

**Name:**

**Note:** There are questions on both sides of the page.

Let  $\mathbb{Z}_5 = \{0, 1, 2, 3, 4\}$  and  $\mathbb{Z}_6 = \{0, 1, 2, 3, 4, 5\}$ . For each function below, determine whether it is an injection or a surjection (or neither, or both):

[3]      1.  $f : \mathbb{Z}_5 \rightarrow \mathbb{Z}_5$ , given by  $f(x) = 3x + 2 \pmod{5}$ .

[3]      2.  $g : \mathbb{Z}_6 \rightarrow \mathbb{Z}_6$ , given by  $g(x) = 3x + 2 \pmod{6}$ .

[3]      3.  $h : \mathbb{Z}_5 \rightarrow \mathbb{Z}_5$ , given by  $h(x) = x^3 + 4 \pmod{6}$ .

[1]      4.  $H : \mathbb{Z}_5 \rightarrow \mathbb{Z}_6$ , given by  $H(x) = x^3 + 4 \pmod{6}$ .