1 (a). $-\frac{2}{x^2+1}$

1 (b). $-\ln(1-x)$

2 (a). Converges to 1, since

$$\lim_{n\to\infty} \frac{n^2+1}{n^2+n} = \lim_{x\to\infty} \frac{x^2+1}{x^2+x} = \lim_{x\to\infty} \frac{2x}{2x+1} = \lim_{x\to\infty} \frac{2}{2} = 1$$

where L'Hospital's rule has been applied twice.

2 (b). Converges to 0, since

$$\left|\frac{\sin n}{n}\right| \leq \frac{1}{n} \to 0, \text{ as } n \to \infty.$$

2 (c). Converges to 0, since

$$\begin{aligned} \frac{2^n}{n!} &= \frac{2}{n} \cdot \frac{2}{n-1} \cdots \frac{2}{2} \cdot \frac{2}{1} \\ &\leq \frac{2}{n} \cdot 1 \cdots 1 \cdot 2 \\ &= \frac{4}{n} \to 0, \text{ as } n \to \infty. \end{aligned}$$