

Question	Answer
1	c
2	a
3	c
4	d
5	c
6	c
7	c
8	a

PIN code: 87734

Long A

a)

Deriving BR functions

$$\Pi_1 = p_1 * S^*(v_1 - 0,5v_2 - p_1 + 0,5p_2)$$

$$\Pi_1 = p_1 * S^*(k_1 - p_1 + 0,5p_2) \quad d\Pi_1/dp_1$$

$$= -2 * (p - 0,25 * (p_2 + 2k_1)) * S$$

↓

$$-2 * (p - 0,25 * (p_2 + 2k_1)) * S = 0$$

$$p_1 = 0,25 * (p_2 + 2k_1) \quad p_1 =$$

$$(p_2 + 2v_1 - v_2) / 4$$

Profit function firm 2 (symmetric):

$$\Pi_2 = p_2 * S^*(v_2 - 0,5v_1 - p_2 + 0,5p_1)$$

Symmetry gives:  $p_2 =$ 

$$0,25 * (p_1 + 2k_2)$$

$$p_2 = (p_1 + 2v_2 - v_1) / 4$$

b)

$$v_1 = v_2 = v$$

$$k_1 = k_2 = k$$

NE prices

$$p_1 = 0.25 * ((0.25 * (p_1 + 2k)) + 2k)$$

$$p_1 = (2k) / 3$$

$$= (2v - v) / 3$$

$$\mathbf{p_1 = v / 3}$$

Symmetry gives: **p2**

$$\mathbf{= v / 3}$$

Where  $v_1 = 1$ ,  $v_2 = 1$ ,  $S = 200$  **p1**

$$\mathbf{= p_2 = 0,3333}$$

Profits:

$$Pi_1 = Pi_2 = Pi$$

$$Pi = 0,3333 * 200 * (1 - 0,5 * 1 - 0,3333 + 0,5 * 0,3333)$$

$$\mathbf{Pi = 22,22}$$

c)

where  $v_1 = 1.25$ ,  $v_2 = 1$  using

BR functions from A:

$$p_1 = (((p_1 + 2 * 1 - 1.25) / 4) + 2 * 1.25 - 1) / 4$$

$$\mathbf{p_1 = 0,45}$$

$$p_2 = (0,45 + 2 * 1 - 1.25) / 4$$

$$\mathbf{p_2 = 0,3}$$

Profits:

$$Pi_1 = 0,45 * 200 * (1.25 - 0,5 * 1 - 0,45 + 0,5 * 0,3)$$

$$\mathbf{Pi_1 = 40,5}$$

$$Pi_2 = 0,3 * 200 * (1 - 0,5 * 1.25 - 0,3 + 0,5 * 0,45)$$

$$\mathbf{Pi_2 = 18}$$

d)

Profit if  $S = 200$  given the investment cost of 30:

$$\pi_1 = 40,5 - 30$$

$$\pi_1 = 10,5$$

(this function shows profits in c) but minus the fixed R&amp;D investment)

Answer here: Firm 1 would not make the investment since the profits are lower if they invest in R&D to improve quality ( $22,22 > 10,5$ )

Profit if  $S = 400$  given the investment cost of 30:

Profit without investment:

$$\pi_1 = 0,45 * 400 * (1,25 - 0,5 * 1 - 0,45 + 0,5 * 0,3)$$

$$\pi_1 = 81$$

Profit with investment:

$$\pi_1 = 81 - 30$$

$$\pi_1 = 51$$

Answer here: Firm 1 would make the investment since the profits are higher if they invest in R&D to improve quality ( $51 > 10,5$ )

This is clearly an endogenous sunk cost industry where sunk costs like investments in R&D in this case pay off as the market size gets larger. When market size increases in endogenous sunk cost industries it typically leads to more concentrated outcomes, where asymmetries (like quality investments) give the incumbents the ability to enjoy higher profits. If this was an exogenous sunk cost industry, quality investments wouldn't matter as much, and a larger market size would lead to more firms entering and more fragmentation of the market.

e)

This wouldn't be a violation of competition laws as there is no abuse by a dominant firm to try to kill competition or keep other firms from entering (there's no restriction or distortion of competition). Quality investments are just part of regular competition in a market in order to try to differentiate one's product and gain market power. Price for firm 1's product is of course higher but their quality is also better (which justifies the higher price). Also, firm 2's price for the product which has the same quality as before is lower than before so it doesn't create a dead weight loss that hurts consumer surplus.

## Long B

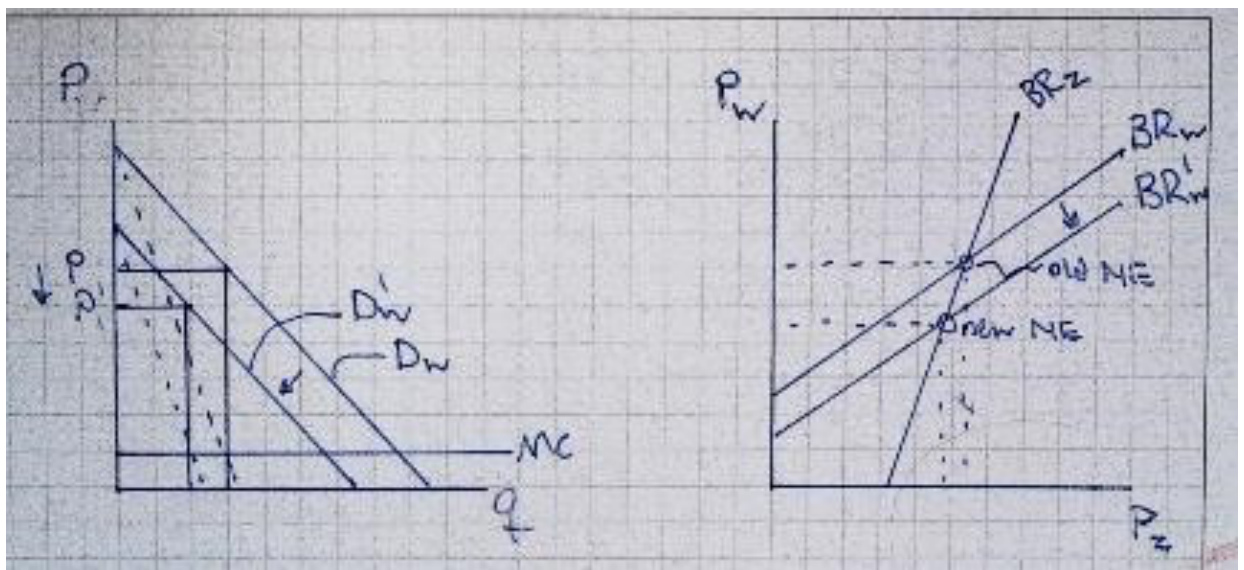
1)

Vertical differentiation means that at equal prices all consumers are going to buy the higher quality product with better performance. If both Zepbound and Wegovy had the same price as the old generation of drugs (which have worse performance in terms of weight loss %, and have more side effects) everyone would buy Zepbound and Wegovy.

Horizontal differentiation means at equal prices consumers are going to choose differently due to tastes and preferences. If Zepbound and Wegovy had the same price, consumers would choose differently because once they've found a drug that works, they are loyal to that product and the switching cost of trying the other product is high.

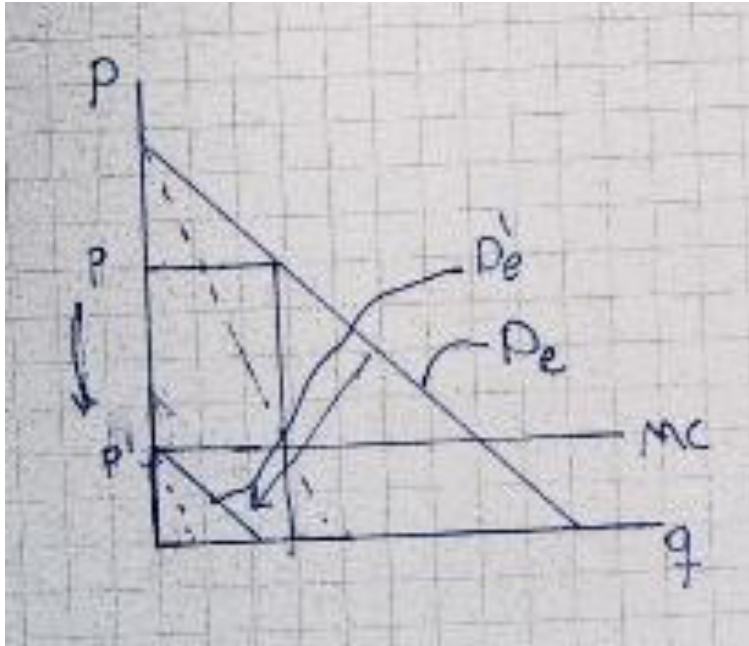
2)

The entry of EL with their new product Zepbound increases variety and choice for consumers (with a high quality product) which intensifies competition and will drive down the residual demand for Wegovy, incentivizing Novo to set a lower price and sell a lower quality. This will hurt their profits. The BR functions shifts down for Novo and the NE prices are lower than before the entry.



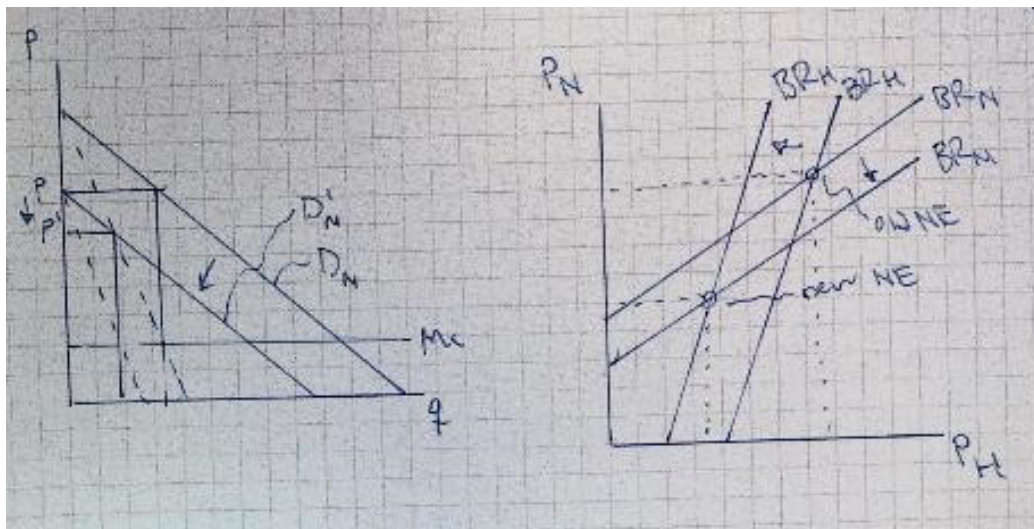
3)

Virtually all sales of early gen drugs have declined because Novo and EL have more or less captured the market with their better-quality product. The quality of old gen drugs relative to Zepbound and Wegovy is very low due to the side effects and lower efficiency which drives down the residual demand for certain old gen drugs to the point where their variable profits are no longer sustaining their fixed costs and they're forced to shut down operations. Below is an illustration of one old gen drug firm that is forced to price at MC due to the decline in demand:



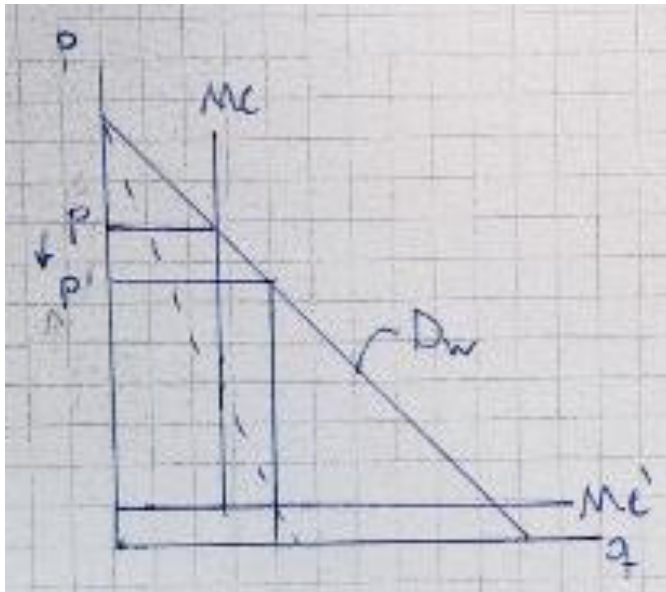
4)

Lower demand for sugary snacks due to a future with drugs shifts back the residual demands for N and H respectively, causing them to set lower prices, which will yield lower profits for both firms. BR for both N and H shift back, lowering the NE prices of confectionary products. The left graph illustrates the effect on Nestle's residual demand but the effects are the same for Hershey's.

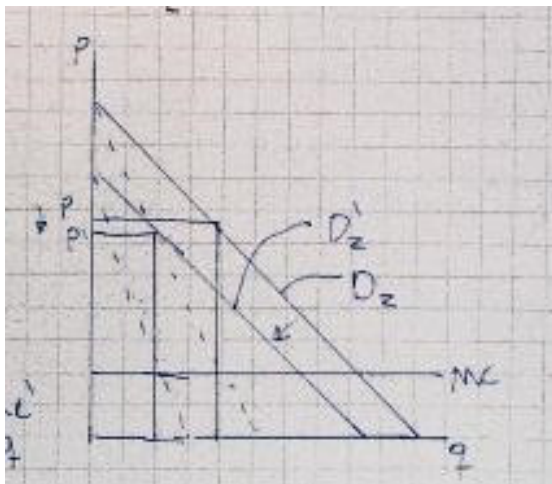


5)

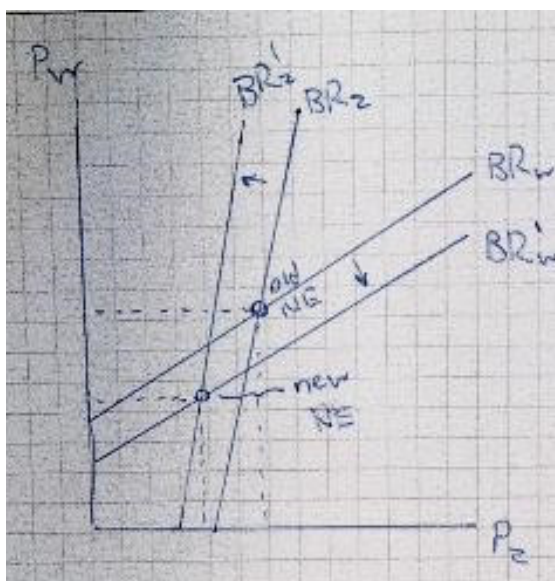
When Novo invests in expanded production capacity, they will be able to meet the market demand and sell more volume at a lower price. However, the increased sales volume makes up for the lower price for which they will be selling at the new capacity, thereby having a positive effect on profits (economic argument is that they wouldn't invest in improved capacity if the profits post-investment are not worth the investment and lower price).



Reduced price for Wegovy will shift back the demand for Zepbound incentivizing them to set lower prices and they will experience lower profits:



BR for both firms shift back, resulting in lower NE prices in the market:



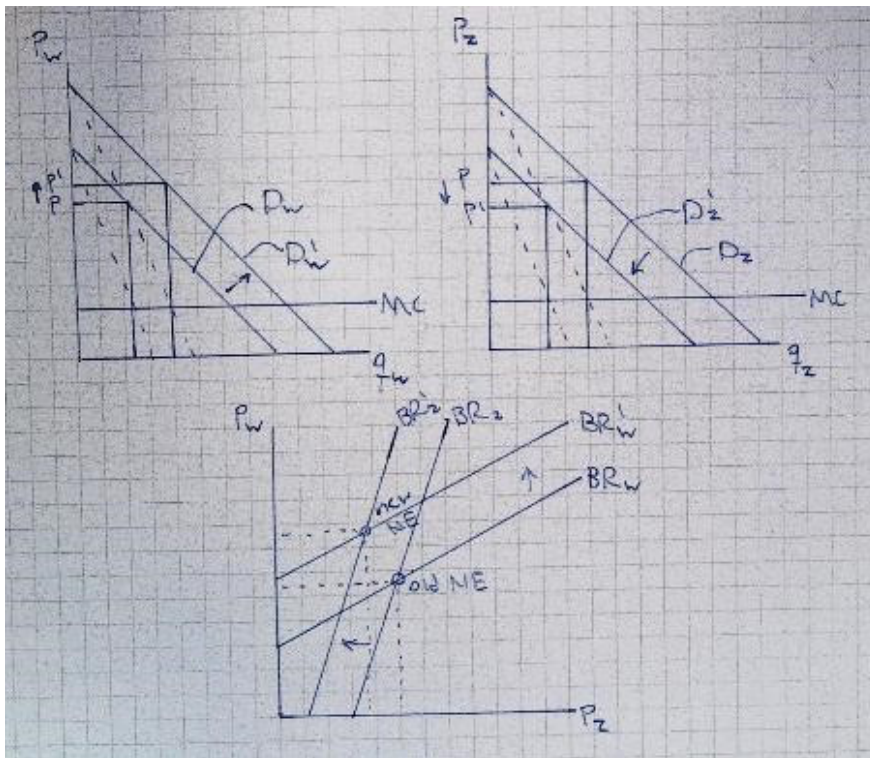


6)

FDA authorization will improve their perceived quality as the use of Wegovy becomes more versatile which shifts up their residual demand, incentivizing them to set higher prices and they will experience higher profits. (illustrated in the top left graph)

Zepbound now has a lower quality relative to Wegovy which whifts their BR function back, incentivizing them to set lower prices and render lower profits. (top right graph)

BR for Wegovy shifts up and BR function for Zepbound shifts back, resulting in higher NE prices for Wegovy and lower NE price for Zepbound:



7)

a)

A new product introduced by Viking Therapeutics that is better than both Wegovy and Zepbound will intensify direct competition with both Novo and EL (because the products are both vertically and horizontally differentiated, all products are in direct competition with each other). This will incentivize both Novo and EL to set lower optimal prices because their respective residual demands shift back, resulting in lower profits for both firms.

b)

If the better product is instead introduced by Novo and they remove Wegovy from the market, the residual demand for the new product would be higher than the residual demand for Wegovy thanks to their improved quality, incentivizing them to set a higher price for the new improved product and will thereby yield higher profits. The residual demand of Zepbound will shift back due to the lower perceived quality relative to Novo's new product, incentivizing them to set lower prices, which will result in lower profits than before.