

- A study has shown that there are three groups of Iphone users, namely, *crazy, love-it, and just-live-with-it*. Demand for Iphone of each group can be given by:

crazy: $Q_c = 100 - p$;

Love-it: $p = 50 - Q_l$;

Just-live-with-it: $Q_j = 20 - p$;

- Find the domain set of price that justifies the demand equation for each group of Iphone user. And, rewrite each demand function in a more appropriate way.
 - At what domain set of prices, do all the three types of Iphone users stay active in the market?
 - Find the function for market demand for Iphone. Be precise about what is needed to make your equation justified.
- Suppose market supply equation is given by: $p = 4 + 3w + \frac{3}{8}Q$.
 - Find the equilibrium when $w = 1/3$ where w is wage rate for each unit of labor hired. How much does each type of consumer consume in the equilibrium?
 - What is the likely effect on market equilibrium when wage drops? State your prediction and develop intuition for your result. (Note: Answer to this question could be made in qualitative sense. You don't need to get into algebraic solution with numbers solved.)

Application: Restricting domain set for demand and the construction of market demand.

- Why this question?
 - Generally, domain/range set of linear function is $\mathbb{R} \times \mathbb{R}$. Function is generally well-defined for the whole set of real number.
 - However, when applying linear function to express any mathematical relationship of economic variables, we need to impose some restrictions on the domain/range set that makes the relationship well-defined.

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- Price is greater than or equal to zero! Price cannot be negative!.
- Can price be \$200? Would it make the three demand equations sensible? If no, what other conditions do we need to justify that $p = 200$ is possible in the reality?

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- *Crazy* $\Rightarrow Q_c = 100 - p \quad ; p \leq 100.$
 $= 0 \quad ; p > 100.$
- *Love – it* $\Rightarrow Q_l = 50 - p \quad ; p \leq 50.$
 $= 0 \quad ; p > 50.$
- *live – with – it*
 $\Rightarrow Q_j = 20 - p \quad ; p \leq 20.$
 $= 0 \quad ; p > 20.$

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- Crazy is high-type consumer. Maximum willingness to pay is \$100.
($p \leq 100$)
- Just-live-with-it is easily attracted by other brands of smartphone, and thus only have the maximum willingness to pay equal to \$20. When price is above \$20, they choose to leave the market.
- Love-it group is in the middle between the two. They choose to stay if price is lower than \$50.

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- So, at what domain of prices, do all the three types stay active in the market?
- When p is less than \$20, we have strict positive value of Q for each type of consumer.

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Application: Restricting domain set for demand and the construction of market demand.

- Market comprises of a number of individual consumers.
- Each person has its own individual demand.
- When looking at the equilibrium, we look at the outcome as a whole. Equilibrium has to be determined at the market level.
- So, we have to establish notion/definition of market demand.
- I'll show you **two approaches** for deriving market demand equation from given sets of individual demand functions.

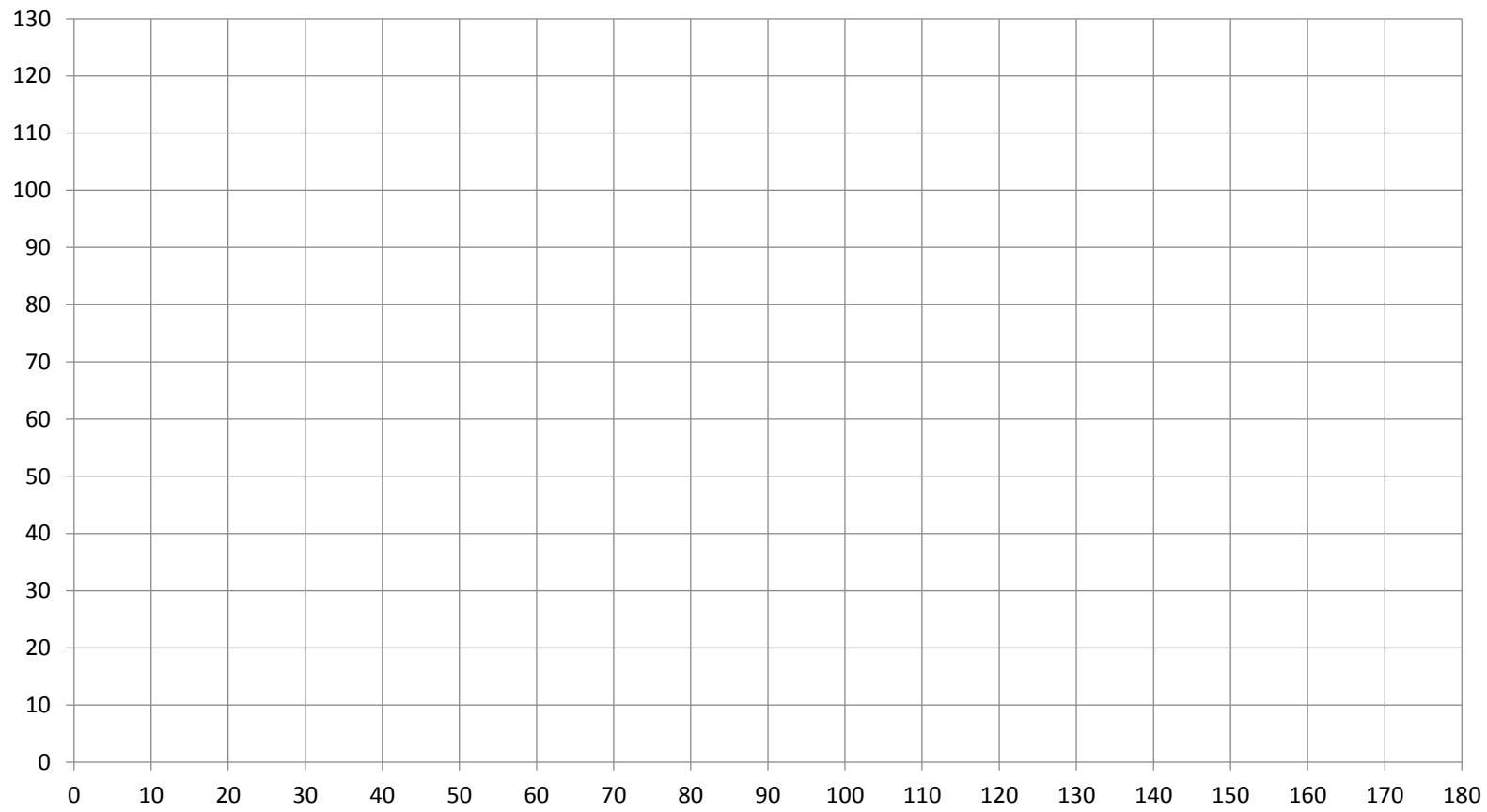
Application: Restricting domain set for demand and the construction of market demand.

- **Definition**

- Market demand = summing up Q for each individual at each given price.
- Different prices $\rightarrow$ different level of each individual Q combined.
- As individual demand is downward sloping, market demand curve should preserve this characteristic as well. That is, as price decreases, total Q combined increases.

Application: Restricting domain set for demand and the construction of market demand.

- Graphical approach, constructing market demand curve:
 - This is called the horizontal sum for each individual demand curve
 - Putting all the curves of individual demand into the same figure, sum-up Q for each individual at each given price, label all the kinked points, and then derive equation for each portion of the demand curve.
 - Market demand equation will be a ***step*** function.



crazy:

$$Q_c = 100 - p ; \rightarrow p = 100 - Q_c$$

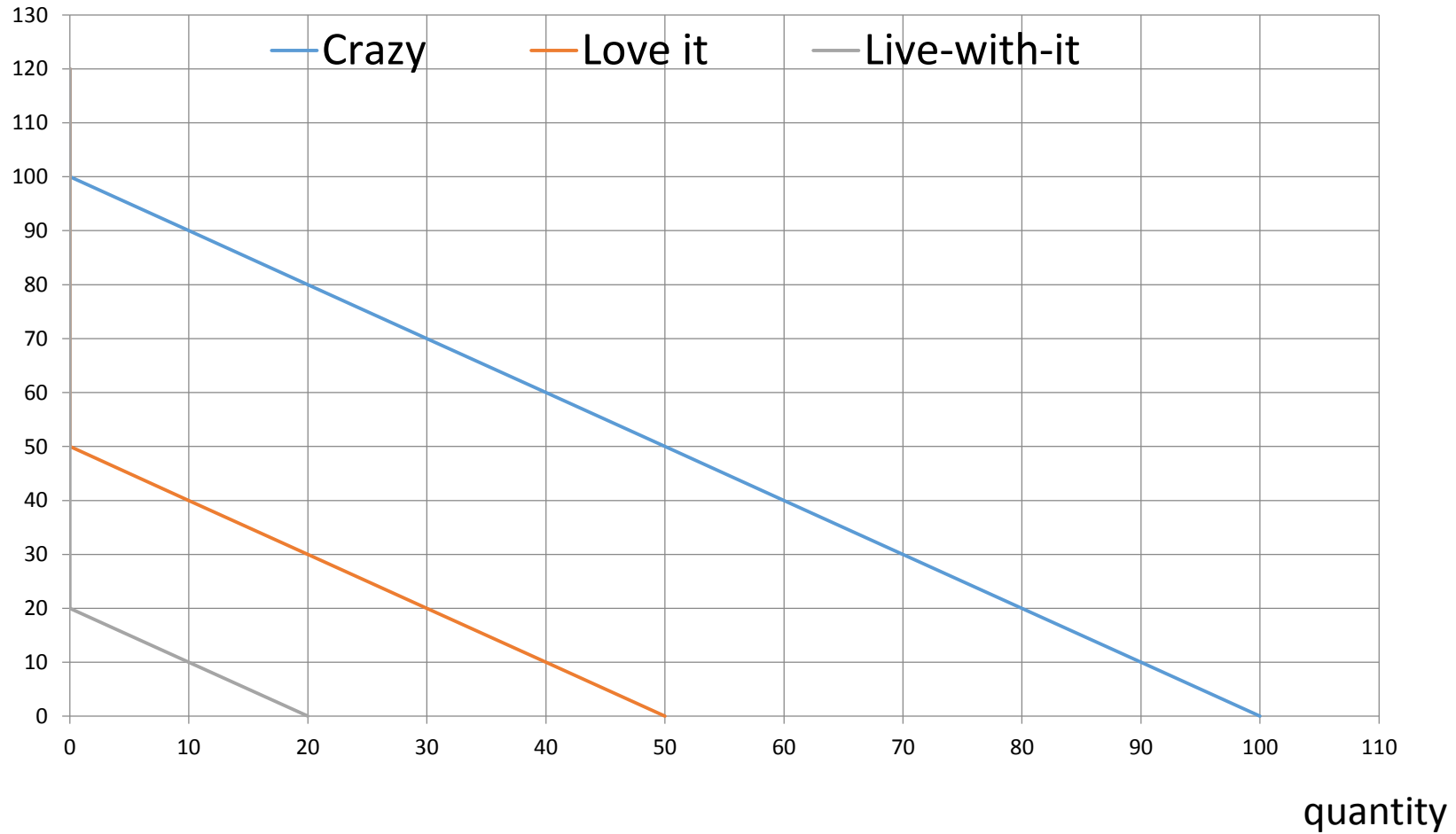
Love-it:

$$p = 50 - Q_l ; \rightarrow \text{ok!}$$

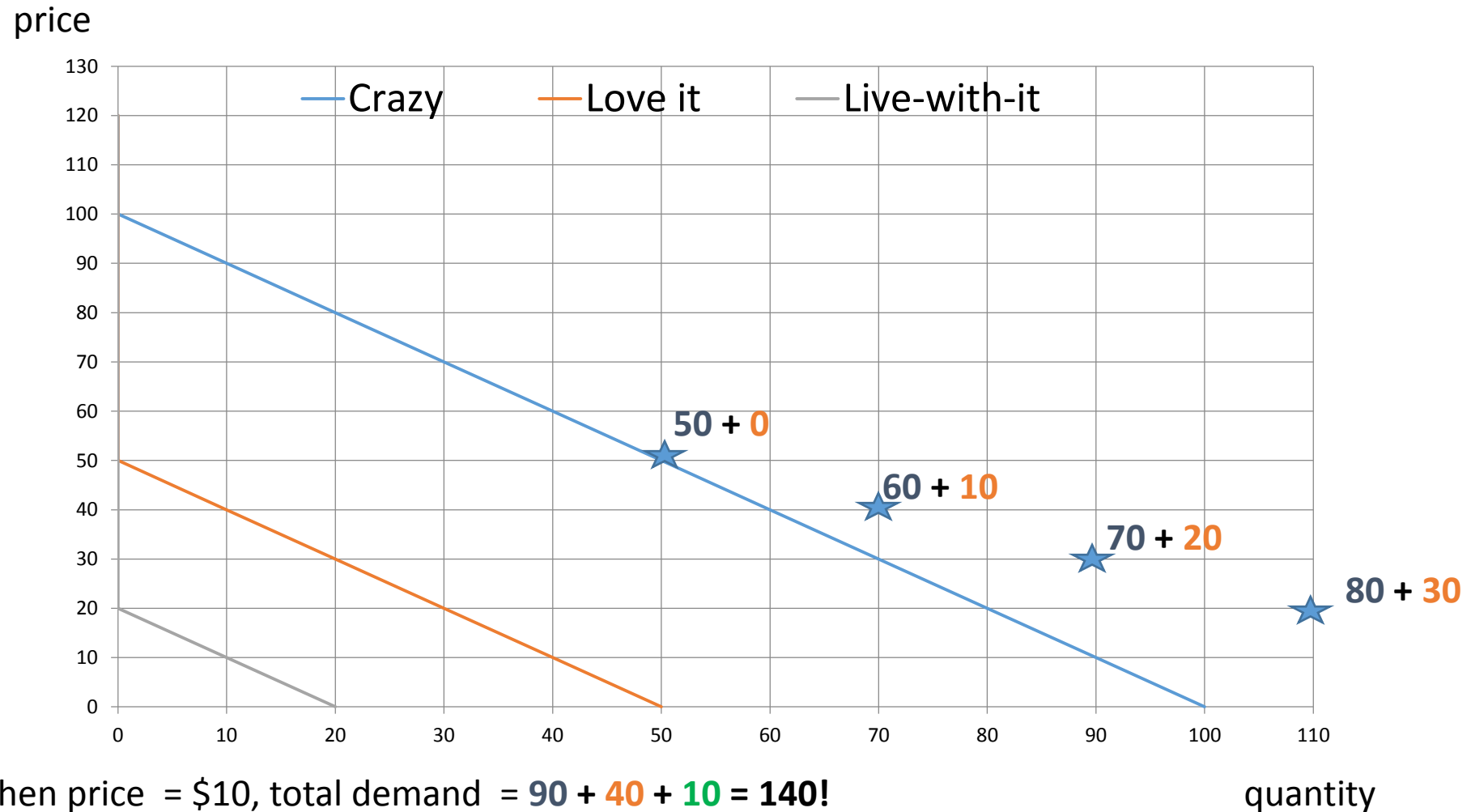
Just-live-with-it:

$$Q_j = 20 - p ; \rightarrow p = 20 - Q_j$$

price



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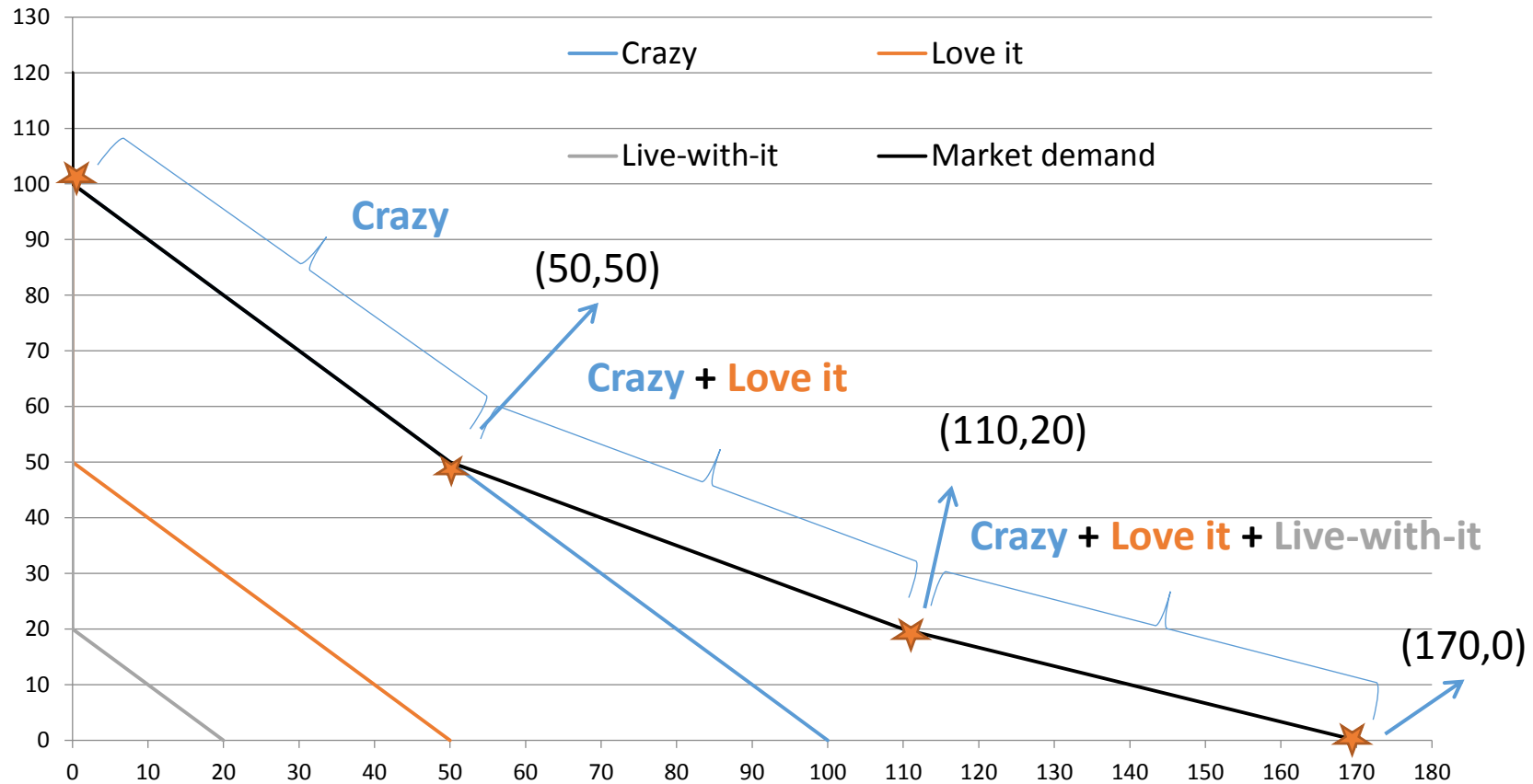
Demand schedule

Price/unit	Crazy	Love it	Just-live-with-it	Q-combined	
120	0	0	0	0	
110	0	0	0	0	
100	0	0	0	0	
90	10	0	0	10	
80	20	0	0	20	
70	30	0	0	30	
60	40	0	0	40	
50	50	0	0	50	
40	60	10	0	70	
30	70	20	0	90	
20	80	30	0	110	
10	90	40	10	140	
0	100	50	20	170	

Price decreases

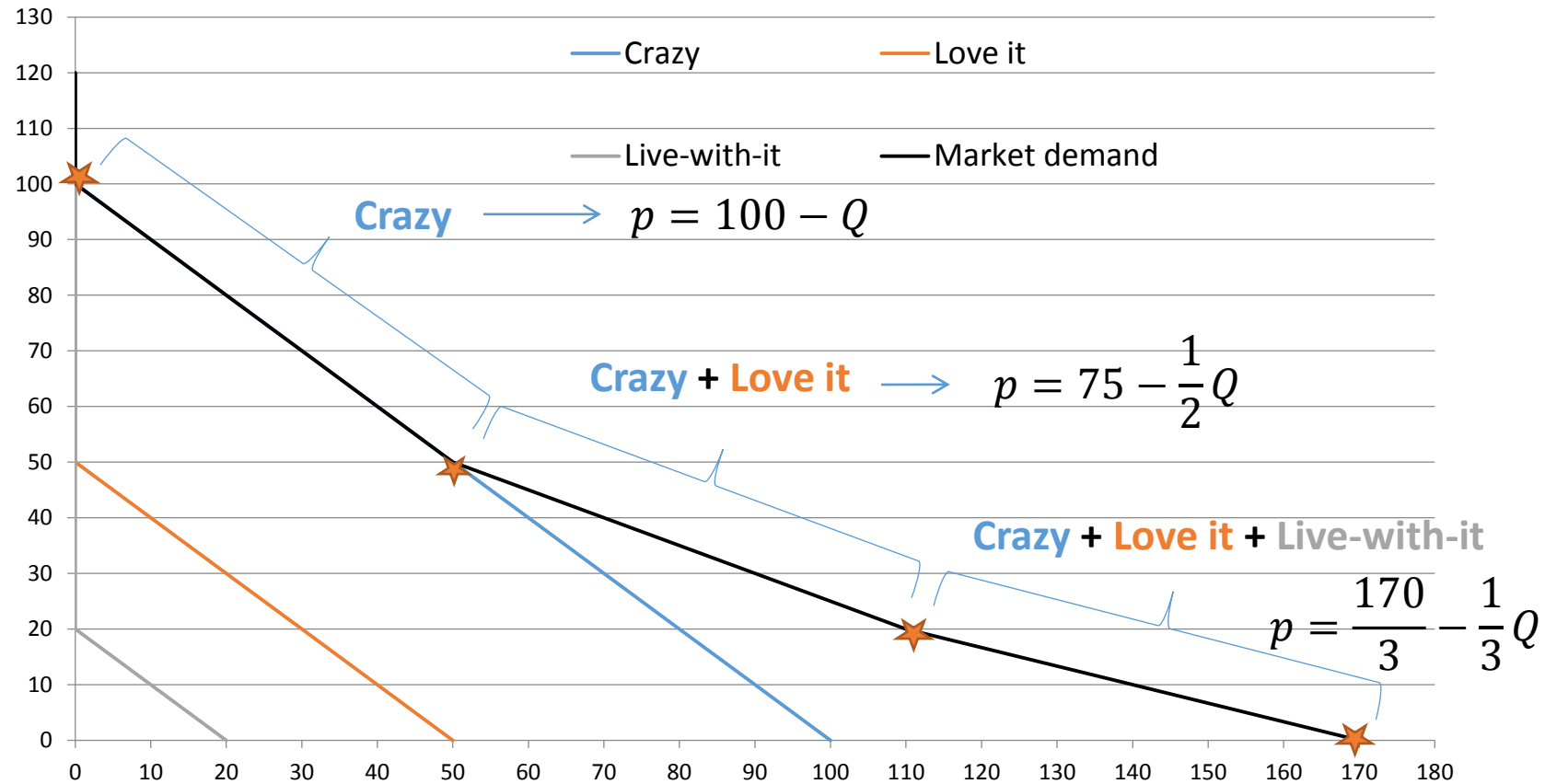
Quantity Increases

Market demand curve = *horizontal* sum of individual demand curve



Demand curve flattens out as quantity of output consumed increases!

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Application: Restricting domain set for demand and the construction of market demand.

- Mathematical summation! Just a simple direct summation.
- But, you have to be very careful when using this method. Not all individual will stay active at the considered price.
- Make sure that you don't sum up Q-equation without checking if that individual remains active in the market.

Application: Restricting domain set for demand and the construction of market demand.

- *Market demand* $= Q = Q_c + Q_l + Q_j$
- $Q = 100 - p + 50 - p + 20 - p = 170 - 3p$
- A naïve guy who doesn't know that individual demand equation is in fact **a step function** would answer that the above equation is the mathematical representation of market demand curve.

Application: Restricting domain set for demand and the construction of market demand.

- But, this is wrong. You were summing Q for some domain sets that result in negative value of quantity. This doesn't make sense in economics!
- For example, if price is \$60, demand of love-it group would be 0. If you were just summing up that way, you would add " $50 - 60 = -10$ " into the equation. **This is wrong!**

Application: Restricting domain set for demand and the construction of market demand.

- Split the domain set of prices into different regions, each associated with what types of consumer are staying in the market.
- $Q = 100 - p$; $50 \leq p \leq 100$
 $= 150 - 2p$; $20 < p \leq 50$
 $= 170 - 3p$; $p < 20$

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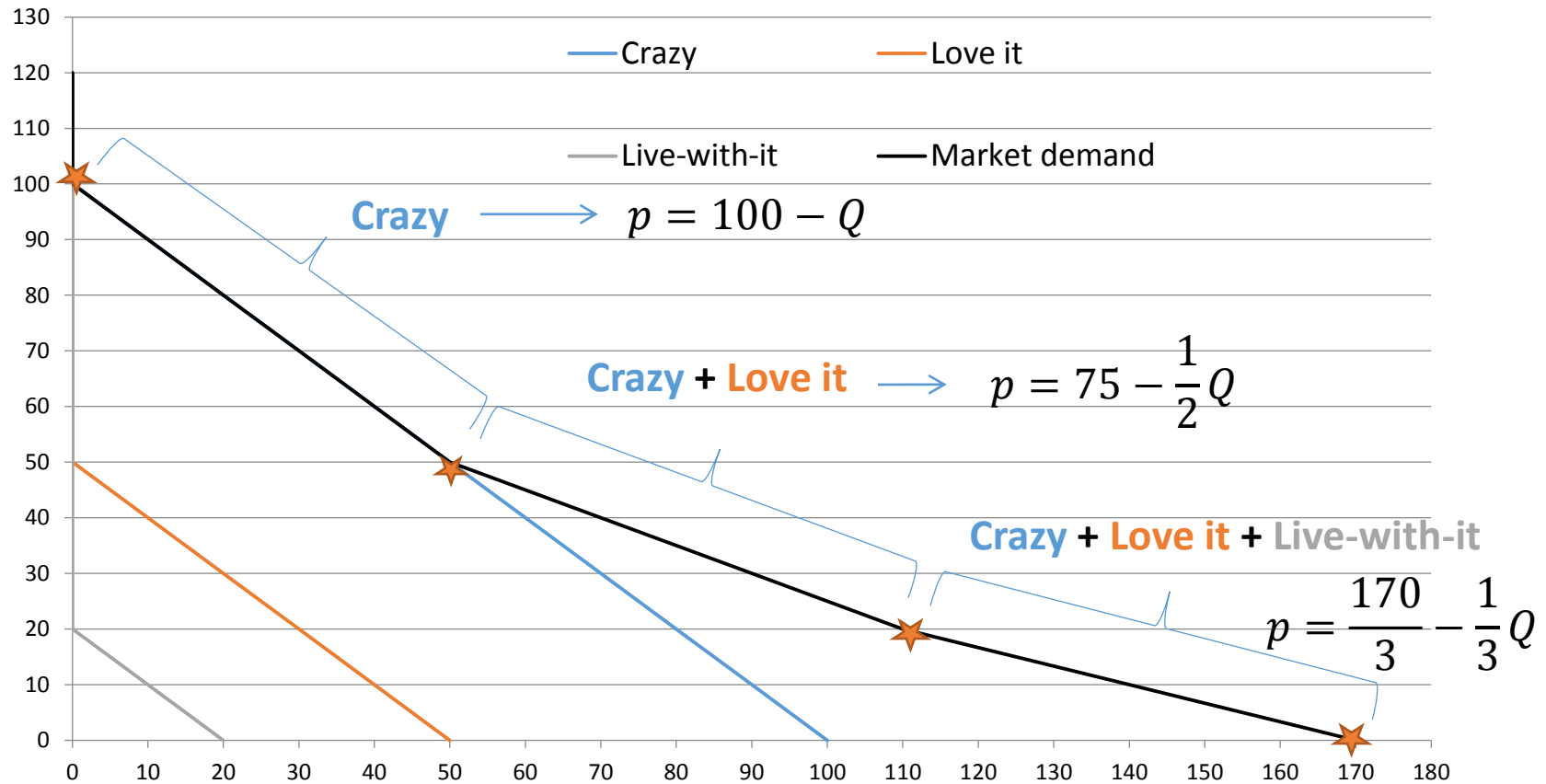
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Market demand = market supply?



Demand curve flattens out as quantity of output consumed increases!

For $W = \frac{1}{3}$, supply equation is then...

- $p = 4 + 3 \left(\frac{1}{3} \right) + \frac{3}{8} Q = 5 + \frac{3}{8} Q$
- An increase in “w” represents the so called a negative “supply shock”.

First try..

- Let's conjecture that supply curve intersects with demand curve in the top part region.

$$\begin{aligned}5 + \frac{3}{8}Q &= 100 - Q \\ \frac{11}{8}Q &= 95 \\ Q &= 69.09 \\ P &= 30.91\end{aligned}$$

- Is this right? Why?

Second try

- Let's recalculate by supposing that supply curve intersects with demand curve in the middle part region.

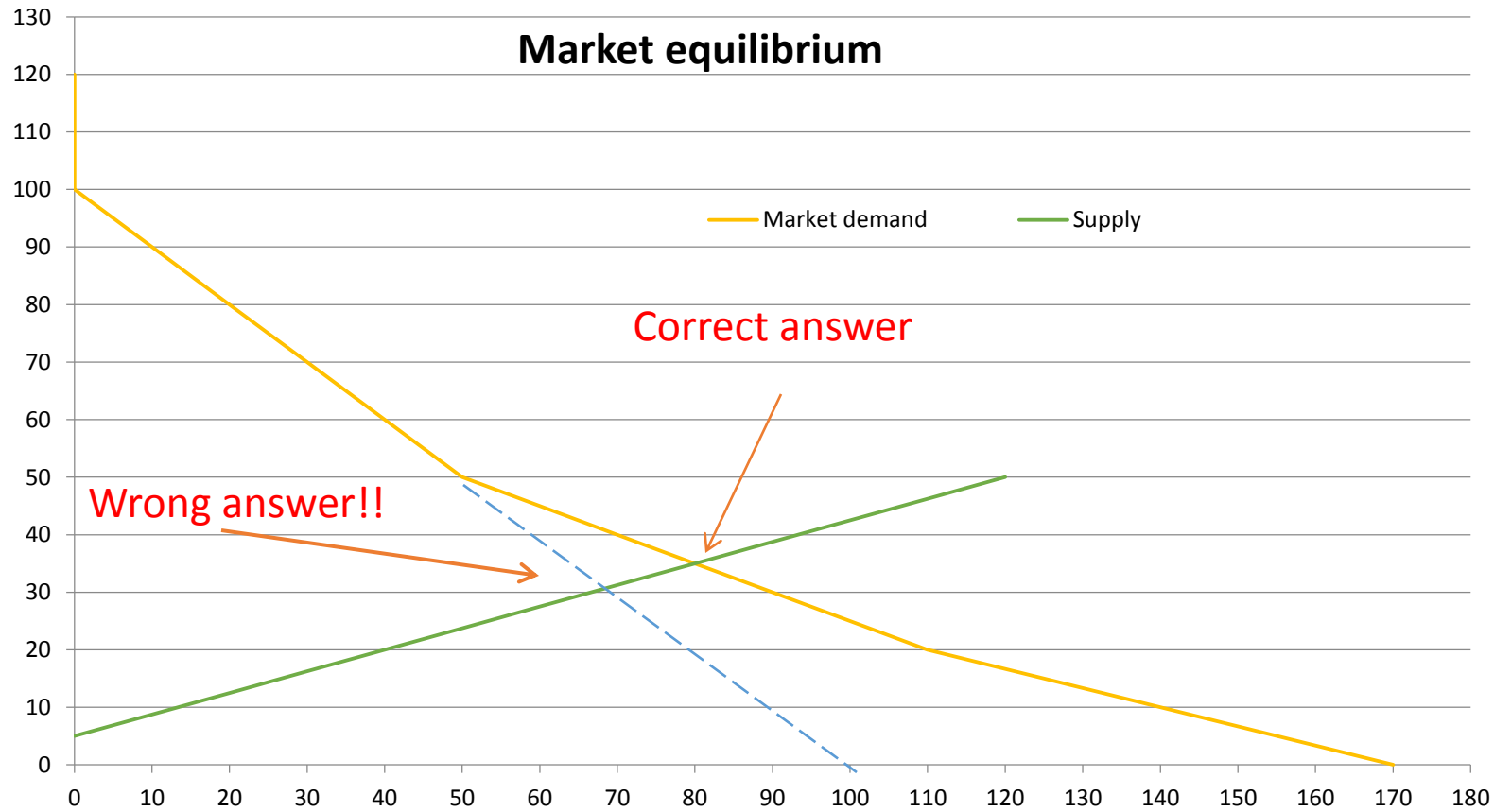
$$5 + \frac{3}{8}Q = 75 - \frac{1}{2}Q$$

$$\frac{7}{8}Q = 70$$

$$Q = 80$$

$$P = 75 - \left(\frac{1}{2}\right)80 = 35.$$

Graphically illustrated!



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- $p = 4 + 3 \left(\frac{1}{3} \right) + \frac{3}{8} Q = 5 + \frac{3}{8} Q$
- An increase in “w” represents the so called a **negative** “supply shock”.
- A decrease in “w” represents the so called a **positive** “supply shock”.

Graphically illustrated!

