

3.1 The Production Function

Name: _____ Class: _____ Date: _____

Total: 10 marks

Objective

Build the skills to answer exam questions on **the production function**.

You must be able to:

- define the **production function** 生产函数 as the relationship between inputs and output
- distinguish the **short run** 短期 from the **long run** 长期
- calculate **total, marginal, and average product**
- explain the **law of diminishing marginal returns** 边际报酬递减

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Production function and time

The production function links **inputs** to **output**. In the **short run** at least one input is **fixed**; in the **long run** all inputs are variable.

■ Product measures

Total product (TP) is total output; **marginal product** $MP = \frac{\Delta TP}{\Delta L}$; **average product** $AP = \frac{TP}{L}$.

■ Diminishing marginal returns

Adding more of a variable input to fixed inputs eventually makes **marginal product fall**.

2 Practice

2.1 State the difference between the short run and the long run.

[2]

2.2 Total product rises from 20 to 26 when a fourth worker is hired. Find the marginal

product of the fourth worker. [2]

2.3 State the law of diminishing marginal returns. [1]

3 Exam-style questions

3.1 In the short run, at least one input is [1]

- **A** variable
 - **B** fixed
 - **C** zero
 - **D** free
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3.2 Diminishing marginal returns means marginal product eventually [1]

- **A** rises
 - **B** falls
 - **C** stays constant
 - **D** is always zero
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3.3 A factory adds workers to a fixed set of machines. Output for 1, 2, 3, 4 workers is 10, 22, 30, 34 units.

(a) Find the marginal product of the third worker. [1]

(b) Find the marginal product of the fourth worker. [1]

(c) State whether diminishing marginal returns have set in. [1]

4 Go further

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- work through the **3.1 The Production Function** lesson on the **Learn** page;
 - read the **Production, Cost, and the Perfect Competition Model** section of the AP Microeconomics handout on the **Know** page.

Solutions

2.1 in the short run at least one input is fixed; in the long run all inputs are variable.

$$\mathbf{2.2} \quad MP = \frac{\Delta TP}{\Delta L} = \frac{26 - 20}{1} = 6 \text{ units.}$$

2.3 as more of a variable input is added to fixed inputs, its marginal product eventually falls.

3.1 B.

3.2 B.

3.3 (a) $30 - 22 = 8$ units. (b) $34 - 30 = 4$ units. (c) yes —marginal product is falling.