

# Congruences & CRT

## 3.AB PrelB Maths – Real Exam

Unless specified otherwise, you are to **always** (at least briefly) explain your reasoning. Even in closed questions.

### Congruences

- a) For which values of  $k < 10$  has the following congruence solutions?

[35 %]

$$k \cdot x \equiv 1 \pmod{10}$$

Write down the possible values or **state how to find them**.

- b) Three mathematicians are walking up a tower and want to count all the stairs that lead up to the top. Unfortunately yet unsurprisingly they don't know any number higher than 10. Help them create a way to count all the stairs.

[20 %]

**Chinese Remainder Theorem**

Solve the following system of congruences.

[45 %]

$$x \equiv 7 \pmod{10}$$

$$x \equiv 2 \pmod{11}$$

$$x \equiv 5 \pmod{13}$$

**Explain** why there is only one solution smaller than  $10 \cdot 11 \cdot 13$ .