

(1) Find the limits if they exist.

$$(a) \lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 + x - 6}$$

$$(b) \lim_{x \rightarrow 0} \frac{2 \sin x^2}{5x}$$

$$(c) \lim_{x \rightarrow 3} \frac{x^3 - 27}{x - 3}$$

$$(d) \lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 + 4x - 5}$$

$$(e) \lim_{x \rightarrow 5} \frac{\sqrt{x} - \sqrt{5}}{x - 5}$$

$$(f) \lim_{x \rightarrow c} \frac{x^3 - c^3}{x - c}$$

$$(g) \lim_{x \rightarrow 0} \sin \frac{1}{x}$$

$$(h) \lim_{x \rightarrow 0} x \sin \frac{1}{x}$$

$$(i) \lim_{x \rightarrow 0} \frac{\cos x}{x}$$

$$(j) \lim_{x \rightarrow 2} \frac{x^2 + 3x - 10}{x^2 + x - 6}$$

$$(k) \lim_{x \rightarrow 0} \frac{5x}{\sin x}$$

$$(l) \lim_{x \rightarrow 0} x^2 \sin \frac{1}{x}$$

$$(m) \lim_{x \rightarrow c} \frac{\sqrt{x} - \sqrt{c}}{x - c}$$

(n) $\lim_{x \rightarrow 0} f(x)$ where

$$f(x) = \begin{cases} \sin x & \text{if } -1 \leq x < 0 \\ 2 & \text{if } x = 0 \\ x & \text{if } x > 0. \end{cases}$$

(o) $\lim_{x \rightarrow 0} h(x)$ where

$$h(x) = \begin{cases} x & \text{if } x \leq 0 \\ \cos x & \text{if } x > 0. \end{cases}$$

(2) Prove that $\lim_{x \rightarrow 5} x^2 = 25$.

(3) Prove that $\lim_{x \rightarrow 2} \frac{1}{x} = \frac{1}{2}$.