Homework 4

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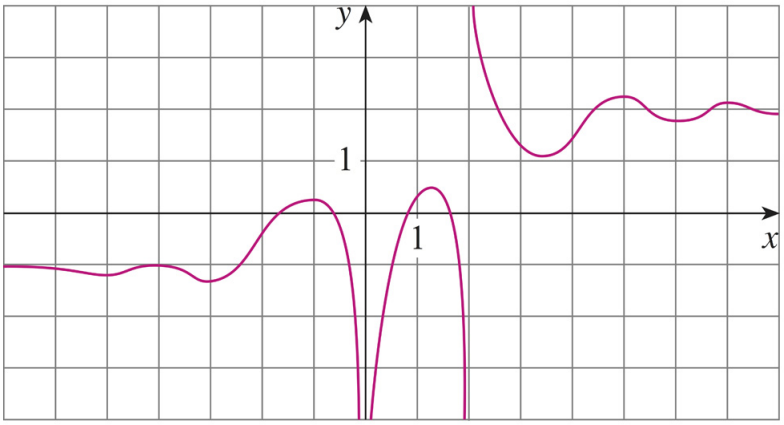
An exercise marked with the symbol $\star$ is considered more difficult and will not be an exam question.

Exercise 1 Given the following graph of the function f:



Find the following limits:

(1)
$$\lim_{x\to\infty} f(x)$$

(2)
$$\lim_{x\to-\infty} f(x)$$

(3)
$$\lim_{x\to 0} f(x)$$

(4)
$$\lim_{x\to 2^+} f(x)$$

(5)
$$\lim_{x\to 2^-} f(x)$$

Exercise 2 Find the following limits

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

(2)
$$\lim_{x\to-\infty}\frac{4x^3+6x^2-2}{2x^3-4x+5}$$

(3)
$$\lim_{t\to\infty}\frac{t-t\sqrt{t}}{2t^{3/2}+3t-5}$$

(4)
$$\lim_{x\to\infty}\frac{x^2}{\sqrt{x^4+1}}$$

(5)
$$\lim_{x\to-\infty}\frac{\sqrt{1+4x^6}}{2-x^3}$$

(6)
$$\lim_{x\to\infty}\frac{x+3x^2}{4x-1}$$

(7)
$$\lim_{x\to-\infty}\sqrt{4x^2+3x}+2x$$

(8)
$$\lim_{x\to\infty}\sqrt{x^2+1}$$

(9)
$$\lim_{x\to\infty}e^{-x}+2\cos(3x)$$

(10)
$$\lim_{x\to-\infty}\frac{1+x^6}{x^4+1}$$

(11)
$$\lim_{x\to\infty}\frac{e^{3x}-e^{-3x}}{e^{3x}+e^{-3x}}$$

(12)
$$\lim_{x\to\infty}\frac{\sin^2(x)}{x^2+1}$$

(13)
$$\lim_{x\to0^+}\tan^{-1}\left(\ln(x)\right)$$

(14)
$$\lim_{x\to\infty}\ln(2+x)-\ln(1+x)$$

Exercise 3 Find $f'(a)$ for the following functions.

(1) $f(t) = 2t^3 + t$

(2) $f(x) = x^{-2}$

(3)$\star$ $f(x) = \frac{4}{\sqrt{1-x}}$

Exercise 4 Find the derivative of the following functions using the definition of the derivative.

(1) $f(x) = 4 + 8x - 5x^2$

(2) $g(t) = \frac{1}{\sqrt{t}}$

(3)$\star$ $f(x) = \frac{x^2-1}{2x-3}$

(4) $f(x) = x^{3/2}$

Exercise 5 Given the following functions, find the first, second, third and fourth derivatives.

(1) $f(x) = x^3 - 3x$

(2) $f(x) = x^5 + x^4 + x^3 + x^2 + x$