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| Math 373  1st midterm examination  First semester, 1430H  Department of Mathematics  College of Sciences  King Saud University |

**Q1.**Prove or disprove the following statements:

1. A subset *U* is open in with the usual topology iff *U* is equal to a union of open intervals
2. The intersection of any collection of closed sets is closed.
3. If *A* is a subset of a topological space, then .

**Q2.** Let X be a nonempty set.

1. Show that the collection = {:, or  is a countable set} is a topology on *X*; called the cocountable topology.
2. Describe closed sets in this topology.
3. Let *X =*  with the cocountable topology and , describe the following:

**(i)** **(ii)** **(iii)** **(iv)** **(v)** 

1. Prove that ( *,* ) is finer than ( ,).

**Q3**. **(a)** Let be a topological space with  and , show that .

**(b)** If X= {a , b , c}, let ={X , , {a} , {a , b}} and = {X , , {a} , {b , c}}*,* find the smallest topology containing and and the largest topology contained in and .

**(c)** Let *A* be a subset of a topological space. If  , show that *A* is dense in *X*.

Good Luck