1.8 Production, Productivity and the Law of Diminishing Returns: 30-minute Pack

AQA 7136 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer all questions in full sentences where indicated. Diagrams should be drawn and labelled carefully. No calculator is allowed. Show working for any arithmetic.

1 Explain why diminishing marginal returns occur in the short run when a firm increases a variable factor such as labour while holding some factors fixed. In your answer, include reference to the behaviour of MP and AP, the role of fixed factors, the point at which diminishing returns begin, and at least two evaluative considerations that could limit or modify the basic theory in practice. You may draw a diagram to support your answer; label any diagram clearly. (12 marks)

(Total for Question 1 is 12 marks)

2 Define total product as used in the short-run production context for a firm such as a small bakery in Manchester.

(Total for Question 2 is 1 mark)

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3 Table 1: Completing marginal and average product. A local printer increases labour in the short run. The table below shows units of labour and total product (TP) per day. Complete the MP and AP columns for workers 1 to 4, and state at which worker the law of diminishing marginal returns first sets in for this printer.

(a) Table 1 data, fill MP and AP. Table: Labour (workers) 0, 1, 2, 3, 4. TP (prints/day): 0, 9, 20, 30, 40. Compute MP for workers 1-4 and AP for workers 1-4. **(3)**

(b) State the worker number at which diminishing marginal returns first set in for this printer and explain briefly why that point qualifies. **(1)**

(Total for Question 3 is 4 marks)

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4 Table 2: Identifying the point of diminishing returns and completing TP. A small cafe records output of sandwiches per hour as it varies staff on the counter. Labour (workers) 0, 1, 2, 3, 4. MP given: -, 7, 6, 4, 2. TP for labour 0 is 0. Complete TP for workers 1-4, state AP for worker 4 to one decimal place, and identify at which worker diminishing marginal returns first set in.

(a) Compute TP for workers 1-4 using the MP column, then compute AP for worker 4 and state the point at which diminishing marginal returns first set in. **(3)**

(b) State in one sentence what the MP sequence in this table tells you about productivity per additional worker. **(1)**

(Total for Question 4 is 4 marks)

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Mark scheme · 1.8 Production, Productivity and the Law of Diminishing Returns: 30-minute Pack

Question 1

Level 1 Basic statements about diminishing marginal returns with limited explanation, little or no reference to MP/AP behaviour, and minimal or no evaluation. **1-4**

Level 2 Clear explanation of why diminishing marginal returns occur, including description of MP falling and relationship to AP, reference to fixed factors, and at least one valid evaluative point or qualification. **5-8**

Level 3 Detailed explanation linking fixed factors, congestion of resources and falling MP, clear discussion of MP/AP interactions and the onset point, plus at least two well-developed evaluative considerations such as time horizons, managerial response, training/technology, and measurement issues; diagrammatic support where helpful. **9-12**

Indicative content:

- Start from the short-run definition: at least one factor (capital, plant) is fixed while labour is variable, so output must be produced using more of the variable factor with the same fixed stock.
- Explain that initially MP may rise due to specialisation and division of labour, so TP increases at an increasing rate, but as more units of the variable factor are added congestion and limited fixed inputs make each additional worker less effective, so MP falls.
- Describe how AP behaves: AP may rise while MP exceeds AP, reaches a maximum where MP = AP, and then falls as MP falls below AP. The point where MP starts to fall marks the start of diminishing marginal returns, and the point where MP becomes zero corresponds to TP maximum.
- Give economic mechanisms: limited number of machines, overcrowding, increased waiting times for use of equipment, and reduced capital per worker lead to lower marginal productivity.
- Include evaluative points: the timing of diminishing returns depends on technology and the degree of fixedness of inputs, managerial organisation and training can delay or mitigate diminishing returns, and measurement/short-run definitions matter (seasonality, part-time hours).
- Consider external factors: if firms can substitute other inputs or use overtime, the short run may be extended; also average versus marginal measures can give different policy implications.
- Conclude with a balanced judgement: the law is a useful short-run regularity for many production processes but its practical onset and severity depend on specific firm-level features, time horizon and scope for adjustment.

Question 2

a numerical or verbal definition that total product is the total quantity of output produced by the firm using a given amount of the variable factor and fixed factors in the short run **B1**

Answer: The total quantity of output produced using the given combination of inputs in the short run.

Question 3

(a) MP values: worker1 = 9, worker2 = 11, worker3 = 10, worker4 = 10 **M1**

(a) AP values: worker1 = 9.0, worker2 = 10.0, worker3 = 10.0, worker4 = 10.0 (allow exact decimals or fractions equivalent) **M1**

(a) values calculated correctly and internally consistent with TP **B1**

(a) Answer: MP: 9, 11, 10, 10. AP: 9.0, 10.0, 10.0, 10.0.

(b) diminishing marginal returns begins at worker 3 because MP rises from 9 to 11 for worker 2 but then falls to 10 for worker 3, so the additional output from the extra worker begins to decline at worker 3 **B1**

(b) Answer: Diminishing marginal returns set in at worker 3, because MP increases from 9 to 11 at worker 2 then falls to 10 at worker 3, showing the start of a decline in the extra output per additional worker.

Question 4

(a) TP values: worker1 = 7, worker2 = 13, worker3 = 17, worker4 = 19 (TP is cumulative sum of MPs) **M1**

(a) AP at worker4 = TP(4) / 4 = 19 / 4 = 4.8 **M1**

(a) diminishing marginal returns begin at worker 2 because MP falls from 7 (worker 1) to 6 (worker 2), so the first fall occurs at worker 2 (accept 'after worker 1') **B1**

(a) Answer: TP: 7, 13, 17, 19. AP at worker 4 = 4.8. Diminishing returns first set in at worker 2 (MP falls from 7 to 6).

(b) a clear statement that MP is falling from worker 2 onward so each additional worker contributes less extra output, indicating falling marginal productivity **B1**

(b) Answer: The MP sequence shows that from the second worker onward each extra worker adds less output than the previous one, indicating falling marginal productivity.

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