Problem 3. «Factoring in 2019»

Nicole is learning about the RSA cryptosystem. She has chosen random 500-bit prime numbers p and q, $2^{499} \leqslant p, q < 2^{500}$, and computed $n = p \cdot q$. Being a curious and creative person, she has also combined the three numbers in funny ways. Her favorite one is an integer h such that

$$h \equiv 3^{2019}p^2 + 5^{2019}q^2 \pmod{n^2 + 8 \cdot 2019}.$$

Unfortunately, she has lost the paper where she wrote the two prime numbers. Luckily, she remembers n and h. Help Nicole to recover p and q.

$$\begin{aligned} n = {} & 40763613025504836845249840044831561583564626405535158138667037 \\ & 18791672670905308860844304055285019651507728831663677166092475 \\ & 16155419756121537288444995708421977847213953345126368990185271 \\ & 10259760189356588305406519080647582874212687596214191915933827 \\ & 67252094717222418132289251314647500491996323400002019, \end{aligned}$$

$$\begin{aligned} h = {} & 78307999278336577586961528110240026923828914927526911949501196 \\ & 64549497756373569985393554661132717198368717093111812566649031 \\ & 17342818449633588647098544612151278035131454234786653136500887 \\ & 08830470996542889124182135320736229037272053968078486037358357 \\ & 72653630883685906916701587362236649126895719656663293825501223 \\ & 97088799629252601249428062432254738935764304610281613264225641 \\ & 74990272864680012560095992125783832230234589257650929348364268 \\ & 48117494065463529201859600747521892957258104033195441014023432 \\ & 36581529201392185327635674923459290749241831590661903965132514 \\ & 21544515183088866585058200066678369344118 81. \end{aligned}$$