

# Mathematical analysis. Lesson 5. Homework

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**1**

$$\begin{aligned}\lim_{x \rightarrow \infty} \left( \frac{x+3}{x} \right)^{4x+1} &= \lim_{x \rightarrow \infty} \left( 1 + \frac{3}{x} \right)^{4x+1} = \lim_{x \rightarrow \infty} \left( 1 + \frac{3}{x} \right)^{\frac{x}{3} \cdot \frac{3}{x} \cdot (4x+1)} = \\ &= e^{\lim_{x \rightarrow \infty} \frac{3(4x+1)}{x}} = e^1 2 \\ \lim_{x \rightarrow \infty} \frac{3(4x+1)}{x} &= \lim_{x \rightarrow \infty} \frac{12x+3}{x} = \lim_{x \rightarrow \infty} \left( 12 + \frac{3}{x} \right) = 12\end{aligned}$$

**2**

$$\begin{aligned}\lim_{x \rightarrow \infty} \left( \frac{4x+3}{4x-3} \right)^{6x} &= \lim_{x \rightarrow \infty} \left( \frac{4x-3+6}{4x-3} \right)^{6x} = \lim_{x \rightarrow \infty} \left( 1 + \frac{6}{4x-3} \right)^{6x} = \\ \lim_{x \rightarrow \infty} \left( 1 + \frac{6}{4x-3} \right)^{\frac{4x-3}{6} \cdot \frac{6}{4x-3} \cdot 6x} &= e^{\lim_{x \rightarrow \infty} \frac{36x}{4x-3}} = e^9 \\ \lim_{x \rightarrow \infty} \frac{36x}{4x-3} &= \lim_{x \rightarrow \infty} \frac{36}{4 - \frac{3}{x}} = \frac{36}{4} = 9\end{aligned}$$

**3**

$$\lim_{x \rightarrow \infty} \left( \frac{\sin x + \ln x}{x} \right) = \lim_{x \rightarrow \infty} \left( \frac{\sin x}{x} + \frac{\ln x}{x} \right) = \lim_{x \rightarrow \infty} \left( \frac{\ln x}{x} \right) = 0$$

**4**

$$\lim_{x \rightarrow 0} \left( \frac{\sin x + \ln x}{x} \right) = \lim_{x \rightarrow 0} \left( \frac{\sin x}{x} + \frac{\ln x}{x} \right) = \lim_{x \rightarrow 0} \left( 1 + \frac{\ln x}{x} \right) =$$

$$1 + \lim_{x \rightarrow 0} \left( \frac{\ln x}{x} \right) = 1 - \infty = -\infty$$