

1. Decide if the following are true or false. Circle one.
 - (a) TRUE FALSE $f : \mathbb{N} \rightarrow \mathbb{N}$, $f(x) = x^2$ is injective.
 - (b) TRUE FALSE $f : \mathbb{Z} \rightarrow \mathbb{Z}$, $f(x) = x^2$ is injective.
 - (c) TRUE FALSE $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = x^2$ is injective.
 - (d) TRUE FALSE $f : \mathbb{N} \rightarrow \mathbb{N}$, $f(x) = x + 1$ is surjective.
 - (e) TRUE FALSE $f : \mathbb{Z} \rightarrow \mathbb{Z}$, $f(x) = x + 1$ is surjective.
 - (f) TRUE FALSE $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = x + 1$ is surjective.
2. If $f : \mathbb{N} \rightarrow \mathbb{N}$, $f(x) = x^2$, find $f^{-1}(9)$.
3. If $f : \mathbb{Z} \rightarrow \mathbb{Z}$, $f(x) = x^2$, find $f^{-1}(9)$.
4. Suppose you have sets X and Y such that $|X| = 12$ and $|Y| = 42$.
 - (a) What is the largest possible value for $|X \cap Y|$?
 - (b) What is the smallest possible value for $|X \cap Y|$?
 - (c) What are the possible values for $|X \cup Y|$?
5. Consider all six-letter words made from the letters a , b , and c .
 - (a) How many words contain no repeated letters?
 - (b) How many words begin with a and end with b ?
 - (c) How many words contain the string “ ccc ” somewhere within the word?

6. In how many ways is it possible to draw one card if that card is either a spade or a 4?

7. Let $A = \{2, 3, 5, 7, 11, 13\}$.

(a) How many subsets have cardinality 2?

(b) How many subset contain at least one odd number?

(c) How many subsets have the property that when you add the numbers in the subset, the sum is odd?

8. How many shortest paths start at $(3, 4)$ and

(a) end at $(7, 6)$?

(b) end at $(7, 6)$ and pass through $(5, 5)$?

