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Example 2
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Intermediate Microeconomics. Lecture 17
Long-Run Competitive Equilibrium

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Example 1   Example 2
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The market equilibrium

- To solve for the long-run competitive equilibrium, we have to represent the firm's decision and the market interaction mathematically
- From the firm's side, we need to know the long-run total cost functions for all the firms
- Then we can find the minimum of the average total cost curve
  - Average total cost is minimized where the marginal cost curve crosses the average total cost curve
  - Perfectly competitive firms maximize profit where

$$P = MC$$

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Example

Suppose that the perfectly competitive market for corn is made up of identical firms. If the long-run total cost curve for each firm is given by

$$TC = 300Q - 10Q^2 + \frac{1}{2}Q^3$$

If there are free entry and exit, the long-run equilibrium price will be equal to the minimum of average total cost and marginal cost. We can find the quantity where average total cost is minimized by setting $MC = ATC$ an solving for Q

$$MC = ATC$$

$$300 - 20Q + \frac{3}{2}Q^2 = 300 - 10Q + \frac{1}{2}Q^2 \Rightarrow Q = 10$$

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Alternatively, we could find the quantity where ATC is minimized by taking its first-order condition with respect to Q (why?)

$$\frac{dATC}{dQ} : \ -10 + Q = 0$$

$$\boxed{Q = 10}$$

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Example

To find the price at which the firm will produce 10 units, plug this quantity into either MC or ATC

$$P = MC$$

$$P = 300 - 20(10) + \frac{3}{2}(10)^2$$

$$\boxed{P = 250}$$

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Example

Suppose the market demand is

$$Q^D = 30,000 - 50P$$

When price is \$250, Q=17,500

$$Q^D = 30,000 - 50(250) = 30,000 - 12,500 = 17,500$$

If each firm produces 10 units, then the number of firms, N, is

$$N = \frac{Q}{q} = \frac{17,500}{10} = 1,750$$

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Example

Suppose that the perfectly competitive market for milk is made up of identical firms with long-run total cost functions given by

$$TC = 50Q - 30Q^2 + 5Q^3$$

Market demand is

$$Q^D = 10,000 - 200P$$

- Find the long-run equilibrium price, the quantity produced by each firm, and the number of firms in the industry

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Example

First, find average total cost

$$ATC = 50 - 30Q + 5Q^2$$

Now find the quantity produced by each firm at the minimum average cost by solving the first-order condition

$$\frac{dATC}{dQ} : \; -30 + 10Q = 0$$

$$\boxed{Q = 3}$$

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Then plug this quantity into the average total cost equation to
get the equilibrium price

$$P = ATC$$

$$P = 50 - 30(3) + 5(3)^2 \ \Rightarrow \ \boxed{P = 5}$$

At this price, the quantity demanded in the market is

$$Q^D = 10,000 - 200P = 10,000 - 200(5) = 9,000$$

$$N = \frac{Q}{q} = \frac{9,000}{3} = 3,000$$