

## Convex Analysis, Sect. 3.3

### Exercise 1

Use the definition + first order optimality conditions a lot. The same can be said for Exercises 2–3 as well.

### Exercise 2

Convexity of  $f_A(x) = x^T Ax/2$  can be for example inferred from the fact that  $f_A = f_A^{**}$ .

### Exercise 4

In all these problems the supremum can only be attained at an extreme point of the set.

(e): when calculating  $\delta_K^*(\phi)$  consider two cases:  $\phi \in K^-$  and  $\phi \notin K^-$ .

### Exercise 8

The inequality follows immediately from the definition of the conjugate function. The equality case requires some more work, but requires little beyond the definition of the subgradient.

### Exercise 23

Start from Theorem 3.3.5. You can benefit from the observation that  $\delta_{b+K} = \delta_K(\cdot - b)$ .