

LECTURE 7

PRODUCTION



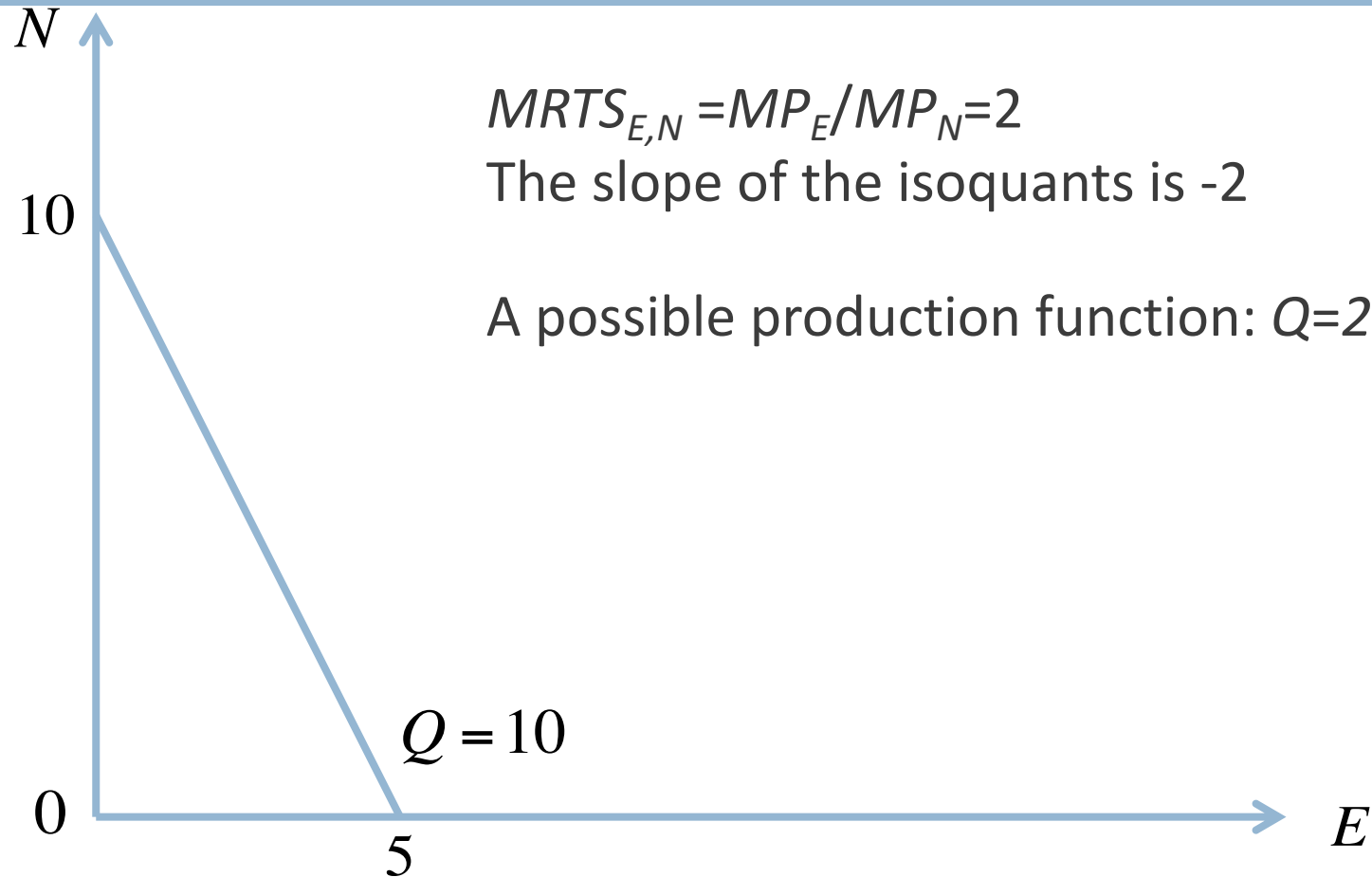
Question 1: Linear Production Function

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- A firm uses two inputs in the production process
 - ▣ Experienced worker (E)
 - ▣ New worker (N)
- Suppose 1 experienced worker is always equivalent to 2 new workers
- Put E on the horizontal axis and N on the vertical axis
- What is the slope of the isoquants?

Question 1: Solution

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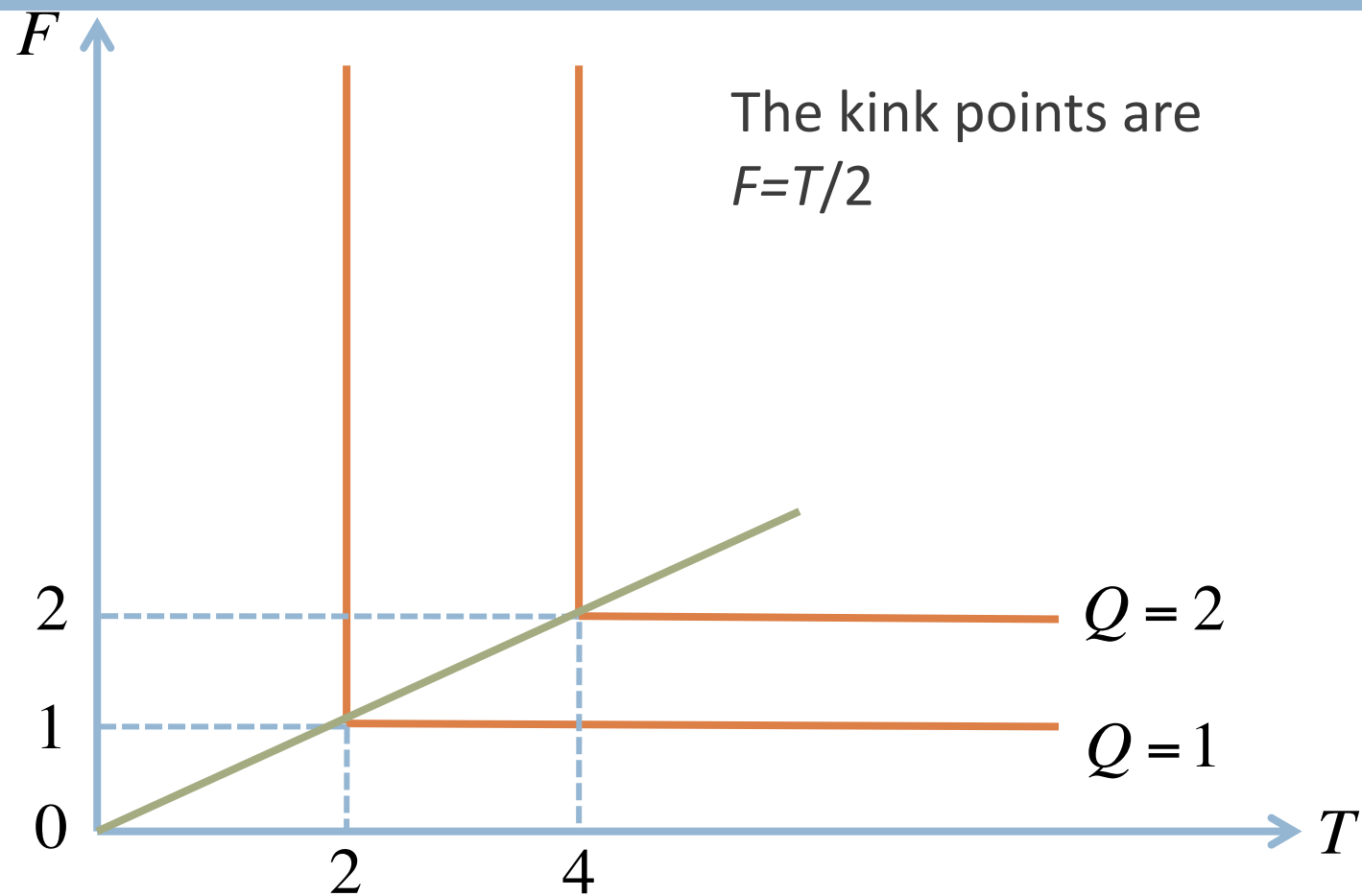
Question 2: Fixed Proportion Production Function

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- A firm uses two inputs in the production process
 - ▣ Bicycle tyres (T)
 - ▣ Bicycle frames (F)
- One bicycle requires exactly 1 frame and 2 tyres
- Put T on the horizontal axis and F on the vertical axis
- What are the kink points of the isoquants?

Question 2: Solution

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Question 3: Technological Progress

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- Suppose the initial production function is

$$Q^1 = KL + K$$

- The new production function is

$$Q^2 = 2(KL + K)$$

- $MRTS_{L,K}$ does not change

$$MRTS_{L,K}^1 = MRTS_{L,K}^2 = \frac{K}{L+1}$$

- Is this a neutral technological progress?

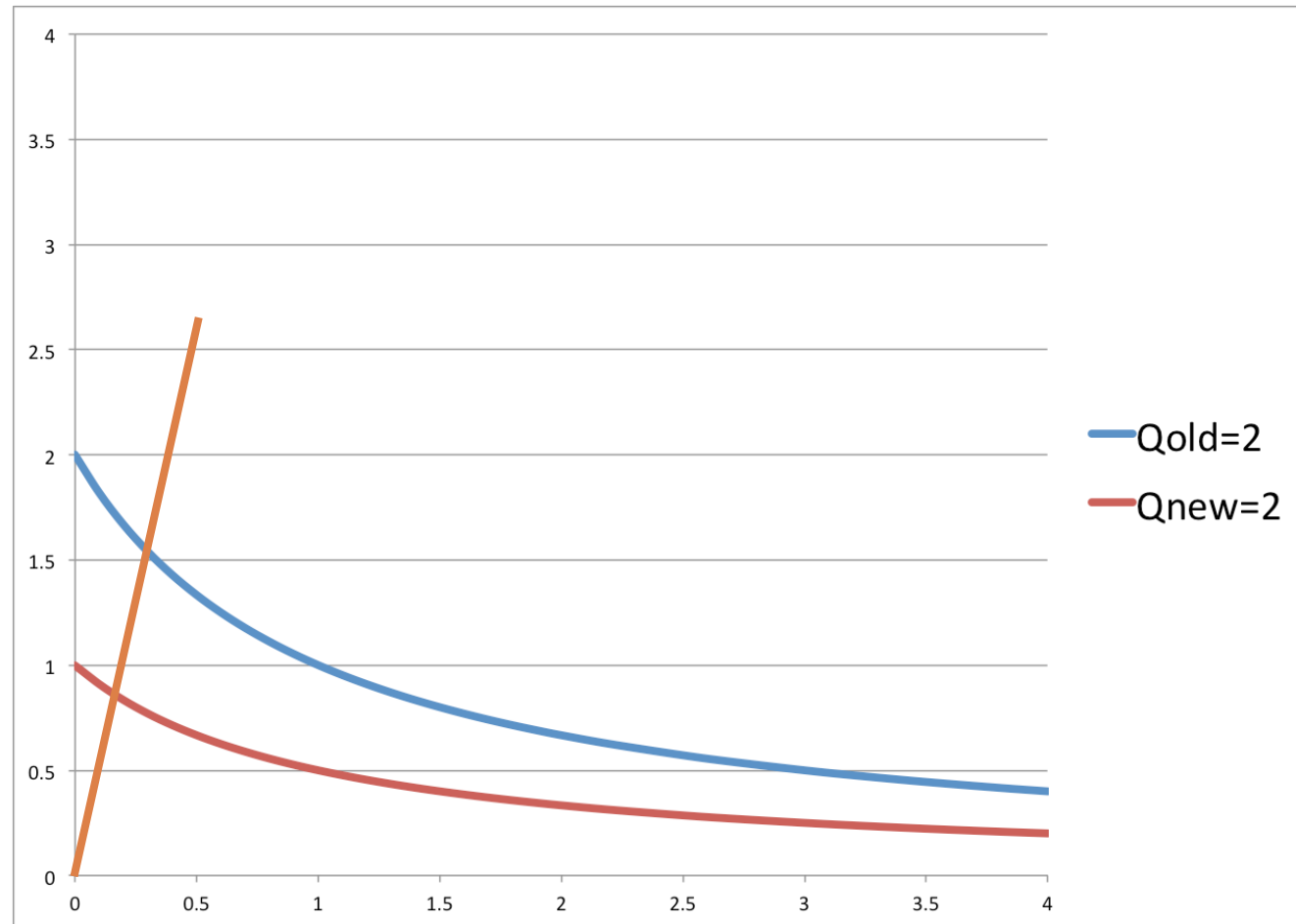
Question 3: Solution

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- What is neutral technological progress?
 - ▣ $MRTS_{L,K}$ along any ray from the origin remains the same
- Is there a difference between the two?
 - ▣ $MRTS_{L,K}$ along any ray from the origin remains the same
 - ▣ $MRTS_{L,K}$ remains the same
- What is a ray from the origin?
 - ▣ A straight line $K=aL$ where $a>0$
- $MRTS_{L,K}$ along any ray from the origin remains the same means
 - ▣ For two points with the same K/L ratio, $MRTS_{L,K}$ remains the same

Question 3: Solution in Graph

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Question 3: Solution Example

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- With the initial production function
 - ▣ When $L=K=1$, $Q=2$
 - ▣ $(L=1, K=1)$ is on the ray $K=L$
 - ▣ At this point $MRTS_{L,K} = 1/(1+1) = 0.5$
- With the new production function
 - ▣ The point on $Q=2$ and $K=L$ is $(L=0.62, K=0.62)$
 - ▣ At this point $MRTS_{L,K} = 0.62/(0.62+1) = 0.38$
- $MRTS_{L,K}$ along the ray $K=L$ not the same!

Question 4: Technological Progress for Cobb-Douglas Production Function

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- Suppose the initial production function is

$$Q^1 = KL$$

- The new production function is

$$Q^2 = 2KL$$

- $MRTS_{L,K}$ does not change

$$MRTS_{L,K}^1 = MRTS_{L,K}^2 = \frac{K}{L}$$

- Is this a neutral technological progress?

Question 4: Solution

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- With the initial production function
 - ▣ When $L=1, K=2, Q=2$
 - ▣ $(L=1, K=2)$ is on the ray $K=2L$
 - ▣ At this point, $MRTS_{L,K}=2$
- With the new production function
 - ▣ The point on $Q=2$ and $K=2L$ is $(L=0.71, K=1.41)$
 - ▣ At this point $MRTS_{L,K}=2$
- $MRTS_{L,K}$ along the ray $K=2L$ are the same
- Same applies to any ray $K=aL$

Question 4: Comment

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- For Cobb-Douglas production functions

$$MRTS_{L,K} = \frac{bK}{L}$$

- For any two points on the same ray $K=aL$

$$MRTS_{L,K} = \frac{bK}{L} = ab$$

- If the equations of $MRTS$ are the same
- $MRTS$ along the ray $K=aL$ are also the same
- For Cobb-Douglas production functions, we can just compare $MRTS$
 - ▣ No need to compare $MRTS$ along a ray from the origin

Q&A on Lecture 7