

$$1. \lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9}$$

$$= \frac{3x^2}{2x}$$

$$= \frac{27}{6}$$

$$= \frac{9}{2}$$

$$2. \lim_{x \rightarrow \infty} \sqrt{\frac{27x^2 + 9}{3x^2 + x}}$$

$$= \sqrt{\frac{27}{3}}$$

$$= \sqrt{9}$$

$$= 3$$

$$3. \lim_{x \rightarrow 1} \frac{\ln x}{x-1}$$

$$= \frac{\frac{1}{x}}{1}$$

$$= 1$$

$$4. \lim_{x \rightarrow 0} \frac{\sin(5x)}{\sin(3x)}$$

$$= \lim_{x \rightarrow 0} \frac{\sin(5x)}{5x} \cdot \frac{3x}{\sin(3x)} \cdot \frac{5x}{3x}$$

$$= 1 \cdot 1 \cdot \frac{5}{3}$$

$$= \frac{5}{3}$$

$$5. \lim_{x \rightarrow 0} \frac{\tan(8x)}{4x}$$

$$= \lim_{x \rightarrow 0} \frac{\frac{\sin(8x)}{\cos(8x)}}{4x}$$

$$= \lim_{x \rightarrow 0} \frac{\sin 8x}{4x} \cdot \frac{1}{\cos 8x}$$

$$= \lim_{x \rightarrow 0} \frac{\sin 8x}{8x} \cdot \frac{2}{\cos 8x}$$

$$= 1 \cdot \frac{2}{1}$$

$$= 2$$

$$6. \lim_{x \rightarrow 0} \frac{\cos 4x - 1}{6x}$$

$$= \frac{4 \cdot (-\sin 4x)}{6}$$

$$= \frac{4 \cdot 0}{6}$$

$$= 0$$

$$7. f(x) = \begin{cases} cx - 1, & x \leq 2 \\ 3 - cx, & x > 2 \end{cases}$$

$$\lim_{x \rightarrow 2} cx - 1 = \lim_{x \rightarrow 2} 3 - cx$$

$$\Rightarrow 2c - 1 = 3 - 2c$$

$$\Rightarrow 4c = 4$$

$$c = 1$$

$$8. f(x) = \begin{cases} \frac{2x^2 + ax + b}{x^2 - x - 2}, & x \neq 2 \\ 5, & x = 2 \end{cases}$$

$$\lim_{x \rightarrow 2} \frac{2x^2 + ax + b}{x^2 - x - 2} = 5$$

$$\Rightarrow \frac{4x + a}{2x - 1} = 5$$

$$\Rightarrow \frac{8 + a}{3} = 5$$

$$a = 7$$

$$2x^2 + ax + b = 0$$

$$2x^2 + 7x + b = 0, \quad x \neq 2$$

$$8 + 14 + b = 0$$

$$b = -22$$

$$9. \lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 + ax + b} = 4$$

$$\Rightarrow \frac{2x}{2x + a} = 4$$

$$\Rightarrow \frac{4}{4 + a} = 4$$

$$a = -3$$

$$x^2 + ax + b = 0$$

$$x^2 - 3x + b = 0, \text{ x it } 2$$

$$4 - 6 + b = 0$$

$$b = 2$$

$$10. \lim_{x \rightarrow \frac{\pi}{2}} (\sec x - \tan x)$$

$$= \frac{1}{\cos x} - \frac{\sin x}{\cos x}$$

$$= \frac{1 - \sin x}{\cos x}$$

$$= \frac{-\cos x}{-\sin x}$$

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

$$= 0$$