1 = 2$

d. $\tilde{m} = 2400$

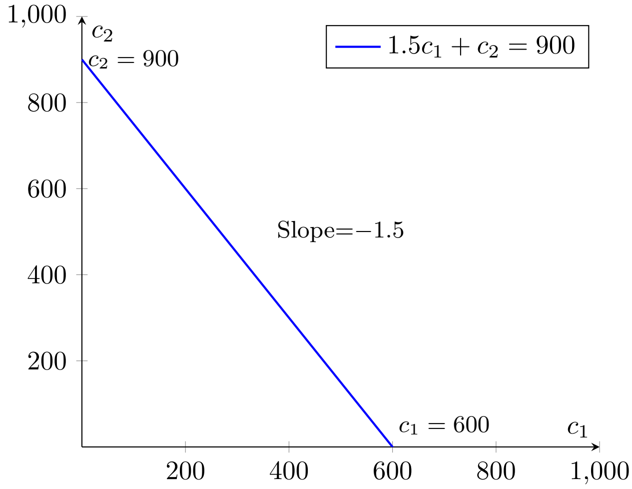
e. $(4, 12)$

f. Decrease of 2 due to substitution effect and decrease of 2 due to income effect.

Solution C.12

a. $600, 900$

b.



c. $300, 450$

d. Borrower

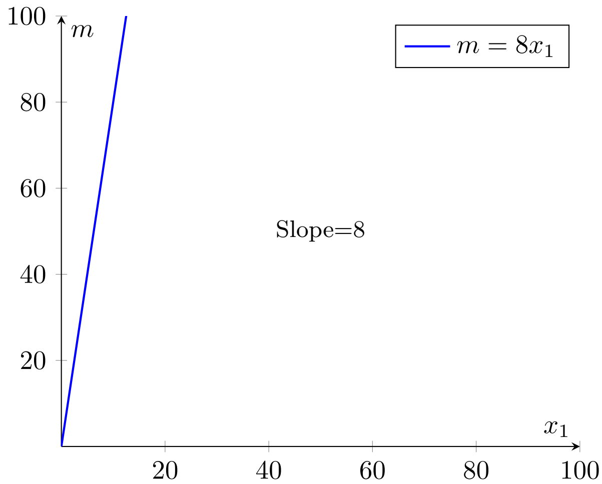
e. Better-Off

Solution C.13

a. $p_1x_1 + p_2x_2 = m$

b. $\frac{m}{p_1+4p_2}$

c.



Solution C.14

a. $(1 + r)c_1 + c_2 = (1 + r)600 + 1500$

b. $(1000, 1000)$

c. Borrower

d. Borrower

Solution C.15

a. $4x_1 + 2x_2 = 20$

b. -1

c. $(0, 10)$

d. $(5, 0)$

e. $\tilde{m} = 50$

f. All 10 is due to substitution.

Solution C.16

a. $x_1 + x_2 = 10$

b. $-\frac{x_2}{x_1}$

c. $x_1 = 5$

d. Seller

Solution C.17

a. $x_1 + 6x_2 = 900$

b. 100

c. Decrease of 40

d. 0 change due to substitution, decrease of 40 due to income

Solution C.18

a. $2x_1 + 4x_2 = 30$

b. $(15, 0)$

c. Buyer

d. Buyer

Solution C.19

a. $p_1x_1 + p_2x_2 = m$

b. $x_1 = 2x_2$

c. $x_1 = \frac{m}{p_1 + \frac{1}{2}p_2}, x_2 = \frac{1}{2}\frac{m}{p_1 + \frac{1}{2}p_2}$

Solution C.20

a. cost

b. decreasing

c. inelastic

Solution C.21

a. p$p = 4$, $Q = 40$.

b. $\varepsilon = -4$.

c. $p = 4.5,\ Q = 20$.

d. $\text{DWL} = 25$.

Solution C.22

a. $p = 100,\ Q = 100$.

b. $\epsilon = -2$.

c. Q decreases by 2%.

d. $p = 125$, $Q = 50$.

e. $\text{DWL} = 1875$.

Solution C.23

a. $p = 9,\ Q = 72$.

b. $\epsilon = -\frac{1}{8}$, inelastic.

c. $p = 17,\ Q = 64$.

d. Consumers pay \$8 more, producers receive \$1 less.

e. $\text{DWL} = 36$.

Solution C.24

a. $p = 100,\ Q = 200$.

b. $\text{CS} = 2500$.

c. $p = 110,\ Q = 120$.

d. $\text{DWL} = 2000$.

e. Revenue $G = t(200 - 1.6t)$ is maximized at $t = 62.5$.

Solution C.25

a. $x_1 = x_2 = y^{3/2}$.

b. $c(y) = 2\,y^{3/2}$.

c. $x_2 = 1$ requires $x_1 = y^3$, so $c(y) = y^3 + 1$.

d. Maximize $300y - (y^3 + 1)$. This is maximizes at $y = 10$.

Solution C.26

a. Decreasing returns to scale.

b. $x_1 = \frac{1}{2}y^{3/2},\ x_2 = 2y^{3/2}$.

c. $c(y) = 4y^{3/2}$.

d. $\pi(y) = 600y - 4y^{3/2}$.

e. $y = 10000$.

Solution C.27

a. Constant returns to scale.

b. $-\dfrac{x_2}{x_1}$.

c. -4.

d. $x_1 = \frac{y}{2},\ x_2 = 2y$.

e. $c(y) = 4y$.

Solution C.28

a. $MP_1 = \frac{1}{2}\frac{x_2^{1/2}}{x_1^{1/2}}$; yes, it is diminishing.

b. $x_1 = x_2 = y$.

c. $c(y) = \frac{1}{2}y + \frac{1}{2}y = y$.

Solution C.29

a. $p = \dfrac{1000 - Q}{10}$.

b. $\pi(q) = q\,\dfrac{1000 - q}{10} - 10q$.

c. $q = 450,\ p = 55$.

d. $\pi_1 = q_1 \dfrac{1000 - q_1 - q_2}{10} - 10q_1$.

e. $q_1 = \dfrac{900 - q_2}{2}$.

f. $q_1 = q_2 = 300$.

g. $Q = 600,\ p = 40$.

Solution C.30

a. $\pi_1 = q_1(29 - (q_1 + q_2)) - 5q_1$.

b. $q_1 = 12 - \frac{1}{2}q_2$.

c. $q_1 = q_2 = 8$.

Solution C.31

a. Increasing marginal cost.

b. $\pi(y) = (1000 - y)y - (2y^2 + 400y + 10)$.

c. $y = 100,\ p = 900$.

d. $\epsilon = -\frac{p}{1000-p} = -\frac{900}{100} = -9$ (elastic).

Solution C.32

a. $\pi(q) = q\,(3000 - q)$.

b. $q = 1500$.

c. $\pi_1 = q_1\,(3000 - q_1 - q_2)$.

d. $q_1 = \frac{3000-q_2}{2}$.

e. $q_1 = q_2 = 1000$.

Solution C.33

a. $p = \dfrac{1000 - Q}{10}$.

b. $\pi(q) = q\,\dfrac{1000 - q}{10} - 10q$.

c. $q = 450,\ p = 55$.

d. $\pi_1 = q_1 \dfrac{1000 - q_1 - q_2}{10} - 10q_1$.

e. $q_1 = 450 - \frac{1}{2}q_2$.

f. $q_1 = q_2 = 300$.

Solution C.34

a. $p = 500 - Q$.

b. $\pi(q) = q\,(500 - q) - 200q$.

c. $q = 150,\ p = 350$.

d. $\pi_1 = q_1\,(500 - q_1 - q_2) - 200q_1$.

e. $q_1 = 150 - \frac{1}{2}q_2$.

f. $q_1 = q_2 = 100$.

Solution C.35

a. $\pi(q_A, q_B) = (120 - 3q_A)q_A + (96 - 3q_B)q_B - 12(q_A + q_B)$.

b. $q_A^* = 18$, $q_B^* = 14$. $p_A^* = 66$, $p_B^* = 54$

c. Maximum profit: $\pi^* = 1560$.

Solution C.36

a. Optimal separate prices: $p_1 = p_2 = 30$. Profit $= 30 + 30 = 60$.

b. Optimal bundle price: $p = 40$.

c. Bundling yields the higher profit.

Solution C.37

a. $q = 15$ and profit is 145.

b. $q = 20$ and profit is 400

c. Long-run profit is higher because it can adjust it's use of any fixed inputs to the optimal level, leading to lower cost for the same output.