MATH1050 Answers to Examples: Relations.

1. ——

2. (a) ——
   (b) ——
   (c) Yes.

3. (a) ——
   (b) ——
   (c) Yes.

4. ——

5. ——

6. (a) Yes.
   (b) No. (*Reason. T* is not anti-symmetric.)

7. (a) ——
   (b) Yes.

8. ——

9. ——

10. ——

11. (a) Define $A = \{0, 1, 2\}$, $G = \{(0,0), (1,1), (2,2), (0,1), (1,0), (0,2), (2,0)\}$, and $R = (A, A, G)$.
    R is reflexive, symmetric but not transitive.
    (b) Define $A = \{0, 1, 2\}$, $G = \{(0,0), (1,1), (2,2), (0,1), (1,2), (0,2)\}$, and $R = (A, A, G)$.
    R is reflexive, transitive but not symmetric.
    (c) Define $A = \{0, 1\}$, $G = \{(0,0)\}$, and $R = (A, A, G)$.
    R is symmetric, transitive but not reflexive.

12. ——

13. ——

14. ——

15. ——

16. (a) ——
    (b) ——
    (c) ——
    (d) $[1] = \{\eta \in \mathbb{C} : \mathsf{Re}(\eta) = 1\}$.
    $[0] = [i] = \{\eta \in \mathbb{C} : \mathsf{Re}(\eta) = 0\}$.

17. ——

18. ——

19. ——

20. (a) No. (*Idea.* Some element of $\mathbb{Z}_{10}$, namely, $[0]_{10}$, is 'assigned' by f to two or more elements of $\mathbb{Z}$, say, 0 and 10.)
    (b) No. (*Idea.* Some element of $\mathbb{Z}_{10}$, namely, $[0]_{10}$, is 'assigned' by f to two or more elements of $\mathbb{Z}_{100}$, say, $[0]_{100}$ and $[10]_{100}$.)
    (c) Yes.
    (d) Yes.
    (e) Yes.

(f) Yes.

(g) No. (*Idea.* Some element of $\mathbb{Z}_{10}$, namely, $[1]_{10}$, fails to be 'assigned' by f to any element of $\mathbb{Z}_{10}$.)

21. ——

22. ——

23. ——