2. Show the following properties of weak and weak* convergence in Banach spaces:
   (a) The weak limit of a sequence is unique;
   (b) the weak* limit of a sequence is unique;
   (c) convergence implies weak convergence;
   (d) convergence implies weak* convergence;
   (e) if $y_k \overset{*}{\rightharpoonup} y$ for $k \to \infty$, then $\|y\| \leq \liminf_{k\to\infty} \|y_k\|$;
   (f) if $x_k \rightharpoonup x$ for $k \to \infty$, then $\|x\| \leq \liminf_{k\to\infty} \|x_k\|$;
   (g) weakly convergent sequences are bounded;
   (h) weakly* convergent sequences are bounded;
   (i) if $x_j \to x$ and $y_j \overset{*}{\rightharpoonup} y$, then $\langle x_j, y_j\rangle \to \langle x, y\rangle$ for $j \to \infty$;
   (j) if $x_j \rightharpoonup x$ and $y_j \to y$, then $\langle x_j, y_j\rangle \to \langle x, y\rangle$ for $j \to \infty$.