Introduction to FinTech Assignment for Bitcoin/Blockchain

- Use the elliptic curve "secp256k1" as Bitcoin and Ethereum. Let G be the base point in the standard. Let d be the last 4 digits of your student ID number.

1. Evaluate $4G$.
2. Evaluate $5G$.
3. Evaluate $Q = dG$.
4. With standard Double-and Add algorithm for scalar multiplications, how many doubles and additions respectively are required to evaluate dG?
5. Note that it is effortless to find $-P$ from any P on a curve. If the addition of an inverse point is allowed, try your best to evaluate dG as fast as possible. Hint: $31P = 2(2(2(2(2P)))) - P$.
6. Take a Bitcoin transaction as you wish. Sign the transaction with a random number k and your private key d.
7. Verify the digital signature with your public key Q.

8. Over $\boldsymbol{Z}_{10007}$, construct the quadratic polynomial $p(x)$ with

$$p(1) = 10, \quad p(2) = 20, \quad \text{and} \quad p(3) = d.$$