

Answers to questions 24, 68, 70 (sections 2.1, 2.2, 2.3, 2.4)

24. Respond to all parts of the question.

Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to "Calculate," you must show how you arrived at your final answer.

A movie theater company obtains the following estimated elasticities of demand.

- The absolute value of the short-run price elasticity of demand for movie tickets is 0.85.
- The absolute value of the long-run price elasticity of demand for movie tickets is 3.2.
- The cross-price elasticity of demand for good X, another product sold by the theater, with respect to the price of movie tickets is -0.26 .
- The income elasticity of demand for movie tickets is 0.75.

Answer each of the following by referring to the given elasticities.

- (a) If the theater raises movie ticket prices by 10 percent, by what percentage and in what direction will the quantity demanded for movie tickets change in the short run?
- (b) Explain why the short-run price elasticity of demand for movie tickets differs from the long-run price elasticity of demand for movie tickets.
- (c) What will happen to total revenue from movie ticket sales in the long run if movie ticket prices increase? Explain using the relative percentage changes in price and quantity.
- (d) Are movie tickets a normal good or an inferior good? Explain.
- (e) Given the increase in the price of movie tickets in part (a), what would be the impact on the demand for good X? Use the appropriate graph for good X to illustrate your answer.

FRQ 24 — Elasticities and the Movie Theater

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- Absolute value of the long-run price elasticity of demand for movie tickets = 3.2
- Cross-price elasticity of demand for good X with respect to the price of movie tickets = -0.26
- Income elasticity of demand for movie tickets = 0.75

(a) Short-run change in quantity demanded

Use the short-run price elasticity of demand (0.85) with the 10% price increase:

$$\% \Delta Q_d = PED \times \% \Delta P = -0.85 \times 10\% = -8.5\%$$

The quantity of movie tickets demanded will decrease by 8.5% in the short run. (It decreases, not increases, because demand curves slope downward — a price increase always reduces quantity demanded; the elasticity value only tells us the size of that decrease.)

(b) Why short-run and long-run elasticity differ

Price elasticity of demand depends heavily on how much time consumers have to adjust their behavior. In the short run, consumers have fewer available substitutes and less time to change their habits, so demand is relatively inelastic (0.85, less than 1). In the long run, consumers have time to find and adopt

substitutes for movie theaters — streaming services, other forms of entertainment, home theater setups — and can adjust habits like how often they go out. This makes demand far more responsive to price over time, which is why the long-run elasticity (3.2) is much larger than the short-run elasticity, and why it is elastic (greater than 1) rather than inelastic.

(c) Effect on total revenue in the long run

In the long run, demand is elastic ($|PED| = 3.2 > 1$). Under elastic demand, the percentage change in quantity demanded is larger than the percentage change in price. If the theater raises prices, the percentage drop in quantity demanded (magnified by the elastic response) outweighs the percentage increase in price, so total revenue will decrease.

Illustration using the same 10% price increase: $\% \Delta Q_d = -3.2 \times 10\% = -32\%$. A 10% price increase paired with a 32% quantity decrease means total revenue ($P \times Q$) falls substantially, since the quantity effect dominates the price effect.

(d) Normal or inferior good?

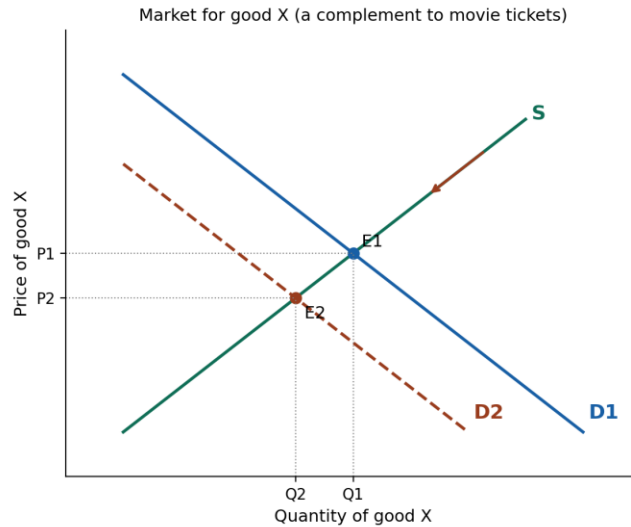
Movie tickets are a normal good. Income elasticity of demand (YED) is positive ($0.75 > 0$), and by definition a positive YED means quantity demanded moves in the same direction as income — as income rises, people buy more movie tickets. (An inferior good would have a negative YED, meaning demand falls as income rises.) Since 0.75 is between 0 and 1, movie tickets are also income-inelastic, meaning demand for them rises less than proportionally to income — consistent with movie tickets being treated more like a modest everyday good than a luxury.

(e) Impact on the market for good X

The cross-price elasticity of demand for good X with respect to the price of movie tickets is -0.26 . Because this value is negative, good X and movie tickets are complements — they are consumed together, so a price increase in one reduces demand for the other.

Using the 10% increase in ticket prices from part (a): $\% \Delta Q_x = XED \times \% \Delta P = -0.26 \times 10\% = -2.6\%$. Demand for good X decreases (though only modestly, since the magnitude of 0.26 indicates a fairly weak complementary relationship).

Graphically, this is a decrease in demand for good X: the entire demand curve for good X shifts to the left, from D_1 to D_2 , because the cause is a change in the price of a related good, not a change in the price of good X itself. Holding the supply of good X constant, this leftward shift moves the equilibrium from $E_1 (P_1, Q_1)$ to $E_2 (P_2, Q_2)$, lowering both the equilibrium price and equilibrium quantity of good X.



Demand for good X shifts left ($D1 \rightarrow D2$) in response to the increase in the price of its complement, movie tickets.

68. Theresa consumes both bagels and toy cars.

Quantity of Bagels	Marginal Utility from Bagels (utils)	Quantity of Toy Cars	Marginal Utility from Toy Cars (utils)
1	8	1	10
2	7	2	8
3	6	3	6
4	5	4	4
5	4	5	3
6	3	6	2

- a. The table above shows Theresa's marginal utility from bagels and toy cars.
 - i. What is her total utility from purchasing three toy cars?
 - ii. Theresa's weekly income is 11, *price of a bagel is 2*, and the price of a toy car is \$1. What quantity of bagels and toy cars will maximize Theresa's utility if she spends her entire weekly income on bagels and toy cars? Explain your answer using marginal analysis.
- b. Assume that the price of wheat, an input for the production of bagels, increases. Will Theresa's demand for bagels increase, decrease, or not change? Explain.
- c. Suppose that Theresa's income elasticity for bagels is -0.2. Does the value of Theresa's income elasticity indicate that bagels are normal goods, inferior goods, substitutes, or complements?
- d. Suppose that when the price of toy cars increases by 10 percent, Theresa buys 5 percent fewer toy cars and 4 percent less of a different toy, blocks. Calculate the cross-price elasticity for toy cars and blocks and indicate if it is positive or negative.

Respond to all parts of the question.

Question 68 — Theresa's Consumption of Bagels and Toy Cars

Theresa consumes both bagels and toy cars.

a.i — Total utility from three toy cars

Total utility is the sum of marginal utilities up through the third unit purchased:

$$TU(3 \text{ toy cars}) = 10 + 8 + 6 = 24 \text{ utils}$$

a.ii — Utility-maximizing bundle

With a weekly income of \$11, a bagel price of \$2, and a toy car price of \$1, Theresa maximizes utility by allocating spending so that marginal utility per dollar is equalized across both goods, subject to spending her full budget. The table below adds a marginal-utility-per-dollar (MU/P) column for each good:

Qty of Bagels	MU from Bagels (utils)	MU/\$ (Price=\$2)	Qty of Toy Cars	MU from Toy Cars (utils)	MU/\$ (Price=\$1)
1	8	4	1	10	10
2	7	3.5	2	8	8
3	6	3	3	6	6
4	5	2.5	4	4	4
5	4	2	5	3	3
6	3	1.5	6	2	2

Buying units in order of highest MU per dollar until the \$11 budget is exhausted gives Theresa 5 toy cars and 3 bagels:

$$\text{Cost check: } (5 \text{ toy cars} \times \$1) + (3 \text{ bagels} \times \$2) = \$5 + \$6 = \$11 \text{ — the entire budget is spent.}$$

Marginal analysis check: at this bundle, MU of the 3rd bagel = 6, so $MU/P = 6 \div \$2 = 3$. MU of the 5th toy car = 3, so $MU/P = 3 \div \$1 = 3$. Since MU per dollar is equal across both goods ($3 = 3$) and the full budget is spent, this bundle satisfies the utility-maximizing rule $MU_{\text{bagels}}/P_{\text{bagels}} = MU_{\text{toy cars}}/P_{\text{toy cars}}$, so no reallocation of spending could increase Theresa's total utility.

b — Effect of a higher wheat price on Theresa's demand for bagels

Theresa's demand for bagels will not change. An increase in the price of wheat raises the cost of producing bagels, which shifts the supply curve for bagels to the left — it does not shift the demand curve. Demand is determined by factors on the buyer's side, such as income, preferences, the price of related goods, and expectations — not by the producer's input costs.

What will happen is a decrease in the equilibrium quantity of bagels Theresa buys, caused by the resulting increase in the market price of bagels. This is a movement along Theresa's existing demand curve (a

change in quantity demanded), not a shift of the curve itself (a change in demand). The demand curve stays exactly where it was.

c — Interpreting an income elasticity of -0.2

An income elasticity of demand of -0.2 is negative, which indicates that bagels are an inferior good for Theresa. A negative income elasticity means quantity demanded moves in the opposite direction of income — as Theresa's income rises, her demand for bagels falls (and as income falls, her demand for bagels rises). The magnitude of 0.2 (well below 1) indicates this relationship is fairly weak, but the sign alone is what classifies bagels as inferior rather than normal. (Note: this value cannot indicate anything about substitutes or complements — that classification comes from cross-price elasticity, not income elasticity.)

d — Cross-price elasticity of toy cars and blocks

Cross-price elasticity of demand (XED) measures the percentage change in quantity demanded of one good relative to the percentage change in price of another good:

$$XED = \% \Delta QD, \text{ blocks} \div \% \Delta P, \text{ toy cars} = -4\% \div 10\% = -0.4$$

The cross-price elasticity is -0.4 . Because this value is negative, toy cars and blocks are complements for Theresa — they are used together, so when toy cars become more expensive, her demand for blocks falls as well rather than rising (which would indicate substitutes).

70. Utility maximization is a fundamental assumption in consumer theory.
- Explain what is meant by diminishing marginal utility.
 - Assume that a consumer buys only two goods: X and Y. What is the utility-maximizing decision rule for the consumer in allocating total income to good X and good Y?
 - Assume that a utility-maximizing consumer is spending all of her income on the two goods, X and Y. The price per unit of good X is 2, and the price per unit of good Y is 3. The marginal utility of the last unit of good Y consumed is 15. What is the marginal utility of the last unit of good X consumed?
 - Assume that good X is a normal good and good Y is an inferior good. Assume that the consumer's income does not change. Assume that the price of good X increases.
 - Indicate how the substitution effect of the increase in the price of good X will affect purchases of
 - good X
 - good Y
 - Indicate how the income effect of the increase in the price of good X will affect purchases of
 - good X
 - good Y

Respond to all parts of the question.

Question 70 — Utility Maximization in Consumer Theory

Utility maximization is a fundamental assumption in consumer theory.

a — Diminishing marginal utility

Diminishing marginal utility means that as a consumer consumes additional units of a good, the extra (marginal) satisfaction gained from each successive unit gets smaller, holding the consumption of all other goods constant. The first unit of a good typically provides the greatest boost in satisfaction; each additional unit adds less than the one before it. This is why marginal utility curves slope downward and why demand curves slope downward as well — consumers are only willing to pay progressively less for each additional unit as its added value to them shrinks.

b — Utility-maximizing decision rule for two goods

A consumer who buys only goods X and Y maximizes utility by allocating income so that the marginal utility per dollar spent is equal across both goods, while spending the entire budget:

$$MU_x / P_x = MU_y / P_y, \text{ with } P_x \cdot Q_x + P_y \cdot Q_y = \text{Income}$$

If the marginal utility per dollar were higher for one good than the other, the consumer could increase total utility by shifting a dollar of spending toward the good with the higher MU per dollar. Utility is maximized only when no such reallocation can make the consumer better off — that is, when the ratios are equal and the budget is fully spent.

c — Solving for the marginal utility of good X

Using the utility-maximizing rule with $P_x = \$2$, $P_y = \$3$, and $MU_y = 15$:

$$MU_x / P_x = MU_y / P_y$$

$$MU_x / 2 = 15 / 3 = 5$$

$$MU_x = 5 \times 2 = 10$$

The marginal utility of the last unit of good X consumed is 10 utils.

d — Effects of a price increase for good X (X normal, Y inferior)

i. Substitution effect

1. Good X: The substitution effect causes the consumer to buy less of good X. When the price of X rises, X becomes relatively more expensive compared to Y (holding utility/purchasing power conceptually constant), so the consumer substitutes away from the now-pricier good.

2. Good Y: The substitution effect causes the consumer to buy more of good Y. Since Y is now relatively cheaper compared to X, the consumer substitutes toward Y.

Note that the substitution effect depends only on the change in relative prices — it does not depend on whether a good is normal or inferior, so this direction holds regardless of the classifications given in part (d).

ii. Income effect

A price increase for good X reduces the consumer's real purchasing power (real income), even though nominal income is unchanged — the same income now buys less overall.

1. Good X: Since good X is a normal good, a decrease in real income causes demand for it to fall further. The income effect causes the consumer to buy less of good X.
2. Good Y: Since good Y is an inferior good, a decrease in real income causes demand for it to rise. The income effect causes the consumer to buy more of good Y.

Summary

	Substitution effect	Income effect	Overall effect
Good X (normal)	Decrease	Decrease	Decrease (reinforcing)
Good Y (inferior)	Increase	Increase	Increase (reinforcing)

For good X, the substitution effect and income effect both push consumption in the same direction (decrease), so the overall quantity demanded of X clearly falls — consistent with the law of demand. For good Y, the substitution effect and income effect also both push in the same direction (increase), so the overall quantity demanded of Y clearly rises.