$$\lim_{x\to 1}\frac{x-1}{x^2-2x+1} = \lim_{x\to 1}\frac{\cancel{x-1}^{\,1}}{(\cancel{x-1}_{\,1})(x-1)} = \lim_{x\to 1}\frac{1}{x-1} = \infty \quad \text{dne}$$

$$\lim_{x\to\infty}\frac{x^2+1}{x^3+5} = \lim_{x\to\infty}\frac{(x^2+1)\left(\frac{1}{x^3}\right)}{(x^3+5)\left(\frac{1}{x^3}\right)} = \lim_{x\to\infty}\frac{\cancel{\frac{1}{x}}^{\,0}+\cancel{\frac{1}{x^3}}^{\,0}}{1+\cancel{\frac{5}{x^3}}_{\,0}} = \frac{0}{1} = 0$$

$$\frac{\frac{x^2}{x^3}+\frac{1}{x^3}}{\frac{x^3}{x^3}+\frac{5}{x^3}}$$

$$\lim_{x\to\infty}\frac{x^3+5}{x^2+1} = \lim_{x\to\infty}\frac{\frac{x^3}{x^2}+\cancel{\frac{5}{x^2}}^{\,0}}{\frac{x^2}{x^2}+\cancel{\frac{1}{x^2}}_{\,0}} = \lim_{x\to\infty}\frac{x}{1} = \infty$$

$$\lim_{x\to\infty}\frac{2x^2+3x-5}{1x^2+4x-11} = \lim_{x\to\infty}\frac{2+\cancel{\frac{3}{x}}-\cancel{\frac{5}{x^2}}}{1+\cancel{\frac{4}{x}}-\cancel{\frac{11}{x^2}}} = \frac{2}{1} = 2$$

$$\lim_{x\to 0}\frac{\sin x}{x} = \frac{0}{0}$$

$$\lim_{x\to a}\frac{f(x)}{g(x)}, \text{ if } \lim_{x\to a} f(x) = \lim_{x\to a} g(x) = 0$$

$$L(x) = f(x_0) + f'(x_0)(x-x_0)$$

diff. at $x=c$

cont at $x=c$

$$f(c) = \lim_{x\to c} f(x) = 0$$

$$g(c) = \lim_{x\to c} g(x) = 0$$

$$f(x) = \boxed{f(c)} + f'(c)(x-c) = f'(c)(x-c)$$

$$g(x) = \boxed{g(c)} + g'(c)(x-c) = g'(c)(x-c)$$

$$\lim_{x\to c}\frac{f(x)}{g(x)} = \lim_{x\to c}\frac{f'(c)\cancel{(x-c)}}{g'(c)\cancel{(x-c)}} = \lim_{x\to c}\frac{f'(c)}{g'(c)}$$

L'Hopital's Rule

$$\lim_{x\to c}\frac{f(x)}{g(x)} = \lim_{x\to c}\frac{f'(x)}{g'(x)}$$

ex.1

$$\lim_{x\to 0} \frac{1-\cos x}{\sin x} = \lim_{x\to 0} \frac{\sin x}{\cos x} = \frac{0}{1} = 0$$

ex.2

$$\lim_{x\to \infty} \frac{e^x}{x} = \lim_{x\to \infty} \frac{e^x}{1} = \infty$$

dne

ex.3

$$\lim_{x\to \infty} \frac{x^2}{e^x} = \lim_{x\to \infty} \frac{2x}{e^x} = \lim_{x\to \infty} \frac{2}{e^x} = 0$$

$$\frac{\infty}{\infty} \qquad \frac{\infty}{\infty}$$

ex.4

$$\lim_{x\to 0} \frac{x^2}{e^x-1} = \lim_{x\to 0} \frac{2x}{e^x} = \cancel{\lim_{x\to 0} \frac{2}{e^x} = \frac{2}{1} = 2}$$

$$\frac{0}{0} \qquad \frac{0}{1} = 0$$

ex. 5

$$\lim_{x\to 0^+} \frac{\ln x}{\csc x} = \lim_{x\to 0^+} \frac{\frac{1}{x}}{-\csc x \cot x} \qquad \frac{\ln x}{\frac{1}{\sin x}} = \ln x \sin x$$

$$\frac{\frac{1}{x}}{-\frac{1}{\sin x \tan x}} = -\frac{\sin x \cdot \tan x}{x} = -\boxed{\frac{\sin x}{x}}\tan x$$

$$\lim_{x\to 0^+}\left(-\frac{\sin x}{x}\tan x\right) = -1(0) = 0$$

p.263-264

1-6, 9-17 odd, 21, 23, 39-42