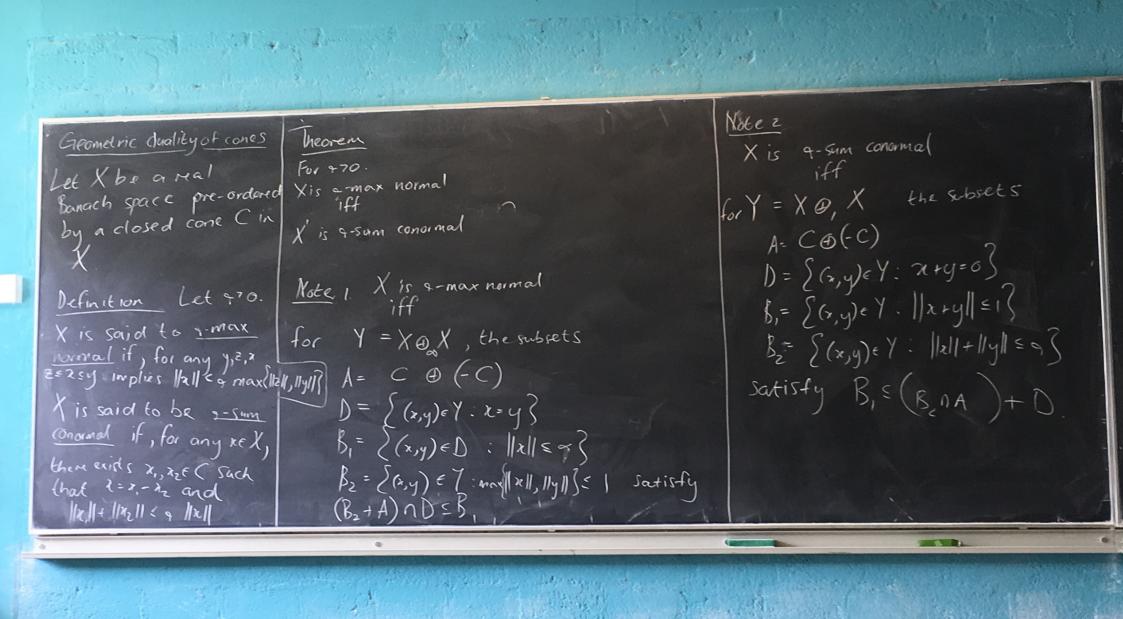
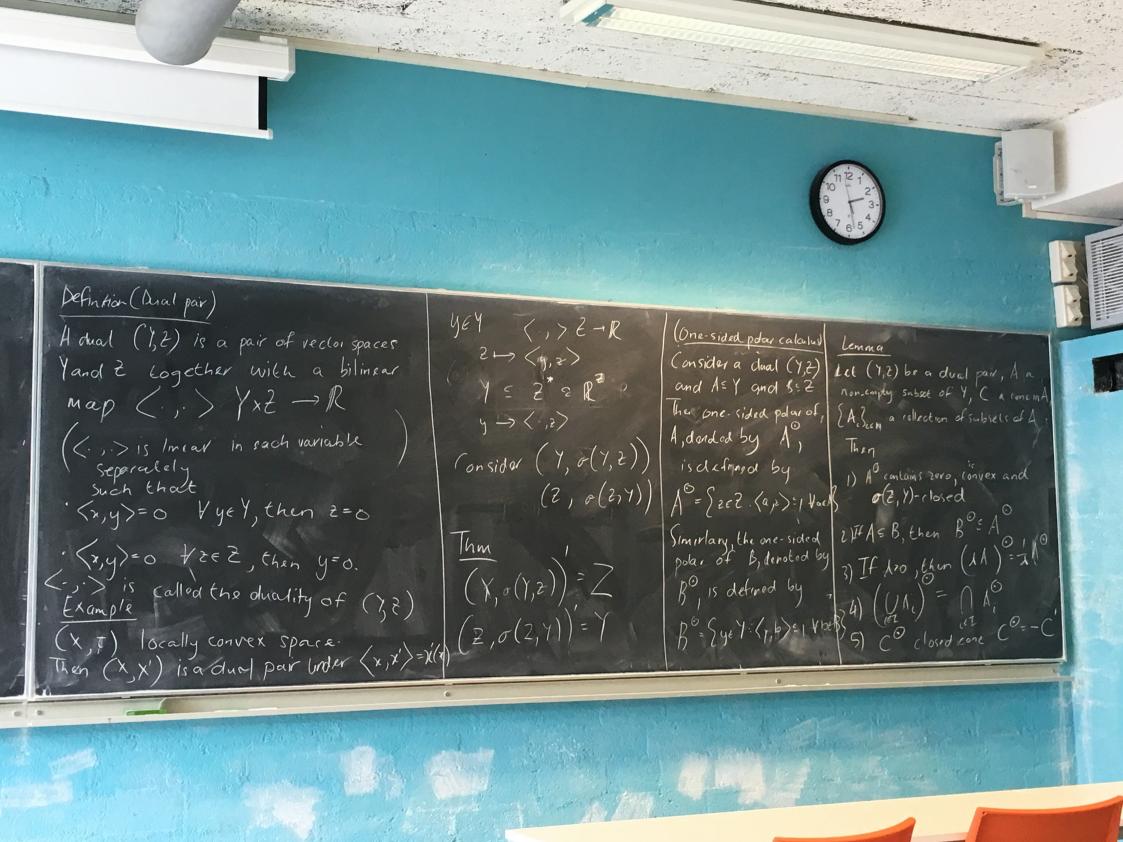
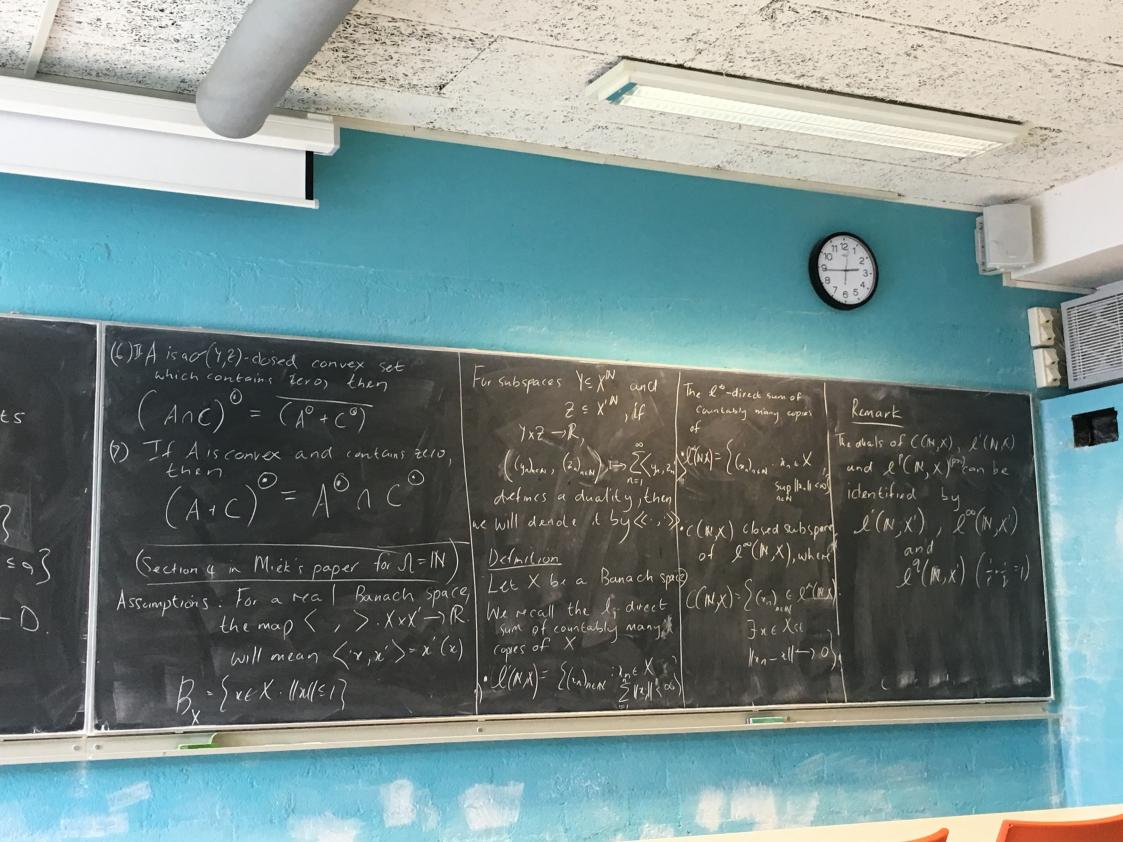
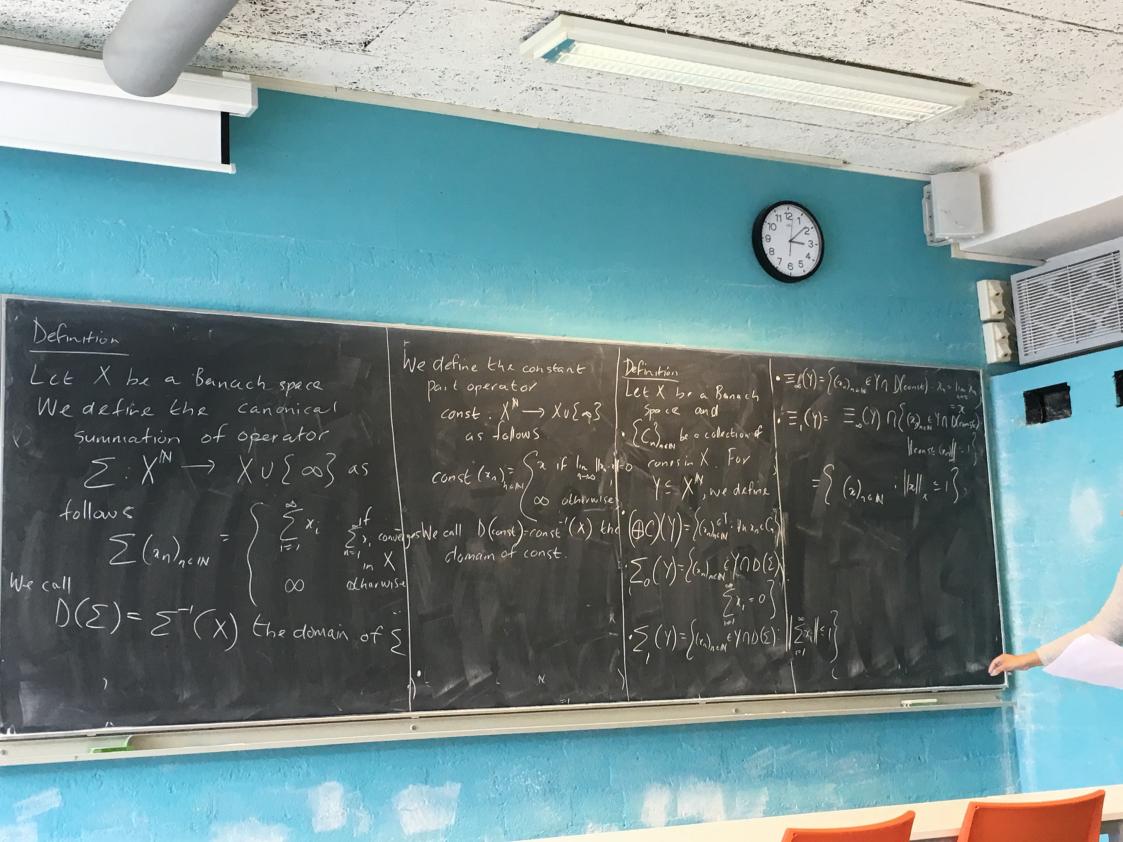
The material in this lecture is based on

M. Messerschmidt, *Geometric duality theory of cones in dual pairs of vector spaces*, J. Funct. Anal. **269** (2015), no. 7, 2018–2044.

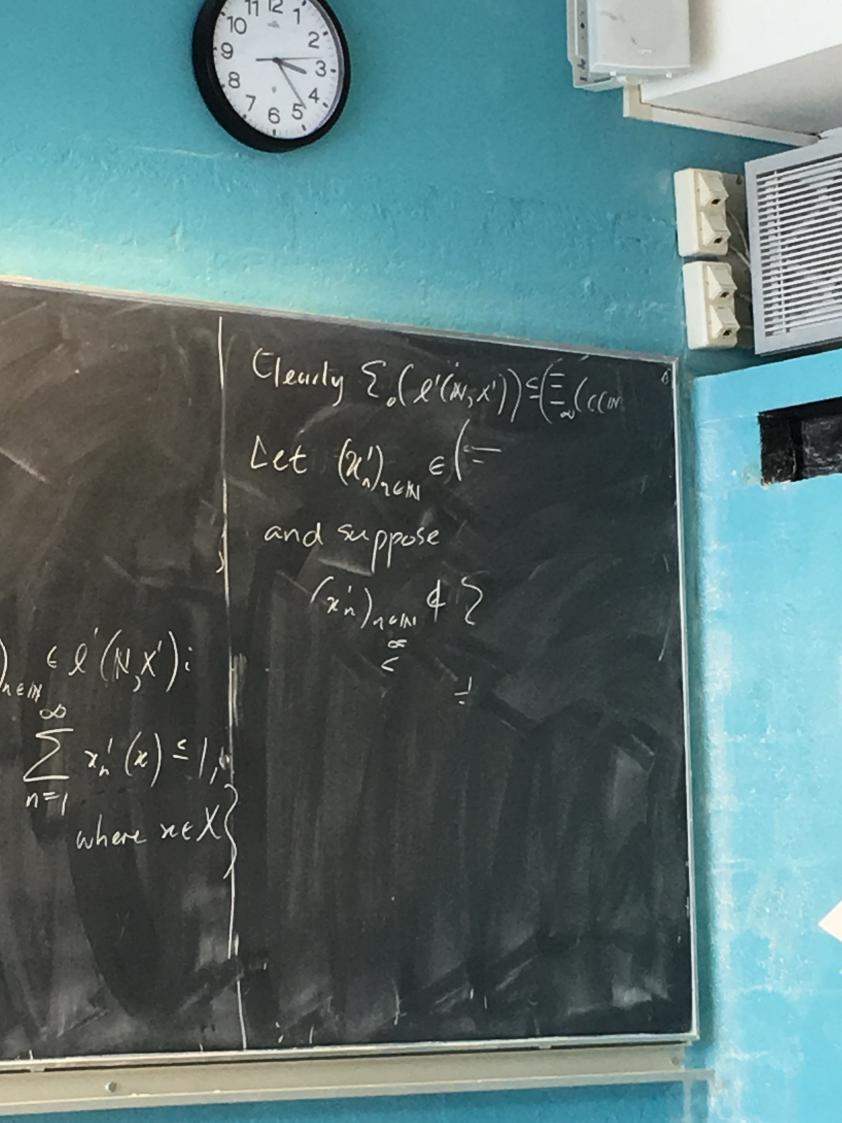














Definition (General notions of normality) Theorem osed cones Let X be a vector space (din,x), l'(mx)) Let 97/1. & toal Banach space Let C, D= X be cones and B, B2 = X convex sets Containing zeros Endrew be a collection of closed (L'(NX) is said to be normal wirt (c, D, R, Bz) The space C(IN X) is neveral If (B2+())) = B, wrt (O(c(nx)), = (dvx)), = =(dvx), B (e'(M,X') is said to be concernal wirt (0,0,0,0) the space l'(IN, X') is conormal e'(IN,X')) $B, \in (B_2^{\prime} \cap C) + D$ IN 1 t (& co(ein,x)), & (ein,x)), & (ein,x),



Suppose X is a-max normal.

Let Y:= X & X and Z=X & X'), l'(kx)) and the duality $\langle , \rangle Y \times Z \rightarrow \mathbb{R}$ be given by $\langle (a,b), (\phi, \psi) \rangle = \phi(a) + \psi(b) + \psi$ EC, S, Let 1) = CO(C)= = $\{(a,b)\in 7: a=b\}$ he =,= {(9,6) == . ||a||4|} w.rt (By = > (a, b) & Y max { llall, 116/13 = 1} Also, E = -C' DC' the sp Σ = S(0, 4) ε 2. φ + 4-0} Σ = S(0, 4) ε 2. | (0 + 4|| ε 1), β = S(0, 4) ε 2: | (0, 4

We shared that the one-sided Proof blais of D, = , = , and By in Suppose X et s is given by E, E, and Bzine and the } By Note 2 (By+D) n = 0 = 9 = 1Hence Y is normal write = 1, By) 54 111 = 93 By Thon we have that ? 1) conormal wirt (E, 50,51,9Bz))+D in Z. By note 2 X' is The converse follow Similarly. B

B) If Z is normal wr E Let (7,2) be a dual pair.
Assume that C,D=Y are a(7,2)-dosel (Co, Bo, Bo), then Banach space pre-ordered Cones and B, Bzhev (1,2)-closed B, = (B, n)+1 convex sets containing zero. (4) If Z is conormal wit (4) (co, bo, B, Bo), then Definition Let 970. B+OnD=B,. X is soild to g-max (i) It Yisnormal wirt (C,D,B,Bz) E=25y implies ||all = g max \||a|| then BOS (BONCO)+DO Suppose Yis normal wirt (CD, B, B) (2) If I is conformed wirt (C,D,R,R2) conoinal if, for any xeX, Then (Bz+C) ND & B. then (Roto) ODO E BO there exists x, , xz & C such that 1 = x, - xz and and hence BOE (B2+C) nD 11x11+ 11x211 < 9 /1x11

