

## Answers - L'Hôpital's Method (page ??)

$$1. \lim_{x \rightarrow 1} \frac{x^2 + 2x - 3}{x^2 - 6x + 5} = \frac{1 + 2 - 3}{1 - 6 + 5} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow 1} \frac{2x + 2}{2x - 6} = \frac{2 + 2}{2 - 6} = \frac{4}{-4} = -1$$

$$2. \lim_{x \rightarrow -2} \frac{x^2 - 4}{x + 2} = \frac{4 - 4}{-2 + 2} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow -2} \frac{(x - 2)(x + 2)}{x + 2} = x - 2 = -4$$

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

$$4. \lim_{x \rightarrow 0} \frac{\sin x}{x} = \frac{0}{0} \text{ (indeterminate)}$$

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

$$5. \lim_{x \rightarrow 0} \frac{\tan x}{\sin x} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow 0} \frac{\sec^2 x}{\cos x} = \frac{1}{\cos^3 x} = \frac{1}{1} = 1$$

$$6. \lim_{x \rightarrow 0} \frac{x - \sin x}{1 - \cos x} = \frac{0 - 0}{1 - 1} = \frac{0}{0} \text{ (indeterminate)}$$

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

$$7. \lim_{x \rightarrow 0} \frac{3x^2 + x^3}{x^2 + x^4} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow 0} \frac{6x + 3x^2}{2x + 4x^3} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow 0} \frac{6 + 6x}{2 + 12x^2} = \frac{6}{2} = 3$$

$$8. \lim_{x \rightarrow \infty} \frac{3x^2 + x^3}{x^2 + x^4} = \frac{\frac{3}{x^2} + \frac{1}{x}}{\frac{1}{x^2} + 1} = \frac{0}{1} = 0$$

$$9. \lim_{x \rightarrow \infty} \frac{e^x}{x^2} = \frac{\infty}{\infty} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow \infty} \frac{e^x}{2x} = \frac{\infty}{\infty} \text{ (indeterminate)}$$

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

$$10. \lim_{x \rightarrow \infty} \frac{\sin \frac{\pi}{x}}{\frac{1}{2x}} = \frac{0}{0} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow \infty} \frac{\cos \frac{\pi}{x} \times -\frac{\pi}{x^2}}{-\frac{1}{2x^2}} = \cos \frac{\pi}{x} \times 2\pi = 1 \times 2\pi = 2\pi$$

$$11. \lim_{x \rightarrow \infty} xe^{-x} = \lim_{x \rightarrow \infty} \frac{x}{e^x} = \frac{\infty}{\infty} \text{ (indeterminate)}$$

$$\lim_{x \rightarrow \infty} \frac{1}{e^x} = \frac{1}{\infty} = 0$$