Skill Mastery Quiz 10

Communicating in Math (MTH 210-01)
Winter 2020

Name:

S1-3 Let $A = \{0, 1, 2, 3, \{4\}\}$. Fill in a correct symbol (from $\in$, $\subset$, $\subseteq$, $=$, $\neq$) for each of the following.

1. $\{4\}$____A As usual, there's more than one answer, in this case I'd choose $\in$ since $\{4\}$ is one of the 5 elements of A.

2. $\{2\}$____A More than one answer, I'd choose $\subset$ or $\subseteq$.

3. $\{1, 2, 3\}$____A I'd choose $\subseteq$

S2-3 Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be the universal set. Let $A = \{2, 4, 6, 8, 10\}$ and $B = \{1, 3\}$.

1. Find $A \cap B$. $A \cap B = \emptyset$ since they have no elements in common
2. Find A^C. $A^c = \{1, 3, 5, 7, 9\}$, everything that is in U but not in A
3. Find $A - B$. $A - B = \{2, 4, 6, 8, 10\}$. In this case $A - B = A$ since A and B have nothing in common.
4. Find $A \cup B$. $A \cup B = \{1, 2, 3, 4, 6, 8, 10\}$

S3-2 Let $R^* = \{x \in \mathbb{R} : x \geq 0\}$. Let $s : \mathbb{R}^* \to \mathbb{R}^*$ be defined by $f(x) = x^2$.

1. State the domain, codomain of f. (Clearly state which one is which.) The domain is R^* and the codomain is R^*, note these are both given in the definition of the function. The range in this case is also R^* since the graph shows all nonnegative real numbers are outputs.

2. Find the image(s) of 3 under f. $f(3) = 3^2 = 9$, so the image of 3 under f is 9

3. Find the preimage(s) of 4. Solve $f(x) = 4$ and take the ones that are in the domain. In this case the only preimage is 2 (since -2 is not in the domain).

S4-1 Let A and B be sets. Carefully complete the definitions of the following terms. (Note: "no collisions" and "range=codomain" are helpful ways to think about these, but they are NOT the definitions.)

1. A function $f : A \to B$ is injective provided that... for all $x, y \in A$ if $x \neq y$ then $f(x) \neq f(y)$

2. A function $f : A \to B$ is surjective provided that... for all $y \in B$, there exists $x \in A$ such that $f(x) = y$

3. A function $f : A \to B$ is bijective provided that... f is both injective and surjective

S6-1 Let $r, s \in \mathbb{Z}$ and $n \in \mathbb{N}$. State the definitions of the following:

- $r \mid s$ (for nonzero r) there exists an integer k such that $rk = s$.

- $r \equiv s \pmod{n}$. $n \mid r - s$

Give an example of integers a and b such that $a \equiv b \pmod{15}$ and $b < 0$. $a = 10$ and $b = -5$ then $10 \equiv -5 \pmod{15}$ since $15 \mid 10 - (-5)$. There are lots of answers to this question though!