In each of the problems on this page, find a set Y and a function f satisfying the condition specified. Then say what must be true of Y for the example to be possible.

1. The function $f : \{1, 2, 3, 4\} \to Y$ is one-to-one but not onto.

2. The function $f : \{1, 2, 3, 4\} \to Y$ is onto but not one-to-one.

3. The function $f : \{1, 2, 3, 4\} \to Y$ is one-to-one and onto.

4. The function $f : \{1, 2, 3, 4\} \to Y$ is neither one-to-one nor onto.

When the domain equals the codomain.

5. For which sets X is it true that if $f : X \rightarrow X$ is one-to-one, then f is also onto?

6. For which sets X is it true that if $f : X \rightarrow X$ is onto, then f is also one-to-one?

7. Find a function $f : \mathbb{N} \rightarrow \mathbb{N}$ which is one-to-one but not onto.

8. Find a function $f : \mathbb{N} \rightarrow \mathbb{N}$ which is onto but not one-to-one.