Homework 2

Homework designed and built for T.J. Borrelli
Due September 21st
Section 3

Alexander Kellermann Nieves

1

1. What is 15 x 29 mod 13
$$= 6$$
2. What is $2 \cdot 29$ mod 13?
$$= 6$$
3. $2 \cdot 3$ mod 13
$$= 6$$
4. -11 $\cdot$ 3 mod 13
$$= 6$$

2

1. 1/5 mod 13

$$5x = 1 \mod 13 \tag{1}$$
$$5(8) = 1 \mod 13 \tag{2}$$
$$x = 8 \tag{3}$$

2. 1/5 mod 7

$$5x = 1 \mod 7 \tag{4}$$
$$5(3) = 1 \mod 7 \tag{5}$$
$$x = 3 \tag{6}$$

3. $3 \cdot 2/5$ mod 7

$$5x = 6 \mod 7 \tag{7}$$
$$5x = 6 \mod 7 \tag{8}$$
$$5(4) = 6 \mod 7 \tag{9}$$
$$x = 4 \tag{10}$$

3

1.

+	0	1	2	3
0	0	1	2	3
1	1	2	3	0
2	2	3	0	1
3	3	0	1	2

2.

*	0	1	2	3
0	0	0	0	0
1	0	1	2	3
2	0	2	0	2
3	0	3	2	1

+	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	0
2	2	3	4	5	0	1
3	3	4	5	0	1	2
4	4	5	0	1	2	3
5	5	0	1	2	3	4

·	0	1	2	3	4	5
0	0	0	0	0	0	0
1	0	1	2	3	4	5
2	0	2	4	0	2	4
3	0	3	0	3	0	3
4	0	4	2	0	4	2
5	0	5	4	3	2	1

4

5

1. $3^2 \mod 13$
   $9 \mod 13 = 9$

2. $7^2 \mod 13$
   $49 \mod 13 = 10$

3. $3^{10} \mod 13$
   $3^2 = 9 \mod 13 = 9$
   $3^2 \times 3^2 \times 3^2 \times 3^2 \times 3^2$

$45 \mod 13 = 9$

4. $7^{100} \mod 13$
   $= 11$

6

$$7^x = 11 \mod 13 \tag{11}$$
$$7^5 = 7 \cdot 7^4 = 63 \mod 13 \tag{12}$$
$$7^5 = 11 \mod 13 \tag{13}$$

The answer is $x = 5$.

7

1. $$\phi(4) = 2$$

2. $$\phi(5) = 4$$

3. $$\phi(9) = 6$$

4. $$\phi(26) = 12$$

8

The cipher text is:
`firstthesentenceandthentheevidencesaidthequeen`