

Mathematical analysis. Lesson 5. Homework

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1

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

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

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

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