

$$(a) \lim_{x \rightarrow -2} \frac{x+2}{x^2+3x+2} = \text{"} \frac{0}{0} \text{"}$$

$$\stackrel{L}{\Rightarrow} \lim_{x \rightarrow -2} \frac{1}{2x+3} = \frac{1}{-1} = \textcircled{-1}$$

$$(b) \lim_{x \rightarrow 0} \frac{x + \tan x}{\sin x} = \text{"} \frac{0}{0} \text{"}$$

$$\stackrel{L}{\Rightarrow} \lim_{x \rightarrow 0} \frac{1 + \sec^2 x}{\cos x} = \frac{1+1}{1} = \textcircled{2}$$

$$(c) \lim_{x \rightarrow \infty} \frac{\ln(\ln x)}{x} = \text{"} \frac{\infty}{\infty} \text{"}$$

$$\stackrel{L}{\Rightarrow} \lim_{x \rightarrow \infty} \frac{\frac{1}{\ln x} \cdot \frac{1}{x}}{1} = \lim_{x \rightarrow \infty} \frac{1}{x \ln x} = \textcircled{0}$$

$$(d) \lim_{x \rightarrow 0} \frac{\sin^{-1} x}{x} = \text{"} \frac{0}{0} \text{"}$$

$$\stackrel{L}{\Rightarrow} \lim_{x \rightarrow 0} \frac{\frac{1}{\sqrt{1-x^2}}}{1} = \frac{1}{\sqrt{1-0}} = \textcircled{1}$$

$$(e) \lim_{x \rightarrow 0} \frac{1 - e^{-2x}}{\sec x} = \frac{1 - e^0}{\sec 0} = \frac{1-1}{1} = \frac{0}{1} = \textcircled{0}$$

↳ L'Hôpital's Rule
does not apply

$$\textcircled{1} \lim_{x \rightarrow \infty} \frac{6(\ln x)^{1/x}}{4x} = \lim_{x \rightarrow \infty} \frac{6 \ln x}{4x^2} = \frac{\infty}{\infty}$$

2. (a) Find $\lim_{x \rightarrow \infty} \frac{\ln x}{x^p}$, where $p > 0$.

$$\textcircled{2} \lim_{x \rightarrow \infty} \frac{6/x}{8x} = \lim_{x \rightarrow \infty} \frac{3}{4x^2} = 0$$

$$\lim_{x \rightarrow \infty} \frac{\ln x}{x^p} = \frac{\infty}{\infty}$$

$$\textcircled{3} \lim_{x \rightarrow \infty} \frac{1/x}{p x^{p-1}} = \lim_{x \rightarrow \infty} \frac{1}{p x^p} = 0$$

(b) What does your answer to part (a) say about the relative rates of growth of $\ln x$ and any power of x as x grows very large?

Since $\frac{\ln x}{x^p} \rightarrow 0$ as $x \rightarrow \infty$, $\ln x$ grows much more slowly than x^p for any $p > 0$.

3. Given that

$$\lim_{x \rightarrow a} f(x) = 0$$

$$\lim_{x \rightarrow a} g(x) = 0$$

$$\lim_{x \rightarrow a} h(x) = 1$$

$$\lim_{x \rightarrow a} p(x) = \infty$$

$$\lim_{x \rightarrow a} q(x) = \infty$$

which of the following are indeterminate forms? For those that are not an indeterminate form, evaluate the limit where possible.

(a) $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{0}{0}$ **INDETERMINATE**

(b) $\lim_{x \rightarrow a} \frac{f(x)}{p(x)} = \frac{0}{\infty} = 0$

(c) $\lim_{x \rightarrow a} \frac{h(x)}{p(x)} = \frac{1}{\infty} = 0$

(d) $\lim_{x \rightarrow a} \frac{p(x)}{f(x)} = \frac{\infty}{0} = \infty$

(e) $\lim_{x \rightarrow a} \frac{p(x)}{q(x)} = \frac{\infty}{\infty}$ **INDETERMINATE**