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1 Introduction

2 Problem 1

Excercise 17, section 2.5.

$$\lim_{x\to 1}\frac{2-x}{(x-1)^2}=\frac{1}{0^+}=\infty$$

3 Problem 2

Excercise 21, section 2.5:

$$\lim_{x\to\infty}\frac{x^3+5x}{2x^3-x^2+4}=\lim_{x\to\infty}\frac{1+\frac{5x}{x^3}}{2-\frac{x^2}{x^3}+\frac{4}{x^3}}=\frac{1}{2}$$

Three other similar examples:

$$\lim_{x\to\infty}\frac{x^2+5x}{2x^3-x^2+4}=\lim_{x\to\infty}\frac{\frac{1}{x}+\frac{5x}{x^3}}{2-\frac{x^2}{x^3}+\frac{4}{x^3}}=0$$

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

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

4 Problem 3

Excercise 25.

$$\lim_{x\to\infty}\left(\sqrt{9x^2+x}-3x\right)=\lim_{x\to\infty}\left(\sqrt{9x^2+x}-3x\right)\frac{\sqrt{9x^2+x}+3x}{\sqrt{9x^2+x}+3x}=\lim_{x\to\infty}\frac{(9x^2+x)-9x^2}{\sqrt{9x^2+x}+3x}=$$

$$=\lim_{x\to\infty}\frac{x}{\sqrt{9x^2+x}+3x}=\lim_{x\to\infty}\frac{1}{\frac{\sqrt{9x^2+x}}{x}+3}=\lim_{x\to\infty}\frac{1}{\sqrt{9+\frac{1}{x}}+3}=\frac{1}{\sqrt{9}+3}=\frac{1}{6}$$

5 Problem 4

Similar to the Excercise 8, section 2.6.

$$y=x^3$$

Calculate the slope of the tangent line at the point $x=a$. The slope at the point a is defined as

$$m=\lim_{h\to 0}\frac{y(a+h)-y(a)}{h}$$

So we get:

$$m=\lim_{h\to 0}\frac{y(a+h)-y(a)}{h}=\lim_{h\to 0}\frac{(a+h)^3-a^3}{h}=\lim_{h\to 0}\frac{3a^2h+O(h^2)}{h}=\lim_{h\to 0}\left(3a^2+O(h)\right)=3a^2$$

6 Quizzes

We did Quiz 5 & 6.