

Limite all'infinito

Periodo 3 - UdA 2

Trovare i seguenti limiti (senza specificare il segno se il limite è infinito)

$$[1] \quad \lim_{x \rightarrow \infty} \frac{3x^3 + x^2 - x - 2}{5x}$$

$$[2] \quad \lim_{x \rightarrow \infty} \frac{4x^3 - 3x^2 - 3}{x^2 - 2x + 2}$$

$$[3] \quad \lim_{x \rightarrow \infty} \frac{2x^3}{3x^2 - 2x + 5}$$

$$[4] \quad \lim_{x \rightarrow \infty} \frac{2x^3 + x - 3}{3x^3 + x^2 - x + 2}$$

$$[5] \quad \lim_{x \rightarrow \infty} \frac{2x^2 - 5x + 1}{3x^3}$$

$$[6] \quad \lim_{x \rightarrow \infty} \frac{x}{2x^3 + x^2 - x - 3}$$

$$[7] \quad \lim_{x \rightarrow \infty} \frac{5x^2 - 1}{3x^3 + 2x + 4}$$

$$[8] \quad \lim_{x \rightarrow \infty} \frac{5x^2 - 2x - 1}{3x^2}$$

$$[9] \quad \lim_{x \rightarrow \infty} \frac{3x^2}{2x^2 - 5x - 1}$$

SOLUZIONI

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1.
$$\frac{3x^3+x^2-x-2}{5x} = \frac{3x^3}{5x} \cdot \frac{3x^3+x^2-x-2}{3x^3} \rightarrow \infty \cdot 1 = \infty$$

$$\frac{3x^3}{5x} = \frac{3x^2}{5} \rightarrow \frac{3 \cdot \infty^2}{5} = \infty$$

$$\frac{3x^3+x^2-x-2}{3x^3} = \frac{3x^3}{3x^3} + \frac{x^2}{3x^3} - \frac{x}{3x^3} - \frac{2}{3x^3} = 1 + \frac{1}{3x} - \frac{1}{3x^2} - \frac{2}{3x^3} \rightarrow 1 + \frac{1}{3 \cdot \infty} - \frac{1}{3 \cdot \infty^2} - \frac{2}{3 \cdot \infty^3} = 1 + 0 - 0 - 0 = 1$$
2.
$$\frac{4x^3-3x^2-3}{x^2-2x+2} = \frac{4x^3}{x^2} \cdot \frac{4x^3-3x^2-3}{4x^3} \cdot \frac{x^2}{x^2-2x+2} = \frac{4x^3}{x^2} \cdot \frac{4x^3-3x^2-3}{4x^3} \cdot \frac{x^2-2x+2}{x^2} \rightarrow \infty \cdot 1 : 1 = \infty$$

$$\frac{4x^3}{x^2} = 4x \rightarrow 4 \cdot \infty = \infty$$

$$\frac{4x^3-3x^2-3}{4x^3} = \frac{4x^3}{4x^3} - \frac{3x^2}{4x^3} - \frac{3}{4x^3} = 1 - \frac{3}{4x} - \frac{3}{4x^3} \rightarrow 1 - \frac{3}{4 \cdot \infty} - \frac{3}{4 \cdot \infty^3} = 1 - 0 - 0 = 1$$

$$\frac{x^2-2x+2}{x^2} = \frac{x^2}{x^2} - \frac{2x}{x^2} + \frac{2}{x^2} = 1 - \frac{2}{x} + \frac{2}{x^2} \rightarrow 1 - \frac{2}{\infty} + \frac{2}{\infty^2} = 1 - 0 + 0 = 1$$
3.
$$\frac{2x^3}{3x^2-2x+5} = \frac{2x^3}{3x^2} \cdot \frac{3x^2}{3x^2-2x+5} = \frac{2x^3}{3x^2} \cdot \frac{3x^2-2x+5}{3x^2} \rightarrow \infty : 1 = \infty$$

$$\frac{2x^3}{3x^2} = \frac{2x}{3} \rightarrow \frac{2 \cdot \infty}{3} = \infty$$

$$\frac{3x^2-2x+5}{3x^2} = \frac{3x^2}{3x^2} - \frac{2x}{3x^2} + \frac{5}{3x^2} = 1 - \frac{2}{3x} + \frac{5}{3x^2} \rightarrow 1 - \frac{2}{3 \cdot \infty} + \frac{5}{3 \cdot \infty^2} = 1 - 0 + 0 = 1$$
4.
$$\frac{2x^3+x-3}{3x^3+x^2-x+2} = \frac{2x^3}{3x^3} \cdot \frac{2x^3+x-3}{2x^3} \cdot \frac{3x^3}{3x^3+x^2-x+2} = \frac{2x^3}{3x^3} \cdot \frac{2x^3+x-3}{2x^3} \cdot \frac{3x^3+x^2-x+2}{3x^3} \rightarrow \frac{2}{3} \cdot 1 : 1 = \frac{2}{3}$$

$$\frac{2x^3}{3x^3} = \frac{2}{3}$$

$$\frac{2x^3+x-3}{2x^3} = \frac{2x^3}{2x^3} + \frac{x}{2x^3} - \frac{3}{2x^3} = 1 + \frac{1}{2x^2} - \frac{3}{2x^3} \rightarrow 1 + \frac{1}{2 \cdot \infty^2} - \frac{3}{2 \cdot \infty^3} = 1 + 0 - 0 = 1$$

$$\frac{3x^3+x^2-x+2}{3x^3} = \frac{3x^3}{3x^3} + \frac{x^2}{3x^3} - \frac{x}{3x^3} + \frac{2}{3x^3} = 1 + \frac{1}{3x} - \frac{1}{3x^2} + \frac{2}{3x^3} \rightarrow 1 + \frac{1}{3 \cdot \infty} - \frac{1}{3 \cdot \infty^2} + \frac{2}{3 \cdot \infty^3} = 1 + 0 - 0 + 0 = 1$$

$$5. \quad \frac{2x^2-5x+1}{3x^3} = \frac{2x^2}{3x^3} \cdot \frac{2x^2-5x+1}{2x^2} \rightarrow 0 \cdot 1 = 0$$

$$\frac{2x^2}{3x^3} = \frac{2}{3x} \rightarrow \frac{2}{3 \cdot \infty} = 0$$

$$\frac{2x^2-5x+1}{2x^2} = \frac{2x^2}{2x^2} - \frac{5x}{2x^2} + \frac{1}{2x^2} = 1 - \frac{5}{2x} + \frac{1}{2x^2} \rightarrow 1 - \frac{5}{2 \cdot \infty} + \frac{1}{2 \cdot \infty^2} = 1 - 0 + 0 = 1$$

$$6. \quad \frac{x}{2x^3+x^2-x-3} = \frac{x}{2x^3} \cdot \frac{2x^3}{2x^3+x^2-x-3} = \frac{x}{2x^3} : \frac{2x^3+x^2-x-3}{2x^3} \rightarrow 0 : 1 = 0$$

$$\frac{x}{2x^3} = \frac{1}{2x^2} \rightarrow \frac{1}{2 \cdot \infty^2} = 0$$

$$\frac{2x^3+x^2-x-3}{2x^3} = \frac{2x^3}{2x^3} + \frac{x^2}{2x^3} - \frac{x}{2x^3} - \frac{3}{2x^3} = 1 + \frac{1}{2x} - \frac{1}{2x^2} - \frac{3}{2x^3} \rightarrow 1 + \frac{1}{2 \cdot \infty} - \frac{1}{2 \cdot \infty^2} - \frac{3}{2 \cdot \infty^3} = 1 + 0 - 0 - 0 = 1$$

$$7. \quad \frac{5x^2-1}{3x^3+2x+4} = \frac{5x^2}{3x^3} \cdot \frac{5x^2-1}{5x^2} \cdot \frac{3x^3}{3x^3+2x+4} = \frac{5x^2}{3x^3} \cdot \frac{5x^2-1}{5x^2} : \frac{3x^3+2x+4}{3x^3} \rightarrow 0 \cdot 1 : 1 = 0$$

$$\frac{5x^2}{3x^3} = \frac{5}{3x} \rightarrow \frac{5}{3 \cdot \infty} = 0$$

$$\frac{5x^2-1}{5x^2} = \frac{5x^2}{5x^2} - \frac{1}{5x^2} = 1 - \frac{1}{5x^2} \rightarrow 1 - \frac{1}{5 \cdot \infty^2} = 1 - 0 = 1$$

$$\frac{3x^3+2x+4}{3x^3} = \frac{3x^3}{3x^3} + \frac{2x}{3x^3} + \frac{4}{3x^3} = 1 + \frac{2}{3x^2} + \frac{4}{3x^3} \rightarrow 1 + \frac{2}{3 \cdot \infty^2} + \frac{4}{3 \cdot \infty^3} = 1 + 0 + 0 = 1$$

$$8. \quad \frac{5x^2-2x-1}{3x^2} = \frac{5x^2}{3x^2} \cdot \frac{5x^2-2x-1}{5x^2} \rightarrow \frac{5}{3} \cdot 1 = \frac{5}{3}$$

$$\frac{5x^2}{3x^2} = \frac{5}{3}$$

$$\frac{5x^2-2x-1}{5x^2} = \frac{5x^2}{5x^2} - \frac{2x}{5x^2} - \frac{1}{5x^2} = 1 - \frac{2}{5x} - \frac{1}{5x^2} \rightarrow 1 - \frac{2}{5 \cdot \infty} - \frac{1}{5 \cdot \infty^2} = 1 - 0 - 0 = 1$$

$$9. \quad \frac{3x^2}{2x^2-5x-1} = \frac{3x^2}{2x^2} \cdot \frac{2x^2}{2x^2-5x-1} = \frac{3x^2}{2x^2} : \frac{2x^2-5x-1}{2x^2} \rightarrow \frac{3}{2} : 1 = \frac{3}{2}$$

$$\frac{3x^2}{2x^2} = \frac{3}{2}$$

$$\frac{2x^2-5x-1}{2x^2} = \frac{2x^2}{2x^2} - \frac{5x}{2x^2} - \frac{1}{2x^2} = 1 - \frac{5}{2x} - \frac{1}{2x^2} \rightarrow 1 - \frac{5}{2 \cdot \infty} - \frac{1}{2 \cdot \infty^2} = 1 - 0 - 0 = 1$$