Modulo Arithmetic
Work Sheet: 08-IP-01-WS

For teachers only

Questions: (* questions can be used for evaluation)

1. Can you identify if the below numbers are in arithmetic progression? Write down the reason for your answer in each case
   a) {1, 2, 3, 4, 5, 6, 7, 8}
   b) {-1,1,3,5,7,9}
   c) {1,5,8,1,5,8}

   Answers:
   a. The numbers {1, 2, 3, 4, 5, 6, 7, 8} are in arithmetic progression because they have a common difference of 1

      2 – 1 = 1

      3 – 2 = 1

      4 – 3 = 1

      4 – 5 = 1

      6 – 5 = 1

      7 – 6 = 1

      8 – 7 = 1

   b. The numbers {-1,1,3,5,7,9} are in arithmetic progression because they have a common difference of 2

      1 – (-1) = 2

      3 – 1 = 2

      5 – 3 = 2

      7 – 5 = 2

      9 – 7 = 2

   c. The numbers {1,5,8,1,5,8} are not in arithmetic progression because they don't have a common difference of 1

      5 – 1 = 4

      8 – 5 = 3

      1 – 8 = -7

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2. In your school can you identify some patterns that are repeating itself?
   Some examples
   Each class has sections A, B, C, D this pattern repeats itself from class 1 to class 8
   Each day is divided into 6 periods with 2 breaks. They repeat every day from Monday to Friday

3. With your knowledge on modulo arithmetic can you solve the following?
   a. * 24 Mod 12 =
   b. * 15 Mod 30 =
   c. Can you identify a relationship between the first and second problem?
   d. * 10 Mod 2 =
   e. * 2 Mod 2 =
   f. If 10 Mod x = 1 can you find one value of x
   g. If 20 Mod x = 3 then find x
   h. If X mod 5 = 3 can you find one value of x
   i. If x mod 7 = 2 can you find one value of x

a) To calculate 24 Mod 12, first we should divide 24 by 12 and see the remainder

```
   __2_____
12) 24
    24
   --------
     0
    --------
```

Therefore 24 Mod 12 = 0 or we can say 0 Mod 12 is congruent to 24 Mod 12

b) To calculate 15 Mod 30, first we should divide 15 by 30 and see the remainder

```
   __2_____
15) 30
    30
   --------
     0
   --------
```

Therefore 15 Mod 30 = 0 or we can say 0 Mod 30 is congruent to 15 Mod 30

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c) Can you identify the relationship between the first and second problem?
We see that the remainder for both the questions is 0 so we can say
24 Mod 12 is congruent to 15 Mod 30

d) * 10 Mod 7

```
  __1_____
7) 10
   07
  --------
   03
   --------
```

Therefore 10 Mod 7 = 3

e) * 23 Mod 2

```
  __1_____
12) 23
    12
   --------
    11
    --------
```

Therefore 23 Mod 12 = 11

f) If 10 Mod x = 1 can you find one value of x

```
  __3_____
3) 10
   09
  --------
     01
  --------
```

Also we see

```
  __3_____
3) 10
   09
  --------
     01
  --------
```

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So we can write 10 Mod 9 = 1 or 10 Mod 3 = 1 or 10 Mod 9 is congruent to 10 Mod 3

10 Mod 9 ≡ 10 Mod 3

g) If 20 Mod x = 3 then find x

```
  3
17) 20
    17
   --------
    03
   --------
```

h) If X mod 5 = 3

In this example, we should find a number that can be divided by 5 leaving a remainder 3

```
  2
5) 13
   10
  --------
   03
  --------
```

```
  4
5) 23
   20
  --------
   03
  --------
```

13Mod 5 = 3 or 23 Mod 5 = 3

We can also write 13Mod 5 is congruent to 23 Mod 5

13Mod5 ≡ 23 Mod 5

i. If x mod 5 = 3 find the value of x

Think of a number that when divided by 5 will give a remainder 3

If we take any number say ‘a’ and multiply it with 5 and add 3 to it we will get the required answer

Lets, try it out

Let x = 3*5+3 = 18

18 mod 5 = ?

```
  3
5) 18
   15
  --
   03
  --
```

So the answer would be any number multiplied by 5 plus 3

j. If x mod 7 = 2 find x

Think of a number that when divided by 7 will give a remainder 2

If we take any number say ‘a’ and multiply it with 7 and add 2 to it we will ge the required answer

Lets, try it out

Let x = 3*7+2 = 23

23 mod 7 = ?

```
  3
7) 23
   21
  --
   02
  --
```

So the answer would be any number multiplied by 7 plus 2