

## Q1 Modular Arithmetic Basics

4 Points

### Q1.1 Definition

1 Point

If  $x \equiv a \pmod{m}$ , then  $x = a + km$  for some  $k \in \mathbb{Z}$ .

True

False

Explanation

By definition.

### Q1.2 Multiplication

1 Point

If  $x \equiv 4 \pmod{6}$  and  $y \equiv 4 \pmod{6}$ , what is  $xy \pmod{6}$ ?

0

1

2

3

4

5

Explanation

To find the remainder when  $xy$  is divided by 6, we can multiply the individual remainders to get 16, which is equivalent to 4  $\pmod{6}$

### Q1.3 Exponentiation

1 Point

What is  $8^{70} \pmod{7}$ ?

- 0
- 1
- 2
- 3
- 4
- 5
- 6

#### Explanation

We have that  $8 \equiv 1 \pmod{7}$ , and  $1^{70} \equiv 1 \pmod{7}$ .

### Q1.4

1 Point

Which of the following sets is modular arithmetic defined on for this course?

- $\mathbb{Z}$  Integers
- $\mathbb{Q}$  Rationals
- $\mathbb{R}$  Reals
- $\emptyset$  Empty

#### Explanation

Modular arithmetic is defined over the Integers. Intuitively, out of the above sets, the idea of a remainder only makes sense for Integers

## Q2 Multiplicative inverses

2 Points

Indicate whether following are multiplicative inverses of 2 (mod 7).

Q2.1

1 Point

3

- Inverse
- Not an inverse

Explanation

$$2 \times 3 = 6 \not\equiv 1 \pmod{7}$$

Q2.2

1 Point

4

- Inverse
- Not an inverse

Explanation

$$2 \times 4 = 8 \equiv 1 \pmod{7}$$

### Q3 Modular Solutions

2 Points

#### Q3.1

1 Point

Solve for  $x$  in  $5x \equiv 3 \pmod{6}$ .

- No solution exists
- 0.6
- 1
- 3
- 5

Explanation

$$5 \cdot 3 \equiv 15 \equiv 3 \pmod{6}$$

#### Q3.2

1 Point

Solve for  $x$  in  $2x \equiv 3 \pmod{6}$ .

- No solution exists
- 1
- 1.5
- 3
- 5

Explanation

$2x$  is even, and its remainder when divided by an even number will also be even. Thus  $2x \pmod{6}$  can never be equal to 3.