

Problem 1. Determine limits.

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

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

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

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

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

$$(6) \quad \lim_{x \rightarrow \infty} \ln \frac{x-1}{3x^2+2}$$

$$(7) \quad \lim_{x \rightarrow \infty} (x - \sqrt{x^2 + x})$$

(Hint: ‘multiply by conjugate’ trick)

Problem 2. Find all horizontal asymptotes of $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

Problem 3. Sketch the graph of $f(x) = \frac{1}{x-1} - \frac{1}{x}$.