Converge or Diverge

1. Determine whether the following sequences $\{a_n\}$ converge (and if so, to what).

(a) $a_n = \dfrac{e^n}{3^n}$

(b) $a_n = \dfrac{\pi^n}{3^n}$

(c) $a_n = \dfrac{3n^2 - 2n + 4}{8n^2 + 5}$

(d) $\dfrac{(-1)^n + n}{(-1)^n - n}$

(e) $a_n = (-1)^n \sqrt{n}$

(f) $a_n = \ln(3n + 2) - \ln(2n + 3)$

(g) $a_n = \left(\dfrac{1 + n}{2n} \right)^4$

(h) $a_n = \left(1 + \dfrac{1}{n} \right)^{2n}$

2. Variations on a theme...

(a) If $a_n = \dfrac{1}{n^{\frac{1}{2}}}$, does the sequence $\{a_n\}$ converge?

(b) If $b_n = (-1)^n \dfrac{1}{n^{\frac{1}{2}}}$, does the sequence $\{b_n\}$ converge?

(c) If $a_n = \dfrac{1}{n^p}$, $0 < p < 1$, does the sequence $\{a_n\}$ converge?

(d) If $b_n = (-1)^n \dfrac{1}{n^p}$, $0 < p < 1$, does the sequence $\{b_n\}$ converge?

3. A sequence of trig sequences...

(a) If $a_n = \sin(\pi n)$, does the sequence $\{a_n\}$ converge? If so, to what?

(b) If $b_n = (-1)^n \sin\left(\dfrac{\pi}{2}(2n+1)\right)$, does the sequence $\{b_n\}$ converge? If so, to what?

(c) If $b_n = (-1)^n \cos\left(\dfrac{\pi}{2}(n+1)\right)$, does the sequence $\{c_n\}$ converge? If so, to what?