(Applied) Cryptography

Tutorial #10

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1. Is $(4, 7)$ a point in the elliptic curve $y^2 = x^3 - 5x + 5$ over $\mathbb{Z}_{23}$? And over $\mathbb{R}$?
2. On the elliptic curve real numbers $y^2 = x^3 - 36x$, let $P = (-2, 8)$ and $Q = (-3, -9)$. Find $P + Q$ and $2P$.
3. Consider the elliptic curve defined by $y^2 = x^3 + x + 6$ over $\mathbb{Z}_{11}$. Determine all of the points of the curve.
4. For the curve defined in the previous question, consider the point $G = (2, 7)$. Compute the multiples of G from $2G$ through $13G$.
5. Write python/SageMath programs that for P-192[1] and ECDSA
   (a) Generates a pair of private/public keys.
   (b) Sign a text using a private key.
   (c) Verifies a signature using a public key.

[1] https://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.186-4.pdf