# Quiz Practice – Detailed Solutions with Formulas and Graphs

## Q1. How does a drought that increases orange prices affect the Orange Juice (OJ) market?

OJ supply depends on orange input costs.  
Higher input prices increase production cost → Supply curve shifts left (up).  
At each quantity, producers now require a higher price to cover costs.  
Result: Equilibrium price rises (P↑) and quantity falls (Q↓).  
Formula: Shift in non-price determinant of supply (input cost).  
Graph: See Q1 figure in the PDF.

## Q2. If OJ price rises, what happens in the Apple Juice market (a substitute)?

Substitutes move in opposite directions — if one becomes expensive, demand for the other rises.  
Demand for Apple Juice shifts right (↑).  
Consumers substitute away from OJ toward Apple Juice.  
Result: Both price (P↑) and quantity (Q↑) of Apple Juice increase.  
Formula: Cross-price elasticity of demand (positive for substitutes).  
Graph: Q2 – Apple Juice Demand Shift (Right).

## Q3. If caffeine is banned in sodas, what happens in the coffee market?

Sodas and coffee are substitutes for caffeine.  
Demand for coffee shifts right (↑).  
Consumers turn to coffee to replace soda’s caffeine.  
Result: Price (P↑) and quantity (Q↑) both rise.  
Formula: Cross-price elasticity > 0 (substitute relationship).  
Graph: Q3 – Coffee Demand Shift (Right).

## Q4. How does this soda ban affect coffee producers’ surplus?

Producer surplus (PS) = area above the supply curve and below market price.  
Since price rises, producer surplus increases.  
Formula: PS = ∫ (P\* - S(Q)) dQ – where did we get this formula?   
Graph: Q4 – Producer Surplus Expansion.

## Q5. What happens to quantity supplied of coffee when the price increases?

Movement along the supply curve.  
Quantity supplied increases (Q↑), but the curve itself doesn’t move.  
Higher price makes production more profitable, so suppliers move up along the same curve.  
Formula: Qs = f(P) — change in P causes movement along S.  
Graph: Q5 – Upward Movement Along Supply Curve.

## Q6. Does a price increase change the supply curve itself?

No. “Supply” refers to the entire curve, not a single point.  
Only quantity supplied changes — the supply curve stays fixed.  
Supply shifts only if production technology, input prices, or number of sellers change.  
Graph: Q6 – Supply vs Quantity Supplied.

## Q7. Gasoline tax increases by $0.05/litre (paid by producers). What happens to price and burden?

Tax on producers shifts supply upward by the amount of the tax.  
Formula: Pb - Ps = t  
Buyer’s price increases by less than $0.05 unless demand is perfectly inelastic.  
The tax burden is shared — inelastic side of the market pays more.  
True statements:  
(b) Prices rise by less than $0.05 — True  
(d) The more inelastic the demand, the greater the price rise — True how can we say that?  
Graph: Q7 – Tax Incidence Diagram.

## Q8. If the elasticity of demand for cigarettes is −0.3, and price increases by 15%, what happens to quantity?

Formula: %ΔQ = ε × %ΔP  
%ΔQ = (−0.3) × (15%) = −4.5%  
Quantity falls by 4.5%.  
Inelastic demand → small change in Q for a big change in P. how can we say that?  
Graph: Q8 – Cigarette Demand Inelastic Response.

## Q9. Demand function: Q = 100 - 20P. What’s elasticity when Q = 40?

Step 1: Find P at Q = 40 → P = (100 - 40)/20 = 3  
Step 2: The slope dQ/dP = -20  
Step 3: E = (dQ/dP) × (P/Q) = (-20) × (3/40) = -1.5 (elastic)  
Meaning: |E|>1, so elastic.  
Small price drop leads to larger increase in Q. how can we say that?  
Graph: Q9 – Elastic Region on Demand Curve.-

## Q10. Using Q9, if price falls a little, does total revenue (TR) rise or fall?

Rule: If |E| > 1 → P↓ ⇒ TR↑ where did we get this rule, share the context in slide number and example  
%ΔQ exceeds |%ΔP|, so P×Q goes up.  
Interpretation: Elastic region — cutting prices increases total revenue.   
Graph: Q10 – Revenue Increases (Elastic Range).

## Q11. Demand function Q = 100 - 20P. What’s elasticity when P = 2?

Step 1: Q = 100 - 20(2) = 60  
Step 2: dQ/dP = -20  
Step 3: E = (-20) × (2/60) = -0.67 (inelastic)  
Meaning: |E| < 1 → inelastic. Why?   
Q responds less than proportionally to P.  
Graph: Q11 – Inelastic Region on Demand Curve.

## Q12. Using Q11, if price rises slightly, what happens to total revenue?

Rule: If |E| < 1 → P↑ ⇒ TR↑ WHERE DID YOU GET THIS RULE? Share the example and the slide no.   
Q decreases less than price increase, so total revenue goes up.  
Interpretation: Inelastic region — higher prices boost TR.  
Graph: Q12 – Revenue Rises (Inelastic Range).

How can we sayeastic region or inelastic region by just seeing it?

## Q13. If a firm with elasticity ε = -0.5 sells 1000 units at $10, what price should it charge to sell 1100 units?

Given: ε = -0.5, Q0 = 1000, P0 = 10, Q1 = 1100  
Step 1: %ΔQ = (1100 - 1000)/1000 × 100 = 10%  
Step 2: %ΔP = %ΔQ / ε = 10% / (-0.5) = -20%  
Step 3: P1 = 10 × (1 - 0.20) = 8 HOW?  
New price = $8  
With inelastic demand, larger price cuts are needed to raise sales volume.  
Graph: Q13 – Price Adjustment with Known Elasticity.

# Formula Cheat Sheet

Elasticity: E = (dQ/dP) × (P/Q)  
Finding slope: dQ/dP = E × (Q/P)  
%Δ relationship: %ΔQ = E × %ΔP  
Tax incidence: Pb - Ps = t  
Revenue rule: Elastic ⇒ P↓ TR↑; Inelastic ⇒ P↑ TR↑

## 💡 Clarification: Why dQ/dP = -20 in Q9–Q11

Demand function: Q = 100 - 20P  
  
This looks just like the line equation y = mx + c, where:  
• Q is like y (dependent variable)  
• P is like x (independent variable)  
• -20 is the slope (m)  
• 100 is the intercept (c)  
  
Hence, the slope or derivative of Q with respect to P is constant:  
  
dQ/dP = -20  
  
Interpretation:  
For every $1 increase in price, quantity demanded falls by 20 units.  
  
This derivative is constant because the demand curve is linear. If it were curved (e.g., Q = 100 - 5P²), dQ/dP would change at each point.  
  
Therefore, when we compute elasticity (E = (dQ/dP) × (P/Q)), we use dQ/dP = -20 for all points on this straight-line demand.

You got it, Ritu! Here are crisp, no-nonsense answers (with quick why’s), plus clean graphs you can download at the end. (My opinion: this is the exact level of detail profs love—tight logic + one clear diagram per idea.)

**Q1. Drought raises orange prices → OJ market**

**Answer:** OJ **supply shifts left (up)** → **P↑, Q↓**.  
**Why:** Orange is an input; higher input cost raises marginal cost at every Q.  
**Formula idea:** Supply shift (non-price determinant). No change in demand.

**Q2. OJ price ↑ → Apple Juice (substitute)**

**Answer:** Apple Juice **demand shifts right** → **P↑, Q↑**.  
**Why:** Substitutes: when OJ becomes expensive, buyers switch to AJ.  
**Formula:** Cross-price elasticity (E\_{AJ,OJ} > 0).

**Q3. Soda caffeine ban → Coffee market**

**Answer:** **Demand for coffee shifts right** → **P↑, Q↑**.  
**Why:** Consumers seek caffeine from coffee instead of soda.  
**Formula:** Positive cross-price elasticity (substitution toward coffee).

**Q4. Effect on producer surplus (coffee)**

**Answer:** **PS increases** because market price rises.  
**Where PS formula comes from:**  
[  
\text{PS}=\int\_{0}^{Q^*}\left(P^*-S(q)\right),dq  
]  
It’s the area **between** the market price line (P^*) and the* ***supply (marginal cost)*** *curve up to (Q^*). Derived from summing (integrating) per-unit surplus (P^\*-MC(q)).

**Q5. When price increases, what happens to quantity supplied?**

**Answer:** **Moves up along** the existing supply curve → **Q↑**.  
**Why:** Price change ≠ supply change; it’s a **movement**, not a shift.  
**Formula:** (Q\_s=f(P)) (holding other determinants fixed).

**Q6. Does a price increase shift supply?**

**Answer:** **No.** Supply (the curve) is unchanged. Only **quantity supplied** changes.  
**Supply shifts** when input prices, technology, taxes, or # of sellers change.

**Q7. Gas tax (t=$0.05)/L on producers — price & burden**

**Answer:** Supply shifts **up by (t)** in price space. Buyer price **(P\_b)** rises by **< $0.05** unless demand is perfectly inelastic; sellers receive **(P\_s=P\_b-t)**.  
**Incidence intuition:** The **more inelastic side** bears **more** of the tax.  
**Why does “more inelastic demand ⇒ bigger price rise” hold?** With inelastic demand, buyers reduce Q only a little, so the market clears only if the **buyer price rises more**; algebraically, pass-through to buyers is larger the steeper (more inelastic) the demand.

**Q8. Cigarette demand elasticity (\varepsilon=-0.3); price ↑ 15%**

**Answer:** (%\Delta Q=\varepsilon\cdot %\Delta P=(-0.3)(15%)=-4.5%) → **Q falls 4.5%**.  
**Why call it inelastic?** (|\varepsilon|<1) ⇒ **%ΔQ smaller** than **%ΔP**.

**Q9. (Q=100-20P). Elasticity at (Q=40)**

* (P=(100-40)/20=3)
* (dQ/dP=-20)
* (E=(dQ/dP)(P/Q)=(-20)(3/40)=-1.5) → **Elastic**.  
  **Why “small P drop → larger Q rise”?** Because (|E|>1): **%ΔQ** exceeds **%ΔP**.

**Q10. With Q9, a tiny price fall: does TR rise?**

**Answer:** **Yes, TR rises** (since (|E|>1)).  
**Rule origin (no slide, here’s the derivation):**  
(TR=P\cdot Q).  
(\frac{dTR}{dP}=Q+P\frac{dQ}{dP}=Q\left(1+\frac{P}{Q}\frac{dQ}{dP}\right)=Q(1+E)).

* If (|E|>1\Rightarrow E<-1\Rightarrow 1+E<0): **TR falls when P rises**, so **TR rises when P falls**.  
  **Example:** At (P=3), lowering price slightly increases TR (see TR plot in the PDF).

**Q11. (Q=100-20P). Elasticity at (P=2)**

* (Q=60)
* (E=(-20)(2/60)=-0.67) → **Inelastic** ((|E|<1)).  
  **Why?** % change in Q is **less** than % change in P.

**Q12. With Q11, a slight price rise: what happens to TR?**

**Answer:** **TR rises** (since (|E|<1)).  
**Same derivation:** (dTR/dP=Q(1+E)). If (-1<E<0), then (1+E>0): **raising P raises TR**.  
**Example:** At (P=2), nudging P up increases TR (see TR plot).

**Q13. Known elasticity (\varepsilon=-0.5): from 1000 units @ $10 to 1100 units**

* (%\Delta Q = (1100-1000)/1000 = 10%)
* (%\Delta P = %\Delta Q/\varepsilon = 10%/(-0.5) = -20%)
* **HOW is new price $8?** (P\_1=P\_0(1+%\Delta P)=10\times(1-0.20)=$8).  
  **Interpretation:** With **inelastic** demand, you need a **bigger** price cut to move volume.

**Quick cheats you asked for**

* **Elasticity:** (E=(dQ/dP)\cdot(P/Q))
* **% relation:** (%\Delta Q = E \cdot %\Delta P)
* **Tax:** (P\_b-P\_s=t); burden higher on **more inelastic** side
* **Revenue rule (derived):**
  + (|E|>1): **P↓ ⇒ TR↑**, **P↑ ⇒ TR↓**
  + (|E|<1): **P↑ ⇒ TR↑**, **P↓ ⇒ TR↓**
* **Linear demand tip (spotting regions by eye):** Top half **elastic**, midpoint **unit elastic**, bottom half **inelastic**. (Because (P/Q) is large at the top, small at the bottom.)