Elliptic Curves and Cryptography

USU Student Research Symposium April 2017
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The Need for Security Increases…

Cryptography

practice and study of techniques for secure communication

RSA

Most popular and understood cryptosyste

How does it work?

Step 1 — 2 Prime numbers — 5, 7

Step 2 — Multiply — 5(7) =35 ← Maximum

Step 3 — Key — 3

Step 4 — Multiply — 8(8)(8) = 512

STEP 5 — Divide — 512 / 35 = 14 Remainder 22

HI

8 9

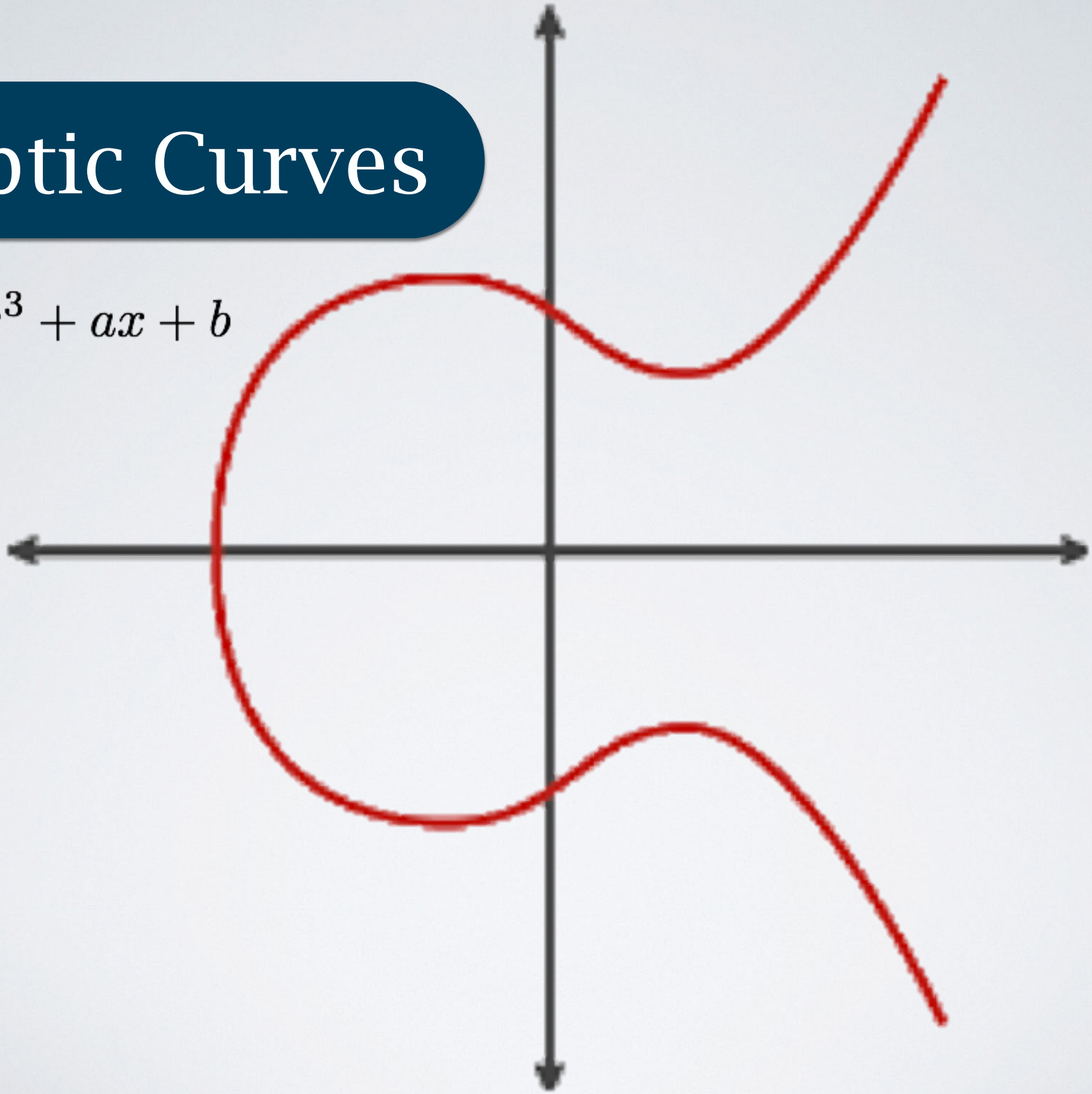
2229

VC

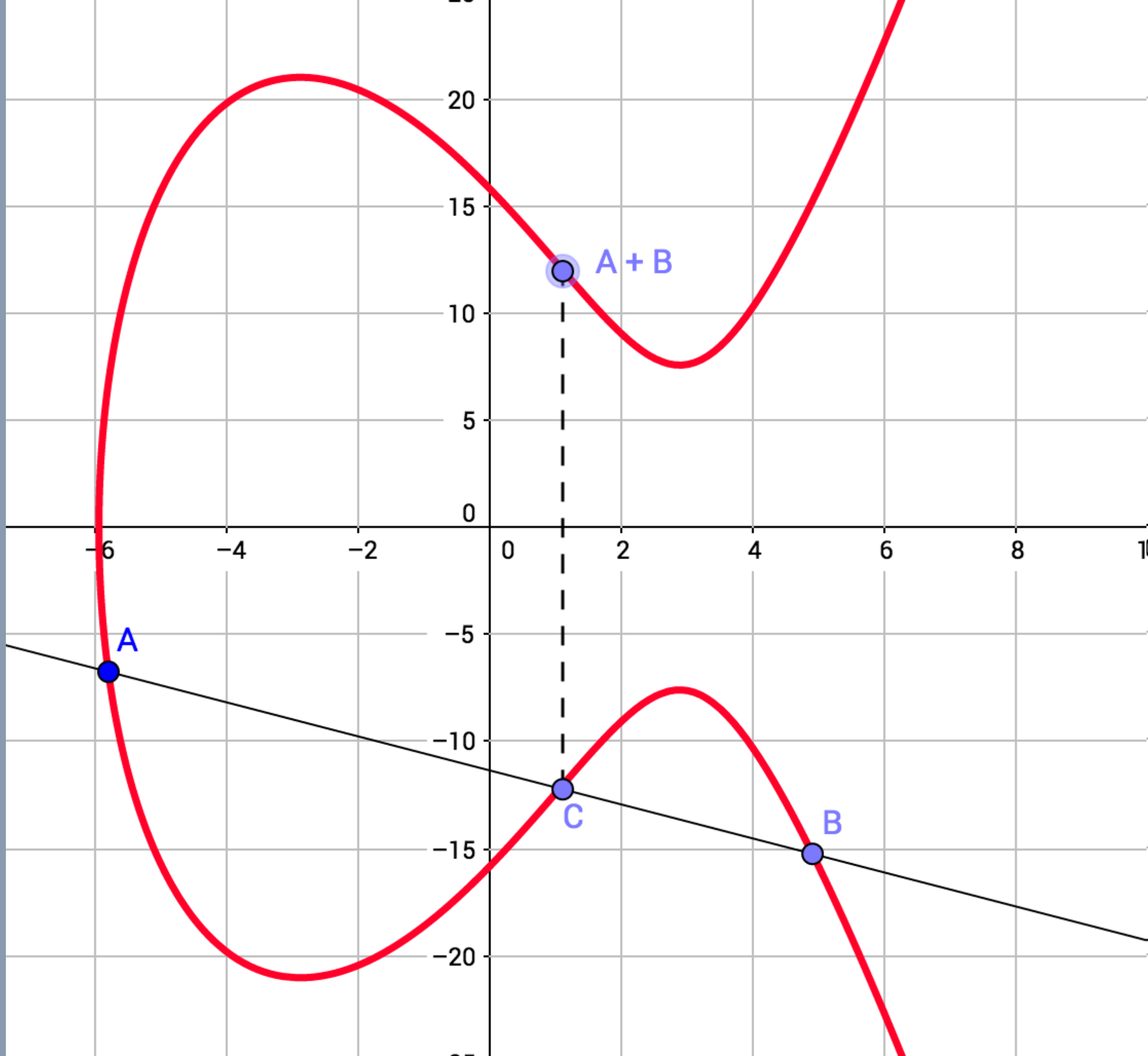
Is a new system really needed?

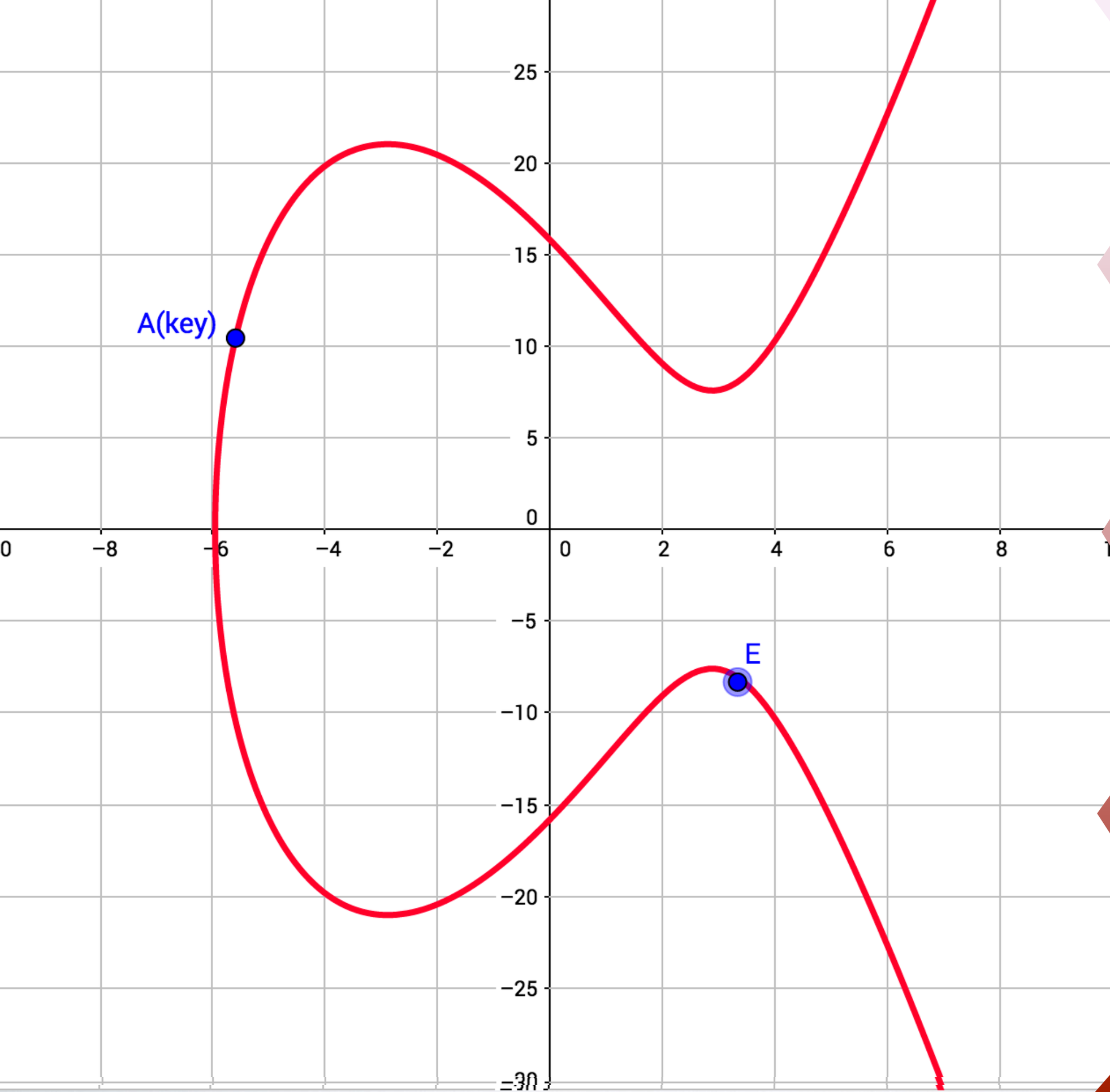
Elliptic Curves

$$y^2 = x^3 + ax + b$$



ADDING POINTS





ELLIPTIC CURVE ENCRYPTION

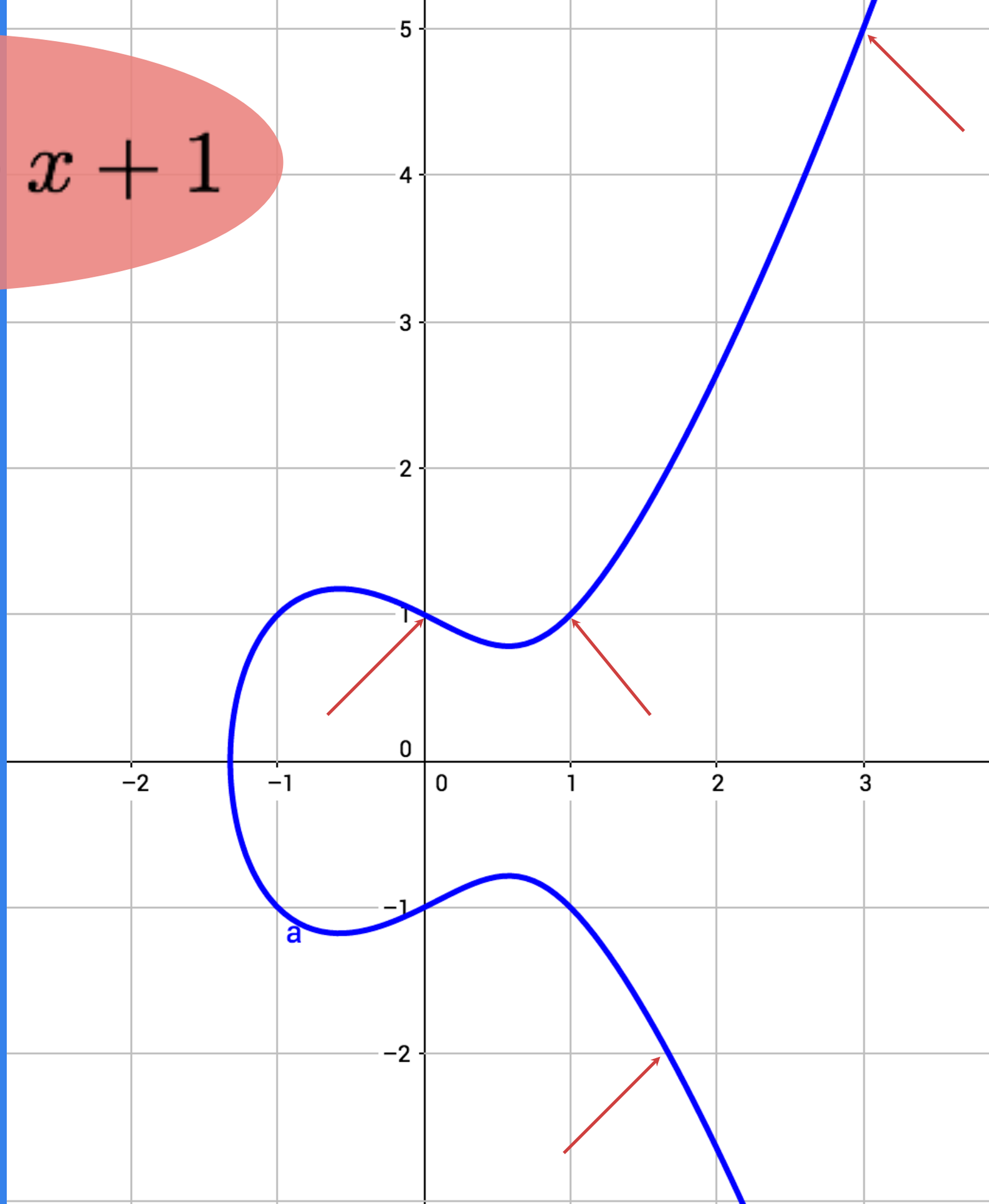
$$y^2 = x^3 - x + 1$$

$$x = 3,$$

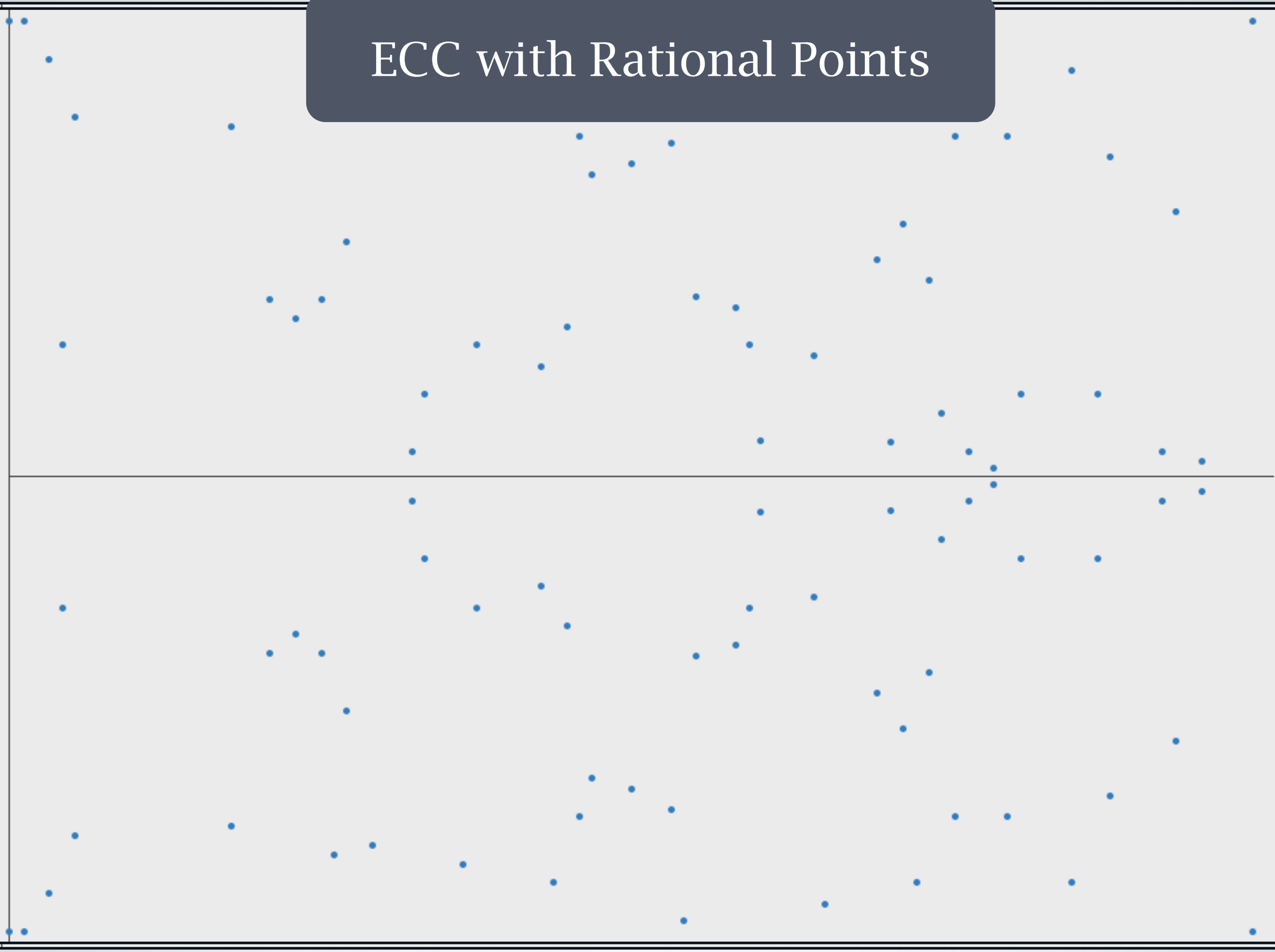
$$y^2 = 3^3 - 3 + 11$$

$$y^2 = 25$$

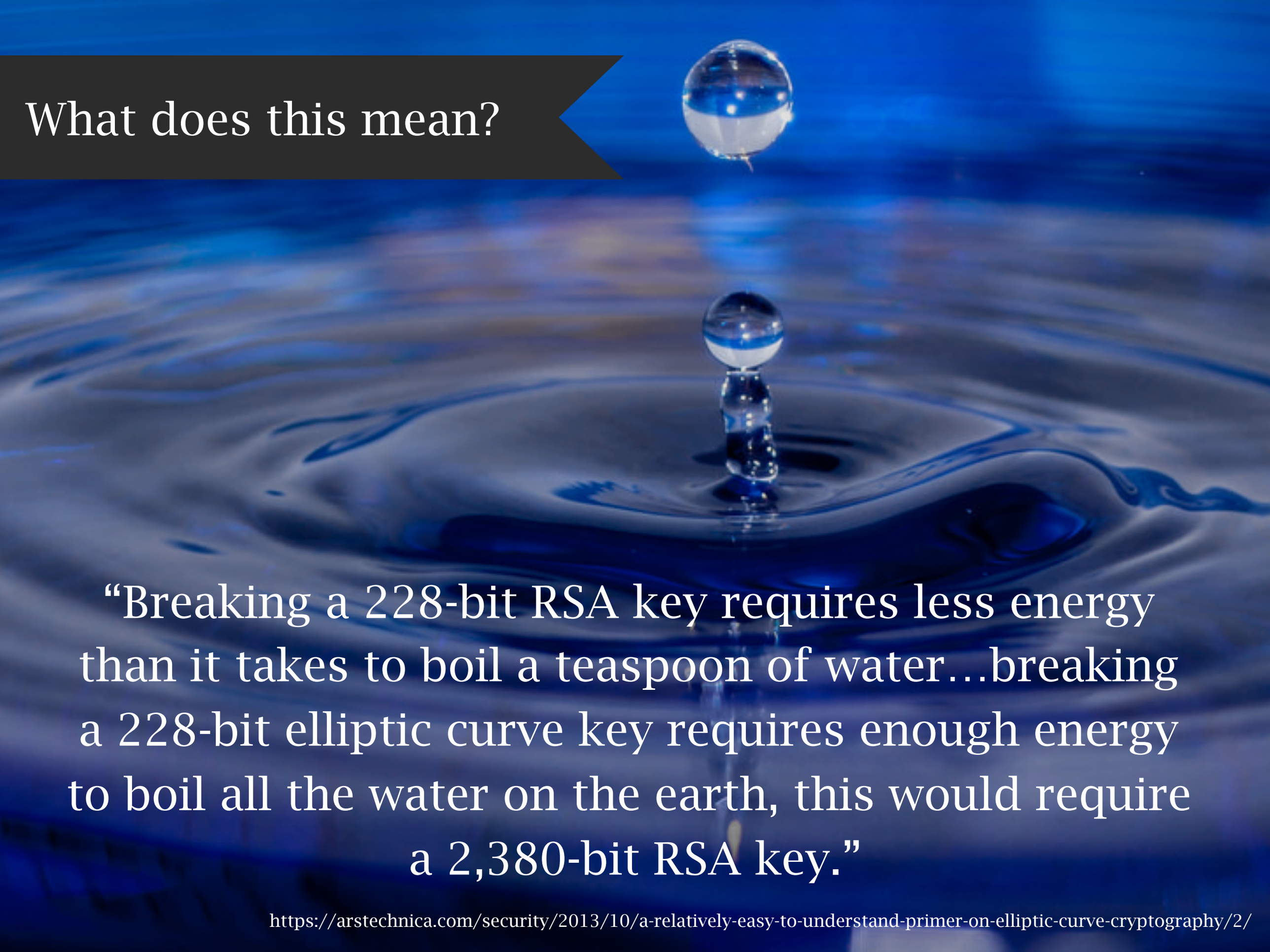
$$y = \pm\sqrt{25}$$



ECC with Rational Points



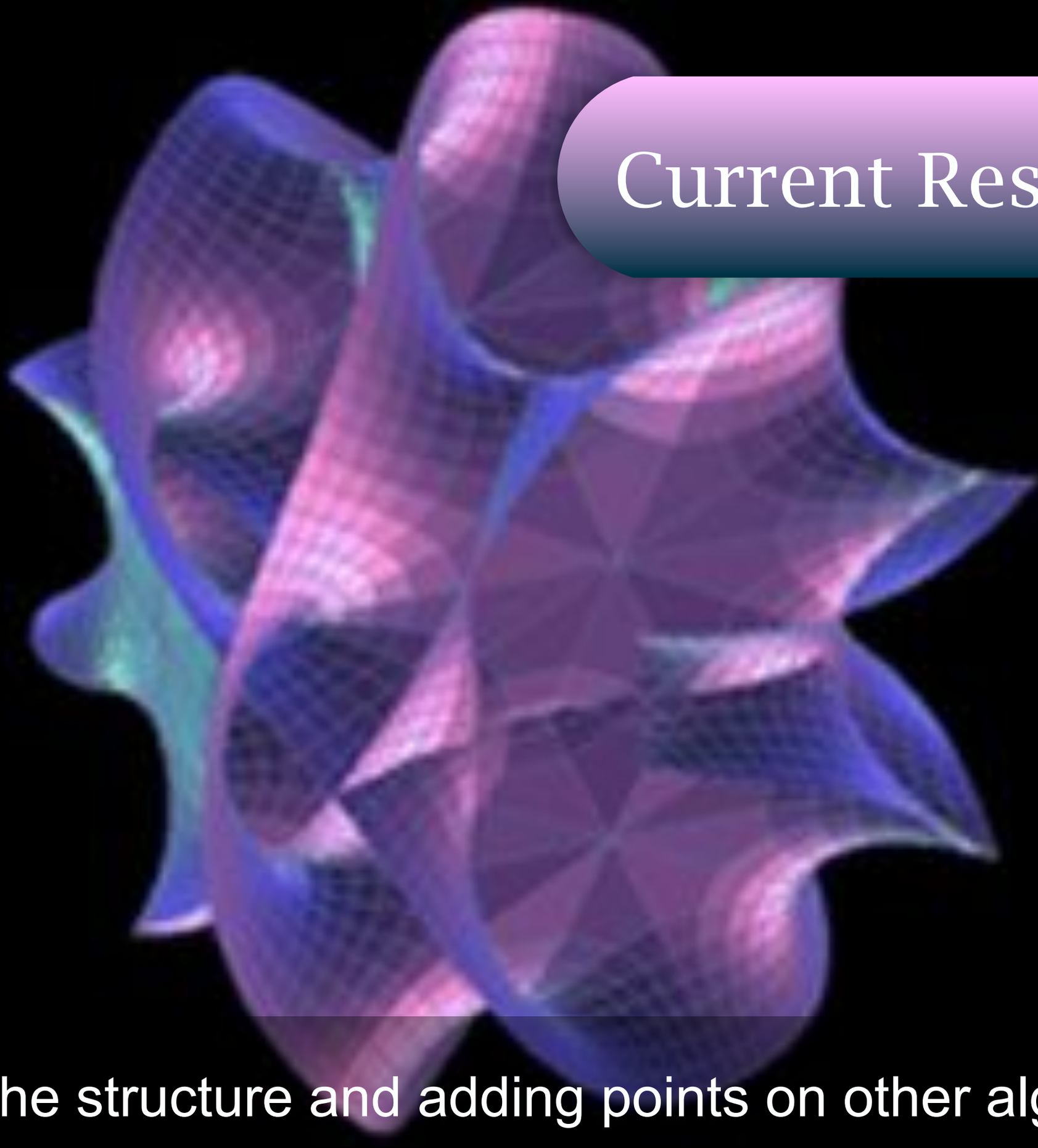
What does this mean?



"Breaking a 228-bit RSA key requires less energy than it takes to boil a teaspoon of water…breaking a 228-bit elliptic curve key requires enough energy to boil all the water on the earth, this would require a 2,380-bit RSA key."

https://arstechnica.com/security/2013/10/a-relatively-easy-to-understand-primer-on-elliptic-curve-cryptography/2/

Current Research



erstanding the structure and adding points on other algebraic cu