Below are notes about the profit-maximizing quantity and cost curves for a perfectly competitive firm. We discussed the profit-maximizing quantity in lecture on Monday, March 29th.

I. Profit-Maximizing Quantity

Claim: A firm maximizes profits when it produces a quantity such that at that quantity marginal revenue (MR) is equal to marginal cost (MC).

(OR: A firm maximizes profits by setting marginal revenue equal to marginal cost).

“Justification” for why profits are maximized when marginal revenue is set equal to marginal cost:

Case 1: The firm produces some \( Q_L \), such that at that quantity \( MC \) (marginal cost) is less than \( MR \) (marginal revenue). \( MC < MR \)
Then the firm could increase profits by increasing its quantity produced (by a small amount).

- The additional revenue the firm receives by selling more will be greater than the additional cost the firm incurs from producing more (because MR is greater than MC).

**Case 2:** The firm produces some $Q_H$, such that at that quantity MC (marginal cost) is greater than MR (marginal revenue). (MC > MR)

Then the firm could increase profits by decreasing quantity produced (a small amount).

- Its total costs would fall more quickly than the total revenue would fall (because MC is greater than MR).

**Conclusion:** Thus profits are not maximized when $MC < MR$ or when $MC > MR$. Thus total profits must be maximized when $MC = MR$.

## II. Cost Curves of a Perfectly Competitive Firm

First, recall the definition of a perfectly competitive market there is:

**Def:** A perfectly competitive market is one in which:

1. Many firms and many consumers.
2. The good (product) produced by each firm is homogenous (all firms produce exactly the same good).
3. Free entry and free exit (no barriers to entry).
4. Perfect information (everyone knows everything).

Recall that “many” means so many such that both consumers and producers are price-takers, they take prices as given. No individual consumer or producer can influence the price.

Below I will give solutions to example questions dealing with graphically depicting a firm in a perfectly competitive market.
**Problem:** “Graphically represent a firm in perfect competition earning a loss. What does the firm do in the short run? What happens in the long run? Illustrate your answer using a market diagram and a firm diagram. **Hint:** Part of your answer will depend on how you draw your picture.”

**Answer:**
We have not gotten to the “market” diagram part, so our “long-run” answer cannot be complete. What we can do:

![Market Diagram](image)

This is a firm earning a loss. Specifically label the rectangle below $ATC(Q_{\pi_{\text{max}}})$ and above $P_{\text{MKT}}^*$ up until $Q_{\pi_{\text{max}}}$ as the loss suffered by the firm (the area that represents loss should be shaded on the diagram and labeled).

To determine the firm’s short run decision, we need the firm’s AVC curve. Depending on how this curve is drawn, the firm’s decision could differ.

In this particular case, AVC at $Q_{\pi_{\text{max}}}$ ($AVC(Q_{\pi_{\text{max}}})$) is below $P_{\text{MKT}}^*$, thus the firm is taking in more money for each unit it sells compared to the variable cost per unit. Thus, in the short-run this firm should operate (it can cover its variable costs and some of its fixed costs).

If AVC at $Q_{\pi_{\text{max}}}$ were above $P_{\text{MKT}}^*$, then the firm should not produce.
In the long-run this firm would leave the market since it is earning a loss.

**Problem:** “Graphically represent a firm in a perfectly competitive market earning a profit. Be sure to label quantity produced and profits earned. What does the firm do in the short run? What happens in the long run? Illustrate your answer using a market diagram and a firm diagram.”

**Answer:**
Again, the long-run part cannot really be addressed (no market diagram).

The profit is the area below $P^{*}_{MKT}$ and above $ATC(Q_{π_{MAX}})$ up until $Q_{π_{MAX}}$. (The area that represents profit on the diagram should be shaded and labeled.) In the short-run this firm will produce $Q_{σ_{MAX}}$. In the long-run the firm will stay in the market.