Relations

R_1 is a relation on $\mathbb{Z}$
defined by
$\{(a,b)|a+b \le 3\}$

R_2 is a relation on $A = \{1,2,3,4\}$
defined by
$\{(a,b)|\max(a,b) = b\}$

R_3 is a relation on $\mathbb{Z}$
defined by
$\{(a,b)|a = b^2\}$

R_4 is a relation on $\mathbb{R}$
defined by
$\{(a,b)|a \cdot b \ge 0\}$

1. For each of the relations R_i defined above, list five ordered pairs that are in the relation.

   R_1:

   R_2:

   R_3:

   R_4:

2. For each of the relations R_i above, determine if R_i has the properties listed (if applicable). If the relation does not have the indicated property, identify an ordered pair (or set of ordered pairs) that exhibits the failure.

	R_1	R_2	R_3	R_4
reflexive				
symmetric				
antisymmetric				
transitive				

3. Find an example of a relation on a set that is both symmetric and antisymmetric.

4. Let R be the relation on the set $\{1, 2, 3, 4, 5\}$ containing the ordered pairs: $(1,1)$, $(1,2)$, $(1,3)$, $(2,3)$, $(2,4)$, $(3,1)$, $(3,4)$, $(3,5)$, $(4,2)$, $(4,5)$, $(5,1)$, $(5,2)$, and $(5,4)$.

   (a) Find $R \circ R$

   (b) Find R^2