**DeFi AMM** | **DeFi Trading: How Prices Set Themselves** | **Standalone**

**Pillar:** Incentives | *Complete before class*

## What You Should Already Know

**DeFi** – Financial services on public blockchains without traditional intermediaries | **Wallet** – Software that stores your private keys and lets you interact with the blockchain | **Token** – A digital asset created and managed by a smart contract | **Smart contract** – Self-executing code on a blockchain that automatically enforces agreements | **Gas fee** – The cost paid to validators for processing your transaction on the blockchain

**Key Terms Preview** **AMM** (Automated Market Maker – a formula that sets prices) | **Liquidity pool** (Paired token reserves in a smart contract) | **LP** (Liquidity Provider – someone who deposits tokens into a pool) | **Constant product** (The rule $x \times y = k$ that governs pricing) | **Slippage** (Price change caused by your own trade) | **Impermanent loss** (Value lost vs simply holding tokens) | **Fee tier** (The percentage traders pay per swap, e.g. 0.3%)

## The Problem

You want to trade tokens, but there is no exchange and no market maker. Just a pool of tokens in a smart contract and a mathematical formula. How does the price get set?

**Can a simple equation replace the entire trading floor of the New York Stock Exchange?**

*In 2025, decentralized exchanges handled 12–21% of all crypto spot trading volume – hundreds of billions of dollars per month – using nothing but math.*

## Warm-Up

On a traditional stock exchange, who decides the price of a stock at any given moment? What information do they use?

Your answer: _____

## Discovery Questions

**Q1.** On a stock exchange, a "market maker" sets prices. Who sets prices in DeFi if there is no market maker?

*Hint: What if the price were just a formula applied to how many tokens are left?*

Your answer: _____

**Q2.** Imagine a seesaw with ETH on one side and USDC on the other. What happens to the price of ETH if many people buy it?

*Hint: If ETH leaves the pool, there is less ETH and more USDC.*

Your answer: _____

**Q3.** Why would someone put their tokens into a pool for strangers to trade with? What is in it for them?

*Hint: Every time someone trades, they pay a fee.*

Your answer: _____

**Q4.** If you trade 50% of a small pool vs 0.1% of a huge pool, which trade gets a better price? Why?

*Hint: Moving more of the pool means moving the price more.*

Your answer: _____

## Cryptoeconomics Challenge

Uniswap V3 LPs earned trading fees but only 37.2% of non-stablecoin positions were profitable. Who captures the other 62.8%? Is this market fair?

## After-Class Reflection

*After the lecture, revisit Q4. Could you now calculate the exact slippage for a trade using the constant product formula? Try it with numbers.*

**Solutions**

Complete answers to all discovery questions.

## Warm-Up Answer

**Market makers and specialists set prices** by posting bids (buy orders) and asks (sell orders). They use order flow, supply/demand, and their own inventory to determine prices. In DeFi, a mathematical formula replaces this entire role.

## Answers

**Q1:** In DeFi, prices are set by a mathematical formula applied to the token reserves in a liquidity pool. The most common is the constant product formula: $x \times y = k$. No human decides the price – it is determined entirely by the ratio of tokens in the pool. When someone buys token X, there is less X in the pool, so the formula automatically increases its price.

**Q2:** When people buy ETH from the pool, ETH leaves and USDC enters. With less ETH and more USDC in the pool, the ratio shifts: each remaining ETH is "worth" more USDC. The price of ETH rises. This is exactly how a seesaw works – one side goes up as the other goes down. The constant product formula ensures the product $x \times y$ always equals $k$.

**Q3:** Liquidity providers (LPs) earn a share of the trading fees. On Uniswap, traders pay 0.01–1% per swap, and this fee is distributed to LPs proportional to their share of the pool. It is passive income from facilitating trades. However, LPs also face impermanent loss – if token prices diverge significantly, they may have been better off simply holding the tokens.

**Q4:** Trading 0.1% of a huge pool gets a far better price. Slippage is proportional to trade size relative to pool depth. A \$10K trade in a \$100K pool moves 10% of reserves, causing massive price impact. The same \$10K trade in a \$100M pool moves only 0.01% – barely nudging the price. This is why pool depth (TVL) matters enormously for traders.

## Cryptoeconomics Answer

The 62.8% who are unprofitable lose value primarily to impermanent loss – the mathematical penalty for price divergence. This value is captured by: (1) arbitrage traders who profit from price discrepancies between the pool and external markets, (2) MEV bots that sandwich LP positions, and (3) informed traders who trade against LPs with better information. Whether this is "fair" depends on perspective: LPs voluntarily accept the risk, but many do not fully understand impermanent loss before depositing.