

Constant Returns Simplified



Which equations represents a production function with constant returns to scale?
(Select each correct answer.)

☐ $q = \sqrt{K} + \sqrt{L}$

☐ $q = \sqrt{K} + L$

☒ $q = \sqrt{KL}$

☐ $q = \sqrt{K+L}$

☐ $q = KL$

☒ $q = K + L$

☒ $q = 4K + L$

☒ $q = 4K + 4L$

☒ $q = \min\{K, L\}$

☐ $q = \min\{\sqrt{K}, \sqrt{L}\}$



Explanation

The condition for constant returns to scale is that doubling each input results in a doubling of output. That is $f(2L, 2K) = 2f(L, K)$.

You are an expert in microeconomics. I have a problem with the solution as shown in the picture. However, I feel the solution explanation is difficult. I feel unfamiliar with the core concepts behind it and with some terms. Please help to re-explain it in beginner-friendly style and include some humor.



Sure! Let me break this down in a beginner-friendly way, and I'll sprinkle in a bit of humor to keep it fun!

The Question

You're trying to figure out which equations show a "**constant returns to scale**" production function. Sounds fancy, right? Don't worry—it's not as scary as it seems.

What's "Constant Returns to Scale"?

Imagine you're running a pizza shop 🍕. If you **double your workers** (labor, or L) and **double your ovens** (capital, or K), you expect to bake **double the number of pizzas**. That's constant returns to scale!

Mathematically, if you multiply your inputs by 2, your output also gets multiplied by 2:

$$f(2L, 2K) = 2f(L, K)$$

(Translation: If you double inputs, you double output!)

How Do These Equations Work?

Each of these equations is like a recipe for making stuff using K (capital) and L (labor). Let's test them one by one to see if doubling K and L doubles the output q :

Example 1: $q = \sqrt{KL}$

- If you double K and L , the output becomes:

$$q = \sqrt{(2K)(2L)} = \sqrt{4KL} = 2\sqrt{KL}$$

- Boom 🌟! It doubles. This one works.
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Example 2: $q = K + L$

- Doubling K and L :

$$q = 2K + 2L = 2(K + L)$$

- Bingo! It doubles too. This one's a keeper.
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Example 3: $q = 4K + 4L$

- Doubling K and L :

$$q = 4(2K) + 4(2L) = 8K + 8L = 2(4K + 4L)$$

- You guessed it—it doubles. Another good one.
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Example 4: $q = \min\{K, L\}$

- Here's the tricky one, but bear with me. Imagine $K = 4$ and $L = 6$. The output q is the smaller of the two:

$$q = \min\{4, 6\} = 4$$

- Now double K and L : $K = 8$ and $L = 12$.

$$q = \min\{8, 12\} = 8$$

- See? The output also doubles. This one's legit too.
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Which Ones DON'T Work?

1. $q = \sqrt{K} + \sqrt{L}$: Doubling K and L doesn't quite double q —it's a slower growth.
 2. $q = KL$: This one explodes! Instead of doubling, it quadruples the output. That's **way** too enthusiastic.
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TL;DR (Too Long; Didn't Read)

Constant returns to scale means "double inputs, double outputs." Equations like $q = \sqrt{KL}$, $q = K + L$, $q = 4K + 4L$, and $q = \min\{K, L\}$ pass the test because their output doubles when the inputs are doubled.

Think of it like ordering pizza: if two chefs and two ovens make 20 pizzas, doubling both should give you 40 pizzas—not 80, not 10, just 40. 🍕 Simple as that!

Did this explanation clear it up? 😊



What concept did Malthus overlook when formulating his theory?

☐ Non-fixed land in the long run
☐ Compounded growth rates
☒ Productivity growth via technological improvement
☐ Democracy and good governance
☐ None of the above

✓

Explanation

Malthus missed the concept of productivity growth via technological improvement — the A in $f = Af(K, L)$. Productivity can increase output, even if labor, capital, land, and other inputs remain fixed. Although there have been famines, there have not been "Malthusian" famines. That is, famines have been due to weak states rather than insufficient agricultural productivity.

now please help to re-explain this problem.



Sure! Let's make sense of this question about Malthus and his theory—and have some fun along the way.

What's This All About?

The question is asking what **Thomas Malthus**—the famous 18th-century economist—**missed** when he made his predictions about the future of humanity. Spoiler alert: Malthus was a bit of a pessimist. He thought population growth would outpace food production, leading to famine, misery, and, well, doom.



What Did Malthus Overlook?

Malthus didn't think about **productivity growth through technology**. In modern terms, this is the "magic" of machines, fertilizers, and clever farming techniques (what economists call the "A" in the formula $f = Af(K, L)$).

Here's what that means in plain English:

- K = capital (e.g., tractors, tools)
- L = labor (e.g., farmers working in the fields)
- A = technology (e.g., better seeds, irrigation, or AI that can predict weather)

Malthus assumed that with fixed land, food production could only grow so much. But he didn't realize that technology could supercharge productivity! ✨


For example:

- With one acre of land, a farmer in 1800 might feed 4 people.


- Thanks to tech like tractors and genetic engineering, today that same acre might feed 40 people.



Why Was Malthus Wrong?

1. **Technology Happened:** Malthus didn't see the industrial revolution coming. Machines replaced manual labor, fertilizers improved soil fertility, and science kept innovating.
 2. **Productivity Went Boom:** Even with limited land, technological improvements meant more food could be produced with the same resources. So instead of famine, we got supermarkets. 
 3. **Modern Famines Aren't "Malthusian":** Famines today are usually caused by political instability or bad governance (e.g., wars, corruption) rather than actual food shortages.
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TL;DR (Too Long; Didn't Read)

Malthus thought we'd all starve because population growth would outpace food production. But he didn't account for **technology** making farming more productive. Basically, he underestimated human ingenuity—and lucky for us, that's why we still have pizza, burgers, and fries. 

Does this help clear it up? 😊