Introductory Microeconomics
Homework 3: Producer Theory and Supply

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1. T/F. The supply of the firm shifts right when the price of the good increases.
2. T/F. Marginal revenue and marginal cost are equal in the profit maximizing quantity.
3. T/F. The law of diminishing returns is the main reason why marginal cost slopes up.
4. T/F. The ATC curve crosses the MC curve where the marginal cost attains a minimum.
5. T/F. Maximizing profits is equivalent to maximizing total revenue.
6. (Mankiw 14.4) A firm produces a single output using only workers. Its production function is given below.

Workers (l)	Output (q)	AP	MP	TC	ATC	MC
0	0	×	×		×	×
1	20					
2	50					
3	90					
4	120					
5	140					
6	150					
7	155					

   (a) Find the marginal product and the average product. Plot them in the same graph. The horizontal axis should be l and the vertical axis the MP and AP.

   (b) A worker costs $100 a day and the firm has fixed costs of $200. Find the total cost.

   (c) Find the average total cost and the marginal cost and plot them in the same graph. The horizontal axis should be q and the vertical axis MC and ATC. Label the minimum efficient scale. Help: You may approximate the marginal cost using $\text{MC} = \frac{\text{TC}_{\text{current}} - \text{TC}_{\text{previous}}}{q_{\text{current}} - q_{\text{previous}}}$.

   (d) Explain intuitively why the MC crosses the ATC on its minimum point.

7. A firm produces a single output. In the short run its cost function is given below.

q	Variable Cost	Total Cost	ATC	AVC	MC
0	0	105	×	×	×
1	29	134			
2	54	159			
3	74	179			
4	92	197			
5	115	220			
6	147	252			
7	189	294			
8	244	349			
9	314	419			

(a) Find the average total cost, the average variable cost and the marginal cost. What's the value of the fixed cost?

(b) Plot the three of them in the same graph. Explain why the MC crosses the other two in the way it does. It's ok if your graph is not drawn to scale.

8. Continue working with the previous exercise. For each of the following prices answer: 1) Will the firm remain open in the short run? 2) If so, how many units will it produce? And what's the value of the profits?

(a) $p = 20$

(b) $p = 32$.

(c) $p = 55$.

Now answer:

(d) What's the price that generates zero profits?

(e) What's the price that defines whether to stay open or shut down in the short run?

9. (Mankiw 15.11) Suppose a firm has the following costs.

$$\text{TC} = 50 + \frac{1}{2}q^2 \qquad \text{MC} = q$$

(a) What's the fixed cost? Give an equation for the average total cost.

(b) Graph the ATC and the MC for q between 5 and 15. At what quantity is the average total cost curve the minimum?

(c) What's the supply of the firm in the long run?

10. A firm produces a single output according the the following technology:

$$\text{TC} = \frac{1}{100}q^3 - \frac{2}{5}q^2 + 10q + 180$$
$$\text{MC} = \frac{3}{100}q^2 - \frac{4}{5}q + 10$$

(a) What's the fixed cost? Give an equation for the average variable cost. Give an equation for the average total cost.

(b) For $q = 10, 15, 20, 25, 30, 35, 40$, plot the MC, ATC, and AVC in the same graph.

(c) What's the price that produces zero profits?

(d) What's the price that makes the firm shut down in the short run?