

Title: A New Marginalism: Gauge Theory in Economics

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Abstract:

# A New Marginalism: Gauge Theory in Economics

Pia Malaney

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# What is economics? Differing Visions



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“The combined assumptions of maximizing behavior, market equilibrium, and stable preferences, used relentlessly and unflinchingly, form the heart of the economic approach”

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# What is economics?

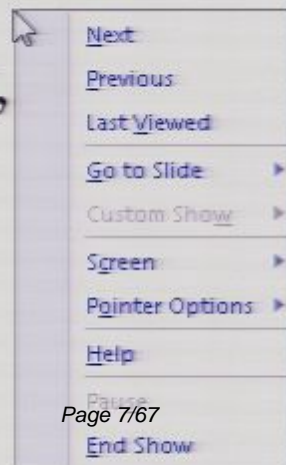
## Differing Visions

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# The Quiet Crisis in Welfare Theory: The most dangerous question at the core

“Traditional neo-classical economics has worked with the assumption that preferences of agents in the economy are fixed. This assumption has always been disputed, and, indeed, in the social sciences outside of neoclassical economics **the assumption has never been accepted by anyone.**”

-C. Christian von Weizsäcker 2005



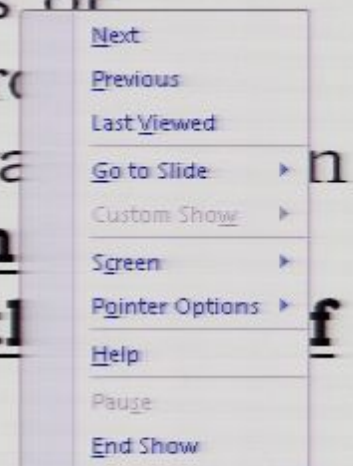
# The Quiet Crisis Continued...

“The obstacle is the lack of an answer to the question: how can you do welfare economics, if preferences change endogenously? After all, preferences of individual agents are the basic measuring rod of economic welfare, of the performance generated in an economic system. **How can we evaluate an economic system with a measuring rod that itself changes with the system?**”

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# First Solution: Define the Problem out of Economics



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“...tastes neither change capriciously nor differ importantly between people. On this interpretation one does not argue over tastes for the same reason that one does not argue over the Rocky Mountains – both are there, will be there next year, too, and are the same to all men.”

-Gary Becker and George Stigler, 1977, *De Gustibus Non Est Disputandum*

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“That the problems [of change of taste] have remained central and largely unresolved for twenty five hundred years no doubt makes some economists think it wise to define them out of the discipline, at whatever cost in realism and relevance.

- M.S. McPherson, ‘Changes in tastes’ entry in *The New Palgrave: A Dictionary of Economics*, 1987, pp. 401-403

Next Solution: Ignore the Problem and  
hope it goes unnoticed

Challenge: Count the percentage of  
work on Changing Preferences as a  
fraction of all economic research.

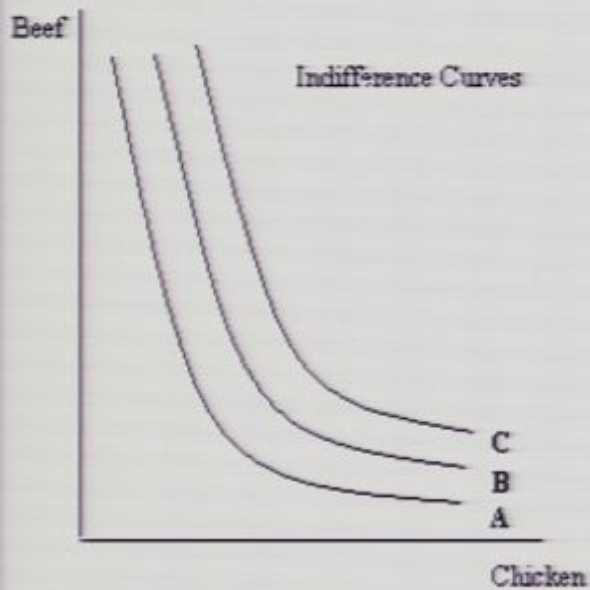
# Better Solution: Confront the Issue via a new economic marginalism

	<b>Market Consumption</b>	<b>Welfare</b>	<b>Production</b>	<b>Geometry</b>
<b>Tradeoff</b>	Budget Constraint	Indifference	Shift	Horizontal Subspace
<b>Increase/Decrease</b>	Purchasing Power	Utility	Growth	Vertical Subspace

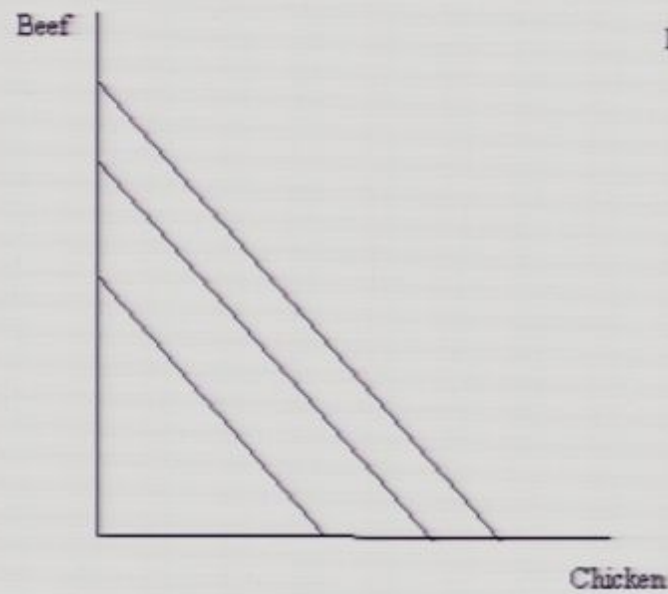
## **Generalized Income and Substitution Effects**

Note: The term 'Marginal Revolution' refers to the broad introduction of the differential calculus into economic theory

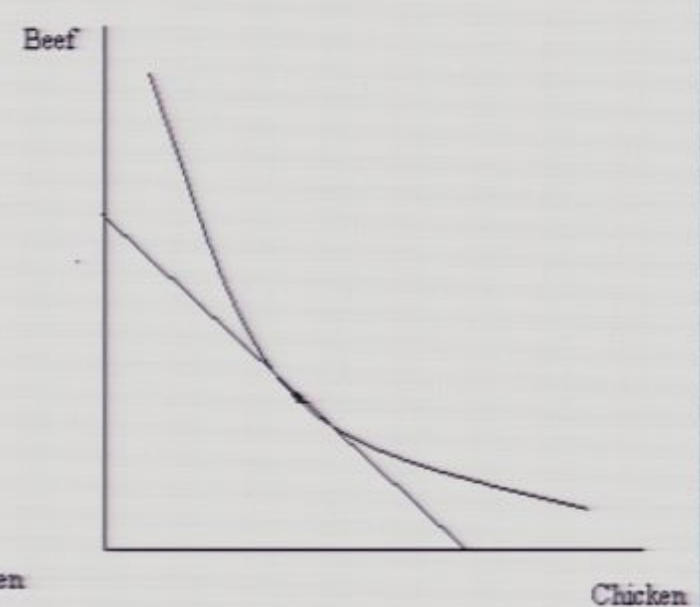
# The Theory of the Consumer



**Preferences**



**Budget Constraint**



**Consumption Basket**

Marshallian Demand: Maximising welfare subject to budget constraint



# Measuring Inflation and Growth : Mechanical Index Numbers in Disagreement

Laspeyres  $P_L(p^0, p^1, q^0, q^1) \equiv \frac{p^1 \cdot q^0}{p^0 \cdot q^0}$

Paasche  $P_P(p^0, p^1, q^0, q^1) \equiv \frac{p^1 \cdot q^1}{p^0 \cdot q^1}$

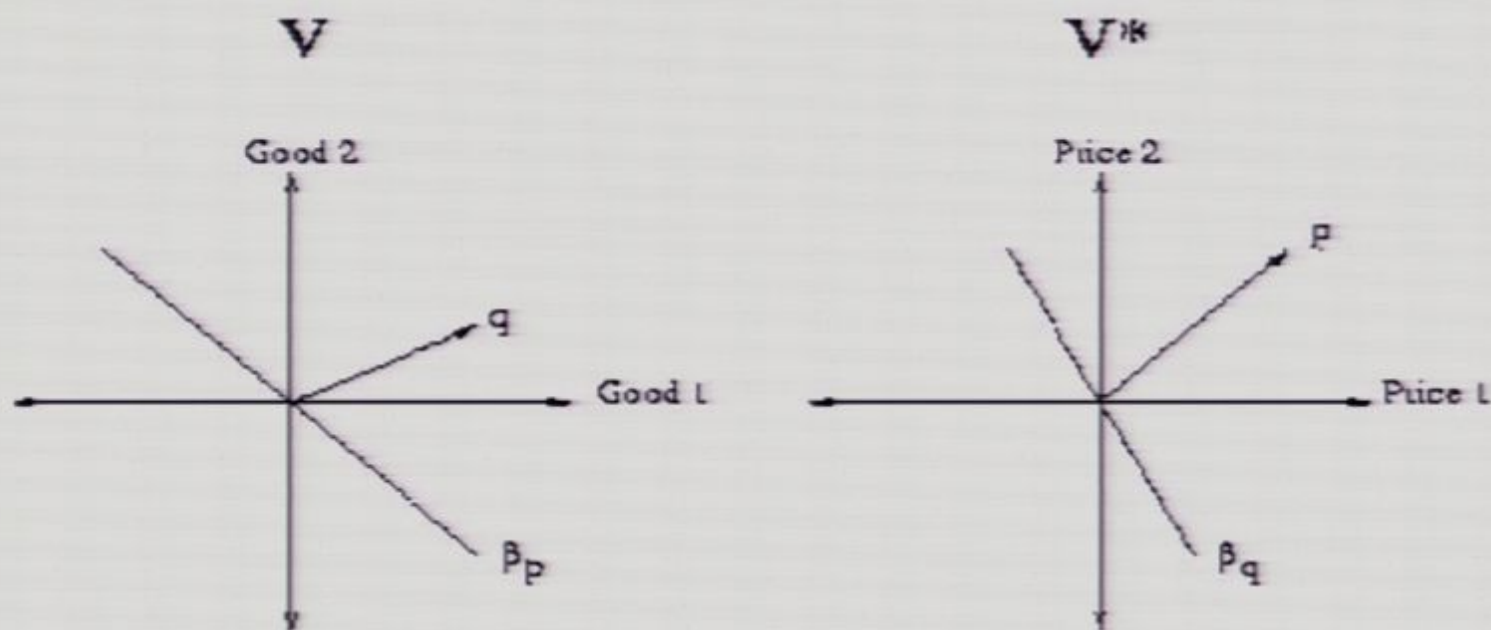
Tornqvist  $P_T(p^0, p^1, q^0, q^1) \equiv \prod_{n=1}^N \sqrt{\left(\frac{p_n^1}{p_n^0}\right)^{\frac{p_n^0 q_n^0}{p^0 \cdot q^0}} \cdot \left(\frac{p_n^1}{p_n^0}\right)^{\frac{p_n^1 q_n^1}{p^1 \cdot q^1}}}$

Fisher  $P_F(p^0, p^1, q^0, q^1) \equiv \sqrt{\frac{p^1 \cdot q^0}{p^0 \cdot q^0} \cdot \frac{p^1 \cdot q^1}{p^0 \cdot q^1}}$

Divisia  $P_D(p^0, p^1, q^0, q^1) \equiv \exp\left(\int_{\alpha(0)}^{\alpha(1)} \sum_{i=1}^n \frac{p_i(t)q_i(t)}{\sum_{j=1}^n p_j(t)q_j(t)} \frac{dp_i(t)}{p_i(t)}\right)$

**Note:** Ragnar Frisch Proves in 1930 there is no index number satisfying 3 so called Fisher Axioms. Note that  $p^0 = p^1$  gives an answer of 1 in all cases but the last

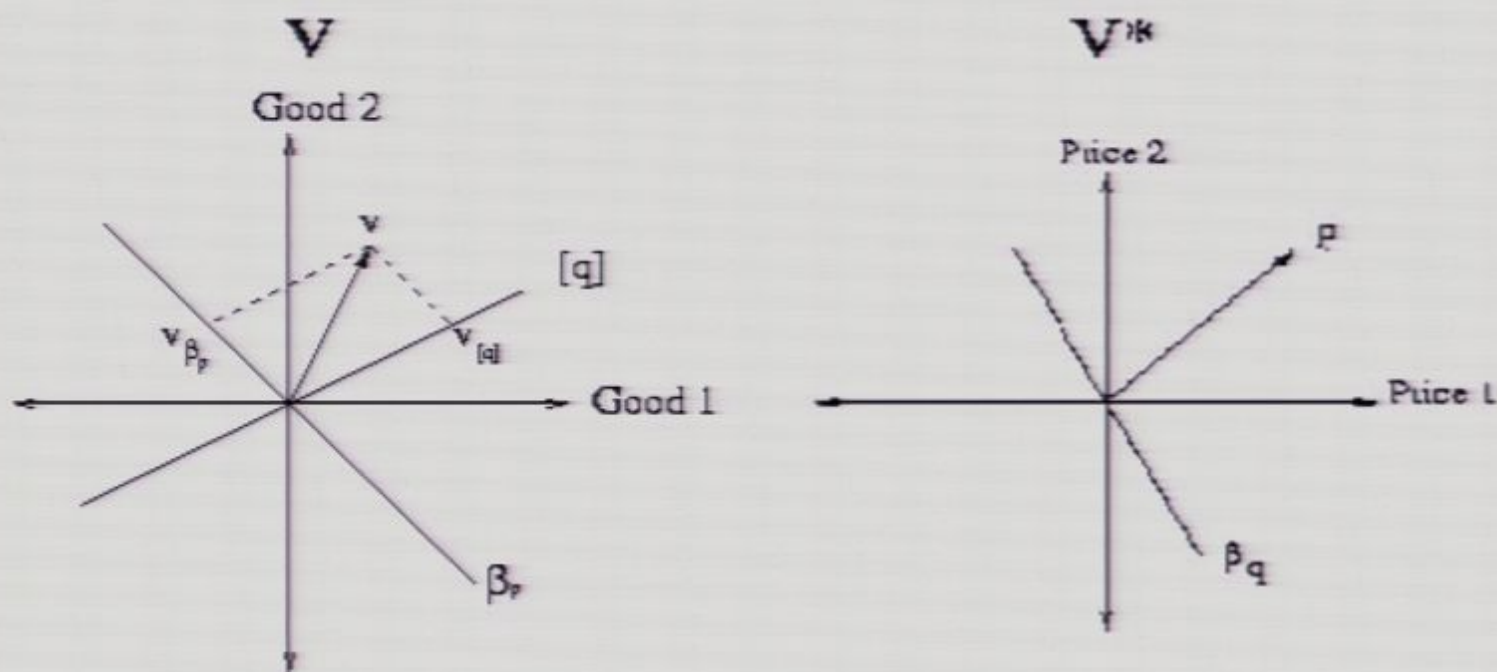
## Mechanical INP Solution by Decomposition into income and substitution effects



There are two natural connections. A trivial connection which allows no change and a connection that allows changes only by substitution effects. Switching from the former to the latter eliminates the index number problem for differentiable models.

This gives a new notion of constancy: *economically constant*.

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# Cycling and other 'Anomalies'

Economic Measurement views Path-Dependence incorrectly as an error and preference shifts as intractable:

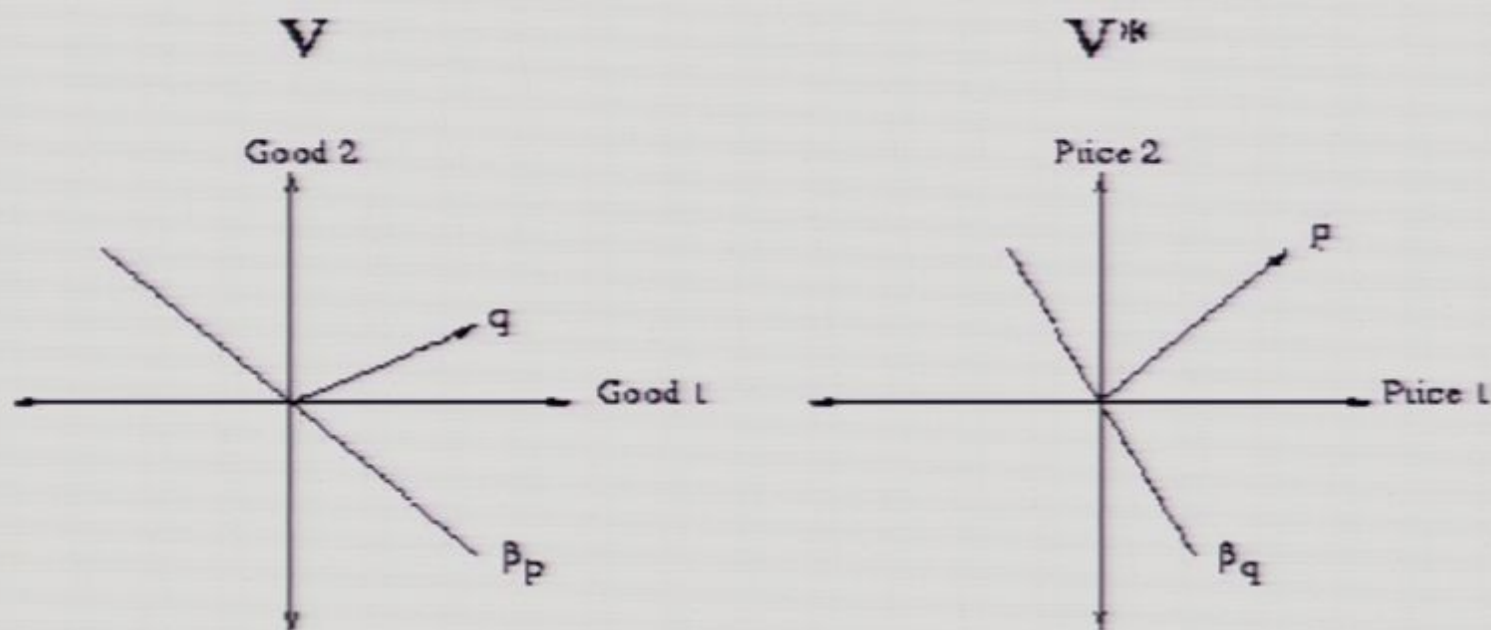
“Any chain index number is likely to be *flawed* by path-dependence.”

-Nicholas Oulton LSE 2008

“[A] time varying objective function generally cannot be tracked by an economic index.”

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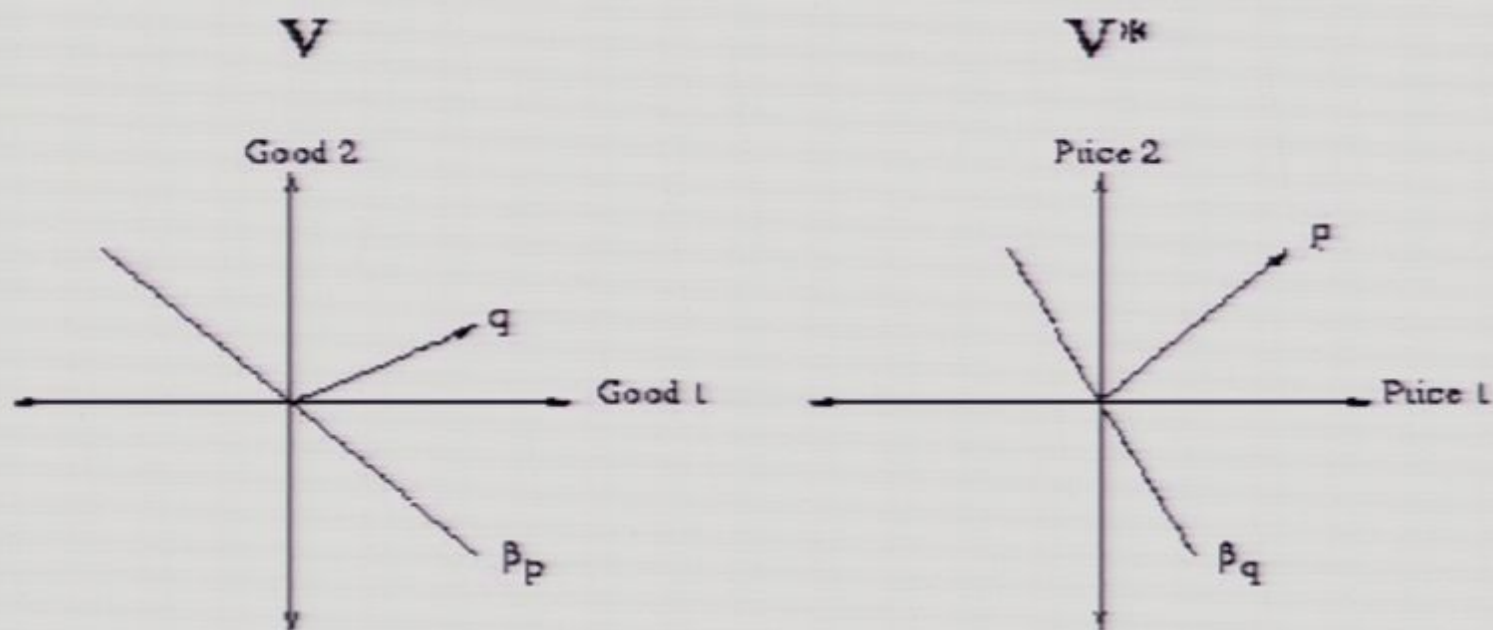
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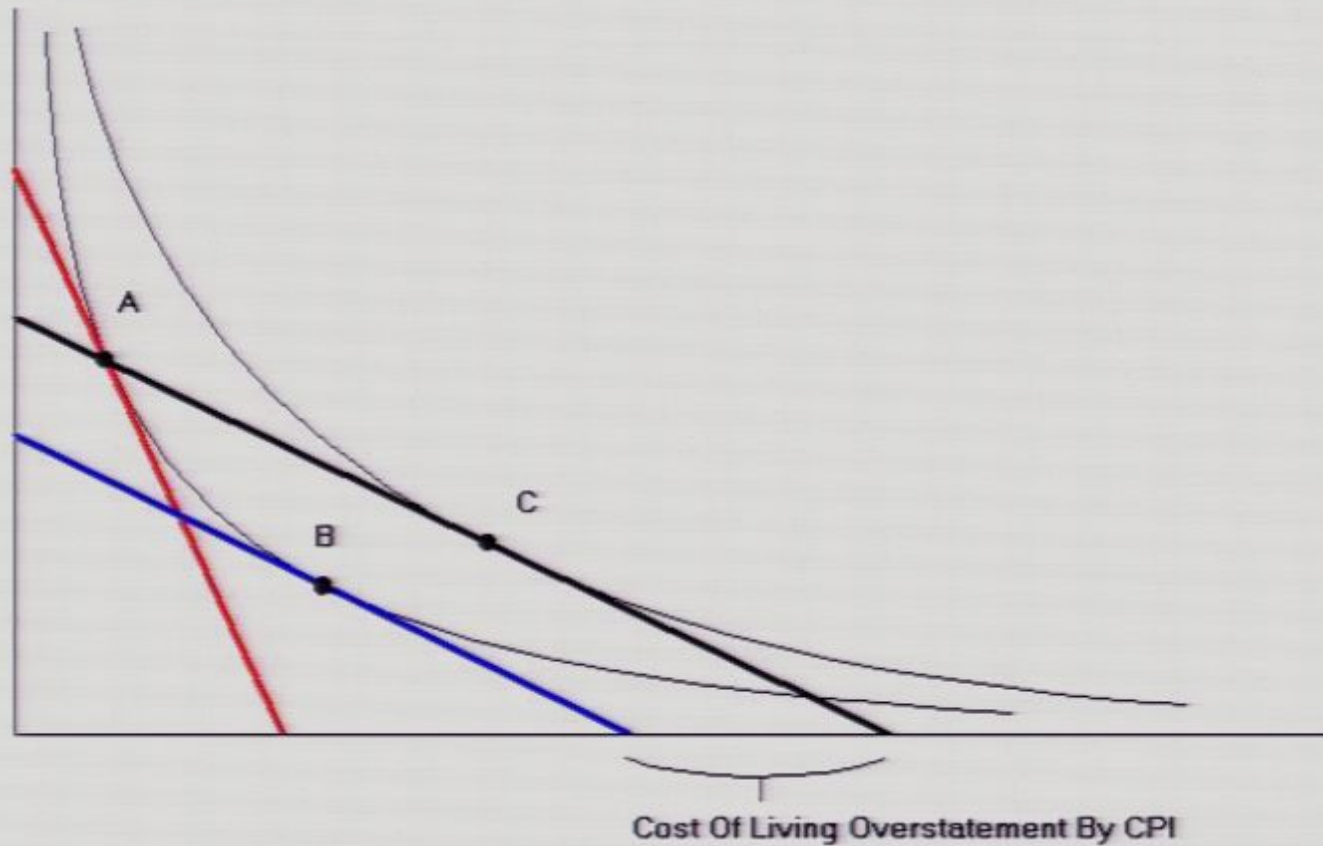
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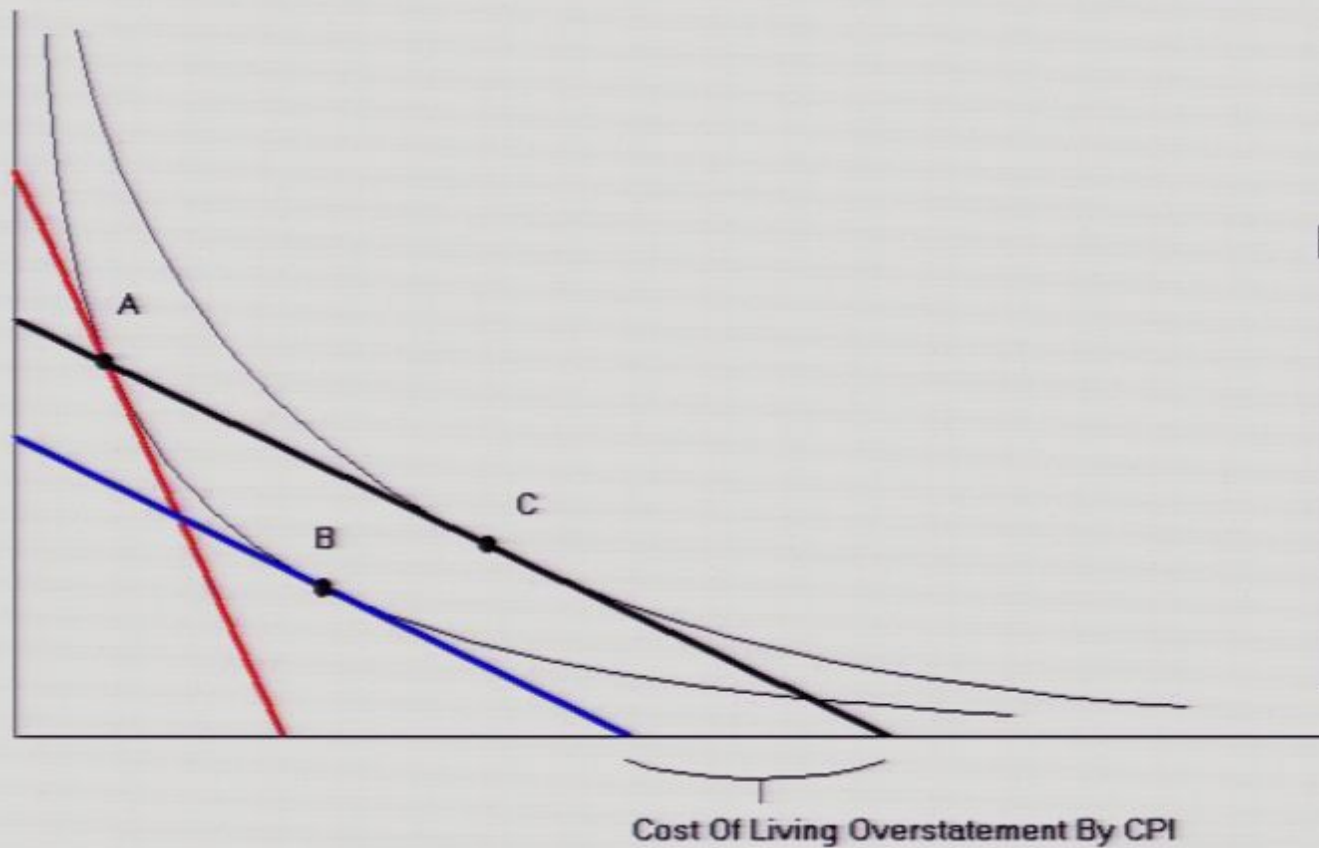
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# Welfare theory I: The Problem of Overstating the Cost of Living

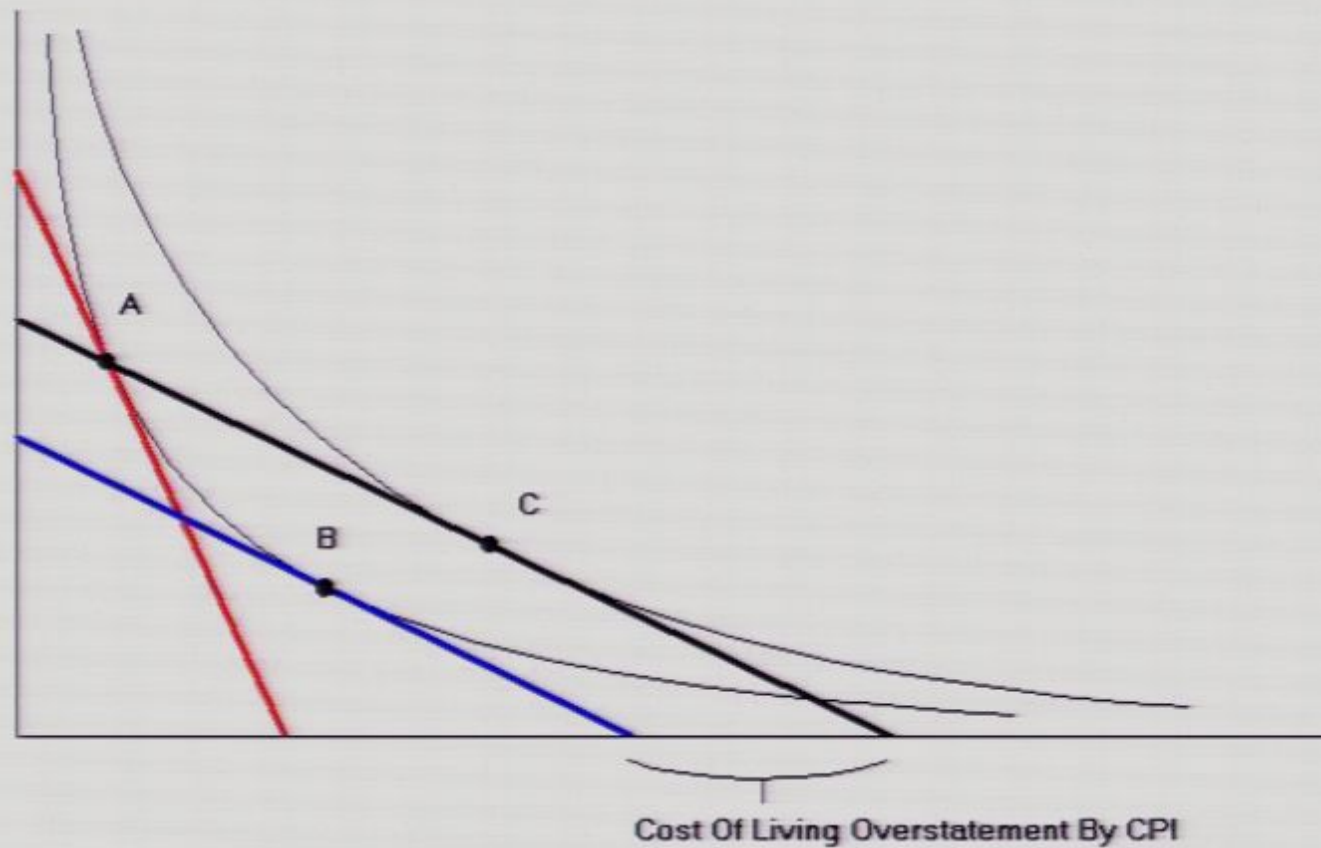


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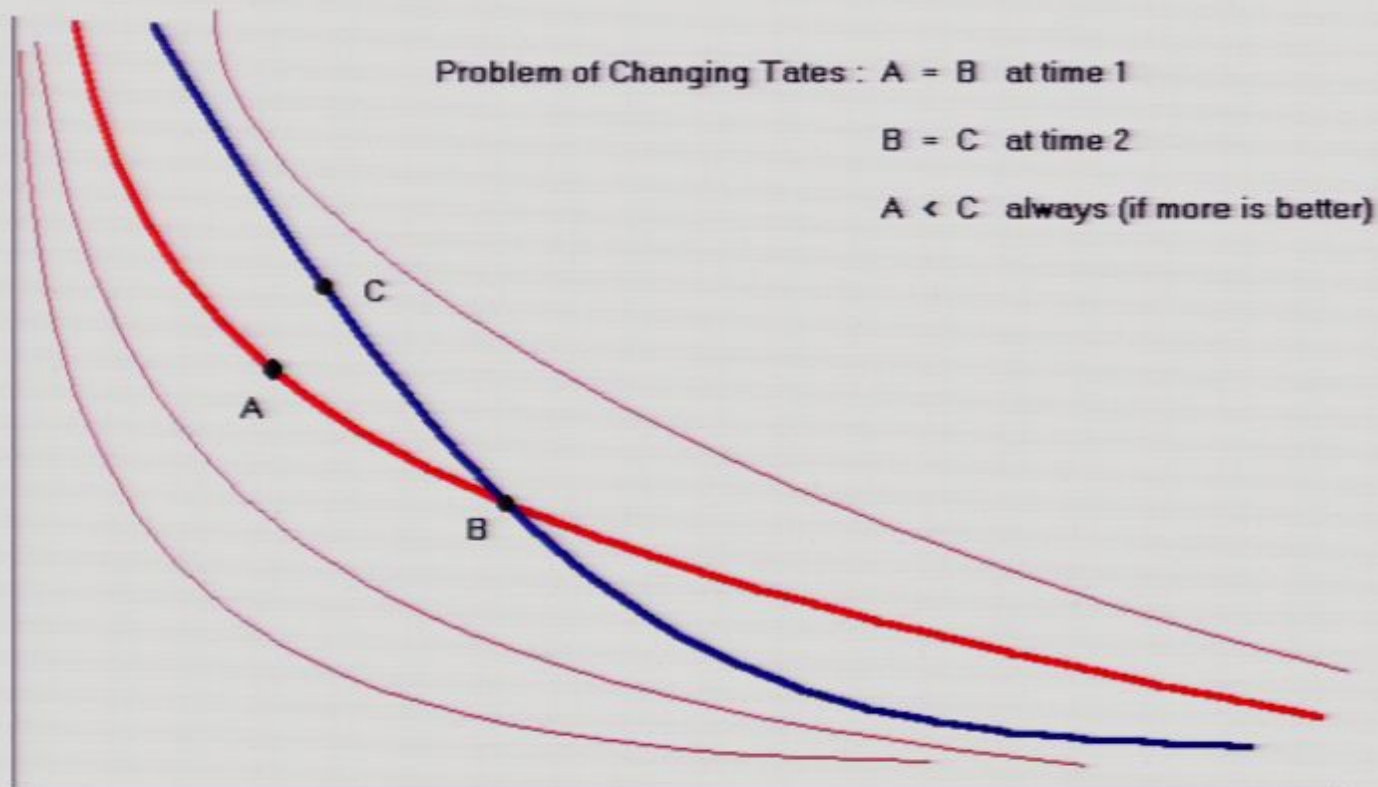
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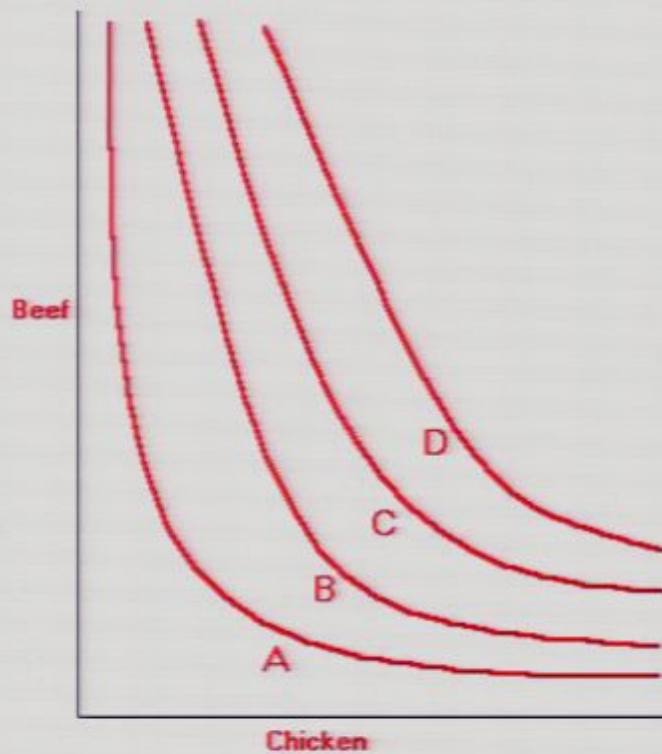


# Welfare Theory II

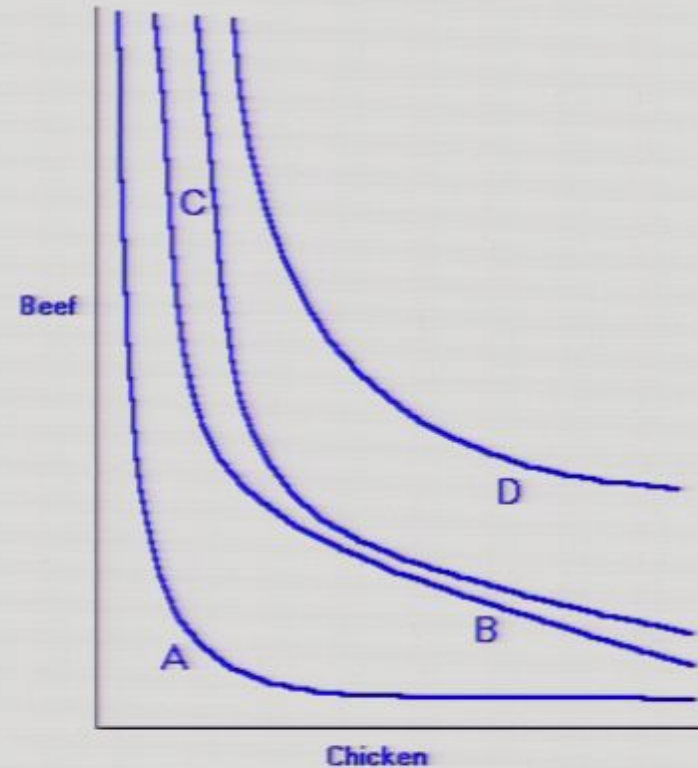
## The Problem of Changing Preferences and the 'Dogma' of Stable Tastes



# A Solution to the Changing Preference problem



Period 1  
Preferences



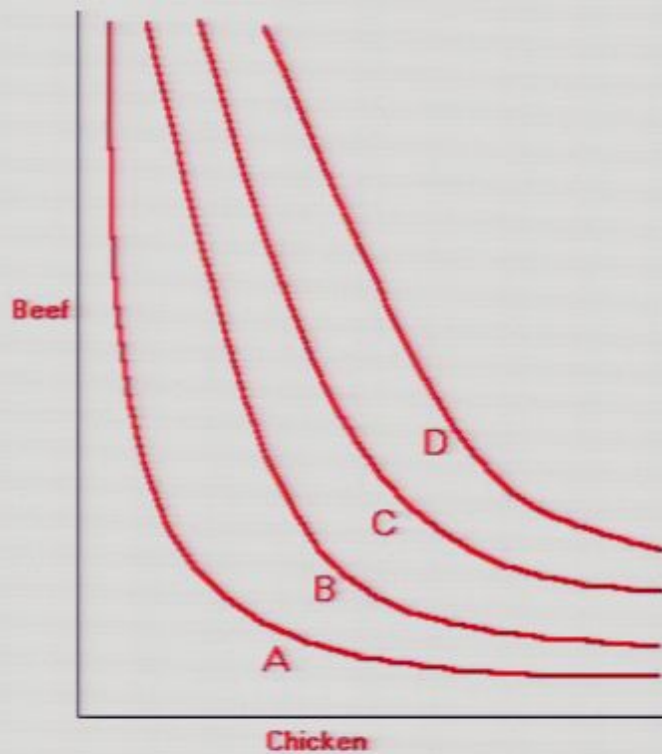
Period 2  
Preferences

Finding an intrinsic way to match curves on the left with curves on the right without using numerical 'cardinal' labels.

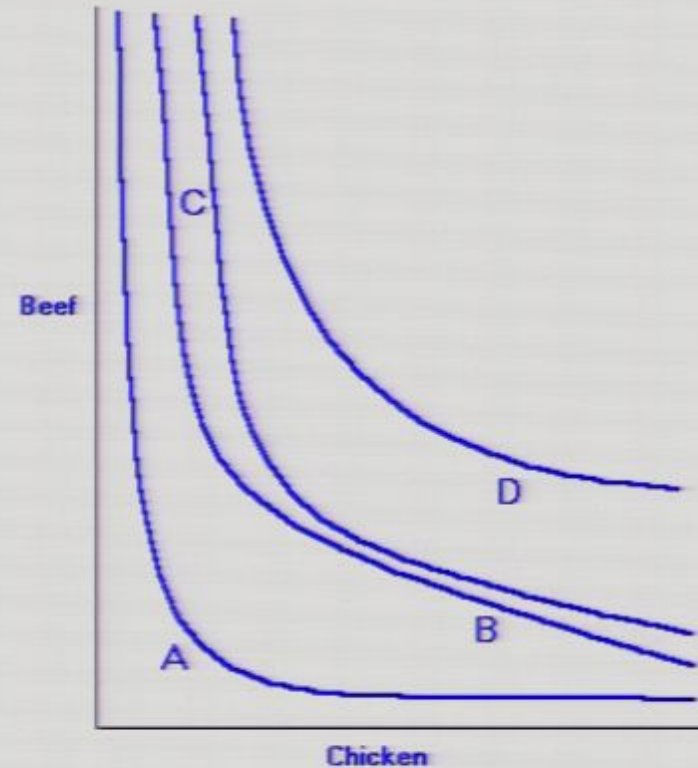
# Visualizing the intertemporal Economic Connection

- The best way to understand what the theory does may be to visualize it.
- We have to work hard to fit a picture in 3D
- With 2-goods, the base space is 4 dimensional. Working with ratios of prices and quantities takes 4 to 2.
- Leaves 1 fiber dimension to plot an absolute quantity.

# A Solution to the Changing Preference problem



Period 1  
Preferences

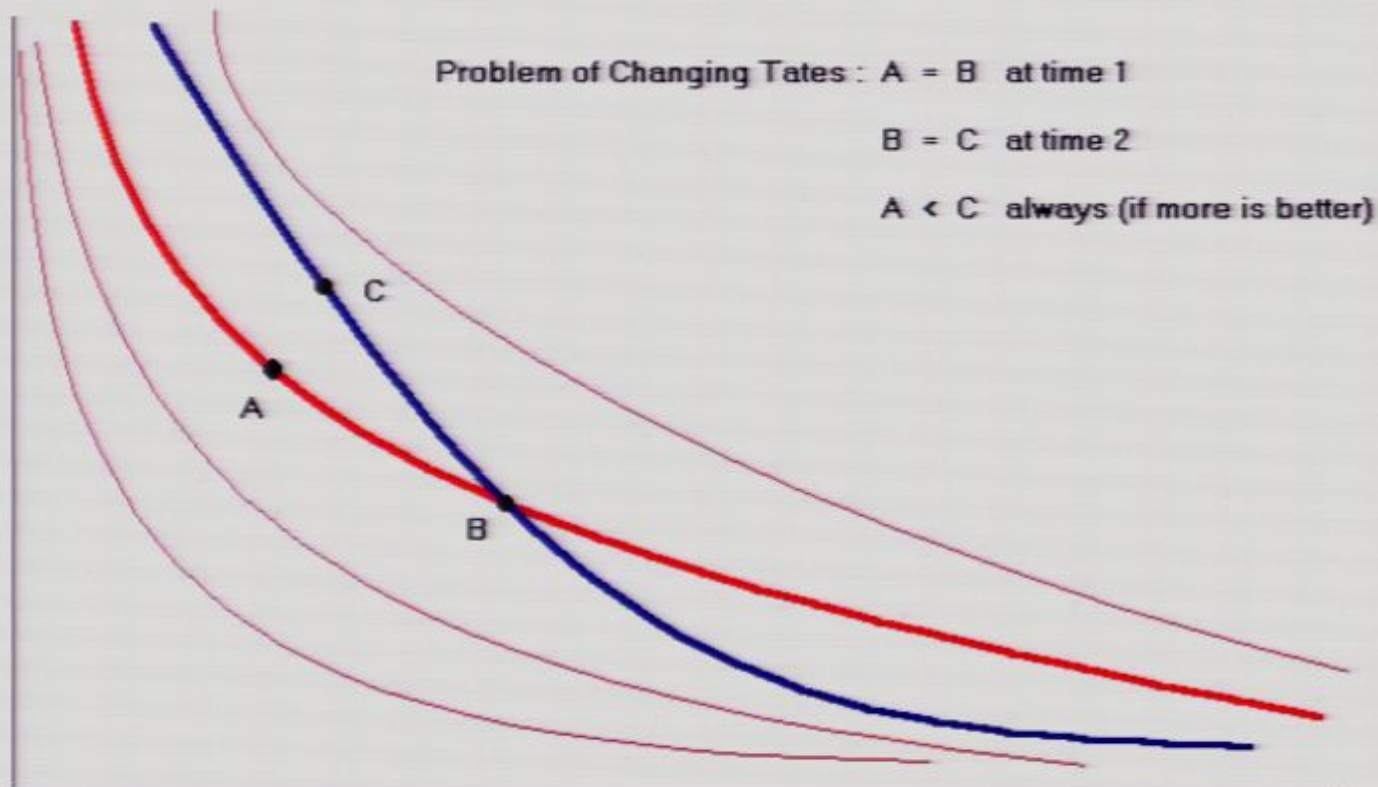


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# Welfare Theory II

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Slides Outline

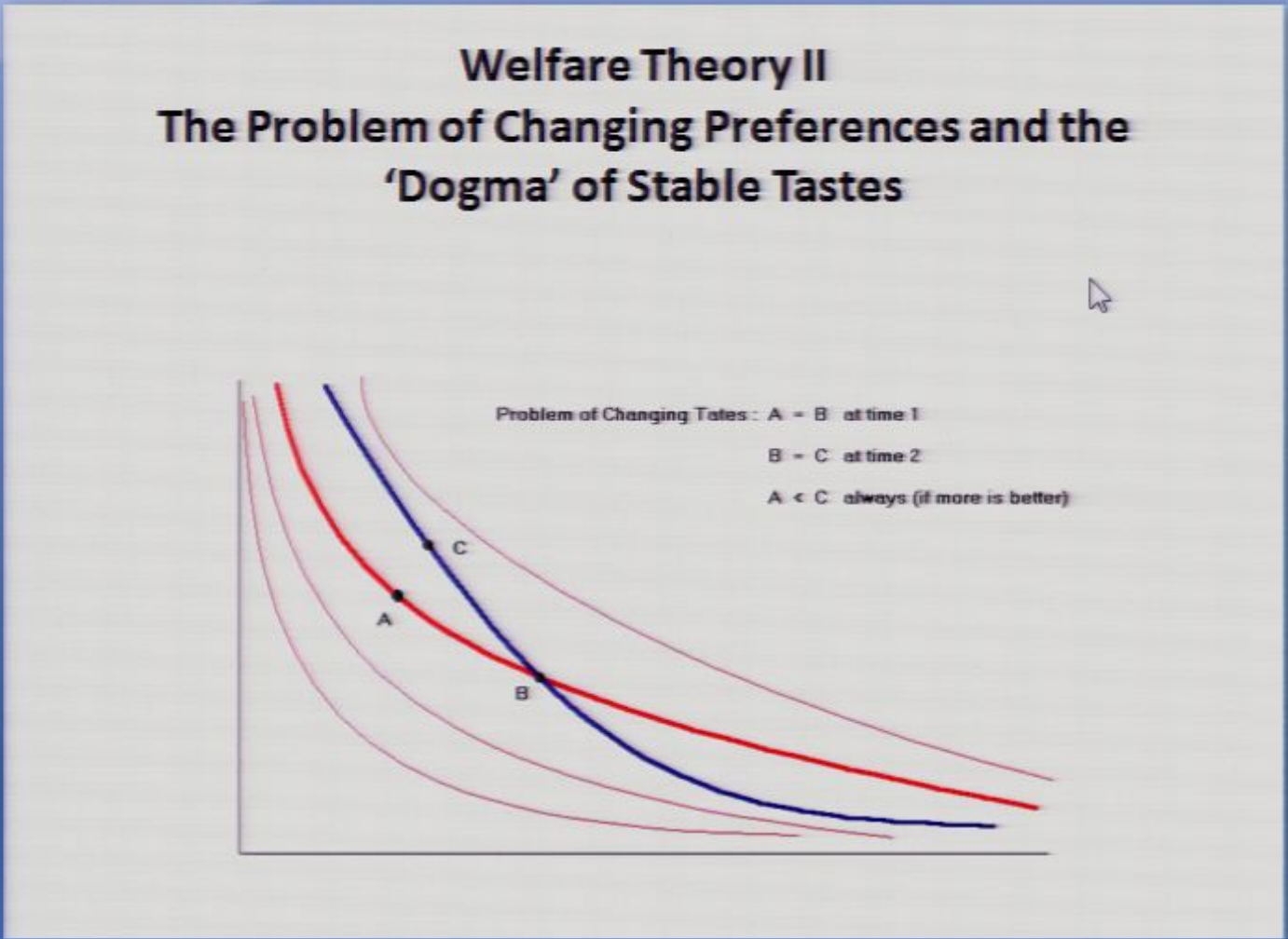
12 Welfare Theory: The Problem of 'Overriding' the Social Contract

13 **Welfare Theory II: The Problem of Changing Preferences and the 'Dogma' of Stable Tastes**

14 Solution to the Changing Preferences problem

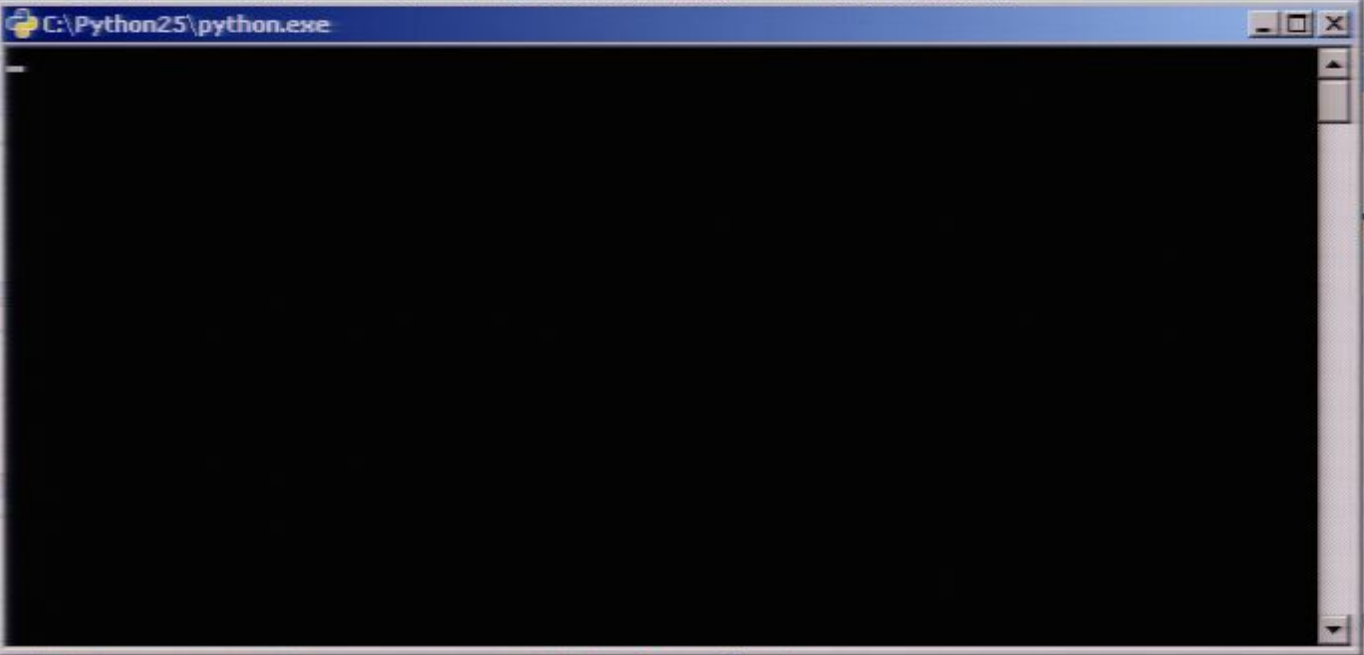
15 Visualizing the Informational Economic Connection

16 Visualizing Gauge Theoretic Welfare

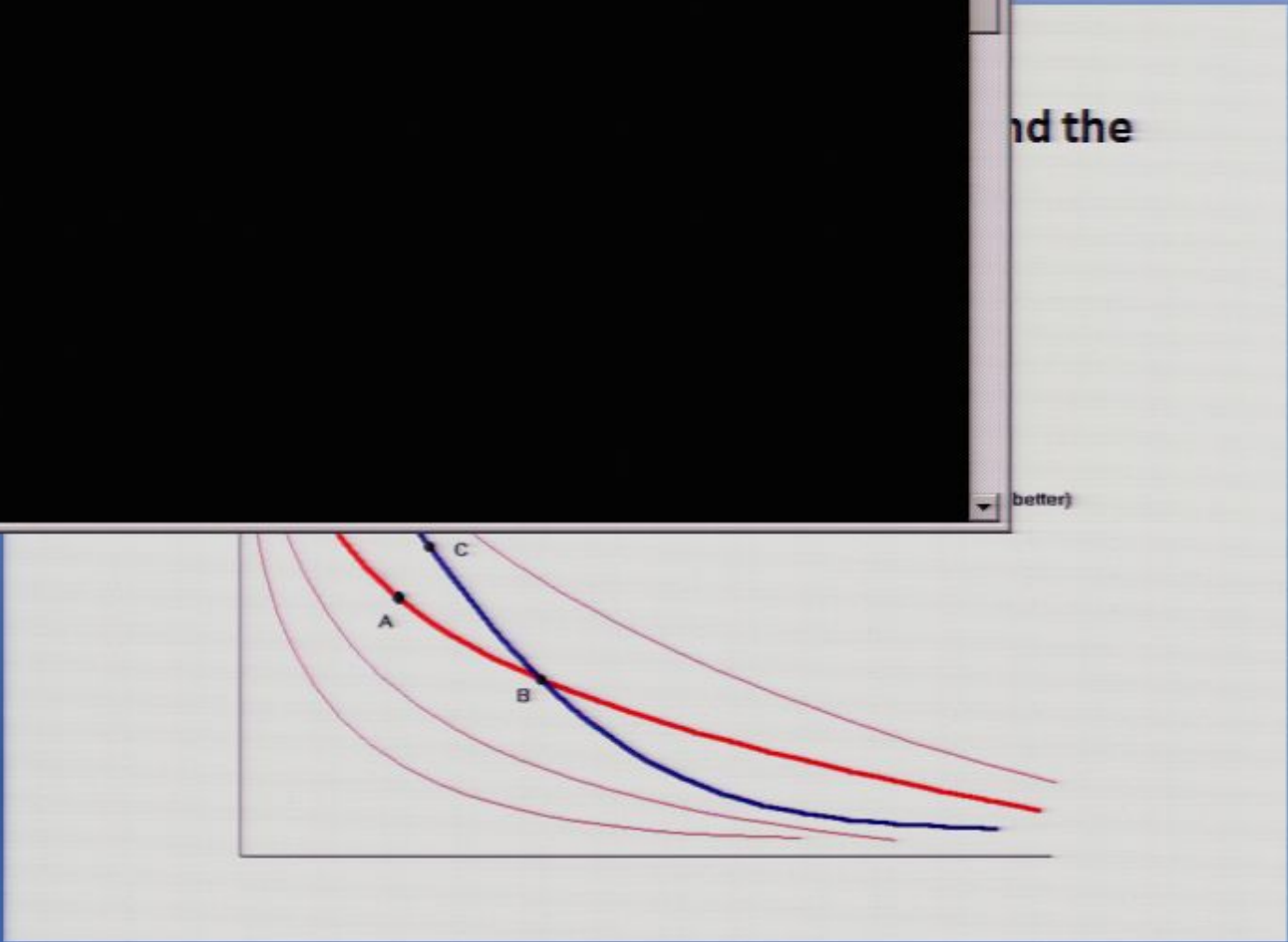


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- 12 Welfare (Health): The Problem of Overriding the Goal
- 13 **Welfare (Health): The Problem of Overriding the Goal**
- 14 A Solution for the Changing Public problem



- 15 Visualizing the Informational Economic Connection
  - The Goal is to understand what the Health Commission can do to resolve it.
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  - With Dignity, The Commission can Dimensional, Developing the value of present and future lives to the C.
  - Lower the Dimensional and can be resolved.
- 16 Visualizing Gauge Theoretic Welfare
  - The Goal is to understand what the Health Commission can do to resolve it.



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12 Welfare (W) over Time: The Problem of "Overriding the Debt"

13 Utility (U) over Time: The Problem of "Overriding the Debt"

14 A Solution for the Changing Policy problem

15 Visualizing the Intertemporal Economic Connection

- The Debt over Time is determined by the Intertemporal Decision Rule (IDR)
- The Debt over Time is determined by the Intertemporal Decision Rule (IDR)
- With a given IDR, the Intertemporal Decision Rule (IDR) is a function of the current state of the economy
- The Intertemporal Decision Rule (IDR) is a function of the current state of the economy

16 Visualizing the Intertemporal Economic Connection

- The Intertemporal Decision Rule (IDR) is a function of the current state of the economy
- The Intertemporal Decision Rule (IDR) is a function of the current state of the economy

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better)

f:  $-y/(1+x*y)$   
g: 0  
x:  $\cos(2*\pi*t)+2$   
y:  $\sin(2*\pi*t)+2$   
t: 0.0

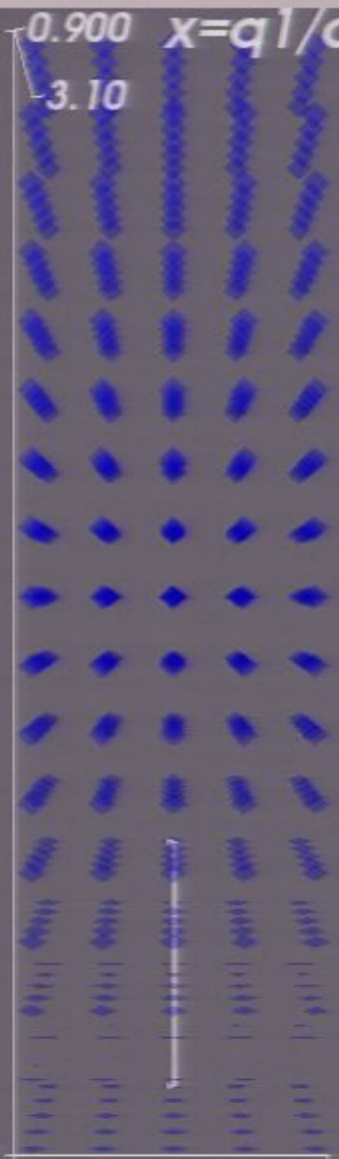
4.0 0.0



8.10 0.900  $x=q1/q2$   
-3.10

$z=q2$

0.000



f:  $-y/(1+x*y)$   
g: 0  
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t: 0.0

4.0 0.0



$z=q2$

0.000

8.10

3.10

f:  $-y/(1+x*y)$   
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y:  $\sin(2*\pi*t)+2$   
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4.0 0.122



$y = p1/p2$   
3.10

0.900  
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$z = q2$

0.000  
0.900  
3.10  
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f:  $-y/(1+x*y)$   
g: 0  
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y:  $\sin(2*\pi*t)+2$   
t: 0.0

4.0 0.852



$$y = p1/p2 \quad 3.10$$

0.900  
8.10

$$z = q2$$

0.000  
0.900  
3.10

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f:  $-y/(1+x*y)$   
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4.0 1.95



$$y = p1/p2 \quad 3.10$$

0.900  
8.10

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0.000  
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4.0 2.875

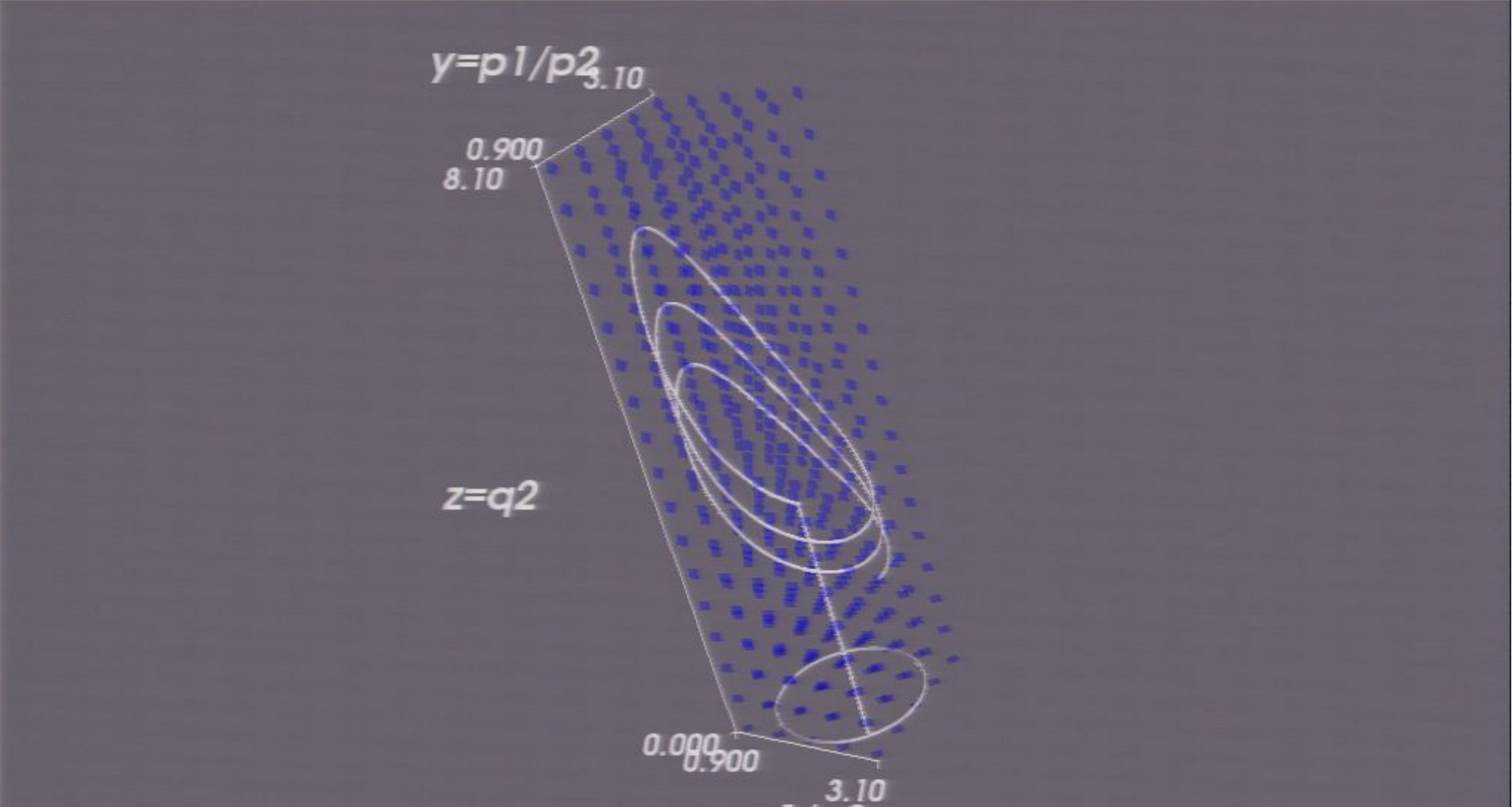


$$y = p1/p2$$

0.900  
8.10

$$z = q2$$

0.000  
0.900  
3.10  
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f:  $-y/(1+x*y)$   
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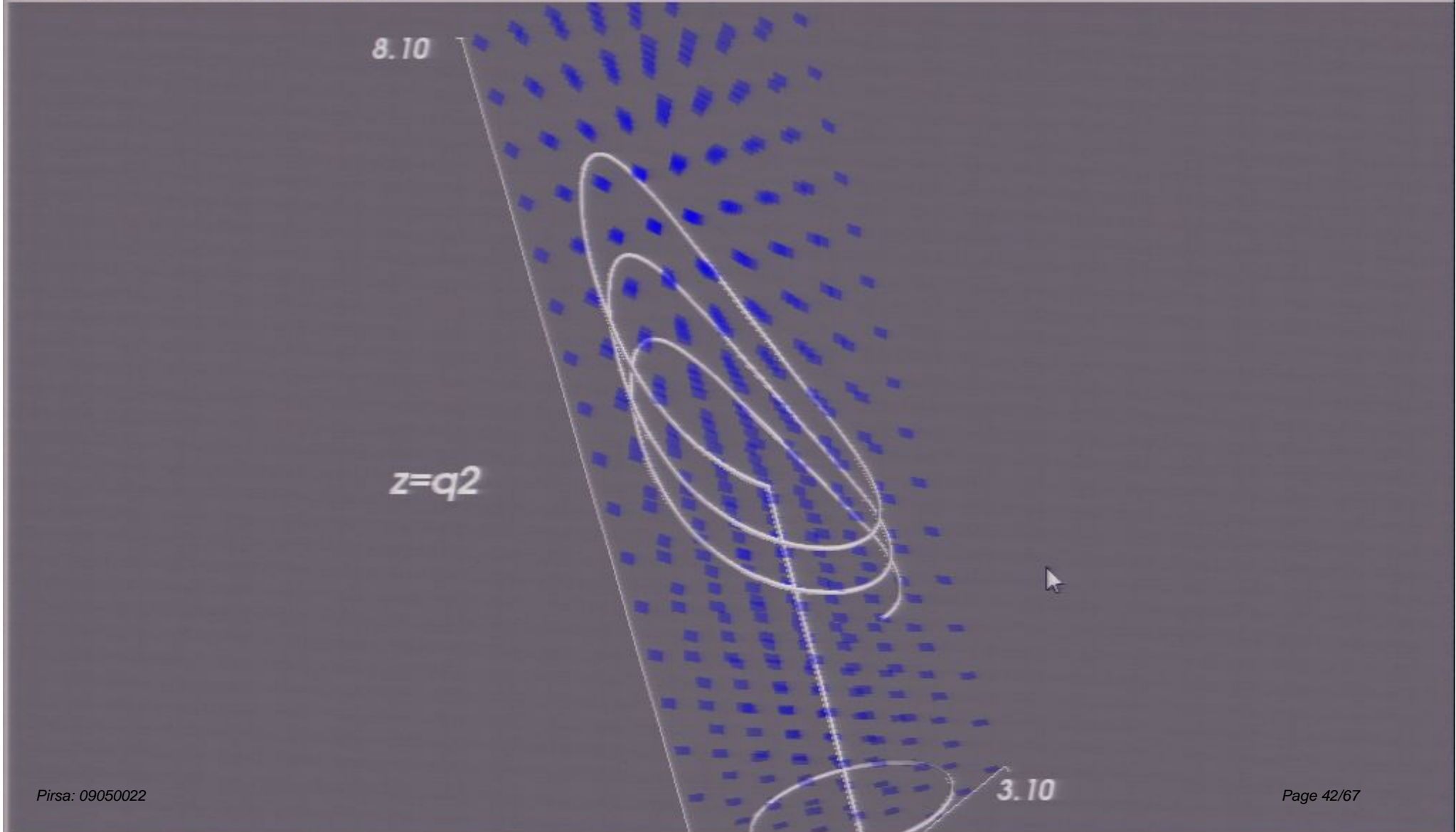
4.0 2.875



8.10

$z=q2$

3.10



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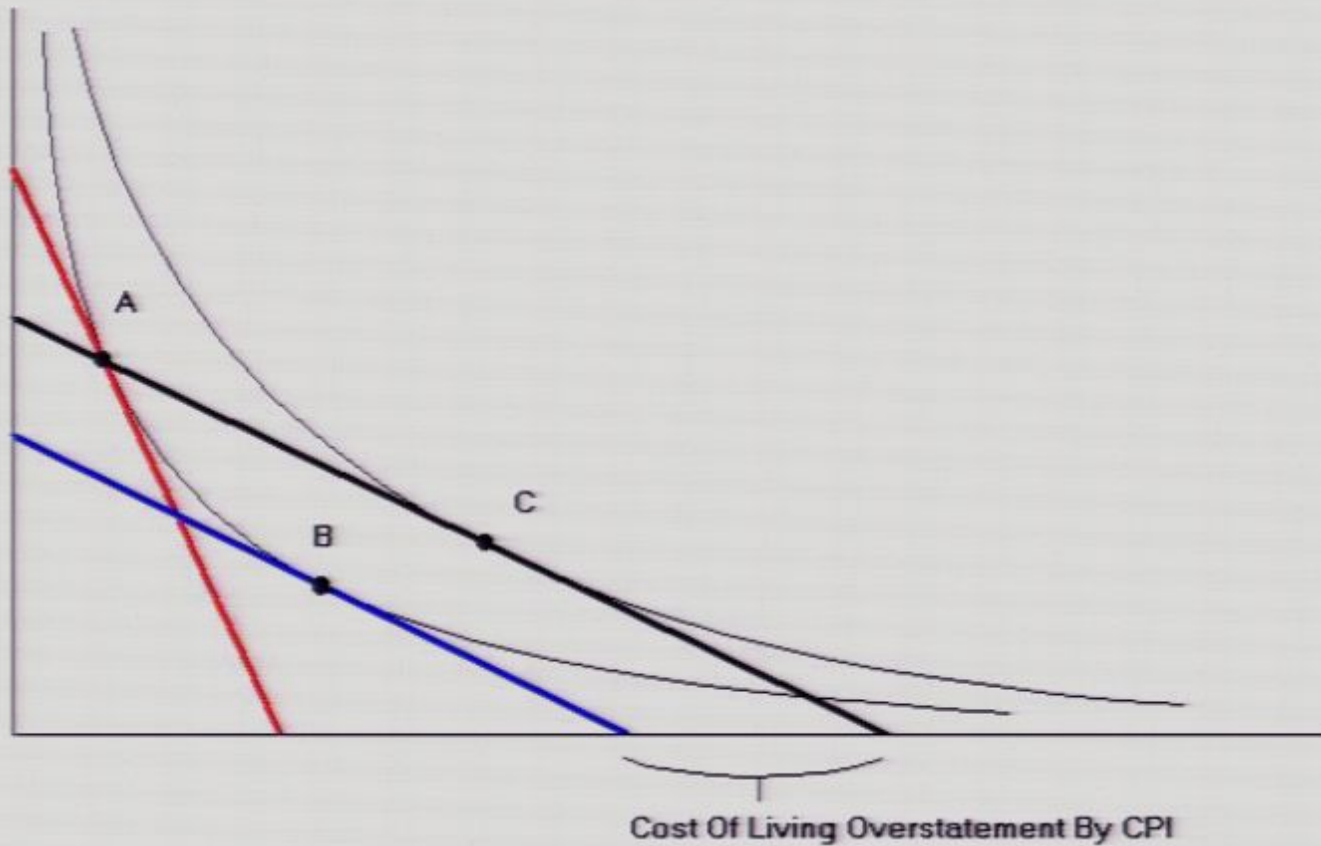
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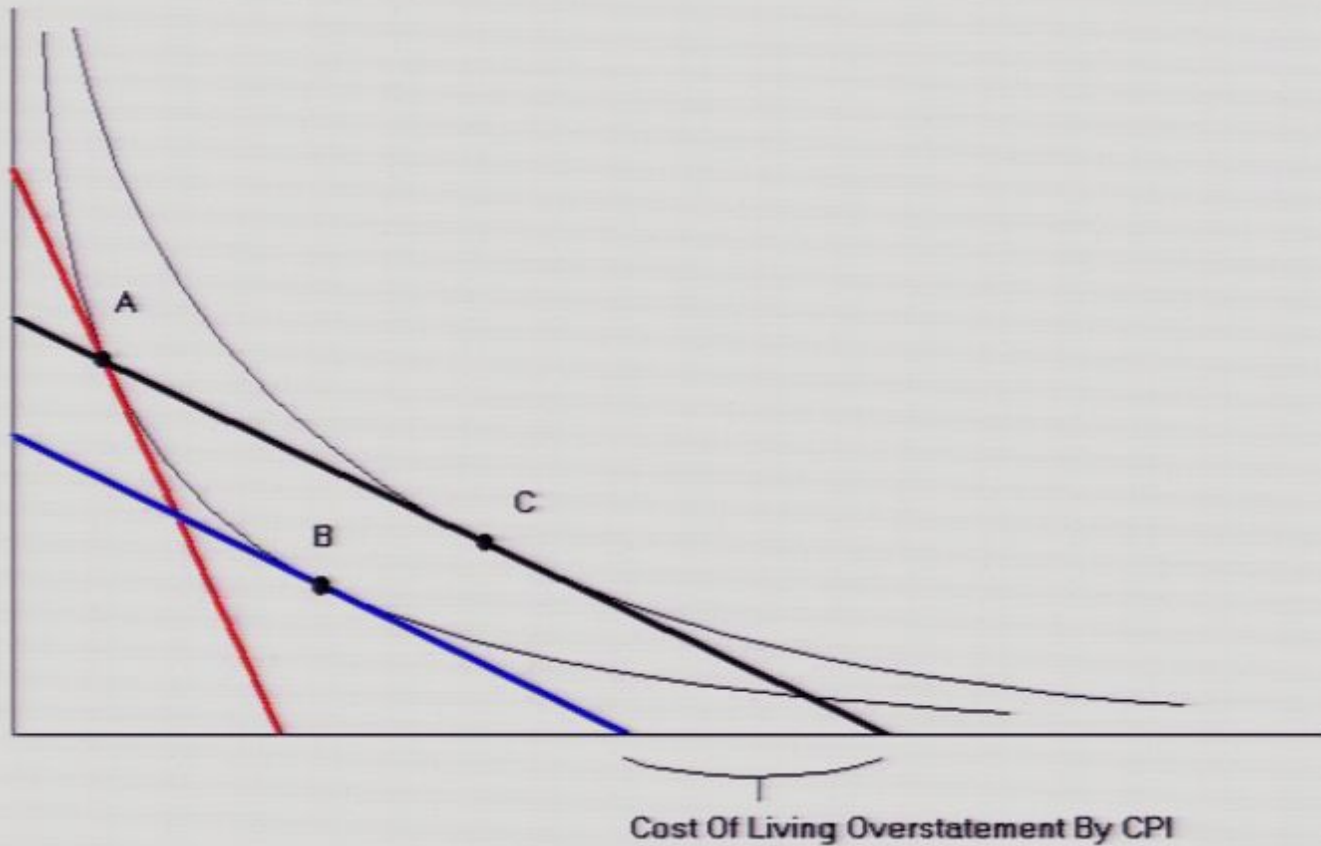
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# Welfare theory I: The Problem of Overstating the Cost of Living

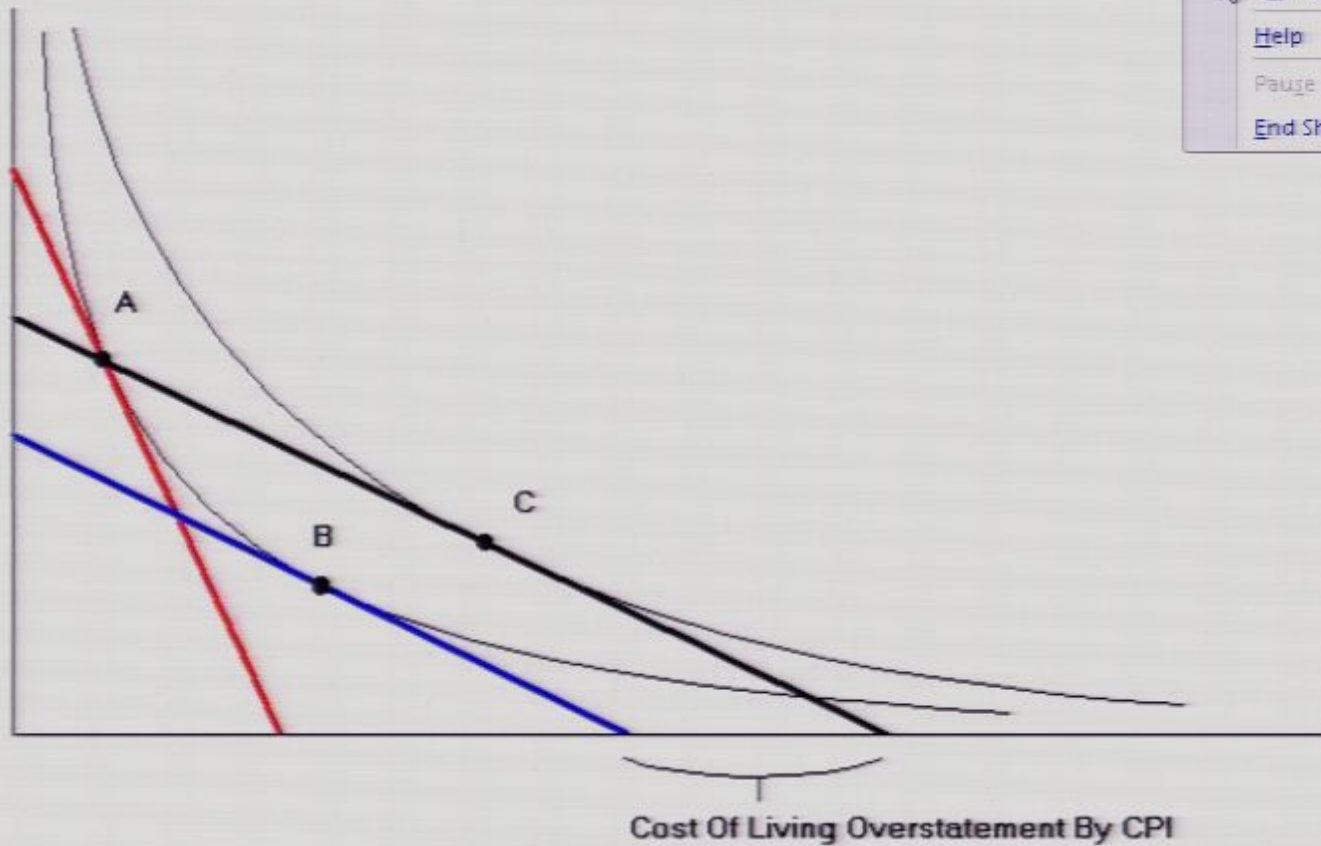


# Welfare theory I: The Problem of Overstating the Cost of Living



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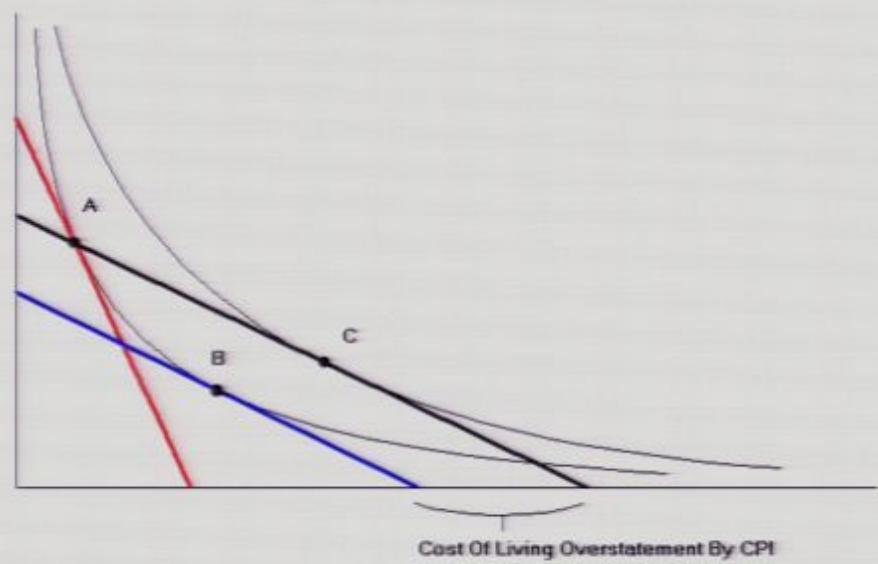
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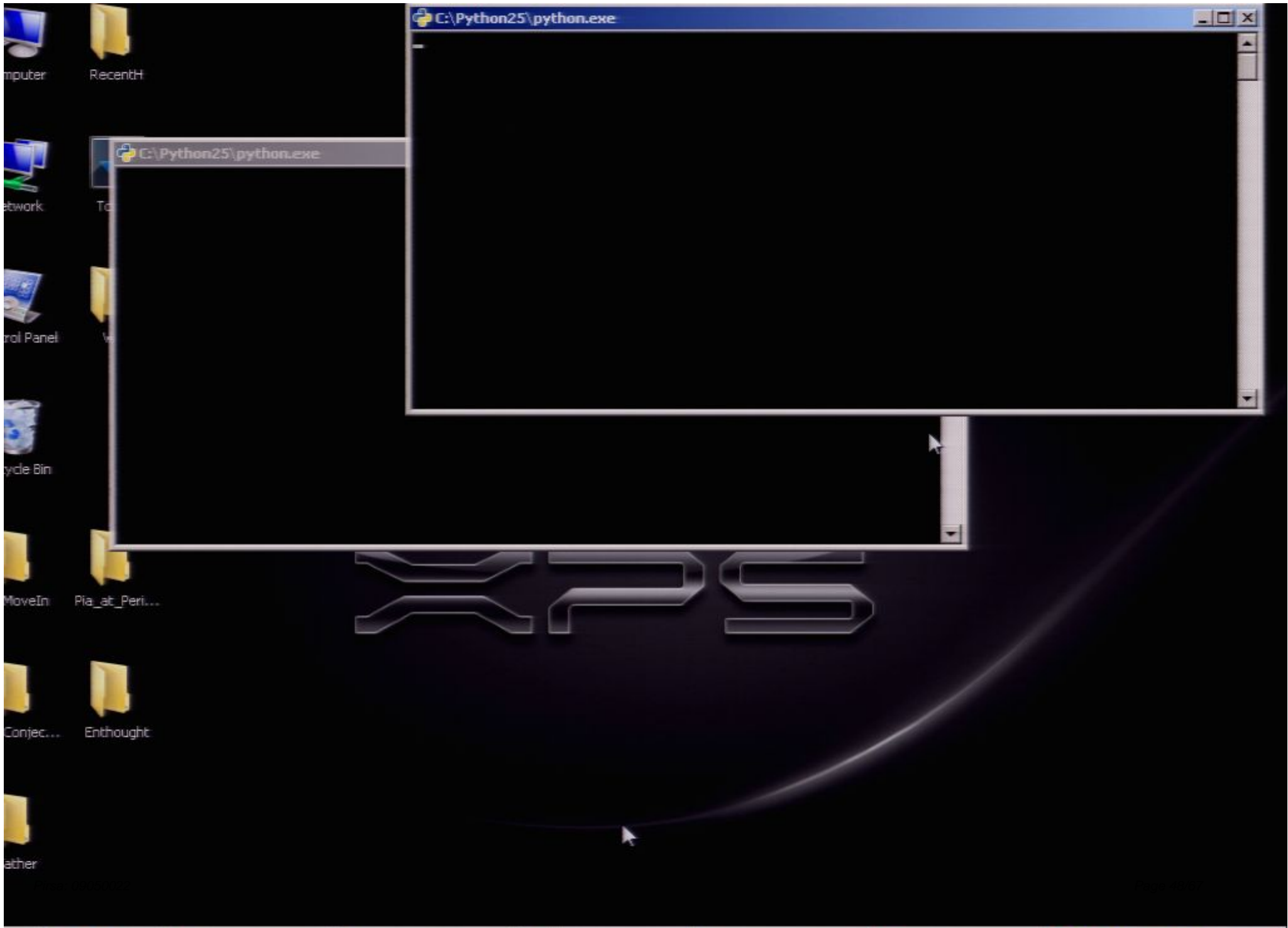
Outline

- The Theory of the Consumer
- Measuring Inflation and Real GDP: Real GDP and Real GDP in Disaggregation
- Consumer Inflation and Consumer Inflation
- Cyclical and other Anomalies
- Welfare Theory I: The Problem of Overstating the Cost of Living

# Welfare theory I: The Problem of Overstating the Cost of Living



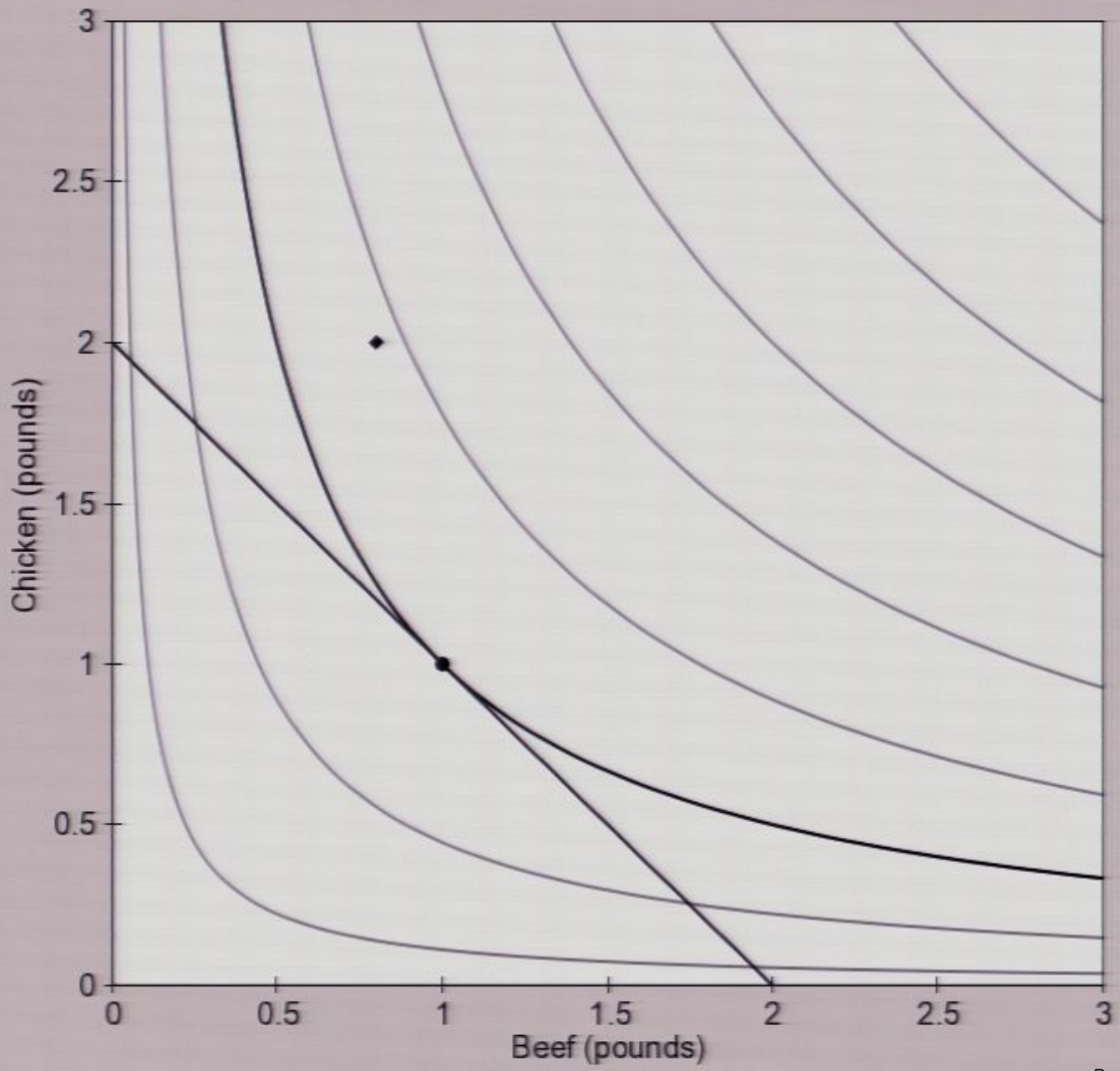
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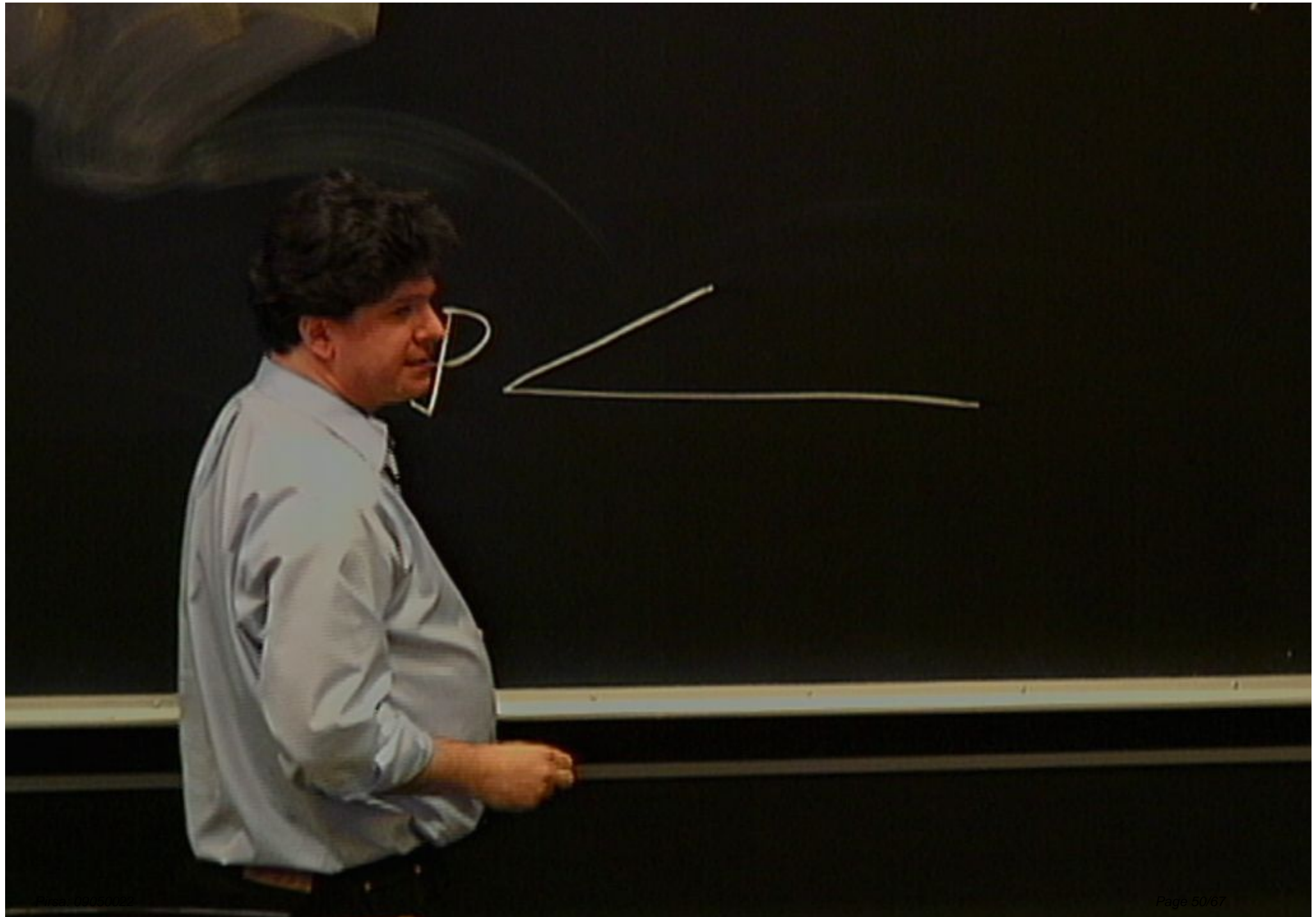


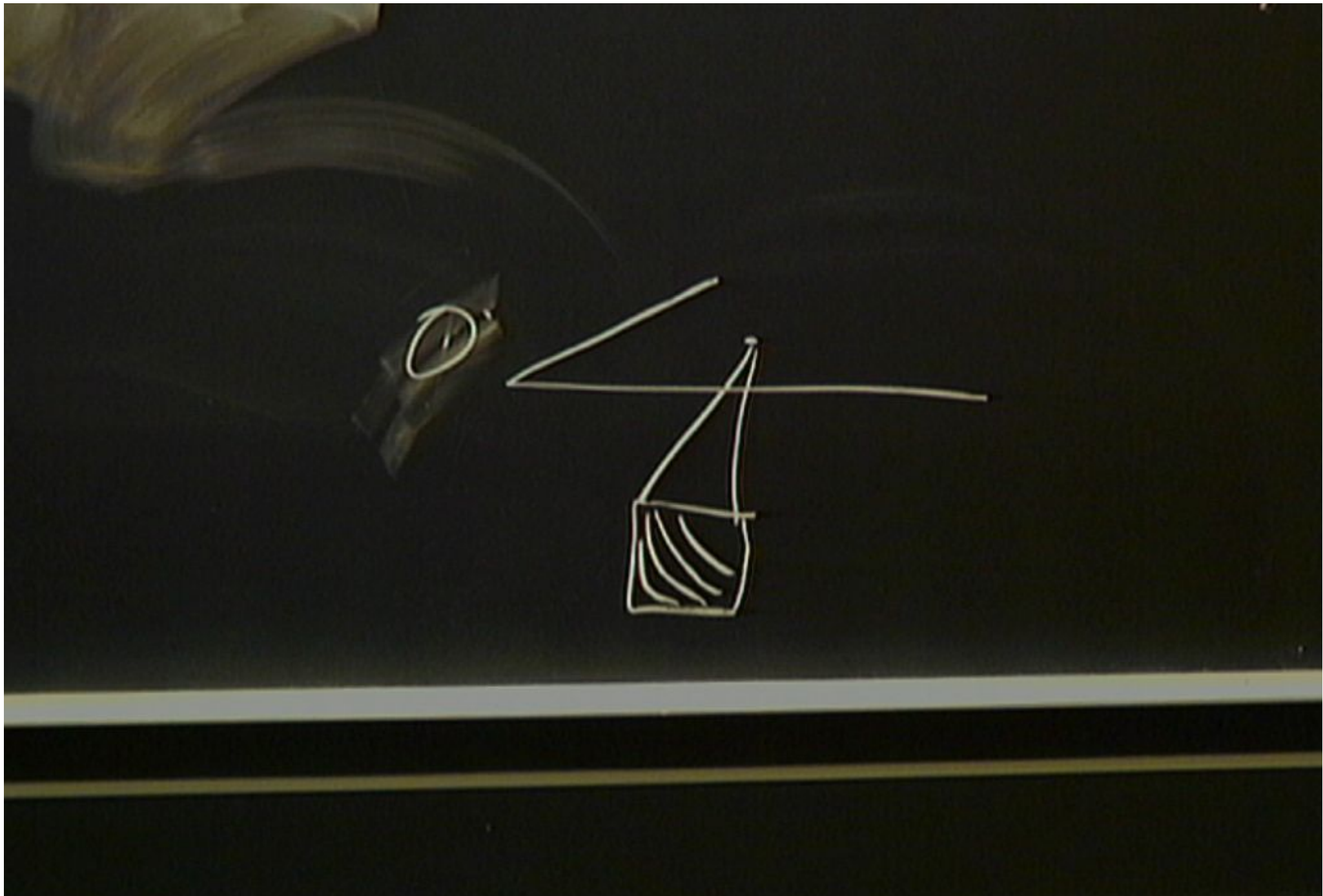


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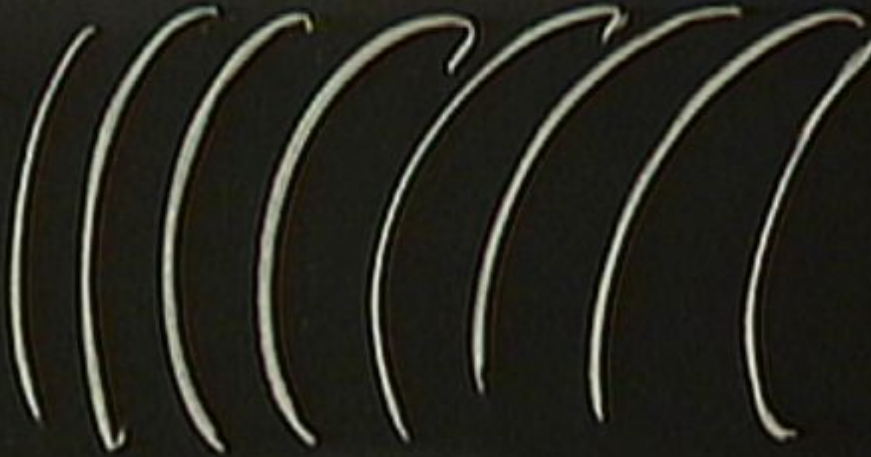
Beef price: \$ 1.00  
Beef quantity: 1.0000 lbs  
Chicken price: \$ 1.00  
Chicken quantity: 1.0000 lbs  
Budget: \$ 2.00  
COLA: 1.0000000  
 $\alpha$ : 0.5000000



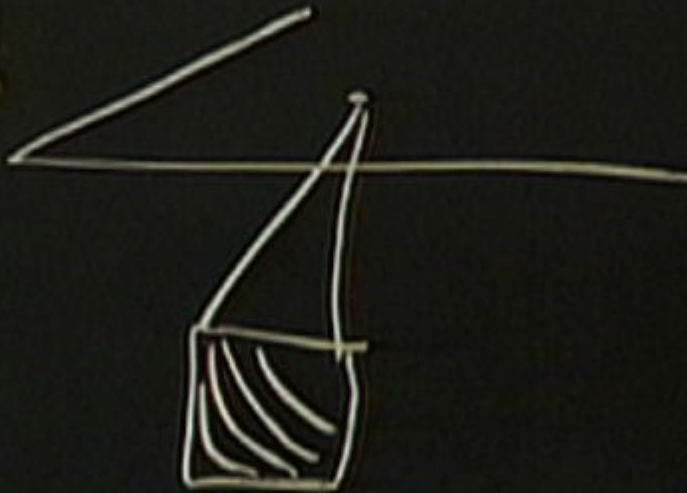




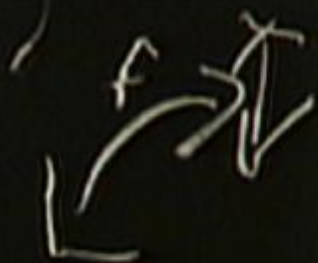
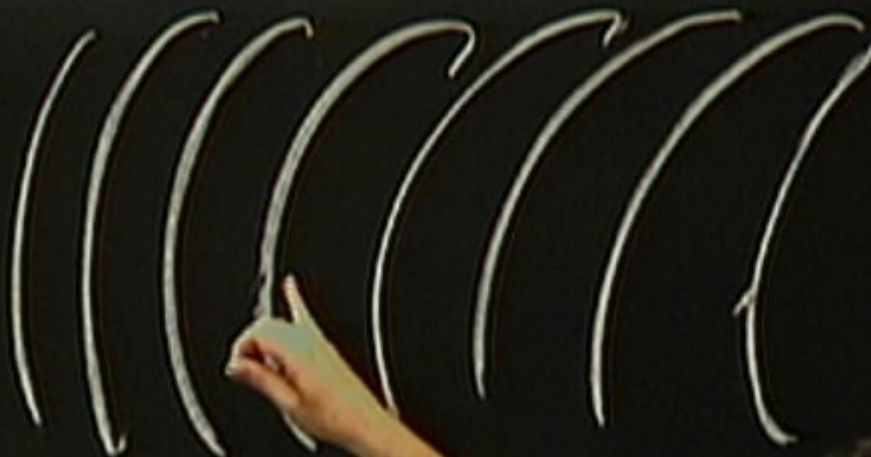
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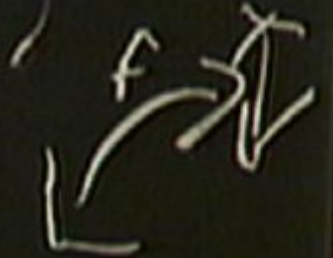
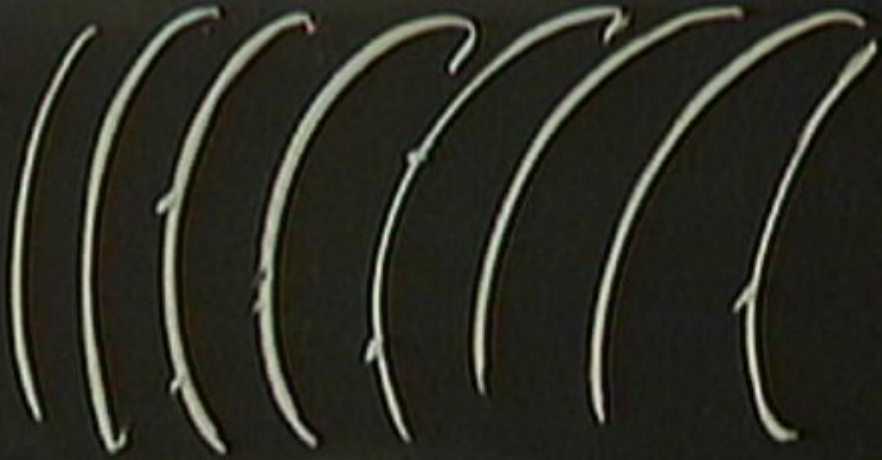
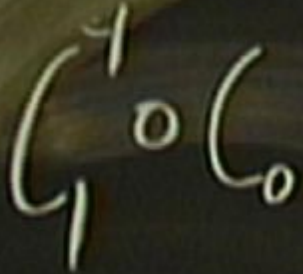
cardinal



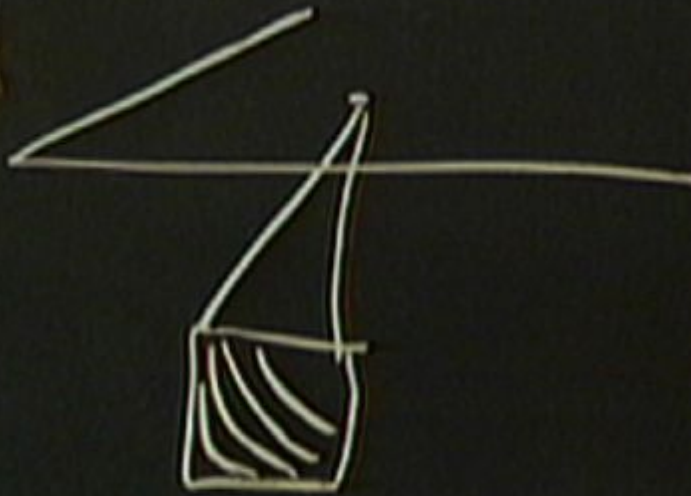
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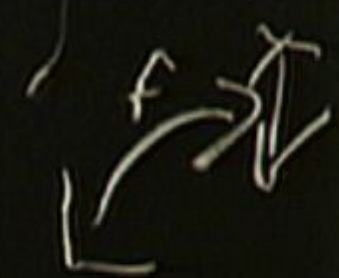
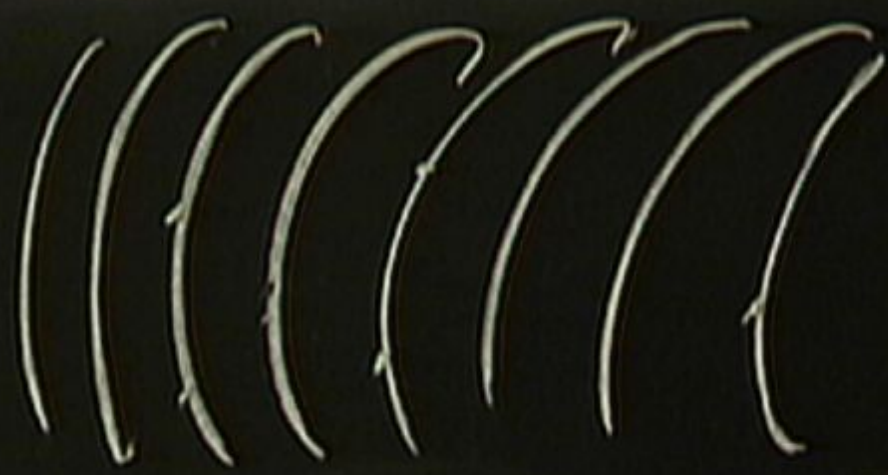
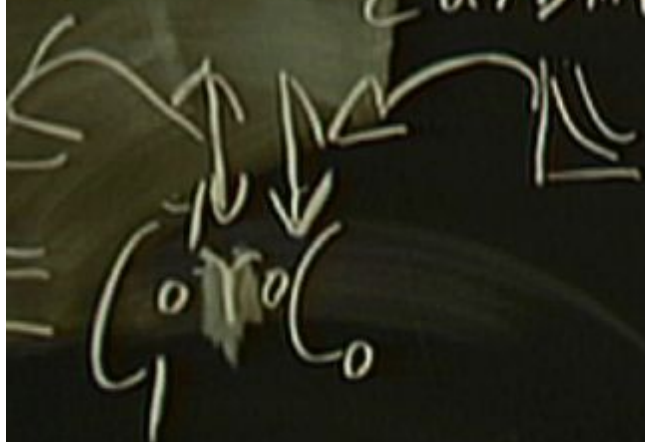
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cardinal



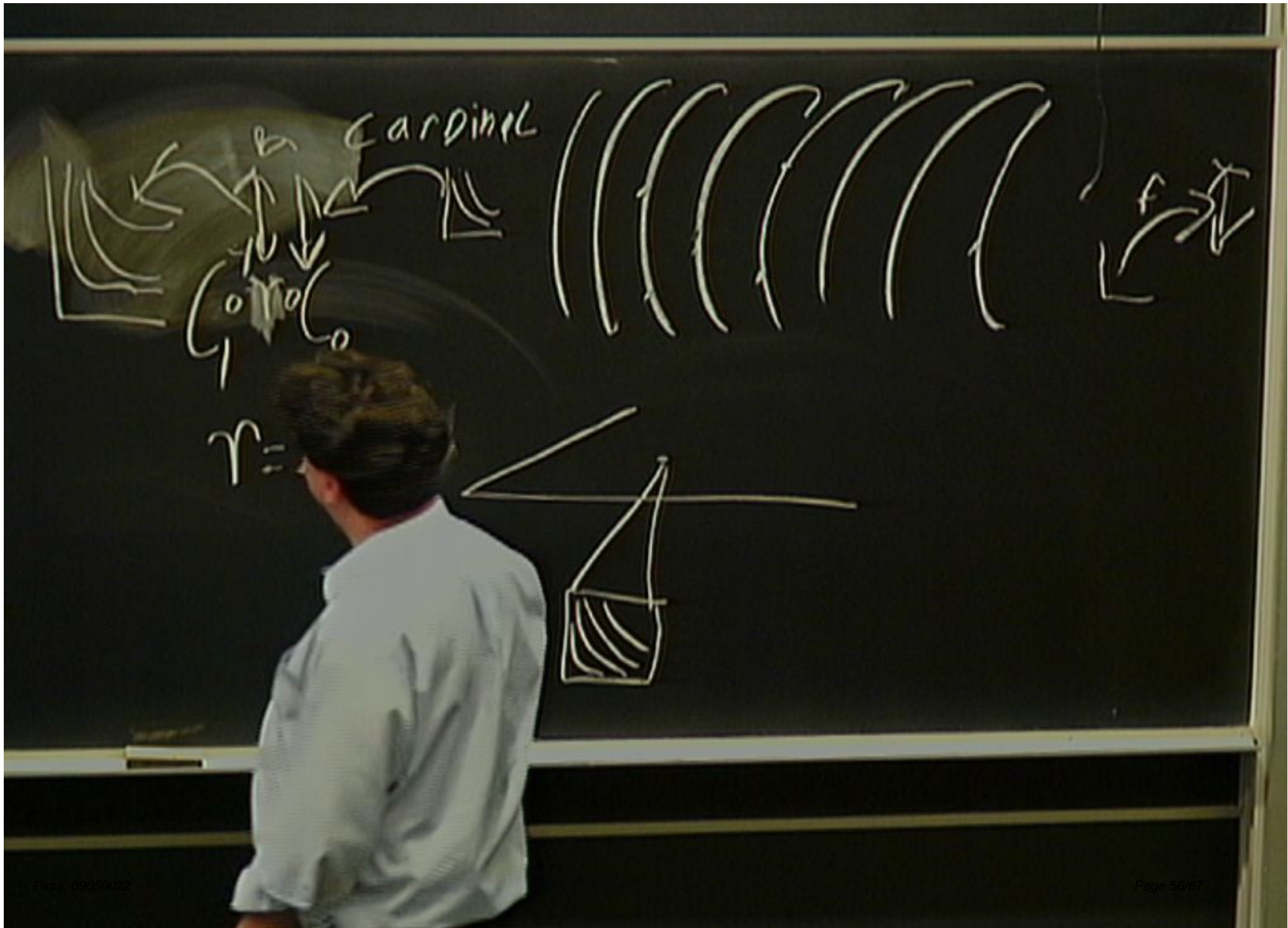
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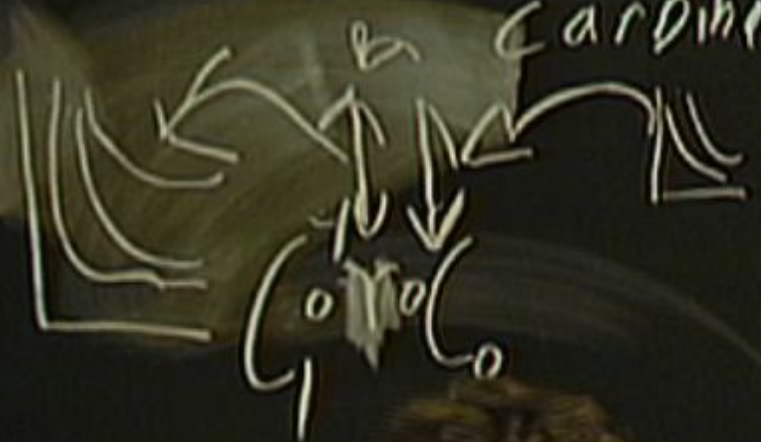
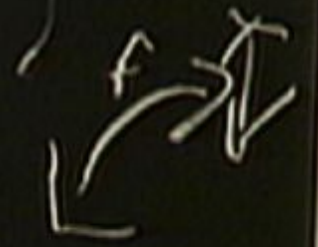
$$r = Id$$

cardinal



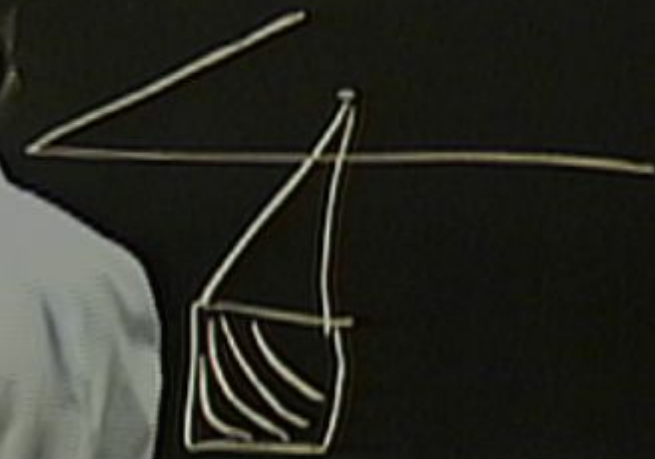


CARDINAL

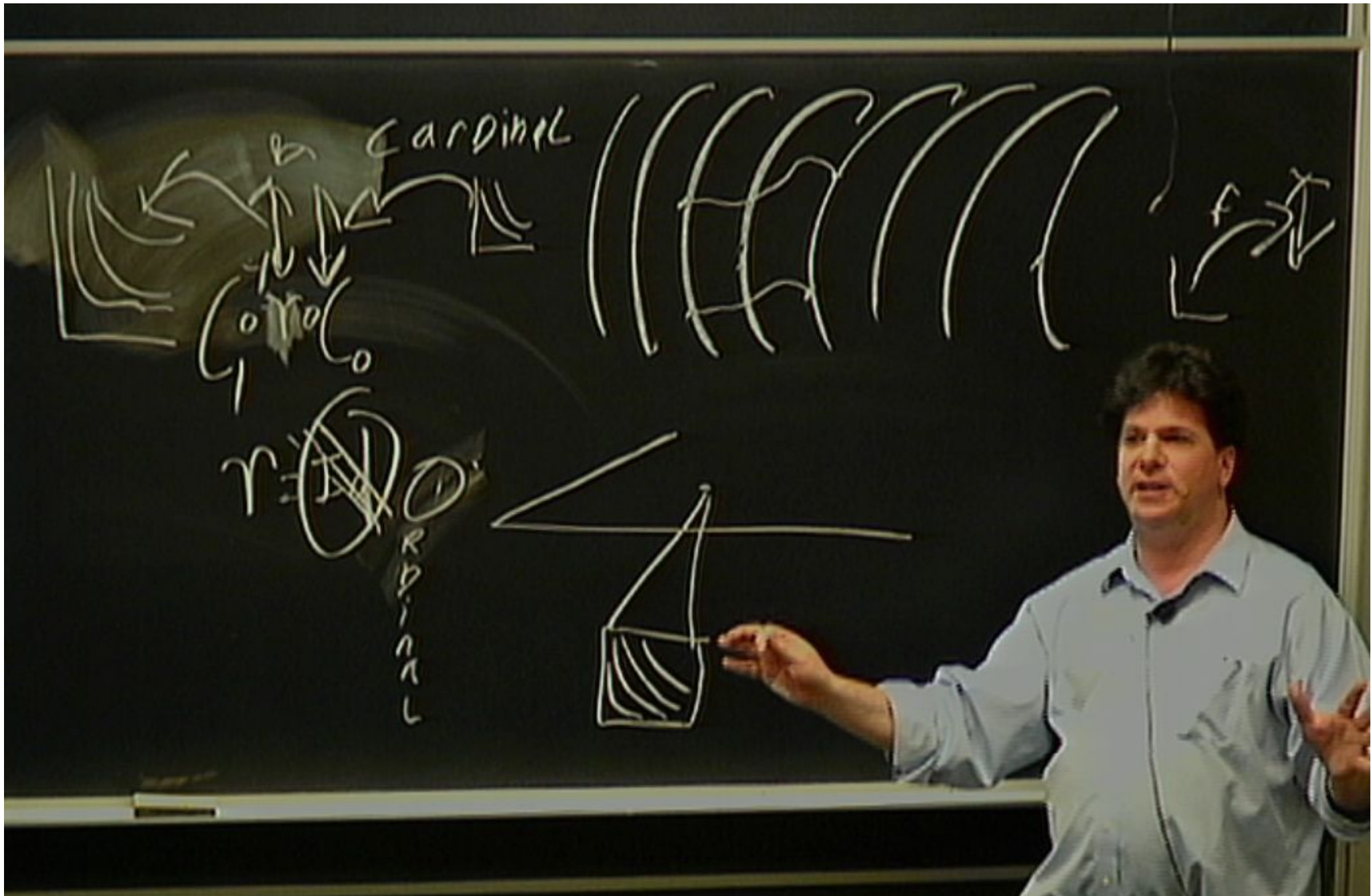


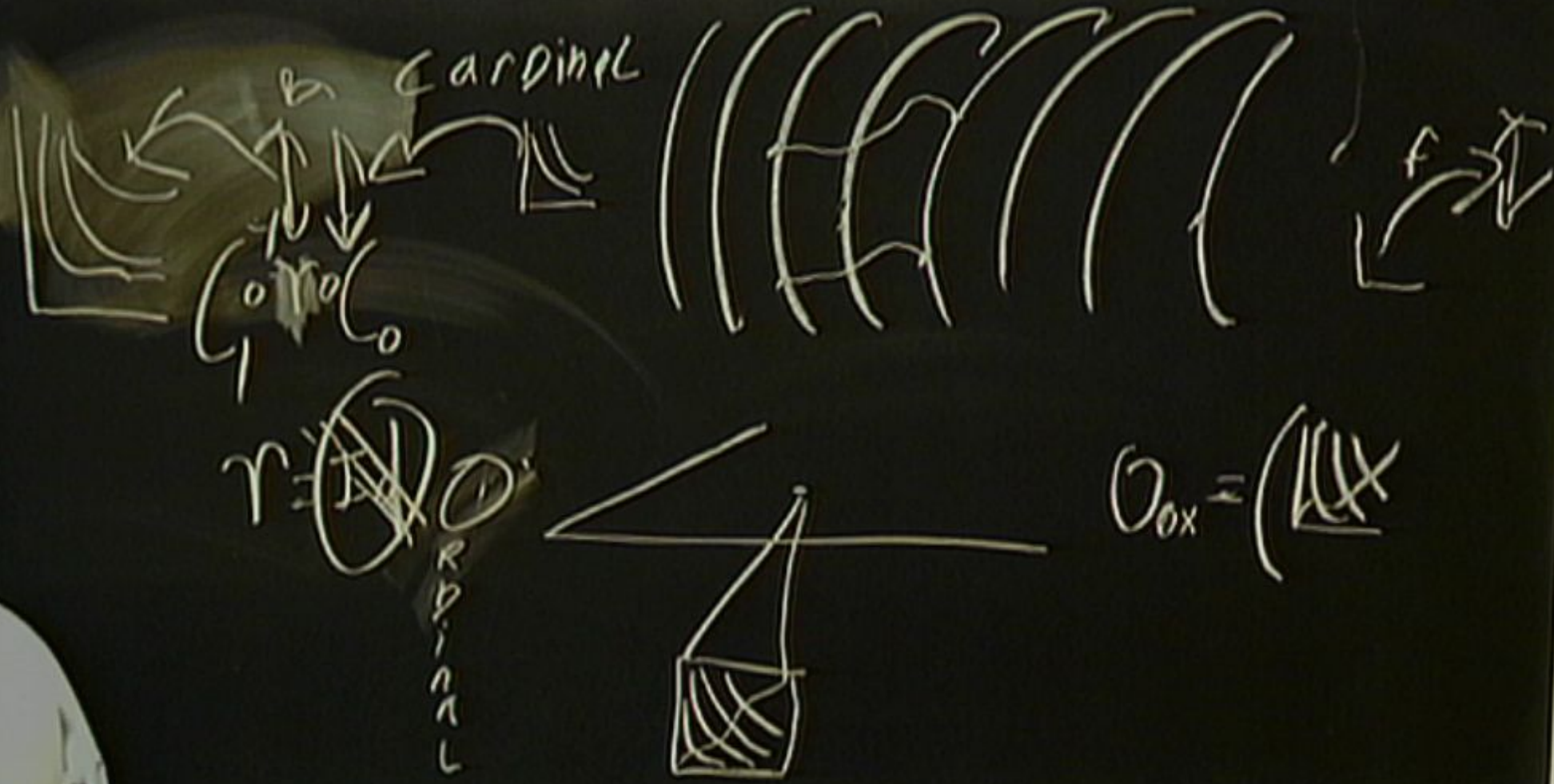
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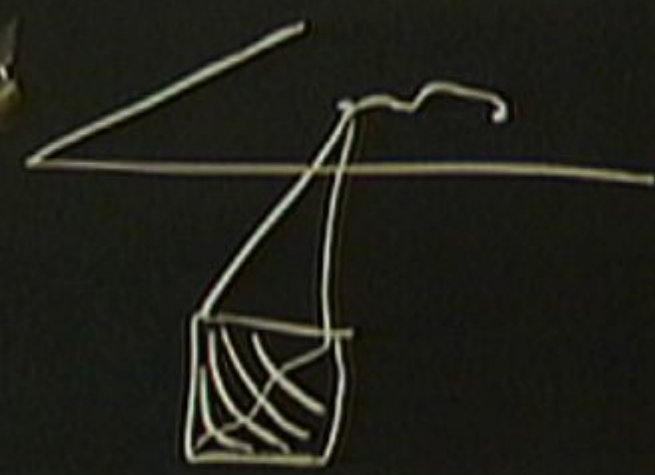
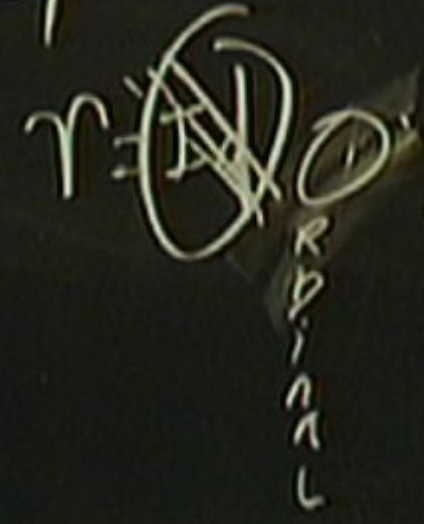
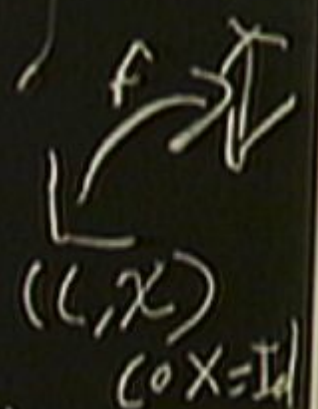
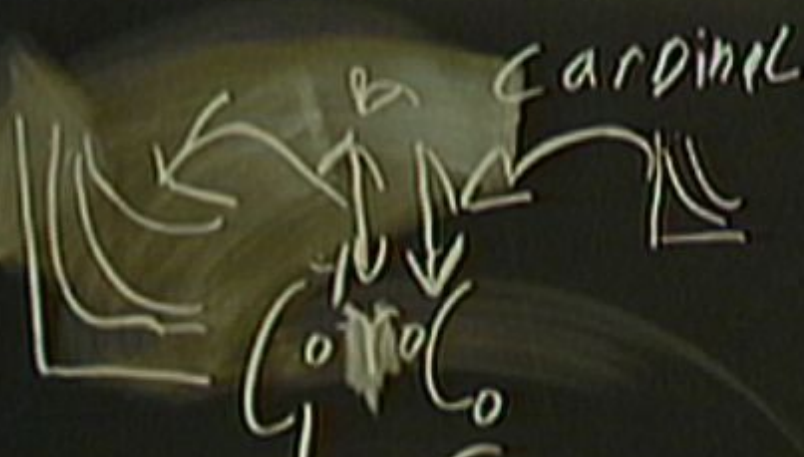
$r =$



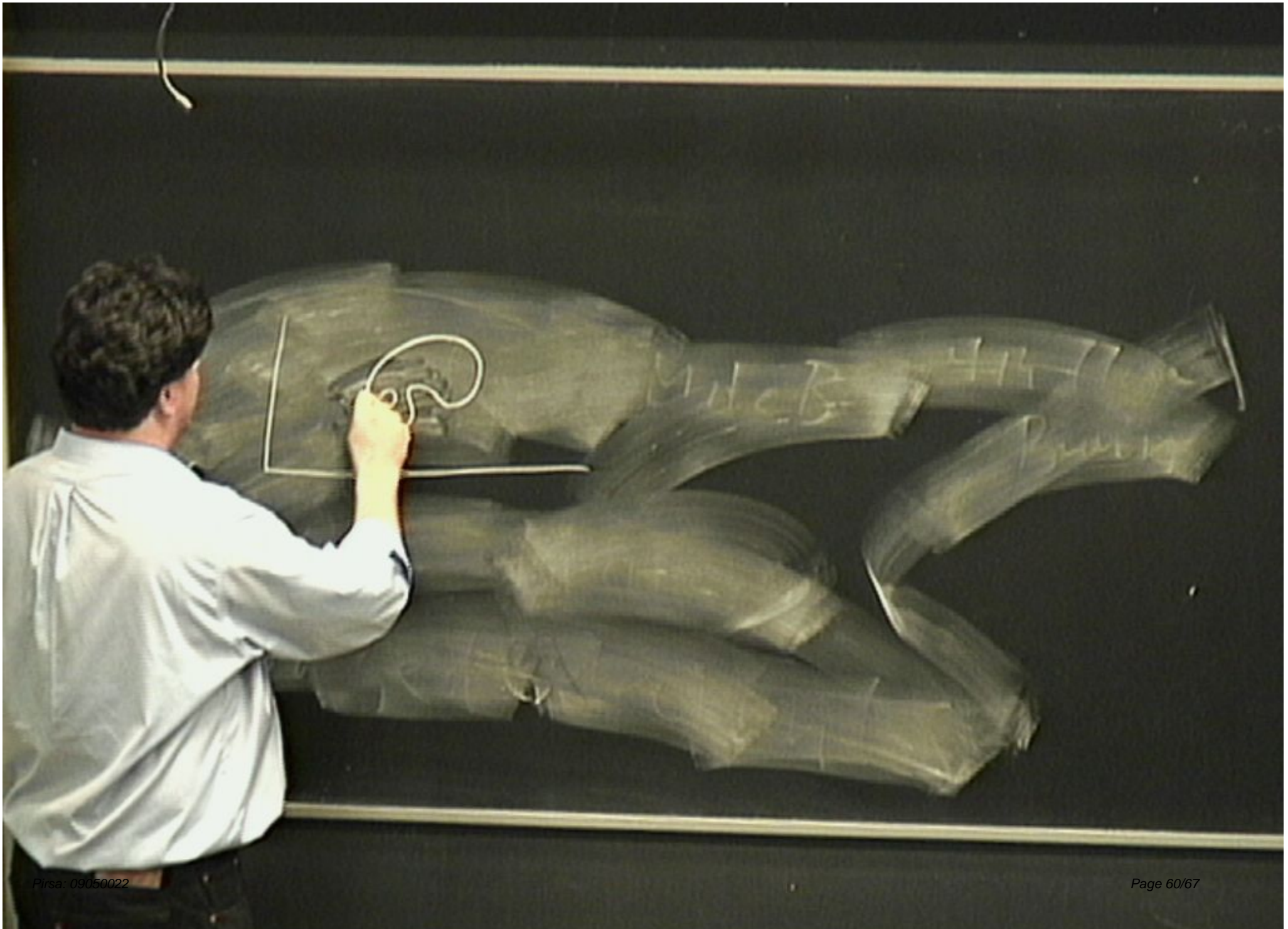


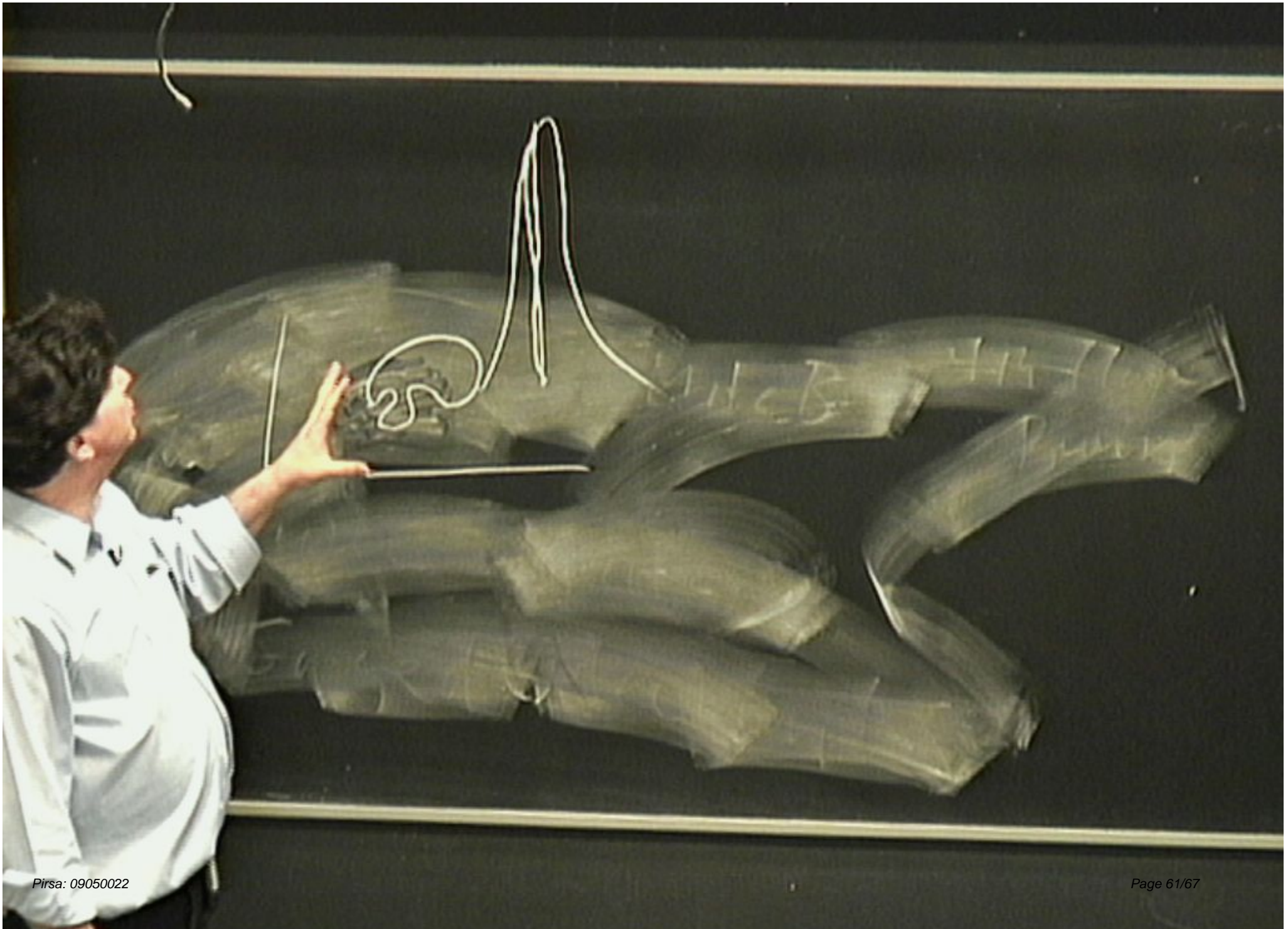


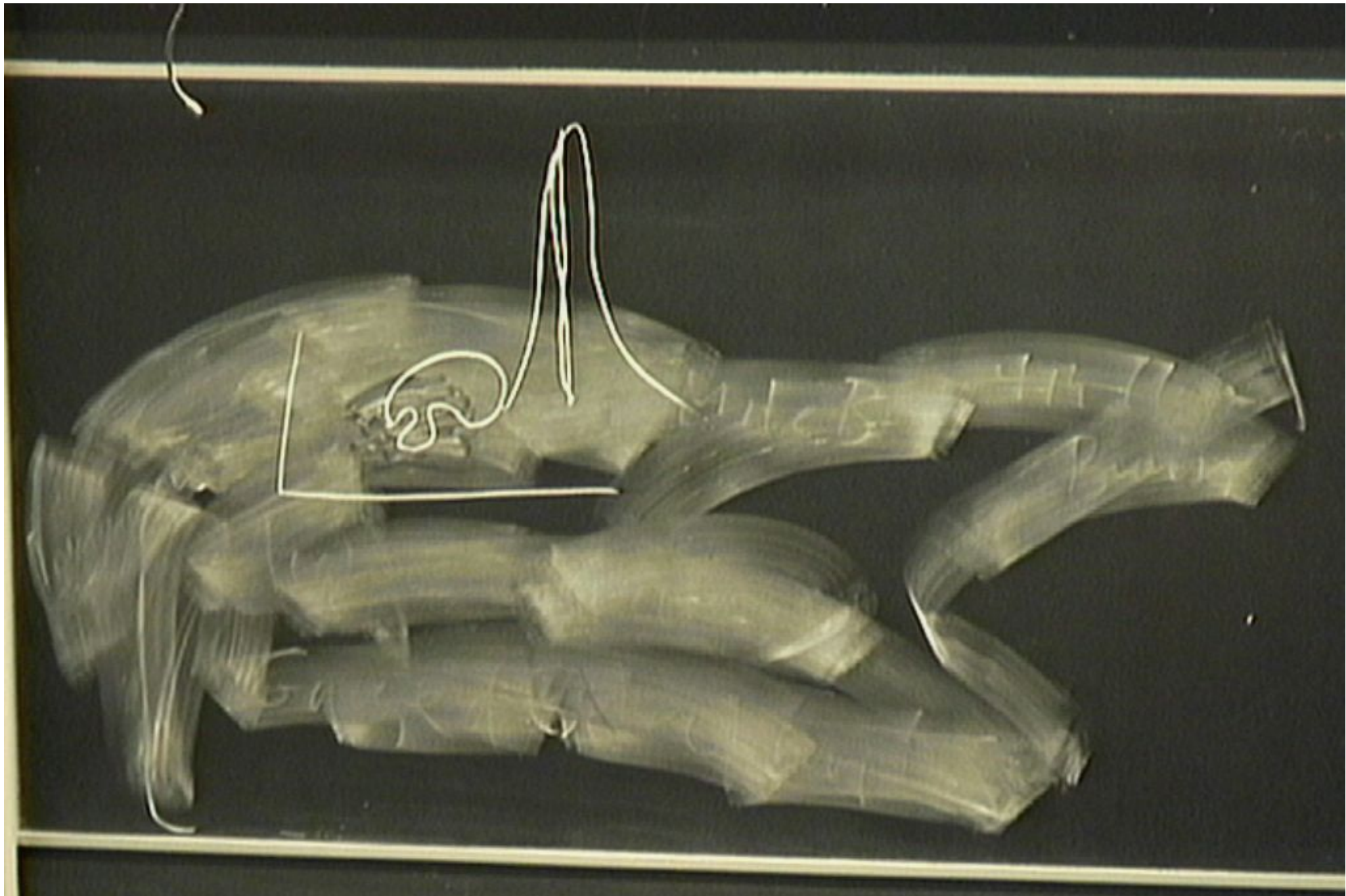




$$O_{OX} = \begin{pmatrix} X \\ X \end{pmatrix}$$

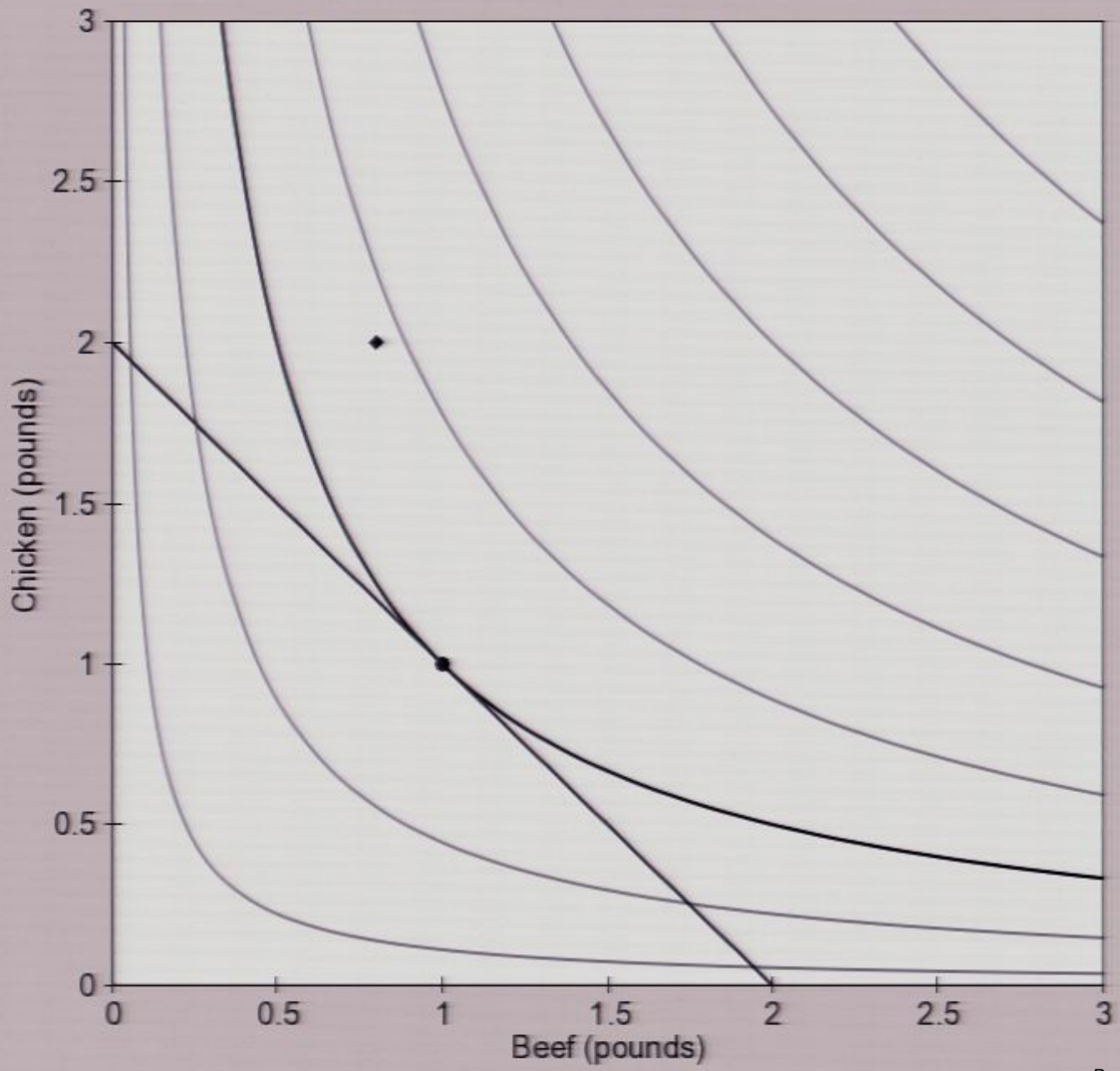




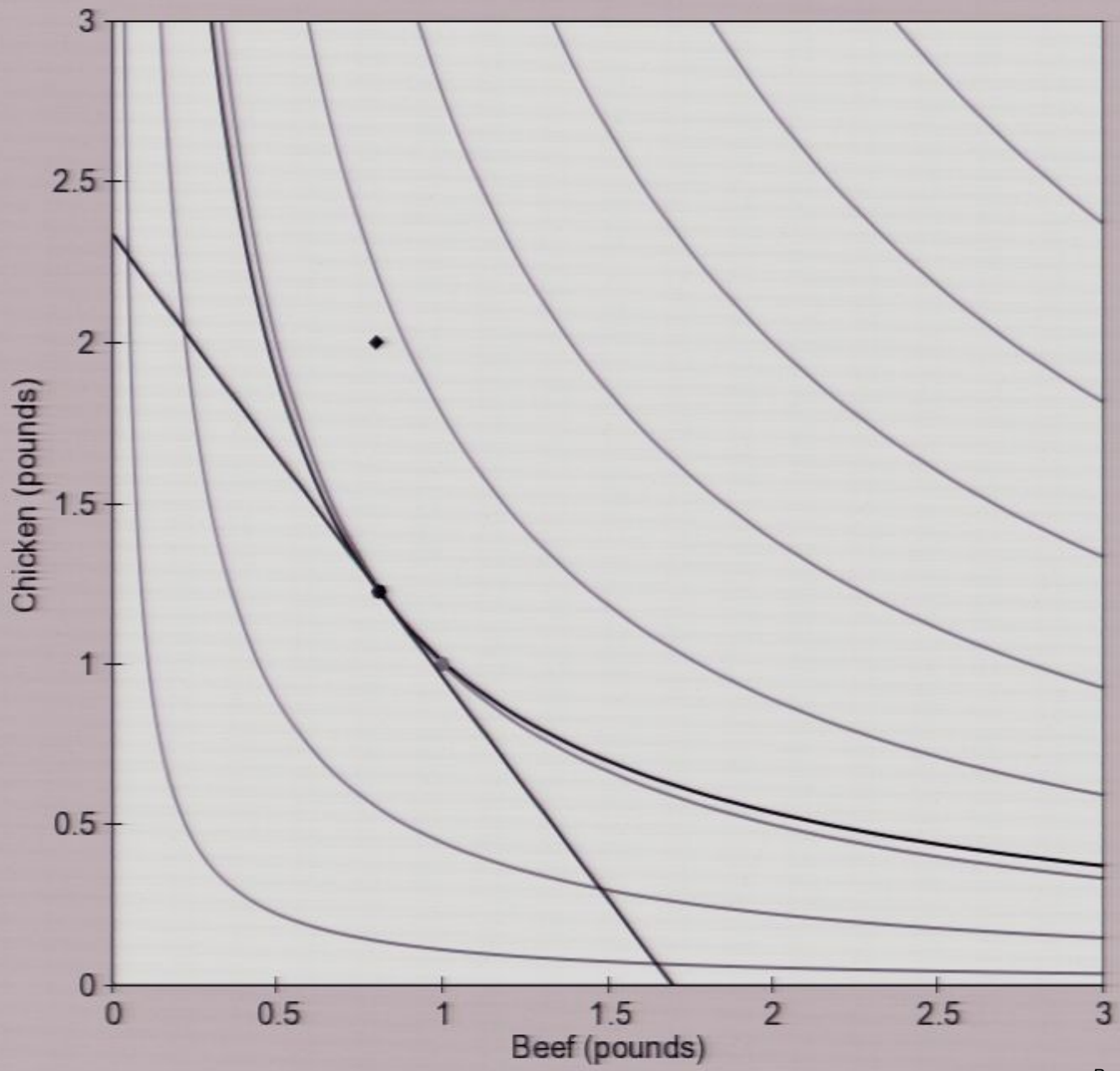


0.0 1.0 0.0

Beef price: \$ 1.00  
Beef quantity: 1.0000 lbs  
Chicken price: \$ 1.00  
Chicken quantity: 1.0000 lbs  
Budget: \$ 2.00  
COLA: 1.0000000  
 $\alpha$ : 0.5000000

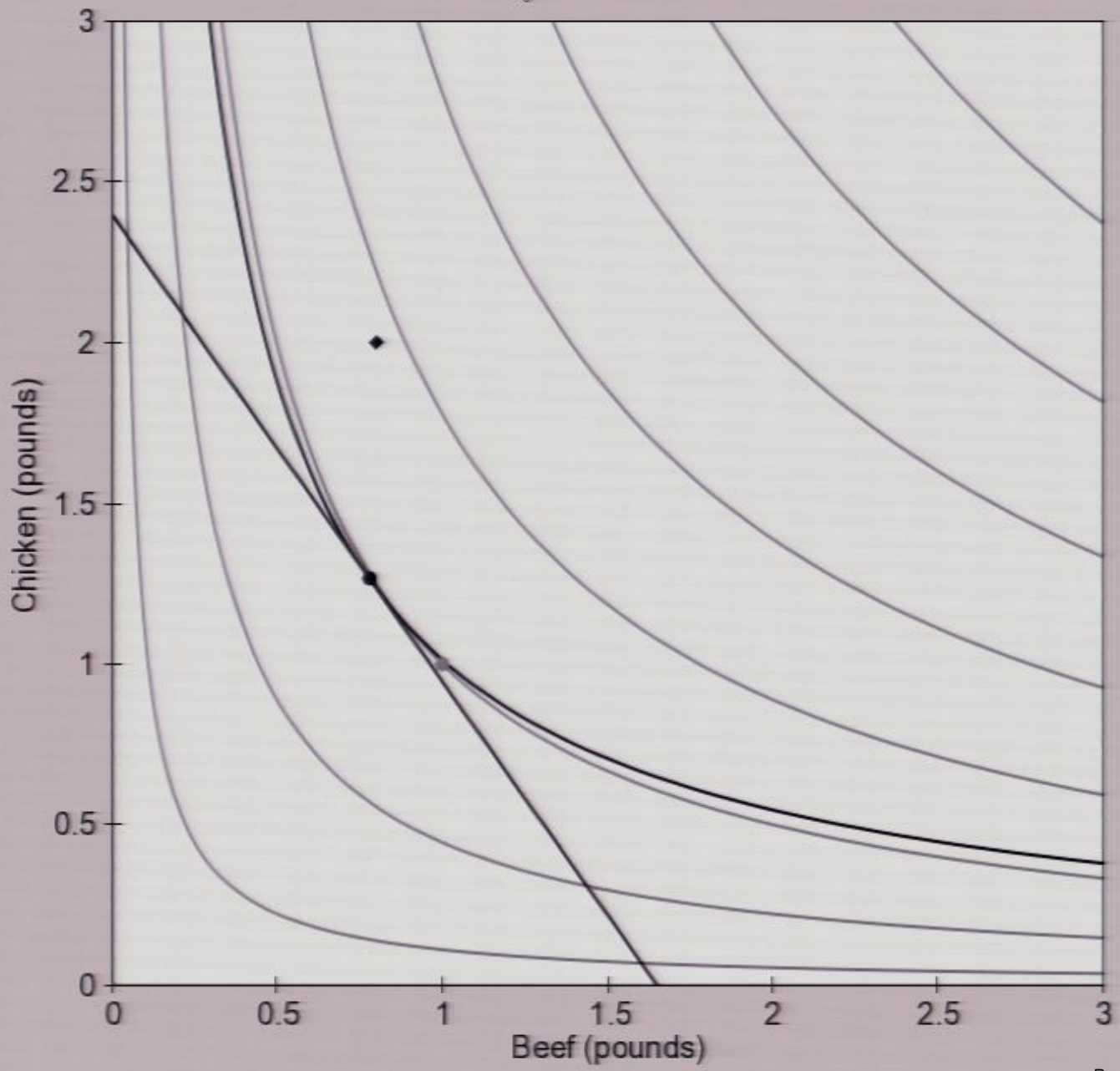


Beef price: \$ 1.26  
Beef quantity: 0.8081 lbs  
Chicken price: \$ 0.91  
Chicken quantity: 1.2255 lbs  
Budget: \$ 2.14  
COLA: 1.0684839  
 $\alpha$ : 0.4760278

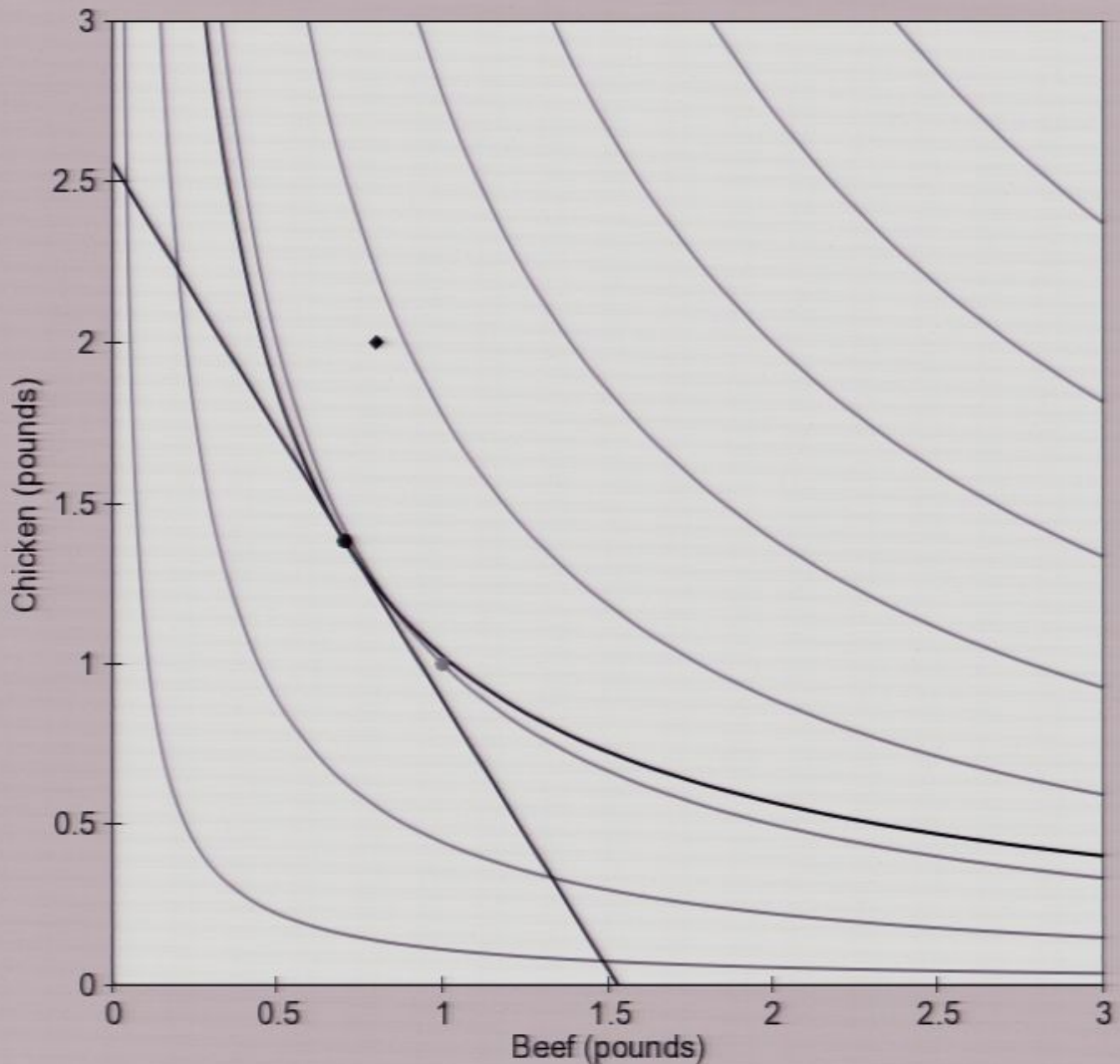




Beef price: \$ 1.35  
Beef quantity: 0.7518 lbs  
Chicken price: \$ 0.88  
Chicken quantity: 1.3070 lbs  
Budget: \$ 2.17  
COLA: 1.0846478  
 $\alpha$ : 0.4676556



Beef price: \$ 1.43  
Beef quantity: 0.7045 lbs  
Chicken price: \$ 0.86  
Chicken quantity: 1.3826 lbs  
Budget: \$ 2.19  
COLA: 1.0961428  
 $\alpha$ : 0.4600444



0.0 1.0 1.0

Beef price: \$ 1.60  
Beef quantity: 0.6170 lbs  
Chicken price: \$ 0.80  
Chicken quantity: 1.5426 lbs  
Budget: \$ 2.22  
COLA: 1.1106713  
 $\alpha$ : 0.4444444

