The Ninth Grade Math Competition Class
Modular Arithmetic
Anthony Wang

1. The remainders when two natural numbers are divided by 12 are 5 and 9. (a) Find the remainder when their product is divided by 12. (b) Find the reminder when their product is divided by 4.

2. Is $21^{100} - 12^{100}$ a multiple of 11?

3. Find the remainder when $24^{50} - 15^{50}$ is divided by 13.

4. Find the tens and units digits of 7^{2006}.

5. Find the remainder when $1^2 + 2^2 + 3^2 + \cdots + 99^2$ is divided by 13.

6. Find the remainder when $9^{42} - 5^{42}$ is divided by 7.

7. Find the remainder when 7^{255} is divided by 11.

8. Find the last two digits of 99^{2005}.

9. A natural number n, has a unit digit of A when expressed in base 12. Find the remainder when n^2 is divided by 6.