

Calculate the following limits, if they exist. Explain your reasoning

$$(a) \lim_{x \rightarrow 0} \frac{(x+2)x+(x+2)}{(x+2)^2}$$

$$(b) \lim_{x \rightarrow 0} \frac{x^5+3x}{x}$$

$$(c) \lim_{x \rightarrow 0} \frac{|x^2-1|}{1-x}$$

$$(d) \lim_{x \rightarrow 0} \frac{\sqrt{x^2+3x^3}}{x}$$

$$(e) \lim_{x \rightarrow 0} \frac{\sqrt{x^2+3x^3}}{\sqrt{x}}$$

For the following functions, calculate $f'(0)$, carefully explaining your work.

(a) $x^5 + x^3 - x - 1$

(b) $5x\sqrt{x} - 12x$

(c) $3x^2 - 4x + \frac{x^2}{x+1}$

(d) $|x^2 - x - 3|$

(e) $1 + x + x^2 + \dots$

(f) $156 - 19x + 3x^2 + \dots$

(g) $2 + 2x^2 + 2x^4 + \dots$