Given The Demand Function D(p) = 200 - 3p?, (- Find The Elasticity Of Demand At A Price Of $5 At This

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Understanding how demand responds to price changes is a fundamental aspect of economics, especially for businesses aiming to optimize pricing strategies. When analyzing demand functions, elasticity measures the sensitivity of quantity demanded to changes in price. In this article, we will explore how to calculate the price elasticity of demand for the given demand function D(p) = 200 - 3p?, specifically at a price point of $5. Along the way, we will delve into the concept of elasticity, its significance, and how to interpret the results within the context of economic decision-making.

What Is Price Elasticity of Demand?

Definition

Price elasticity of demand (PED) quantifies the percentage change in quantity demanded resulting from a one-percent change in price. It is expressed mathematically as:

$$
\text{Elasticity (E)} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}
$$

or, more precisely,

$$
E = \frac{dQ/dp \times p}{Q}
$$

where:
- Q is the quantity demanded,
- p is the price,
- dQ/dp is the derivative of the demand function with respect to price.

Understanding the Demand Function D(p) = 200 - 3p

Interpreting the Demand Function

The demand function $D(p) = 200 - 3p$ indicates the relationship between the price p and the quantity demanded $D(p)$. Specifically:

- When the price is zero, demand is at its maximum, $D(0) = 200$.
- As the price increases, demand decreases linearly at a rate of 3 units per dollar.

Calculating Quantity Demanded at $5

To analyze the elasticity at a price of $5, first, determine the quantity demanded at that price:

$$
D(5) = 200 - 3 \times 5 = 200 - 15 = 185
$$

Thus, at a price of $5, the quantity demanded is 185 units.

Calculating the Price Elasticity of Demand at $5

Step 1: Find the derivative dQ/dp

Given the demand function:

$$
Q(p) = 200 - 3p
$$

the derivative with respect to p is:

$$
\frac{dQ}{dp} = -3
$$

This derivative indicates that for each $1 increase in price, the quantity demanded decreases by 3 units.

Step 2: Apply the elasticity formula

The elasticity at a specific point is given by:

$$
E = \frac{dQ/dp \times p}{Q}
$$

Substituting the known values at $p = 5$:

\[

$$
E = \frac{-3 \times 5}{185} = \frac{-15}{185}
$$

Step 3: Interpret the result

Calculate:

$$
E \approx -0.0811
$$

The negative sign indicates the inverse relationship between price and demand, which is typical. For reporting purposes, the absolute value is often considered to understand the magnitude of elasticity:

$$
|E| \approx 0.0811
$$

Interpreting the Elasticity Result

Elasticity Magnitude and Demand Behavior

An elasticity of approximately 0.0811 indicates that demand at a price of $5 is inelastic. Specifically:

- Inelastic demand ($|E| < 1$): Consumers are relatively unresponsive to price changes.
- Elastic demand ($|E| > 1$): Consumers are highly responsive to price changes.
- Unit elastic ($|E| = 1$): Percentage change in demand equals the percentage change in price.

Since our calculated elasticity is much less than 1, a 1% increase in price would lead to less than a 0.1% decrease in quantity demanded, implying that demand is relatively insensitive at this price point.

Implications for Pricing Strategies

Knowing that demand is inelastic at a price of $5 suggests that:

- Raising prices slightly could increase total revenue, as the decrease in quantity demanded will be proportionally smaller.
- Conversely, lowering prices may not significantly boost demand or revenue.

Additional Insights and Applications

Elasticity at Different Price Points

Because demand is linear, elasticity varies along the demand curve:

- At higher prices, demand tends to be more elastic.
- At lower prices, demand is often more inelastic.

Calculating elasticity at different points can help businesses determine optimal pricing strategies.

Calculating Elasticity at Other Prices

For example, at $p = 10$:

$$
Q = 200 - 3 \times 10 = 170
$$

$$
E = \frac{-3 \times 10}{170} \approx -0.176
$$

Still inelastic but slightly more responsive than at \$5.

Conclusion

Calculating the price elasticity of demand provides valuable insights into consumer behavior and helps inform effective pricing policies. For the demand function $D(p) = 200 - 3p$, the elasticity at a price of \$5 is approximately -0.0811, indicating highly inelastic demand at this price point. Businesses operating in such markets can consider these factors to optimize revenue—potentially increasing prices without significantly reducing demand. Understanding the nuanced relationship between price and demand elasticity across different price levels is essential for strategic decision-making in competitive markets.

Summary of Key Points

- Price elasticity of demand measures responsiveness of quantity demanded to price changes.

- For $D(p) = 200 - 3p$, elasticity is calculated as $E = \frac{dQ/dp \times p}{Q}$.

- At a price of \$5, demand is highly inelastic with an elasticity of approximately -0.0811.

- Inelastic demand suggests that price increases may boost revenue without significant drops in sales.

- Elasticity varies along the demand curve; understanding this helps optimize pricing strategies across different market conditions.

Frequently Asked Questions

What is the demand function provided in the problem?

The demand function is D(p) = 200 - 3p.

How do you calculate the price elasticity of demand at a specific price?

Price elasticity of demand is calculated as (dD/dp) (p / D(p)), where dD/dp is the derivative of the demand function with respect to price.

What is the derivative of the demand function D(p) = 200 - 3p?

The derivative dD/dp = -3.

How do you find the quantity demanded when the price is $5?

Substitute p = 5 into D(p): D(5) = 200 - 35 = 200 - 15 = 185 units.

What is the elasticity of demand at a price of $5?

Elasticity = (dD/dp) (p / D(p)) = (-3) (5 / 185) ≈ -0.0811.

What does the calculated elasticity indicate about demand at a $5 price point?

Since the absolute value of elasticity is less than 1, demand is inelastic at that price, meaning consumers are relatively insensitive to price changes around $5.

Additional Resources

Given The Demand Function D(p) = 200 - 3p: An In-Depth Analysis of Price Elasticity at a $5 Price Point

Understanding the concept of price elasticity of demand is fundamental for businesses, economists, and policymakers alike. It provides insight into how consumers respond to price changes, helping determine optimal pricing strategies and forecast revenue impacts. In this article, we will explore the demand function D(p) = 200 - 3p, focusing specifically on calculating and interpreting the price elasticity of demand at a price of $5. By dissecting the mathematical foundation and practical implications, readers will gain a comprehensive understanding of demand responsiveness within this context.

What is the Demand Function D(p) = 200 - 3p?

The demand function D(p) = 200 - 3p is a linear representation of the relationship between the price of a good (p) and the quantity demanded (D). The function indicates that as the price increases, the quantity demanded decreases, which aligns with the law of demand. Specifically:

- When p = 0, the maximum demand is 200 units.
- When p increases, demand decreases by 3 units for each dollar increase in price.

This linear model simplifies understanding demand behavior over a specific price range and allows for straightforward calculations of elasticity at any given price point.

Understanding Price Elasticity of Demand

Definition and Significance

Price elasticity of demand (E_d) measures the percentage change in quantity demanded resulting from a one percent change in price. It is calculated as:

E_d = (% Change in Quantity Demanded) / (% Change in Price)

or, more precisely for a point on a demand curve:

E_d = (dQ/dP) (P / Q)

where:

- dQ/dP is the derivative of demand with respect to price,
- P is the specific price point,
- Q is the quantity demanded at that price.

The value of E_d indicates the demand's responsiveness:

- If |E_d| > 1, demand is elastic (high sensitivity).
- If |E_d| < 1, demand is inelastic (low sensitivity).
- If |E_d| = 1, demand is unit elastic.

Understanding elasticity helps firms decide whether to raise or lower prices, predict revenue changes, and analyze market behavior.

Features of Elasticity

- Elastic demand: Small price changes lead to large changes in quantity

demanded.
- Inelastic demand: Price changes have little effect on demand.
- Unit elasticity: Percentage change in quantity demanded equals the percentage change in price, leading to constant total revenue.

Calculating Elasticity at a Price of $5

Step 1: Find Quantity Demanded at p = $5

Using the demand function $D(p) = 200 - 3p$,

$Q = 200 - 3(5) = 200 - 15 = 185$ units

At a price of $5, consumers demand 185 units.

Step 2: Calculate the Derivative dQ/dP

Since $D(p) = 200 - 3p$ is linear,

$dQ/dP = -3$

This derivative indicates the rate at which quantity demanded changes with respect to price, which is constant across all prices in this model.

Step 3: Apply the Elasticity Formula

Using the point elasticity formula:

$E_d = (dQ/dP) (P / Q)$

Plug in the values:

$E_d = (-3) (5 / 185) \approx -3 \; 0.02703 \approx -0.0811$

Interpretation:

The elasticity of demand at a price of $5 is approximately −0.0811. The negative sign reflects the inverse relationship between price and demand, but in magnitude, we focus on the absolute value to interpret responsiveness.

Interpreting the Elasticity Result

Given that $|E_d| \approx 0.0811$, which is much less than 1, this indicates that demand is highly inelastic at the $5 price point. In practical terms:

- Consumers are relatively insensitive to small price changes around this price.
- A 1% increase in price would lead to only about a 0.0811% decrease in quantity demanded.
- Conversely, a 1% decrease in price would result in roughly a 0.0811% increase in demand.

This suggests that, at this price, consumers are less likely to significantly change their purchasing behavior in response to price fluctuations.

Implications for Businesses and Policymakers

Pricing Strategies

For firms operating within this demand framework:

- Raising prices slightly above $5 might not significantly reduce demand, allowing for potential profit maximization.
- Lowering prices to stimulate demand is unlikely to yield substantial increases in sales volume at this point.
- Since demand is inelastic here, revenue could actually increase if prices are increased, provided the cost structure supports it.

Revenue Considerations

Total revenue (TR) = Price (P) Quantity demanded (Q)

At p = $5:

TR = 5 185 = $925

If the firm considers a 10% increase in price to $5.50:

New demand:

Q_new = 200 - 3(5.50) = 200 - 16.5 = 183.5 units

New total revenue:

TR_new = 5.50 183.5 ≈ $1009.25

Revenue increases slightly, indicating that, in the inelastic region, raising prices can boost total revenue.

Limitations of the Model

While the linear demand function simplifies calculations, real-world demand often exhibits non-linear characteristics. Factors such as consumer preferences, substitute goods, and market conditions can alter elasticity estimates. Additionally:

- The constant derivative assumption ($dQ/dP = -3$) may not hold across broader price ranges.
- External influences like advertising, income levels, or seasonal effects are not captured here.

Pros and Cons of Using This Demand Model

Pros:

- Simplicity: Linear functions are easy to analyze mathematically.
- Clarity: Clear relationship between price and demand facilitates straightforward elasticity calculations.
- Predictability: Constant slope allows for easy estimation of demand responses at various prices.

Cons:

- Lack of Realism: Demand curves are often non-linear; linear models may oversimplify real market behavior.
- Limited Range: The model may only be accurate within certain price ranges; extrapolating beyond can lead to inaccuracies.
- Ignores External Factors: External market influences and consumer preferences are not modeled.

Conclusion: The Significance of Demand Elasticity at $5

The analysis of the demand function $D(p) = 200 - 3p$ at a $5 price point reveals a highly inelastic demand scenario. With an elasticity magnitude of approximately 0.0811, consumers show minimal responsiveness to price changes around this level. For businesses, this suggests that small price increases can be advantageous, potentially increasing total revenue without significantly deterring demand. Conversely, efforts to lower prices in hopes of boosting sales may not be fruitful and could diminish revenue.

Understanding the elasticity at specific price points enables firms to fine-tune their pricing strategies, optimize revenue, and better anticipate consumer behavior. While the linear demand model provides a valuable starting point, it is essential to consider real-world complexities and validate models with empirical data for more accurate decision-making. Overall, the ability to compute and interpret demand elasticity equips stakeholders with critical insights into market dynamics and consumer sensitivities, fostering more informed economic and business strategies.

In summary:

- The demand function D(p) = 200 - 3p indicates a linear relationship between price and demand.
- At p = $5, quantity demanded is 185 units.
- The elasticity of demand at this price is approximately -0.0811, indicating highly inelastic demand.
- Businesses can leverage this information to make strategic pricing decisions, understanding that small price changes will have limited impact on demand but can influence revenue outcomes.
- Recognizing the limitations of the model ensures better application and interpretation of elasticity in real-world scenarios.

Final thoughts: Mastery of demand elasticity calculations, especially within specific demand functions, is a valuable tool for economic analysis and strategic planning. It empowers decision-makers to optimize pricing, forecast sales, and understand consumer behavior more precisely.

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