

**Set Theory**

Let  $A = \{a, b, c, d\}$  and  $B = \{a, c, e, f\}$  compute

- (1)  $A \cup B$
- (2)  $A \cap B$
- (3)  $A \setminus B$
- (4)  $B \setminus A$ .

**Equivalence Relations**

Explain which of the following relations are reflexive, transitive, or symmetric.

Which are equivalence relations?

- (1) A group of students wait in a straight line outside of class. Define a relation on the set of people,  $\sim$  by  $x \sim y$  if person  $x$  stands in front of person  $y$ .
- (2) For a function  $f : X \rightarrow Y$ , define a relation  $x \sim y$  if  $f(x) = f(y)$ .
- (3) A pseudo metric on a space  $X$  is a function  $d : X \times X \rightarrow [0, \infty)$  which has the properties  $d(x, y) = d(y, x)$ ,  $d(x, x) = 0$ , and  $d(x, z) \leq d(x, y) + d(y, z)$  for all  $x, y, z \in X$ . Define a relation  $\sim$  on  $X$  via  $x \sim y$  if and only if  $d(x, y) = 0$ .
- (4) Define a relation on the set of all lines in the plane which says that two lines are related if and only if they are perpendicular.
- (5) Same set up as the previous part but with lines being related if they are parallel.