

PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Final Exam

Number Theory

26-05-2019

1. (7 points) Find all the solutions of $x^{13} \equiv 2 \pmod{23}$.
2. (7 points) Find all the solutions of $5^x \equiv 3 \pmod{11}$.
3. (8 points) Find all the solutions of $x^2 \equiv 60 \pmod{77}$.
4. (8 points) Evaluate the Legendre symbol $\left(\frac{-66}{191}\right)$.
5. (10 points) Solve 2 problems from the following 3:
 - (a) Prove that if k is even, then $\phi(2k) = 2\phi(k)$.
 - (b) Prove that if $a^8 \equiv -1 \pmod{17}$, then a is primitive root mod 17.
 - (c) Prove that if $p \% 8 = 3$, then $\left(\frac{-2}{p}\right) = +1$

-Amin Witno