I. Profit maximization for a competitive firm.

A. 3 rules.

B. Calculating profit or loss.

C. Shut down or operate at a loss.

I. Profit maximization for a competitive firm.

The objective of the firm is to maximize its profit. Profit is calculated as:

$$\pi = TR - TC$$

The perfectly competitive firm does not choose its cost curves or the market price. The only thing the firm can choose is what quantity to produce, and it will do that using the 3 rules of profit maximization.

A. 3 rules.

1. MR = MC. For a perfectly competitive firm, MR = P*. Therefore, the first rule can be rewritten as P* = MC.
2. MC is rising.
3. Is P* > AVC. If not, shut down.

The quantity $q^*$ satisfies all three rules and so it is the profit maximizing quantity.
B. Calculating profit or loss.

The formula for calculating profit is: \( \pi = TR - TC \).

We are working with average cost curves rather than total cost curves. Therefore, it is useful to rewrite the profit equation in terms of average costs. To do this, first note that:

\[
ATC = \frac{TC}{q}, \quad \text{and so,} \quad TC = q \times ATC.
\]

Keeping this in mind, another way to write the same formula is:

\[
\pi = TR - TC.
\]

\[
\pi = P^* q^* - TC, \quad \text{because} \quad TR = P^* q^*.
\]

\[
\pi = P^* q^* - q^* (ATC), \quad \text{because} \quad TC = q^* (ATC).
\]

\[
\pi = q^* (P^* - ATC).
\]

The new formula is the same as the original. It is useful because it is written in terms that appear on the graph we have been using.

Notice that if \( P^* > ATC \) then profit will be positive, if \( P^* < ATC \) then profit will be negative (a loss), and if \( P^* = ATC \) then profit will be zero.

Graphically, profit is:
If the market price is lower than the minimum of the firm’s average total cost (ATC), then the firm’s profit will be negative.

$$\pi = q^* (P^* - ATC)$$ (Loss)

If the market price is equal to the minimum of the firm’s average total cost (ATC), then the firm will earn zero economic profit.

$$\pi = q^* (P^* - ATC) = 0$$

C. Shut down or operate at a loss.

A firm will not operate in the long-run if its profit is negative. If a firm shuts down, then in the short-run, its total cost (TC) equals its fixed cost (FC), and in the long-run, its total cost (TC) equals zero. Therefore, if a firm shuts down, its short-run loss equals its fixed costs (FC), while it’s long-run loss is zero.
A firm will produce in the short-run if it earns an economic profit, or if its operating loss is less than its fixed cost.

This is what the 3rd rule of profit maximization checks. If the price is greater than the average variable cost (AVC) then the firm will produce in the short-run, even if its profit is negative.

This firm will operate in the short-run:

This firm will shut-down in the short-run: