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Practice Set 2

Consumer Choice & Demand

This set contains problems for your own practice. Do not just read the provided solutions — try to solve the problems first, and use the solutions only when you are stuck. Reading solutions without attempting the problems first has the same value for your preparation as watching someone else run a marathon and then expecting to be able to run it yourself. If you are unable to comprehend the solution of a problem even after reading the instructional answer key, you have most likely missed the relevant part of the material underlying this problem. Direct any questions about this problem set to your section's teaching assistant.

1. Colette's weekly demand for bubble tea is given in the following table.

Price	\$1	\$2	\$3	\$4	\$5	\$6	\$7
Cups per week	8	6	5	4	3	2	1

   (a) Does Colette's demand follow the *law of demand*?
   (b) How much will her *demand* increase if the price decreases from \$5 to \$4?
   (c) How would an *increase* in Colette's *demand* be represented in the table above?
   (d) Colette also likes Frappuccino. Could a decrease in the price of Frappuccino from \$5 to \$4, affect her demand for bubble tea?
   (e) Name 3 factors that could cause Colette's *demand* for bubble tea to *decrease*.

2. Marianna was surveyed on two different dates regarding her purchasing habits for mosquito repellent spray.

Price	\$1	\$1.5	\$2	\$2.5	\$3	\$3.5	\$4
Bottles (13/4/2024)	5	4	3	3	2	2	1
Bottles (22/6/2024)	5	4	4	3	2	2	1

   Can we say that her demand for mosquito repellent spray has increased?

3. Dwight's demand for beetroot is given by $p = 100 - 4q$, where p is the price in dollars and q is the quantity in lbs.
   (a) Does Dwight's demand follow the law of demand?
   (b) Provide a possible demand equation where Dwight's demand has increased.
   (c) Provide a possible demand equation where Dwight's demand has decreased.
4. What kind of good would you expect to exhibit an almost *vertical* demand curve?
5. What kind of good would you expect to exhibit an almost *horizontal* demand curve?
6. It can be shown that for every linear demand function $p = a - bq$, where p is the price, q is the quantity, and a, b are constants, the elasticity of demand at any quantity q is given by

$$\varepsilon_d = 1 - \frac{a/b}{q}.$$

   (a) For the demand equation $p = 120 - 4q$, calculate the elasticity of demand at $q = 20$.
   (b) For the demand equation $p = 120 - 4q$, calculate the quantity for which $\varepsilon_d = -1$.

7. True or false? An inelastic linear demand curve is inelastic at all of its points; and an elastic linear demand curve is elastic at all of its points.
8. True or false? The elasticity of a linear demand is the gradient of the demand.
9. [OPTIONAL – requires knowledge of calculus] Prove that elasticity of demand for a linear demand function is indeed given by the formula in task 6.

Answer Key

1. Colette's weekly demand for bubble tea is given in the following table.

Price	$1	$2	$3	$4	$5	$6	$7
Cups per week	8	6	5	4	3	2	1

(a) Does Colette's demand follow the *law of demand*?

The law of demand states that price and quantity demanded are inversely related. Here they are indeed inversely related, so the law of demand holds.

(b) How much will her *demand* increase if the price decreases from $5 to $4?

This question cannot be answered as stated — demand is the entire table, not a single value. We can only say that if price decreases from $5 to $4, her quantity demanded will increase from 3 to 4 cups. Recall: 'Demand and quantity demanded are two entirely different concepts. Demand is a relationship; quantity demanded is a variable in this relationship.'

(c) How would an *increase* in Colette's *demand* be represented in the table above?

An increase in demand means that Colette would buy more at every price than she did before. In the table, this would be represented by higher quantities demanded across all price levels. For instance,

Price	*$1*	*$2*	*$3*	*$4*	*$5*	*$6*	*$7*
Cups per week	*10*	*7*	*6*	*5*	*4*	*3*	*2*

(d) Colette also likes Frappuccino. Could a decrease in the price of Frappuccino from $5 to $4, affect her demand for bubble tea?

Yes — a cheaper Frappuccino would increase Colette's quantity demanded of Frappuccino, and she would likely consume less bubble tea regardless of its price.

Price	*$1*	*$2*	*$3*	*$4*	*$5*	*$6*	*$7*
Cups per week	*7*	*5*	*4*	*3*	*1*	*0*	*0*

Note that the decrease in the price of Frappuccino does not cause Colette to entirely replace bubble tea with Frappuccino; she merely substitutes some bubble tea with Frappuccino because Frappuccino is now relatively cheaper.

(e) Name 3 factors that could cause Colette's *demand* for bubble tea to *decrease*.

(i) Her income. With less to spend, she may reduce her consumption of bubble tea. (ii) Her preferences. If she decided to consume more healthy beverages, she would decrease her consumption regardless of the price. (iii) Prices of related goods. A decrease in the price of Frappuccino, as explained above, would reduce her demand for bubble tea.

2. Marianna was surveyed on two different dates regarding her purchasing habits for mosquito repellent spray.

Price	$1	$1.5	$2	$2.5	$3	$3.5	$4
Bottles (13/4/2024)	5	4	3	3	2	2	1
Bottles (22/6/2024)	5	4	4	3	2	2	1

Can we say that her demand for mosquito repellent spray has increased?

Yes. For the same price of $2, Marianna bought 3 bottles in April and 4 bottles in June. In general, any change in the quantities in the table constitutes a change in demand. A change in quantity demanded due to a price change, by contrast, would be represented by moving from one column of the table to another, with the table itself remaining unchanged.

3. Dwight's demand for beetroot is given by $p = 100 - 4q$, where p is the price in dollars and q is the quantity in lbs.

   (a) Does Dwight's demand follow the law of demand?

   It does — as price increases, quantity demanded decreases, so they are inversely related.

   (b) Provide a possible demand equation where Dwight's demand has increased.

   One possibility is $p = 101 - 4q$. With the original equation, Dwight would pay \$96 for 1 lb; with the new equation he is willing to pay \$97 for 1 lb. Another possibility is $p = 100 - 3q$, which similarly results in a higher willingness to pay at every quantity.

   (c) Provide a possible demand equation where Dwight's demand has decreased.

   Any equation with a constant below 100 (e.g. $p = 99 - 4q$) or a steeper gradient (e.g. $p = 100 - 5q$) would represent a decrease in demand.

4. What kind of good would you expect to exhibit an almost *vertical* demand curve?

   A vertical demand curve implies that the consumer buys the same quantity regardless of price. This describes necessities with no substitutes — such as emergency surgery or lifesaving medication — or products associated with severe addiction, such as heroin.

5. What kind of good would you expect to exhibit an almost *horizontal* demand curve?

   A horizontal demand curve implies that the consumer will buy the product only at a specific price — not above it, since perfect substitutes are available at that price, and not below it, since no seller would offer it cheaper. A common example is price-controlled goods, where the government sets the price and no transaction can occur at a different price (e.g. rent controls in NYC, bottled water in Greece, stamps in Singapore).

6. It can be shown that for every linear demand function $p = a - bq$, where p is the price, q is the quantity, and a, b are constants, the elasticity of demand at any quantity q is given by

$$\varepsilon_d = 1 - \frac{a/b}{q}.$$

   (a) For the demand equation $p = 120 - 4q$, calculate the elasticity of demand at $q = 20$.

   Here $a = 120$ and $b = 4$. Then, $\frac{a}{b} = 30$; thus, $\varepsilon_d = 1 - \frac{30}{20} = -0.5$.

   (b) For the demand equation $p = 120 - 4q$, calculate the quantity for which $\varepsilon_d = -1$.

   Setting $\varepsilon_d = -1$: $1 - \frac{30}{q} = -1$ or $\frac{30}{q} = 2$ or $2q = 30$ or $q = 15$.

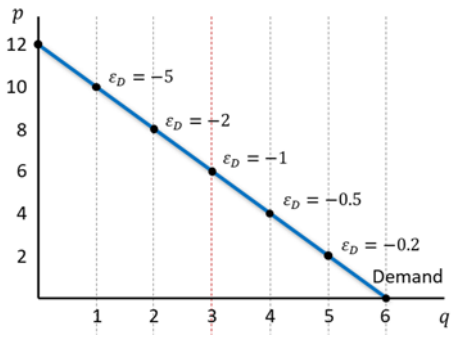
   This formula makes elasticity calculations straightforward — use it!

7. True or false? An inelastic linear demand curve is inelastic at all of its points; and an elastic linear demand curve is elastic at all of its points.

   False. Any linear demand curve with a negative gradient contains both an elastic and an inelastic portion. Using the formula from task 6:

$$\varepsilon_d = 1 - \frac{a/b}{q}$$

   for $q = 0.5 \cdot \frac{a}{b}$, elasticity equals -1. For smaller quantities, demand is elastic ($\varepsilon_d < -1$); for larger quantities, it is inelastic ($\varepsilon_d > -1$). For instance, along $p = 12 - 2q$, elasticity is shown in the figure: for $q < 3$ demand is elastic, and for $q > 3$ it is inelastic.



8. True or false? The elasticity of a linear demand is the gradient of the demand.

   False. For any linear demand function $p = a - bq$, the gradient is $-b$ while elasticity is

   $$\varepsilon_d = 1 - \frac{a/b}{q}.$$

   The gradient is constant along the demand curve, whereas elasticity varies with quantity. Thus, $\varepsilon_d \neq -b$.

9. [OPTIONAL – requires knowledge of calculus] Prove that elasticity of demand for a linear demand function is indeed given by the formula in task 6.

   The first derivative of a linear demand $p = a - bq$, is

   $$\frac{dp}{dq} = -b. \quad (1)$$

   Elasticity of demand is defined as

   $$\varepsilon_d = \frac{dq}{dp} \cdot \frac{p}{q}. \quad (2)$$

   Notice that dq/dp in equation (2) is the inverse of the left-hand-side of equation (1). Thus, (2) can be written as

   $$\varepsilon_d = -\frac{1}{b} \cdot \frac{p}{q},$$

   in which we can substitute $p = a - bq$ from the demand:

   $$\varepsilon_d = -\frac{1}{b} \cdot \frac{a - bq}{q} = \frac{-a + bq}{bq} = \frac{-\frac{a}{b} + q}{q} = \frac{-\frac{a}{b}}{q} + \frac{q}{q} = 1 - \frac{a/b}{q}. \quad [QED]$$

Please report any typos, mistakes, or suggestions for improvement to kmarinakis@smu.edu.sg.