微分積分 II 春課題

平成 27 年 3 月 19 日

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(1)

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

(2)

$$\lim_{x \to \infty} \frac{2x^2 + 9x - 5}{3x^2 - x - 2}$$
$$= \lim_{x \to \infty} \frac{2 + \frac{9}{x} - \frac{5}{x^2}}{3 - \frac{1}{x} - \frac{2}{x^2}}$$
$$= \frac{2+0-0}{3-0-0} = \frac{2}{3}$$

(3)

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

(4)

$$\lim_{x \to 3-0} \frac{|x-3|}{x^2 - x + 6}$$
$$= \lim_{x \to 3-0} \frac{1}{-x-2}$$
$$= -\frac{1}{5}$$

(5)

$$\lim_{x \to 0} \frac{\sin 5x}{4x}$$
$$= \lim_{x \to 0} \left(\frac{\sin 5x}{5x} \frac{5x}{4x} \right)$$
$$= 1 \cdot \frac{5}{4} = \frac{5}{4}$$

(6)

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

(7)

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

(8)

$$\lim_{h \to 0} (1 + 3h)^{\frac{1}{h}}$$
$$= \lim_{h \to 0} (1 + 3h)^{\frac{3}{3h}}$$
$$= e^3$$