

$$1) \lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \sin x}{1 - \cos x}$$

$$\frac{1 + \sin \frac{\pi}{2}}{1 - \cos \frac{\pi}{2}} = \boxed{2}$$

$$2) \lim_{x \rightarrow \infty} \frac{\cos 2x}{x^2} = \boxed{0}$$

$$3) \lim_{x \rightarrow \infty} \frac{6x^3 - 5x}{x^2 + 4x^3}$$

$$\lim_{x \rightarrow \infty} \frac{6x^3}{4x^3} = \boxed{\frac{3}{2}}$$

$$4) \lim_{x \rightarrow \infty} \frac{x^2 + x^4}{x^2 + x^6} \rightarrow \lim_{x \rightarrow \infty} \frac{x^4}{x^6}$$

$$= \boxed{0}$$

$$5) \lim_{x \rightarrow -\infty} \frac{8x^3 - 5x}{x^2 - 3x}$$

$$\lim_{x \rightarrow -\infty} \frac{8x^3}{x^2}$$

$$\lim_{x \rightarrow -\infty} 8x = \boxed{-\infty}$$

$$6) \lim_{x \rightarrow 4^-} \frac{5}{x-4} = \infty$$

$$7) \lim_{x \rightarrow 2} \frac{4x^3 - 32}{5x^2 - 20} \rightarrow \frac{0}{0}$$

$$\lim_{x \rightarrow 2} \frac{4(x^3 - 8)}{5(x^2 - 4)}$$

$$\lim_{x \rightarrow 2} \frac{4(x-2)(x^2 + 2x + 4)}{5(x-2)(x+2)}$$

$$\lim_{x \rightarrow 2} \frac{4(x^2 + 2x + 4)}{5(x+2)} = \frac{48}{20}$$

$$= \boxed{\frac{12}{5}}$$

$$8) \lim_{x \rightarrow -\infty} \frac{1}{1 + e^x} = \frac{1}{1 + e^{-\infty}}$$

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

$$= \boxed{1}$$

$$9) \lim_{x \rightarrow -\infty} \frac{e^x}{4x^3 - 3} \Rightarrow \frac{e^{-\infty}}{4(-\infty)^3 - 3}$$

$$\Rightarrow \frac{0}{\infty}$$

$$= \boxed{0}$$

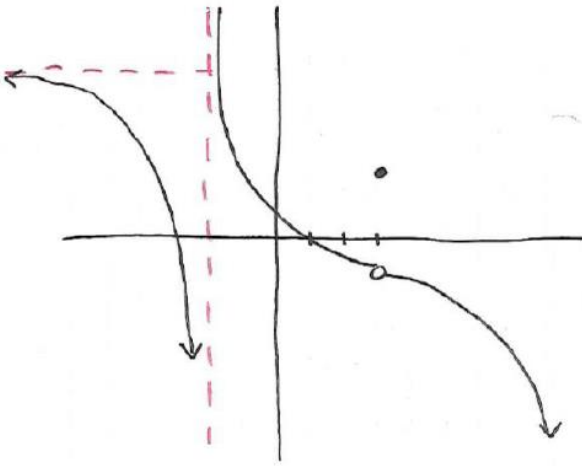
$$10) \lim_{x \rightarrow 0} \frac{\sin 3x}{7x} \cdot \left(\frac{3}{7}\right)$$

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{3x} \cdot \frac{3}{7}$$

$$= 1 \cdot \frac{3}{7}$$

$$\boxed{\frac{3}{7}}$$

11)



$$12) g(x) = \begin{cases} a+3, & x \leq 1 \\ (x+a)^2 - 10, & x > 1 \end{cases}$$

$$I. g(1) = a+3$$

$$II. \lim_{x \rightarrow 1^-} (a+3) = \lim_{x \rightarrow 1^+} (x+a)^2 - 10$$

$$a+3 = (1+a)^2 - 10$$

$$a+3 = 1+2a+a^2-10$$

$$0 = a^2 + a - 12$$

$$0 = (a+4)(a-3)$$

$$\boxed{a = -4 \quad a = 3}$$

$$13) \lim_{x \rightarrow 1^+} f(x) = 1$$

$$14) \lim_{x \rightarrow 1^-} f(x) = -2$$

$$15) \lim_{x \rightarrow 1} f(x) \text{ DNE}$$

$$16) \lim_{x \rightarrow -1} f(x) = 2$$

$$17) \lim_{x \rightarrow 2} f(x) = 1$$

$$18) \lim_{h \rightarrow 0} \frac{2(x+h)^2 - 7(x+h) - (2x^2 - 7x)}{h}$$

$$\lim_{h \rightarrow 0} \frac{2(x^2 + 2xh + h^2) - 7x - 7h - 2x^2 + 7x}{h}$$

$$\lim_{h \rightarrow 0} \frac{4xh + 2h^2 - 7h}{h}$$

$$\lim_{h \rightarrow 0} \frac{h(4x + 2h - 7)}{h} = \boxed{4x - 7}$$

$$19) f(x) = \begin{cases} 2x-1, & x \leq 1 \\ -3x+1, & x > 1 \end{cases}, \quad x=1$$

$$I. f(1) = 1$$

$$II. \lim_{x \rightarrow 1^-} f(x) = 1 \neq \lim_{x \rightarrow 1^+} f(x) = -2$$

$f(x)$ is not continuous at $x=1$
b/c $\lim_{x \rightarrow 1} f(x) \text{ DNE.}$

$$20) f(x) = \begin{cases} \frac{x^2+6x+8}{x+2}, & x \neq -2 \\ 2, & x = -2 \end{cases}$$

$$I. f(-2) = 2$$

$$II. \lim_{x \rightarrow -2} \frac{x^2+6x+8}{x+2}$$

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

$$III. f(-2) = \lim_{x \rightarrow -2} f(x)$$

$f(x)$ is continuous at $x=-2$

$$21) f(x) = \frac{x^2-16}{x-4}$$

$f(x)$ is not cont. @ $x=4$

$$\lim_{x \rightarrow 4} \frac{x^2-16}{x-4}$$

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

$$\lim_{x \rightarrow 4} (x+4) = 8$$

$$g(x) = \begin{cases} f(x), & x \neq 4 \\ 8, & x = 4 \end{cases}$$