3.4 Production and costs

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS marginal cost • average total cost • marginal product

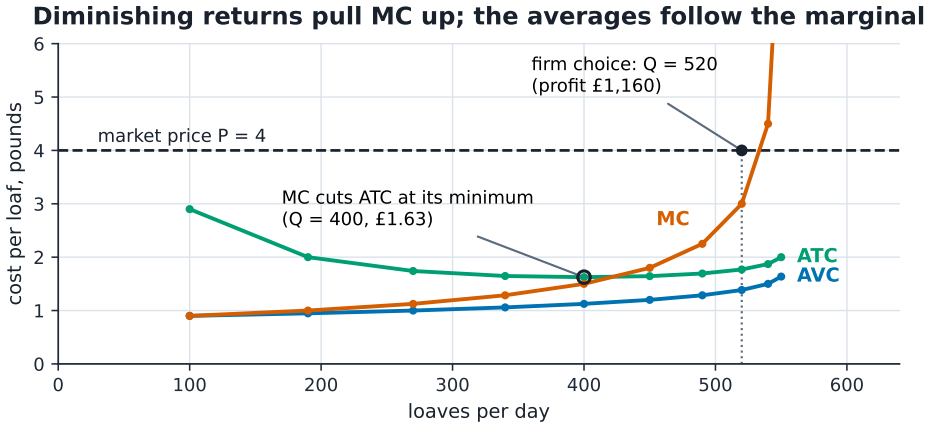
Objective

Derive marginal and average costs from a production table; locate minimum ATC and explain the crossing; run the produce/shutdown rules at a given price; keep the short run and the long run apart.

1 Key knowledge and worked examples

■ Production first, costs after

$MC = w/MPL$: the wage divided by the **marginal product** . As **diminishing returns** bite, MC rises; the averages chase it, and MC cuts **average total cost** at its minimum. **Fixed cost** never moves with output; **variable cost** does.



Diminishing returns pull MC up; the averages follow the marginal

■ Worked example. Nimbus's eighth and ninth bakers

Eighth baker: MPL 30, MC $90/30 = £3.00$ – below the £4 price, so hire ✓. Ninth: MPL 20, MC $90/20 = £4.50 > 4$ – do not. Output 520, profit $4 \times 520 - 920 = £1{,}160$ ✓. Produce while $P \geq MC$; shut below minimum AVC (£0.90).

2 Practice

A coffee cart pays each worker £60 a day; its espresso machine costs £150 a day however much it sells. Daily cups by workers:

L	1	2	3	4	5	6
cups	60	110	150	180	200	210

2.1 Compute MPL, MC, AVC and ATC for $L = 1, 2, 3$. [4]

2.2 Where does ATC bottom out on this table (compute it for the remaining rows), and why does MC pass through that minimum? [4]

2.3 The market price of a cup is £2.00. How many workers does the cart employ, and what profit or loss does the day show? Verify the loss is smaller than shutting down would be. [4]

2.4 A price war drops the cup to £0.95. What does the cart do, and why, with numbers? [3]

2.5 The owner says: "ATC falls from L = 1 to L = 4 – that's our economies of scale kicking in." Correct him in two lines. [2]

2.6 True or false with one line each: (a) the £150 machine is irrelevant to how many cups to sell; (b) MC can be computed from the change in ATC; (c) the shutdown rule compares price with ATC. [3]

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Solutions

2.1

- L=1: MPL 60, MC 60/60 = £1.00, AVC 60/60 = £1.00, ATC 210/60 = £3.50.
- L=2: MPL 50, MC £1.20, AVC 120/110 = £1.09, ATC 270/110 = £2.45.
- L=3: MPL 40, MC £1.50, AVC £1.20, ATC 330/150 = £2.20.
- MC rises with each worker because MPL falls.

2.2

- Remaining ATC: L=4: 390/180 = £2.17; L=5: 450/200 = £2.25; L=6: 510/210 = £2.43.
- The minimum is at **L = 4 (£2.17)**.
- MC there is 60/30 = £2.00, passing through from below.
- A cup cheaper than the average pulls the average down, a dearer one pushes it up, so the average can only turn where MC equals it.

2.3

- Employ while $MC \leq 2.00$: the fourth worker's cups cost exactly £2.00, the fifth's £3.00 – stop at **L = 4, 180 cups**.
- Revenue £360 against cost 240 + 150 = £390: a **loss of £30**.
- Shutting down loses the £150 fixed cost, and £30 < £150, so operating is right.
- The price covers AVC (£1.33) and £120 of the fixed cost.

2.4

- £0.95 is below the smallest AVC on the table (£1.00, the first worker's 60 cups).
- No scale even pays its own wages – the best candidate, one worker, brings £57 against £60.
- **Shut down** and lose only the £150.

2.5

- The machine never changed size: that fall is the £150 fixed cost spreading over more cups, a short-run effect.
- **Economies of scale** are long-run, about changing the cart itself.

2.6

- (a) True for the marginal decision (how many cups), false for shutdown.
- (b) False – MC comes from w/MPL, never from differencing ATC.
- (c) False – shutdown compares price with minimum AVC; P < ATC means loss, not closure.

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