Maximizing profit with Perfect Competition
Haworth/Econ 201

Assume that firm X operates in a market that is characterized by **Perfect Competition**. I.e., firm X is one of many small firms producing exactly the same good as everyone else, where there are no barriers to entry into or exit from that market over the long run.

Let's say that firm X has the following cost curves:
$TC = q^2 + 2q + 100$ if $q > 0$
$MC = 2q + 2$ if $q > 0$

Note that we did not include a TC equation for when q = 0. That was intentional, because we're focusing on situations where the firm will be open and producing/selling output (i.e. q > 0).

Let's say we plug values for q into the TC and MC equations above, but let's restrict those values to be q = 8, q = 9, q = 10, q = 11 and q = 12.

Output (q)	TC	MC
8	180	18
9	199	20
10	220	22
11	243	24
12	268	26

Now, as we said in class, firm X will make choices which lead to the firm maximizing profit. Let's consider the process we laid out for this in class.

Profit max process for a Perfectly Competitive firm (i.e. like firm X):
1. The market sets a market price (we'll call this P*)
2. The firm will respond to that price by setting an output level that maximizes profit (we'll call that output level q*)
3. The firm will calculate their profit using P*, q* and the TC that corresponds with producing q* units of output

If the price is $24, then we will add an extra column for total revenue (TR) and profit (TR – TC):

Output (q)	TC	MC	TR	Profit
8	180	18	192	12
9	199	20	216	17
10	220	22	240	20
11	243	24	264	21
12	268	26	288	20

How much output should firm X produce in order to earn maximum profit?

According to our table, firm X should produce 11 units in order to earn $21 in profit. Note that we know this because profit will increase as you produce more, then hit a maximum point before decreasing again. We don't observe profit increasing, hit a high point, decrease and then increase again later on.

Suppose that instead of the market setting a market price of $24, the market sets a price of $20 instead. The TC and MC values will remain the same, no matter what price is set, but the revenue earned from selling at a price of $20 will certainly change, as will the resulting profit.

If the price is $20, then here's our new table with new columns for TR and Profit:

Output (q)	**TC**	**MC**	**TR**	**Profit**
8	180	18	160	-20
9	199	20	180	-19
10	220	22	200	-20
11	243	24	220	-23
12	268	26	240	-28

In this situation, firm X will be earning negative profit, which we could also call a loss. Here, maximum profit is consistent with earning the lowest possible loss. That minimum loss would be to lose $19, which is what happens when firm X chooses to produce 9 units.

What do we learn from these 2 situations? Let's reproduce the tables below and highlight the row where we ended up.

Finding maximum profit when P* = $24

Output (q)	**TC**	**MC**	**TR**	**Profit**
8	180	18	192	12
9	199	20	216	17
10	220	22	240	20
11	243	24	264	21
12	268	26	288	20

Finding maximum profit when P* = $20

Output (q)	**TC**	**MC**	**TR**	**Profit**
8	180	18	160	-20
9	199	20	180	-19
10	220	22	200	-20
11	243	24	220	-23
12	268	26	240	-28

Note that maximum profit is always earned when firm X produces where the price set by the market is the same as (equal to) the firm's marginal cost when producing that level of output.

In the first situation, firm X will continue increasing output until it gets to 11 units, because at that point, P* and MC are both equal to $24. If firm X produced 10 units, then P* and MC would not be the same (P* would be $24, but MC would be $22). In the second situation, we get the same result in that firm X will produce 9 units, because this is where the price and marginal cost are equal in that setting.

Some additional questions we can ask:

1) If the firm earns negative economic profit, similar to what occurred above when the price is $20, then should the firm remain open and produce, or would it be better for the firm to close in that situation? E.g. in the setting above, if the price is $20 and the firm earns -$19 from producing and selling 9 units, then would it be better to lose $19 or just close and pay whatever sunk cost you incur in that situation?
2) Is there a correlation between changes in price and changes in profit? E.g., in the setting above, if price increases, then does the profit tend to go up or down?
3) How does this process change when we're told that a firm is maximizing profits by producing a set number of units, but we're not given the price? E.g., in the setting above, if we know that the firm is maximizing profit by producing 10 units of output, but we're not given the price, then by what process do we determine what the price must be?
4) This process of the firm determining how much output to produce is similar to our example with buying donuts that corresponded with marginal analysis. How can we frame this situation as marginal analysis? I.e., when a firm is deciding how much output to produce, then what would be the marginal benefit and marginal cost associated with that decision?