

**HW for 2019-05-21**

(due: 2019-05-21)

**1: Trial and error** Using your favorite language and plotting system, produce a log-log plot of  $\|(A + hE)^{-1} - (A^{-1} - hA^{-1}EA^{-1})\|$  versus  $h$  for small  $h$  and for

$$A = \begin{bmatrix} 6 & 3 \\ 1 & 3 \end{bmatrix}, \quad E = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}.$$

What is the asymptotic slope on the log-log plot, and why?

**2: Quadratics and bilinears** Given a quadratic form  $\phi : \mathcal{V} \rightarrow \mathbb{R}$ , show that  $\phi(v) = a(v, v)$  where the bilinear form  $a$  is

$$a(v, w) = \frac{1}{2} (\phi(v + w) - \phi(v) - \phi(w)).$$

**3: Convexity and inertia** Show that a quadratic form is only strongly convex if the inertia is  $(n, 0, 0)$ .