Multiple choice

1	c
2	a
3	c
4	b
5	b
6	c
7	b
8	a

Long A

a)

Profit function for F1:

$$\pi_1 = p_1 \cdot Q_1$$
$$\pi_1 = p_1 \cdot (S(v_1 - 0.5v_2 - p_1 + 0.5p_2))$$

Profit function for F2:

$$\pi_2 = p_2 \cdot Q_2$$
$$\pi_2 = p_2 \cdot (S(v_2 - 0.5v_1 - p_2 + 0.5p_1))$$

With simplified notation:

$$\underline{\pi_1 = p_1 \cdot \big(S(k_1 - p_1 + 0.5p_2)\big)}$$
$$\underline{\pi_2 = p_1 \cdot \big(S(k_2 - p_2 + 0.5p_1)\big)}$$

First order condition for profit maximization for F1:

$$\frac{d\pi_1}{dp_1} = 0.5Sp_2 - 2Sp_1 + Sk_1$$
$$0 = 0.5S \cdot p_2 - 2S \cdot p_1 + S \cdot k_1$$

$$\underline{BR_1{:}\ p_1 = 0.25p_2 + 0.5k_1}$$

Because of symmetry (in all the variables and constants used to derive BR):

$$\underline{BR_2{:}\ p_2 = 0.25p_1 + 0.5k_2}$$

b)

Nash equilibrium prices for both firms for the case where $v1 = v2$

When $v_1 = v_2$ we have that:

$$k_1 = v - 0.5v = 0.5v$$
$$k_2 = v - 0.5v = 0.5v$$

I use the BR functions derived in a), writing k_1 as $0.5v$ and inserting BR2 into BR1

$$p_1 = 0.25(0.25p_1 + 0.5(0.5v)) + 0.5(0.5v)$$

Solving for p_1:

$$p_1 = 0.3333v$$

And because of symmetry:

$$p_2 = 0.3333v$$

Nash equilibrium prices and profits for the case where $v_1 = 1, v_2 = 1,\ S = 200$
Using the expressions from above, prices are:

$$p_1 = 0.3333v$$
$$p_1 = 0.3333 \cdot 1 = 0.3333$$
$$\underline{p_1 = 0.3333}$$

And because of symmetry:

$$\underline{p_2 = 0.3333}$$

Using the profit function sat up in a):

$$\pi_1 = p_1 \cdot (S(v_1 - 0.5v_2 - p_1 + 0.5p_2))$$
$$\pi_1 = 0.3333 \cdot \big(200(1 - 0.5 \cdot 1 - 0.3333 + 0.5 \cdot 0.3333)\big) \approx 22.22111$$
$$\underline{\pi_1 = 22.22}$$

And because of symmetry:

$$\underline{\pi_2 = 22.22}$$

c)
Nash equilibrium prices for both firms for the case where $v_1 = 1.25,\ v_2 = 1$
Using the BR derived I a) and writing the simplification of k_1 and k_2 out:

$$BR_1:\ p_1 = 0.25p_2 + 0.5(v_1 - 0.5v_2)$$
$$BR_2:\ p_2 = 0.25p_1 + 0.5(v_2 - 0.5v_1)$$

Inserting BR2 into BR1, and inserting given values for v_1 and v_2:

$$p_1 = 0.25(0.25p_1 + 0.5(1 - 0.5 \cdot 1.25)) + 0.5(1.25 - 0.5 \cdot 1)$$

Solving for p_1:

$$\underline{p_1 = 0.45}$$

Inserting p_1 into BR2 to find p_2:

$$p_2 = 0.25 \cdot 0.45 + 0.5(1 - 0.5 \cdot 1.25)$$
$$\underline{p_2 = 0.3}$$

Nash equilibrium profits for both firms when $v_1 = 1.25,\ v_2 = 1,\ S = 200$
Using the profit functions sat up in a):

$$\pi_1 = p_1 \cdot (S(v_1 - 0.5v_2 - p_1 + 0.5p_2))$$
$$\pi_1 = 0.45 \cdot \big(200(1.25 - 0.5 \cdot 1 - 0.45 + 0.5 \cdot 0.3)\big)$$

$$\underline{\pi_1 = 40.5}$$

$$\pi_2 = p_2 \cdot (S(v_2 - 0.5v_1 - p_2 + 0.5p_1))$$
$$\pi_2 = 0.3 \cdot \big(200(1 - 0.5 \cdot 1.25 - 0.3 + 0.5 \cdot 0.45)\big) = 18$$
$$\underline{\pi_2 = 18}$$

d)
In the case where $S = 200$, F_1 will, by investing, go from the profit from sub question b) to c).

Hence their profit will increase (without subtracting I):
$$\pi_{after\ investment} - \pi_{before\ investment} = 40.5 - 22.22 = 18.28$$

Since:
$$I = 30 > 18.28$$

It would not be profitable for F_1 to spend $I = 30$ on the investment when $S = 200$.

To calculate profits if $S = 400$ I use the profit functions from sub question b) to c), and only change S from 200 to 400:

Before investment:
$$\pi_1 = 0.3333 \cdot \big(400(1 - 0.5 \cdot 1 - 0.3333 + 0.5 \cdot 0.3333)\big)$$
$$\pi_1 = 44.44$$

After investment:
$$\pi_1 = 0.45 \cdot \big(400(1.25 - 0.5 \cdot 1 - 0.45 + 0.5 \cdot 0.3)\big) = 81$$
$$\pi_1 = 81$$

Hence their profit will increase (without subtracting I):
$$\pi_{after\ investment} - \pi_{before\ investment} = 81 - 44.44 = 36.56$$

Since:
$$I = 30 < 36.56$$

It would be profitable for F_1 to spend $I = 30$ on the investment when $S = 400$.

Since investing (a large share of their profits $> 3\%$) in R&D can improve their quality and thereby increase profits, this is an endogenous sunk cost industry.

This will presumably with time mean that the competition will be more concentrated, comparing to an exogenous sunk cost industry. This is happening as the best performing firms, will continue to improve perceived quality (by e.g., investing in R&D and marketing), making it harder for smaller firms to follow up, and with time the distance will be too big and an entry barrier is created.

e)
The investment will improve the quality of F_1s product which will lead to a higher p_1 (from 0.33 to 0.45), this has ambiguous effect for consumers, as they receive better quality, but at the same time a higher price.

This will put F2 into a worse situation, as their price will decrease (from 0.33 to 0.3). However, this will benefit the consumers.

As F_1 does not have a dominant position prior to the investment (50/50 market share between F_1 and F_2) and it is done with the intent of improving the market position (higher quality) and not driving out any rival. I do not believe this would be a violation to the competition laws in either EU or U.S.

However, it does have ambiguous effects. E.g., it is leading to F1 having a dominant position, with is taking for it being a violation to the competition laws in the EU and U.S.

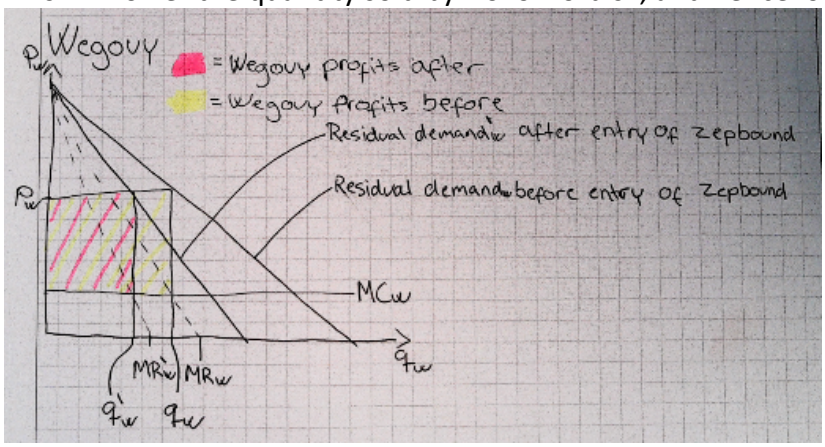
Long B

1)
Vertical product differentiation is when, at same prices, everyone would choose the same product, because of different perceived qualities. A simple way of illustration this is the typical weight loss difference between Zepbound (20%) and Wegovy (15%). It must be assumed that people who uses this medicine, all would prefer the most effective one (not thinking of other factors as side effects) which is Zepbound.

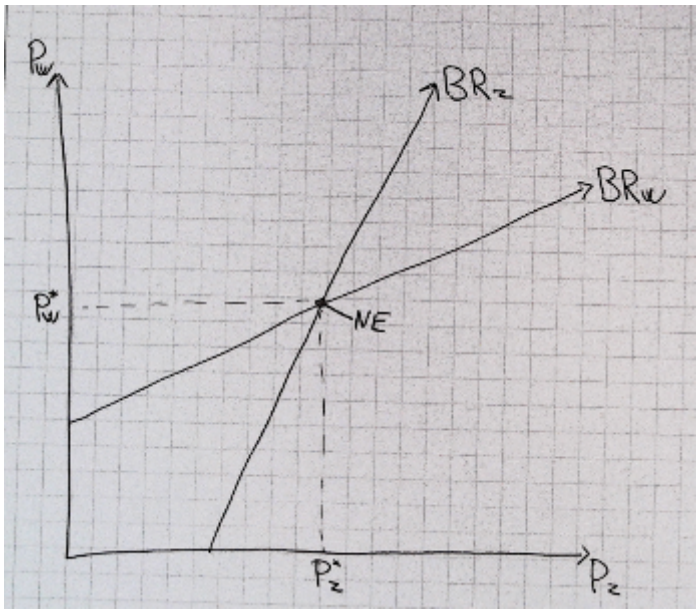
Horizontal product differentiation is when, at same prices, there is demand for all products, as people have different preferences. In the case of Zepbound and Wegovy this can be illustrated with if the drug is covered by the individual consumers health care plan (US) or if the product work for the costumer (response to a given drug varies across individuals).

2)
I would argue that the residual demand for Wegovy will pivot inwards, as the WTP for the costumers where Wegovy drug works, does not lower by the entrant of Zepbound, however some costumers will prefer Zepbound over Wegovy, and therefore some of the demand will move to Zepbound.

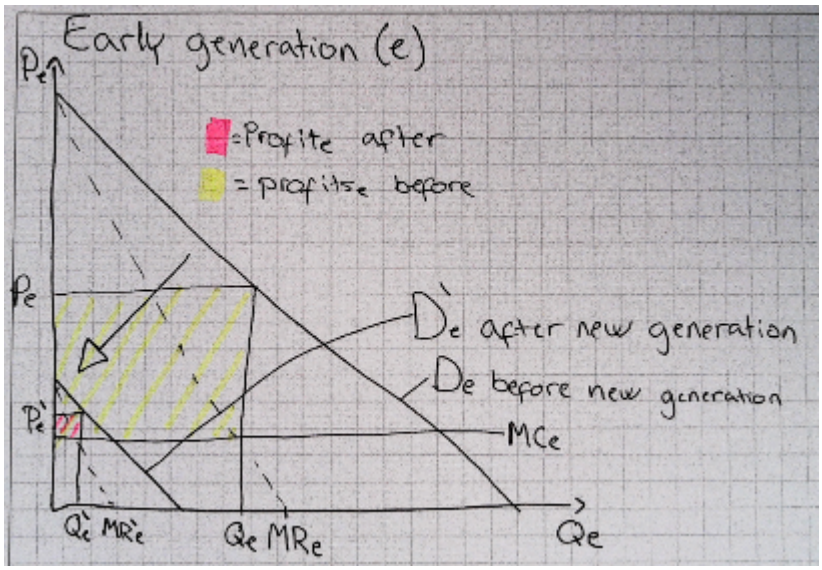
This will lower the quantity sold by Novo Nordisk, and hence lower their profits:



Before Zepbound entered the market, Novo Nordisk where monopolist, and would price maximize at MR=MC. After the entry the NE prices are found at the intercept of the two firms BR functions:



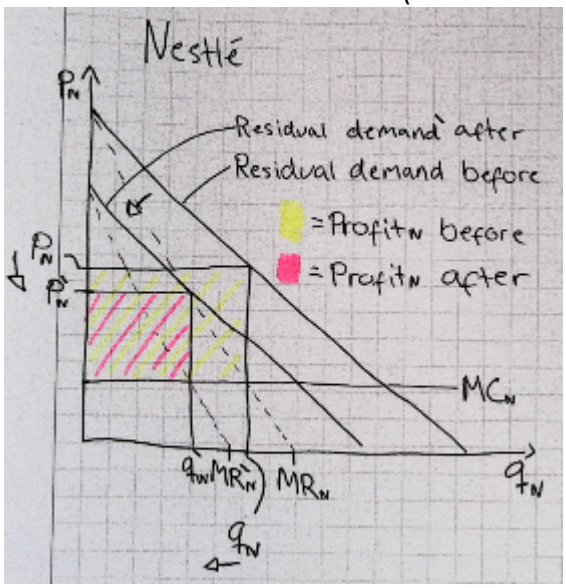
3)
With the new generation obesity drugs, the demand for the early generation have shifted significantly to the left, hence, lower optimal price and lower quantity, which is lowering profit a lot, meaning there is less room for firms to operate profitably, pricing above MC.



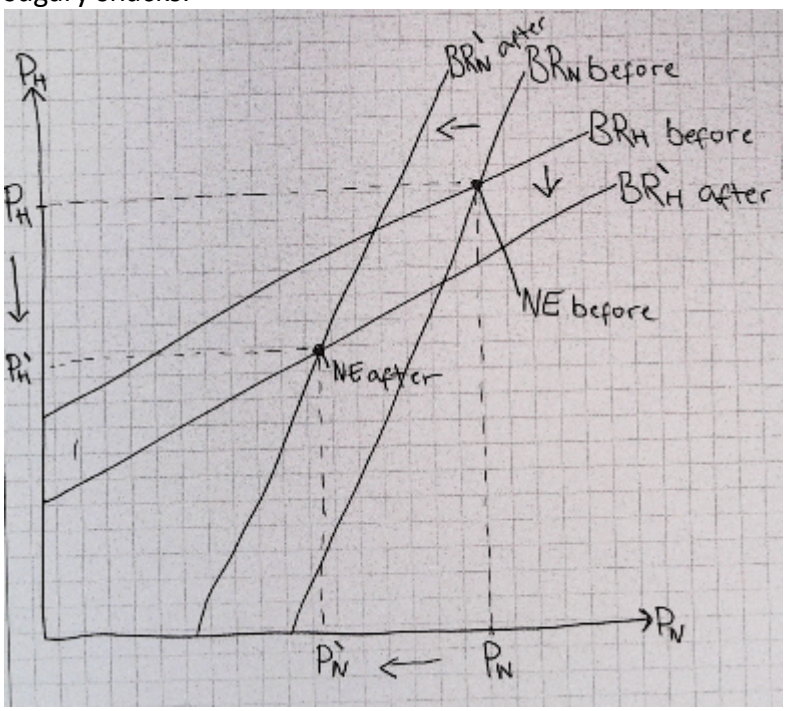
In addition, you could argue that MC would raise, as there is the opposite effect as of economies of scale, as production might be a lot lower for the remaining firms. This would only add to the issue for the old generation producers. However, this is not illustrated.

4)
The residual demand for sugary snacks will be lower for firms like Nestlé and Hershey, lowering optimal prices and quantity, and therefore also profits.

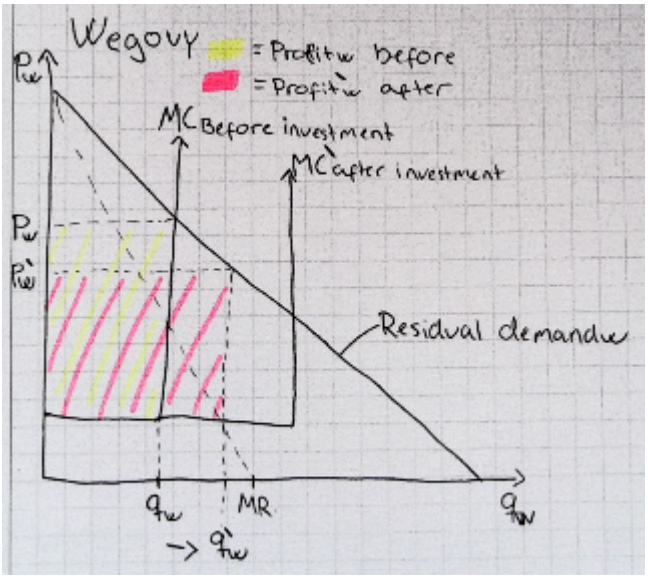
Here it is illustrated for Nestlé (it is the same situation for Hershey):



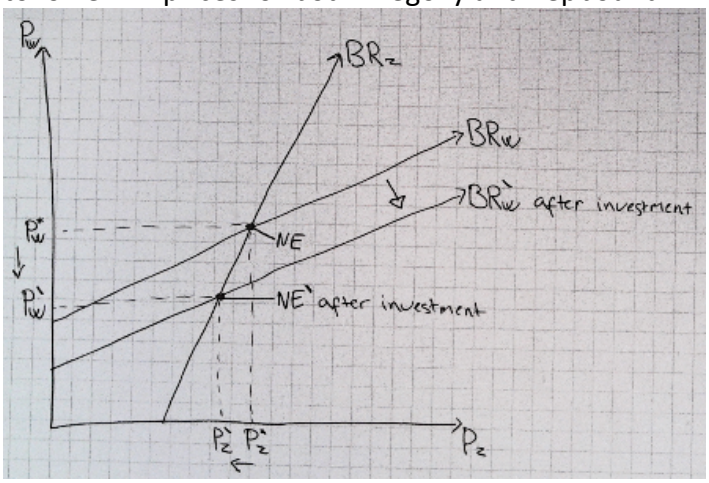
This will result in a shift down in BR functions of both firms, leading to lower NE prices for sugary snacks.



5)
When Novo Nordisk expands its production, their optimal price will lower, and quantity will increase. This is illustrated here:



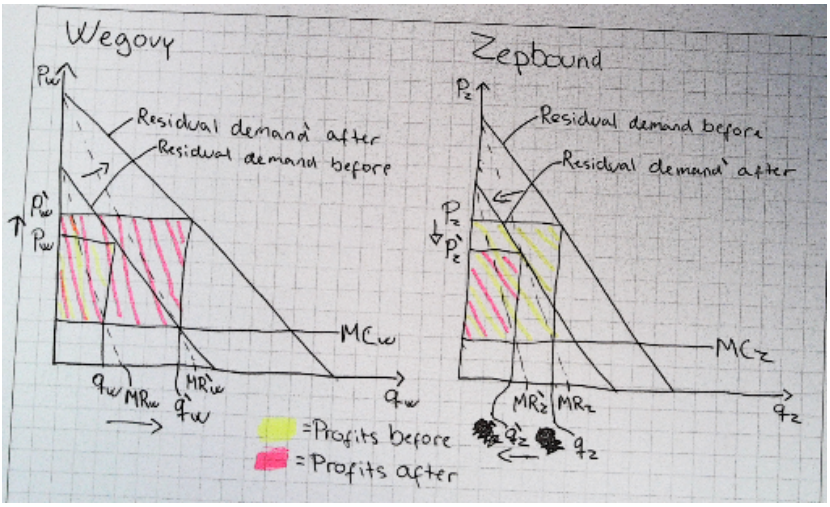
Looking at the BR graph from 2) this will now lead to Novo Nordisk BR to shift down, leading to lower NE prices for both Wegovy and Zepbound:



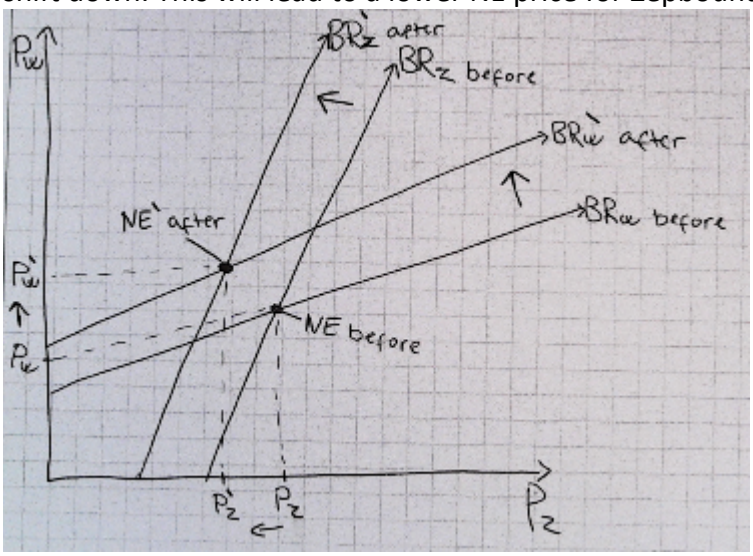
Holding everything else constant, this will lead to lower profits for Eli Lilly and higher profits for Novo Nordisk.

6)
As more health benefits only will increase demand from insurers, and bring more on board, the FDA authorization will lead to an increase in demand for Wegovy (moving up the line of vertical product differentiation), and as the products are substitutes, this will decrease the demand for Zepbound.

The residual demand for Wegovy will shift out, leading to a higher optimal price and higher quantity indicating higher profits. The opposite will happen for Zepbound. This is illustrated here:



As a result of this, Wegovy (Novo Nordisk´s) BR will shift up and Zepbound (Eli Lilly´s) BR will shift down. This will lead to a lower NE price for Zepbound and higher NE price for Wegovy.



7)

A) Introduced by Viking Therapeutics

First of all, introducing a new product to the market will intensify competition. This will lead to a shift inward (or pivot) for both firms residual demand, leading to lower prices indicating lower profits for Novo Nordisk and Eli Lilly

Thinking of vertical product differentiation, the new product from Viking Therapeutics will be above both Wegovy and Zepbound. This means that they are forces to lower prices, if they are not heightening quality, as with vertical differentiation.

b) Introduced by Novo Nordisk (replacing Wegovy)

If Novo already is the one with highest perceived quality (assuming the FDA authorization still only are for Wegovy), and the new product is a replacement for Wegovy, this will make

the distance between the two products even bigger, if considering vertical product differentiation.

Residual demand will shift inwards for Zepbound, leading to lower optimal prices and quantity indicating lower profits. However, the lower prices will again increase the vertical product differentiation and hence drive demand up again. It's hard to say which effect is the strongest, and therefore also whether, the profits of Zepbound will increase or decrease.

For Novo Nordisk, the increase in quality will lead to a shift out their residual demand curve for Wegovy. It's a easier product to use, and better results, hence both more consumers and higher WTP for those that are already using it. This will lead to higher optimal prices and quantity, indicating an increase in profits.