



## SET DUALITIES

### ℔Why

How does taking complements relate to forming unions and intersections.

### ℔Complements of unions or intersections

Let  $E$  denote a set. Let  $A$  and  $B$  denote sets and  $A, B \subset E$ . All complements are taken with respect to  $E$ . The following are known as *DeMorgan's Laws*.<sup>1</sup>

**Proposition 1.**  $C(A \cup B) = C(A) \cap C(B)$

**Proposition 2.**  $C(A \cap B) = C(A) \cup C(B)$

### ℔Principle of duality

As a result of DeMorgan's Laws<sup>2</sup> and basic facts about complements (see **Set Complements**) theorems having to do with sets come in pairs. In other words, given an inclusion or identity relation involving complements, unions and intersections of some set (above  $E$ ) if we replace all sets by their complements, swap unions and intersections, and flip all inclusions we obtain another result. This is called the *principle of duality for sets*.

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<sup>1</sup>Proofs will appear in a future edition.

<sup>2</sup>A future edition will change the name to remove the reference to DeMorgan in accordance with the project's policy.



