

Find The Consumers' Surplus At A Price Level Of $P=7$ For The Demand Equation $D(q)=300-0.1q$ where Q Is Quantity.

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Understanding consumer surplus is fundamental in economics as it measures the benefit consumers receive when they purchase a product at a price lower than the maximum they are willing to pay. In this article, we will explore how to determine the consumers' surplus at a specific price point, particularly when given a demand function. Our focus will be on calculating the consumer surplus at a price level of $P=7$ for the demand equation $D(q) = 300 - 0.1q$, where Q represents the quantity demanded.

What Is Consumer Surplus?

Consumer surplus is a key concept in microeconomics that reflects the difference between the highest price consumers are willing to pay for a good or service and the actual market price they pay. It is an indicator of the additional benefit or value consumers derive from purchasing a product at a lower price.

Key points about consumer surplus:

- It measures consumer welfare.
- It is represented graphically as the area between the demand curve and the market price line, up to the quantity purchased.
- It can be calculated mathematically when the demand function is known.

Understanding the Demand Equation $D(q)=300 - 0.1q$

The demand function given is:

$$\backslash [D(q) = 300 - 0.1q \backslash]$$

where:

- $D(q)$ is the maximum price consumers are willing to pay for quantity q .
- q is the quantity demanded.

This demand function indicates a downward-sloping demand curve, typical in most markets, meaning as quantity increases, the maximum price consumers are willing to pay decreases.

Interpreting the demand function:

- When $q = 0$, $D(0) = 300$. Consumers are willing to pay up to 300 units of currency for zero quantity (the theoretical maximum price).
- When $D(q) = 0$, solving for q gives the quantity demanded when the price drops to zero:

$$\begin{aligned} 0 &= 300 - 0.1q \\ 0.1q &= 300 \\ q &= \frac{300}{0.1} = 3000 \end{aligned}$$

Hence, at a price of zero, the maximum quantity demanded is 3000 units.

Calculating Consumer Surplus at Price $P=7$

Our goal is to find the consumer surplus when the market price is set at $P=7$.

Step 1: Find the quantity demanded at $P=7$.

Using the demand equation:

$$\begin{aligned} D(q) &= 300 - 0.1q \end{aligned}$$

Set $D(q) = 7$:

$$\begin{aligned} 7 &= 300 - 0.1q \\ 0.1q &= 300 - 7 = 293 \\ q &= \frac{293}{0.1} = 2930 \end{aligned}$$

So, at a price of 7, the quantity demanded is 2930 units.

Step 2: Understand the demand curve and consumer surplus area.

Graphically, the demand curve is a straight line from $(q=0, P=300)$ to $(q=3000, P=0)$.

The consumer surplus is the area of the triangle between:

- The maximum willingness to pay (the demand curve at $(q=0)$, which is 300),
- The market price line $(P=7)$,
- The quantity demanded at $(P=7)$ (which is 2930 units).

Step 3: Calculate the maximum willingness to pay at $(q=0)$.

At $(q=0)$, maximum price $(P_{\max} = 300)$.

Step 4: Find the consumer surplus.

Consumer surplus (CS) is the area of the triangle:

$$CS = \frac{1}{2} \times \text{Base} \times \text{Height}$$

- Base: the quantity demanded at $(P=7)$, which is 2930 units.
- Height: the difference between the maximum willingness to pay and the market price:

$$P_{\max} - P = 300 - 7 = 293$$

Therefore:

$$CS = \frac{1}{2} \times 2930 \times 293$$

Calculate:

$$CS = 0.5 \times 2930 \times 293$$

Multiplying:

$$= (2930 \times 293):$$

Break down:

$$=$$

$$2930 \times 293 = 2930 \times (300 - 7) = 2930 \times 300 - 2930 \times 7$$

$$= 879000 - 20510 = 858490$$

$$= 858490$$

Subtract:

$$879000 - 20510 = 858490$$

Now, compute the consumer surplus:

$$CS = 0.5 \times 858490 = 429245$$

Final answer:

$$\boxed{\text{Consumer Surplus at } P=7 = 429,245 \text{ units of currency}}$$

Summary of the Calculations

Step	Description	Result
1	Find q at $P=7$	$q=2930$ units
2	Demand at $q=0$	$P=300$ units
3	Consumer surplus formula	$CS = \frac{1}{2} \times 2930 \times (300 - 7)$
4	Calculate CS	$429,245$ units of currency

Implications of Consumer Surplus in Market Analysis

Calculating consumer surplus provides valuable insights into market

efficiency and consumer welfare. A higher consumer surplus indicates that consumers are benefiting significantly from the current market price, which can influence pricing strategies and policy decisions.

Benefits of understanding consumer surplus include:

- Assessing the impact of price changes.
- Evaluating the efficiency of markets.
- Informing government policies such as taxation or subsidies.
- Analyzing the effects of market interventions.

Additional Considerations

While the calculation above assumes a perfect linear demand curve, real-world demand may exhibit non-linear characteristics, requiring more complex calculus-based methods. Additionally, consumer surplus is just one aspect of overall market welfare, which also includes producer surplus and total social welfare.

Conclusion

By analyzing the demand function $(D(q) = 300 - 0.1q)$, we determined that at a price of 7, the consumer surplus amounts to 429,245 units of currency. This calculation involved identifying the quantity demanded at the given price, understanding the demand curve, and computing the area of the triangle representing consumer benefit. Such analyses are crucial for businesses and policymakers aiming to optimize pricing strategies and understand market dynamics.

In summary:

- The demand equation allows us to find the maximum willingness to pay and the quantity demanded at any given price.
- Consumer surplus can be calculated as the area of a triangle using demand data.
- At $(P=7)$, consumers enjoy a surplus of approximately 429,245 units of currency, illustrating significant consumer benefit at this price point.

Understanding and calculating consumer surplus helps in making informed economic decisions, fostering efficient markets, and enhancing consumer

welfare.

Would you like to explore how consumer surplus changes at different price levels or how to calculate producer surplus?

Frequently Asked Questions

What is the demand function given in the problem?

The demand function is $D(q) = 300 - 0.1q$.

How do you determine the consumer's surplus at a price level of $P=7$?

Consumer's surplus is calculated as the area of the triangle between the demand curve and the price line, up to the quantity demanded at $P=7$.

What is the quantity demanded when the price is set at $P=7$?

Set $P=7$ in the demand equation: $7 = 300 - 0.1q$, then solve for q : $q = (300 - 7) / 0.1 = 293 / 0.1 = 2930$ units.

How do you calculate the consumer's surplus at $P=7$?

Consumer's surplus = $(1/2)$ (Maximum price consumers are willing to pay - P) Quantity demanded at $P=7$. The maximum price is found where quantity demanded drops to zero.

What is the maximum price consumers are willing to pay according to the demand function?

The maximum price is when $q=0$, which is $D(0)=300$, so $P_{\max}=300$.

What is the numerical value of the consumer's surplus at $P=7$?

Consumer's surplus = $(1/2) (300 - 7) 2930 = 0.5 \cdot 293 \cdot 2930 = 429,445$ units of currency.

Additional Resources

Find The Consumers' Surplus At A Price Level Of $P=7$ For The Demand Equation $D(q)=300 - 0.1q$ where Q Is Quantity

Understanding consumer surplus is fundamental in microeconomics, as it measures the difference between what consumers are willing to pay and what they actually pay. In this detailed analysis, we will explore how to find the consumers' surplus at a specific price point, $P=7$, given a particular demand equation $D(q) = 300 - 0.1q$. This process involves understanding the demand function, identifying the relevant quantities, and calculating the surplus accordingly. Such an exercise not only enhances comprehension of consumer behavior but also provides insights into market efficiency and welfare analysis.

Understanding the Demand Equation and Its Components

Before delving into the calculation of consumer surplus, it is essential to understand the demand equation and its implications.

Demand Equation Explanation

The demand function provided is:

$$D(q) = 300 - 0.1q$$

Here:

- $D(q)$ represents the maximum price consumers are willing to pay for a quantity q .
- The equation indicates that as quantity increases, the maximum willingness to pay decreases linearly.
- The intercept at $q=0$ is 300, meaning consumers are willing to pay up to 300 units of currency for zero quantity (theoretically, the maximum price they are willing to pay).
- The slope, -0.1 , indicates that for each additional unit of quantity demanded, the maximum price decreases by 0.1 units.

Implications of the Demand Equation

This linear demand curve suggests a downward-sloping relationship typical in

most markets, reflecting the law of demand. As price decreases, quantity demanded increases, and vice versa.

Features:

- Linearity simplifies calculations and visualization.
- Negative slope confirms the inverse relationship between price and quantity.
- Maximum willingness to pay at zero quantity is 300, providing a useful benchmark for consumer surplus calculations.

Calculating the Quantity Demanded at P=7

To find the consumer surplus at a price level of $P=7$, the first step is to determine the corresponding quantity demanded at this price.

Solving for Q

Given the demand equation $D(q) = 300 - 0.1q$, and knowing that at $P=7$, the consumer's maximum willingness to pay is 7, we set:

$$D(q) = 7$$

Substituting:

$$7 = 300 - 0.1q$$

Rearranged to solve for q:

$$0.1q = 300 - 7$$

$$0.1q = 293$$

$$q = 293 / 0.1$$

$$q = 2930$$

Result: At a price of 7, the demanded quantity Q is 2930 units.

Interpretation

This means consumers are willing to purchase 2930 units when the market price is 7. Knowing this quantity will be crucial in calculating the consumer surplus, as it represents the quantity consumers actually buy at that price.

Understanding Consumer Surplus

Consumer surplus is a key concept in welfare economics, representing the benefit consumers receive when they pay less than their maximum willingness to pay.

Definition and Formula

Mathematically, consumer surplus (CS) is the area of the triangle between the demand curve and the market price, up to the quantity demanded.

For a linear demand curve, the consumer surplus can be calculated as:

$$CS = 0.5 (\text{Maximum Willingness to Pay} - \text{Market Price}) \text{ Quantity Demanded}$$

Alternatively, it can be visualized as the area of the triangle under the demand curve, above the market price level, from zero to Q.

Key Components for Calculation

- Maximum willingness to pay (intercept of demand curve): 300
- Market price (P): 7
- Quantity demanded at P=7: 2930 units

Calculating Consumer Surplus at P=7

Using the formula:

$$CS = 0.5 (\text{Maximum willingness to pay} - \text{Market price}) Q$$

Plugging in the known values:

$$CS = 0.5 (300 - 7) 2930$$

First, calculate the difference:

$$300 - 7 = 293$$

Then, multiply:

$$CS = 0.5 \cdot 293 \cdot 2930$$

Calculating step-by-step:

$$1. \ 0.5 \ 293 = 146.5$$

$$2. \ 146.5 \ 2930 = ?$$

Let's compute:

$$146.5 \ 2930$$

Break down:

$$- \ 146.5 \ 2000 = 293,000$$

$$- \ 146.5 \ 900 = 131,850$$

$$- \ 146.5 \ 30 = 4,395$$

Adding these:

$$293,000 + 131,850 + 4,395 = 429,245$$

Therefore, the consumer surplus (CS) is approximately 429,245 units of currency.

Visualizing the Consumer Surplus

Understanding the graphical representation enhances comprehension.

Graphical Representation

- The demand curve is a straight line from (Q=0, P=300) down to (Q=3000, P=0).
- The market price is P=7, a horizontal line intersecting the demand curve at Q=2930.
- The consumer surplus is the area of the triangle above P=7, between the demand curve and the market price, from Q=0 to Q=2930.

Features of the Surplus Area

- Base of the triangle: 2930 units (quantity demanded at P=7).
- Height of the triangle: 293 units (difference between maximum willingness to pay and market price).

Additional Considerations and Market Implications

While the calculation provides a clear numerical estimate of consumer surplus, several factors influence its interpretation and significance.

Market Efficiency

- The consumer surplus represents an additional welfare benefit derived from the market.
- A high consumer surplus indicates consumers are gaining significant benefits from purchasing at the market price, possibly suggesting a competitive market environment.

Effect of Price Changes

- If the price decreases below 7, consumer surplus increases, as consumers pay less and buy more.
- If the price increases, consumer surplus decreases, potentially leading to a reduction in consumer welfare.

Limitations and Assumptions

- Assumes the demand function is perfectly linear and accurately represents consumer preferences.
- Assumes all units are sold at the same price without discounts or differential pricing.
- Does not account for externalities, supply side considerations, or market imperfections.

Pros and Cons of Using This Approach

Pros:

- Simplicity: Linear demand equations make calculations straightforward.
- Clarity: Provides clear insight into how consumer surplus relates to maximum willingness to pay and market prices.
- Visual Aid: Graphical interpretation helps in understanding welfare effects.

Cons:

- Oversimplification: Real-world demand curves may be non-linear or affected by other factors.
- Static Analysis: Does not account for dynamic market changes over time.
- Assumption of Rationality: Assumes consumers always act rationally and have complete information.

Conclusion

Calculating the consumer surplus at a specific price point, such as $P=7$, using the demand equation $D(q) = 300 - 0.1q$, illustrates the fundamental relationship between price, quantity demanded, and consumer welfare. By determining the quantity demanded at that price and applying the triangular area formula, we find that the consumer surplus is approximately 429,245 units of currency, a substantial benefit for consumers in this market scenario. Such analyses are vital for policymakers, firms, and economists interested in market efficiency, consumer welfare, and the impacts of pricing strategies. Understanding these concepts provides a foundation for more advanced welfare analysis and market intervention strategies, ultimately contributing to more informed economic decision-making.

[Find The Consumers Surplus At A Price Level Of P 7 For The Demand Equation \$D\(Q\) = 300 - 0.1Q\$ where Q Is Quantity](#)

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