

L'Hospital rule

Problem 1. Using the L'Hospital rule evaluate the following limits:

$$1. \lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 - 3x + 2} \quad (4)$$

$$2. \lim_{x \rightarrow -1} \frac{x^3 + 1}{x^2 - 1} \quad \left(-\frac{3}{2}\right)$$

$$3. \lim_{x \rightarrow 0} \frac{\sqrt{x+2} - \sqrt{2}}{x} \quad \left(\frac{\sqrt{2}}{4}\right)$$

$$4. \lim_{x \rightarrow -2} \frac{\sqrt{x+6} - 2}{x+2} \quad \left(\frac{1}{4}\right)$$

$$5. \lim_{x \rightarrow 1} \frac{\sqrt[3]{x} - x}{\sqrt[4]{x} - x} \quad \left(\frac{8}{9}\right)$$

$$6. \lim_{x \rightarrow 0} \frac{\ln(2x+1)}{x} \quad (2)$$

$$7. \lim_{x \rightarrow \frac{\pi}{3}} \frac{1 - 2 \cos x}{\pi - 3x} \quad \left(-\frac{\sqrt{3}}{3}\right)$$

$$8. \lim_{x \rightarrow 0} \frac{x - \arctg x}{x^3} \quad \left(\frac{1}{3}\right)$$

$$9. \lim_{x \rightarrow 0} \frac{e^x - 1}{\sin x} \quad (1)$$

$$10. \lim_{x \rightarrow 0} \frac{\sin x}{x} \quad (1)$$

$$11. \lim_{x \rightarrow 0} \frac{\operatorname{tg} 2x}{\operatorname{tg} x} \quad (2)$$

Problem 2. Using the L'Hospital rule evaluate:

$$1. \lim_{x \rightarrow \infty} \frac{x^2 - 4}{x^2 - 3x + 2} \quad (1)$$

$$2. \lim_{x \rightarrow -\infty} \frac{7x^2 - 4}{3x - x^2} \quad (-7)$$

$$3. \lim_{x \rightarrow \infty} \frac{x^3 - 1}{x^4 + x + 2} \quad (0)$$

$$4. \lim_{x \rightarrow \infty} \frac{x^3 + 2x - 3}{x + 2} \quad (\infty)$$

$$5. \lim_{x \rightarrow \infty} \frac{e^x - 1}{2 - x} \quad (-\infty)$$

$$6. \lim_{x \rightarrow -\infty} \frac{\ln(4 + x^2)}{x} \quad (0)$$

Problem 3. Using the L'Hospital rule evaluate the following limits:

$$1. \lim_{x \rightarrow 0^+} \left(\frac{1}{\sin x} - \frac{1}{x} \right) \quad (0)$$

$$2. \lim_{x \rightarrow 1^+} \left(\frac{1}{x-1} - \frac{3}{x^3-1} \right) \quad (1)$$

$$3. \lim_{x \rightarrow 1^+} \left(\frac{x}{x-1} - \frac{1}{\ln x} \right) \quad \left(\frac{1}{2} \right)$$

$$4. \lim_{x \rightarrow \frac{\pi}{2}} (1 - \sin x) \cdot \operatorname{tg} x \quad (0)$$

$$5. \lim_{x \rightarrow 0^+} x^2 \ln x \quad (0)$$