1. \( \liminf_{n \to \infty} a_n \quad \limsup_{n \to \infty} a_n \)

a) -1
b) \( e \)
c) -4

2. (a) Divergent (nth term test: e.g., show \( a_{n+1} - a_n > 1 \) \( \forall n \geq N \))
   b) Convergent (e.g., comparison with \( \sum \frac{1}{n^2} \)) hence \( \lim_{n \to \infty} a_n = \infty \)
   c) Divergent (ratio test)
   d) Abs. convergent (p-test, \( p \geq 2 \))
   e) Abs. convergent (comparison with geometric series)
   f) Abs. convergent (ratio or root)

3a) Given \( \varepsilon > 0 \) want \( \delta > 0 \) s.t.

\[
1 - x < \delta \implies |f(x) - f(2)| < 3
\]

\[
\implies |(x^2 + 7) - (2^2 + 7)| < 3
\]

\[
i.e., |x - 2| |x + 2| < 3
\]

Choose \( \delta < 1 \) \( \implies |x - 2| < 1 \implies |x| < 3 \implies |x + 2| < 5 \).

So it's easy to check that \( \delta < \min\{1, \frac{3}{5}\} \) suffices.