You must show all your work and explain your answers carefully. There is no credit for just writing down the answer, whether it is correct or not.

(1) Suppose $|A| = n$. How many relations on A are there which are
  (a) reflexive? (I think we did this in class)
  (b) symmetric?
  (c) anti-symmetric?
  (d) reflexive and symmetric?
  (e) reflexive and anti-symmetric?
  (f) symmetric and anti-symmetric?
  (g) reflexive, symmetric and anti-symmetric?
  (Hint: Use matrices.)

(2) Define a relation $\sim$ on the set $P(\mathbf{Z})$ by $A \sim B \iff A \cap B \neq \emptyset$. Is the relation $\sim$
  (a) reflexive?
  (b) symmetric?
  (c) anti-symmetric?
  (d) transitive?

(3) Recall that if $f : A \to A$ is a function then the graph of f is the set $G_f = \{(a, f(a)) | a \in A\}$ which is a subset of $A \times A$ and so G_f defines a relation on A. What property must the associated digraph of such a relation have?

(4) How many different equivalence relations are there on the set A if $|A| = 5$? (Hint: Count the number of different partitions.)

(5) Let S denote the set of students in a MA2322 class, and define a relation R on S by $(a, b) \in R$ if and only if students a and b have the same major. Under what conditions is R an equivalence relation?

(6) Find an example of an equivalence relation on $\mathbf{R}$ for which
  (a) every set in the corresponding partition is finite.
  (b) every set in the corresponding partition is countably infinite.
  (c) the corresponding partition includes at least one finite set, at least one countably infinite set and at least one uncountable set.