Eastern Area Mathematical Challenge 2010

Round 3 Modular Arithmetic (20 marks)

1. Convert the following numbers:

16 = 1 (mod 3) 21 = 1 (mod 4)

32 = 4 (mod 7) 176 = 7 (mod 13)

1 mark each - Total 4

2. Find the possible values of x:

41 = 3 (mod x)

19, 38 (1 mark each, minus 1 for each error) 0/1/2 marks

3. Find the possible values of x:

25 = 1 (mod x)

2,3,4,6,8,12,24 (3 marks all, 2 marks four or more, 1 mark 2 or more, minus 1 for each error) 0/1/2/3 marks

4. Complete the addition table (mod 5) and the multiplication table (mod 6)

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

2 marks all correct, 1 mark less than 3 errors

x mod 6	1	2	3	4	5
1	1	2	3	4	5
2	2	4	0	2	4
3	3	0	3	0	3
4	4	2	0	4	2
5	5	4	3	2	1

3 marks all correct,
2 marks less than 3 errors,
1 mark less than 5 errors

5. Given that $3n + 4 = 2 \pmod 5$, find the possible values of n.

1,6,11,16,21,26,31,.....

1 mark 2 or more correct answers,
2 marks 4 or more correct answers,
3 marks for an complete (infinite) list

6. Given that $x = 3 \pmod 5$ and $x = 2 \pmod 7$, find the possible values of x.

23,58,93,128,163,198,233, ...

1 mark 2 or more correct answers,
2 marks 4 or more correct answers,
3 marks for an complete (infinite) list