BUEC 311: Business Economics, Organization and Management

Supplemental Problem Set

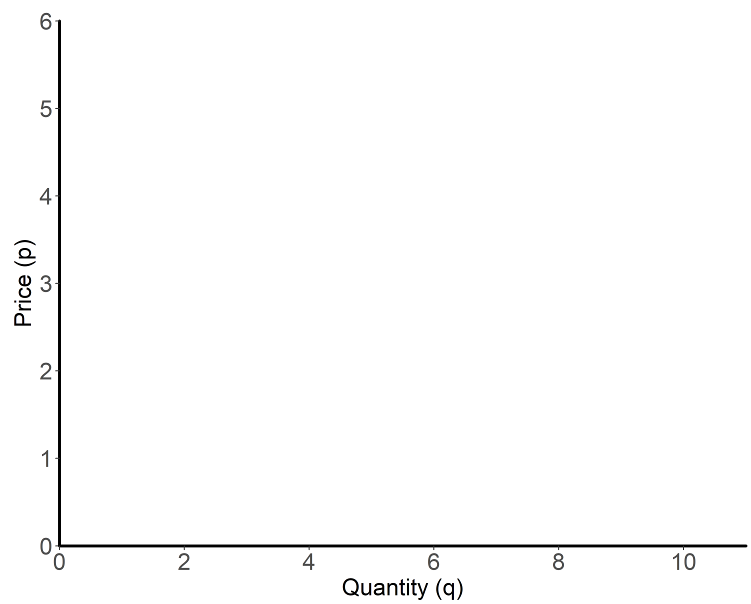
Graphing and Manipulating Demand and Supply

September 7, 2020

This set will supplement some discussion of supply and demand curves in this week's classes.

1. First key task in a lot of this week will be inverting demand curves. Generally, demand curves are stated as quantity as a function of price, for example $Q = 10 - 2p$, while they are graphed as price as a function of quantity (the inverse demand).

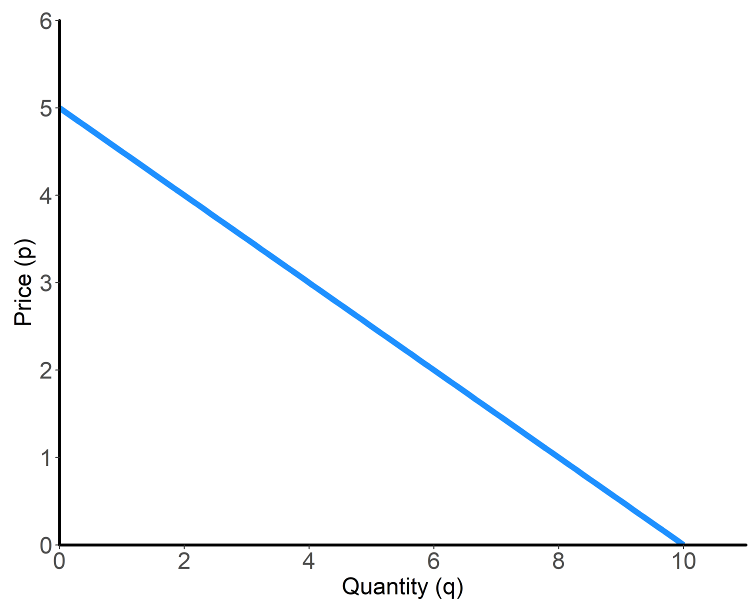
Step 1 before graphing anything is to make sure we're using the RIGHT expression to match the graph we're trying to draw. In the case of supply and demand, we always want to draw p on the vertical axis, as a function of q on the horizonal axis:



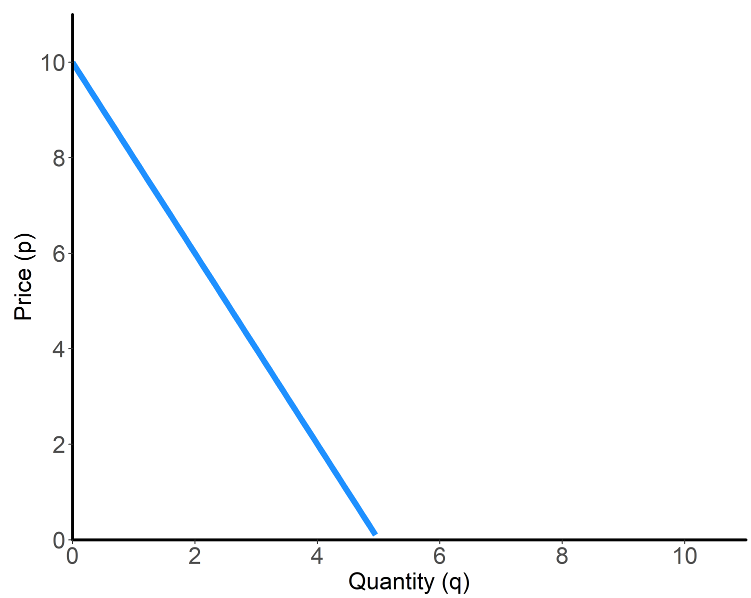
So, we need to convert $Q = 10 - 2p$ into an equation with p as a function of Q.

$$Q = 10 - 2p$$
$$\frac{Q}{2} = 5 - p \text{, after dividing both sides by 2}$$
$$p = 5 - \frac{Q}{2} \text{, after rearranging terms}$$

And now we have a p as a function of Q that we can graph:



Where are things likely to go wrong? When you're in a time-crunch, if you forget to check carefully what's given to you, you might end up doing this:



Can you spot what I've done wrong here?

A couple of useful error checks you can do at this point are to check whether your inverse demand yields the same results as your original demand function by substituting in a price and then seeing if I can get the same price back at the end as follows:

$Q_d = 10 - 2p$, so it must be that at p=4, $Q_d = 10 - 2(4) = 2$

Let's see if this works in my inverse demand curve

$p = 5 - \frac{Q}{2}$, substituting in $Q_d = 2$ yields:

$p = 5 - \frac{2}{2} = 4$, which is where I started, so I know I've done it correctly.

Before you even get that far, it's often helpful to see if price is decreasing in quantity. Since you know that the law of demand is such that higher price means lower quantity demanded, it must also be the case that higher quantity means lower willingness to pay, and so there should be a negative sign on the term with Q in your function determining p.

2. The next skill we're going to use is solving two equations with two unknowns (supply and demand solved for p and Q). So, let's use our previous example of $Q_d = 10 - 2p$ as demand, and use $Q_s = 3\,p$ as a simple supply curve. Now, to solve for equilibrium, we'll need a few steps.

$Q_d = 10 - 2p,\ Q_s = 3p$

$10 - 2p = 3p$, after setting supply equal to demand

$10 = 3p + 2p = 5p$, after adding $2p$ to both sides of the equation

$2 = p$, after dividing both sides of the equation by 5

and now we check our result and solve for quantity supplied AND demanded:

$Q_s = 3p = 3(2) = 6$, after substituting the equilibrium price into the supply function

$Q_d = 10 - 2p = 10 - 2(2) = 10 - 4 = 6$, after substituting the equilibrium price into the demand function.

This is a useful test because, if you don't get the same quantity, you've done it incorrectly.

Now, let's check this graphically. But, be careful! I need to convert my supply curve to a function of price as well.

$Q = 3p$

$\frac{Q}{3} = p$, after dividing both sides by 3

$p = \frac{Q}{3}$, after rearranging terms

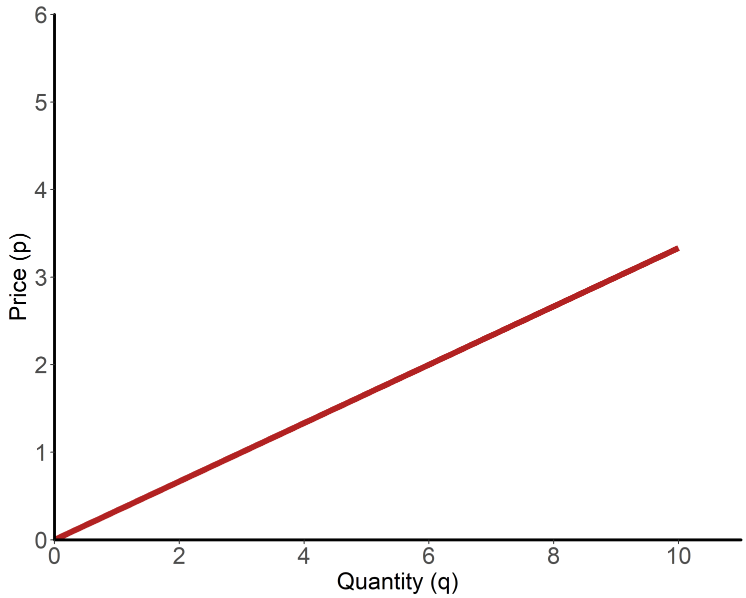
Here, again, we have an opportunity to check our work.

$Q = 3p$, so at $p = 3$, $Q_s = 9$

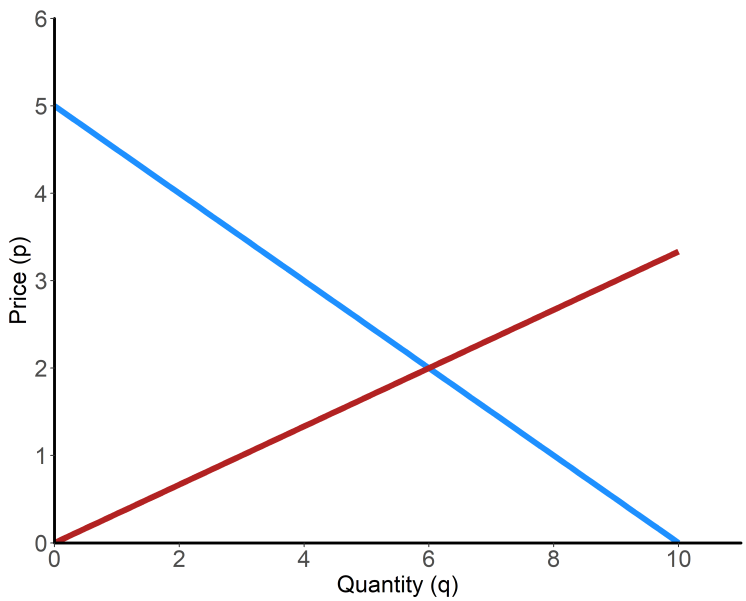
now, let's check that with our inverted supply function

$p = \frac{9}{3} = 3$, which is where we started. Excellent.

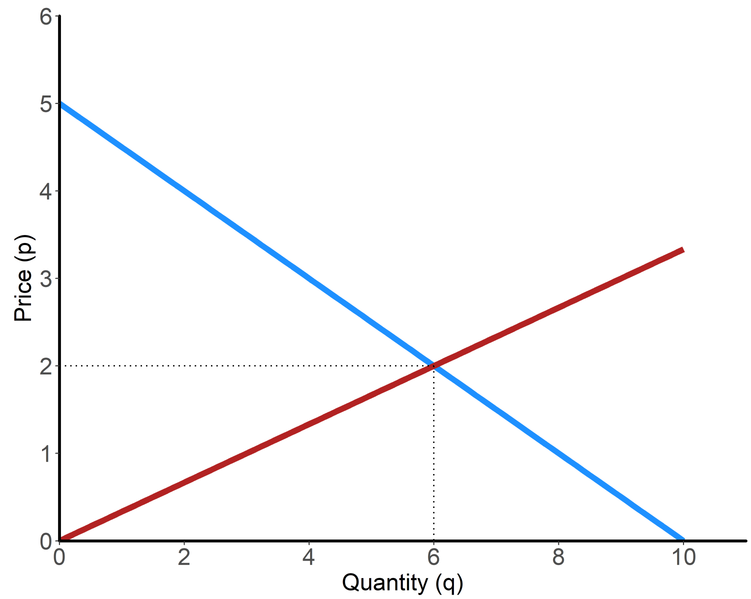
Now, let's graph the supply curve on the same set of axes.



When we add the supply and demand graphs on the same set of axes, the equilibrium point is obvious, although you likely don't want to rely just on your graphing skills to solve questions in the class!



But, when we add some detail to the graphs, you can see the p=2, Q=6 is indeed the equilibrium.



Work through this step-by-step to see if you can replicate each step without fail. If you have no issues with this, you're in good shape. The steps are always the same, but the numbers might not always divide as evenly as they do here.