I. FIND EACH LIMIT. IF A LIMIT FAILS TO EXIST, STATE THAT FACT.
IF A LIMIT VALUE IS ∞ OR $-\infty$, STATE THAT FACT.

1. $\lim\limits_{x\to 2\pi} \dfrac{5-\cos(x)}{\sin(x)+2}$

2. $\lim\limits_{x\to(-3)} \dfrac{x^2+8x+15}{x^2-x-12}$

3. $\lim\limits_{h\to 0} \dfrac{2(a+h)^2+4(a+h)-5-\left(2a^2+4a-5\right)}{h}$

4. $\lim\limits_{x\to 2}\left(3x^3-5x^2-6|x-1|\right)$

5. $\lim\limits_{x\to 0} \dfrac{\sin(8x)\tan(x)}{2x^2}$

6. $\lim\limits_{x\to 0} \dfrac{\tan(x)}{x\sec(x)}$

Hint: Let $2x^2 = 2x \cdot x$ and split into two fractions

7. $\lim\limits_{x\to(-5)} \dfrac{\sqrt{x+14}-3}{x+5}$

8. $\lim\limits_{x\to 4^+} \dfrac{x+8}{x-4}$

9. $\lim\limits_{x\to 2} f(x)$ where $f(x)=\begin{cases} 4x-x^2, & x<2 \\ \dfrac{18}{x+4}, & x\geq 2 \end{cases}$

10. $\lim\limits_{x\to 5} f(x)$ where $f(x)=\begin{cases} x^2-1, & x\leq 2 \\ 3x-4, & x>2 \end{cases}$

11. $\lim\limits_{x\to \pi} f(x)$ where $f(x)=\begin{cases} \tan(x)-3\cos(x), & x<\pi \\ \dfrac{6}{\sin(x)+2}, & x\geq \pi \end{cases}$

12. $\lim\limits_{x\to 3^-} \dfrac{-5x}{3-x}$

II. FIND THE x-VALUES WHERE EACH FUNCTION IS <u>NOT</u> CONTINUOUS.

13. $f(x)=\dfrac{x^3}{x^3-9x}$

14. $f(x)=\sec(x)$

15. $f(x) = \begin{cases} \dfrac{8x}{x^2+1}, & x \le -1 \\ \dfrac{4}{x}, & x > -1 \end{cases}$

16. $f(x) = \begin{cases} -\cos(x), & x \le \pi \\ x, & x > \pi \end{cases}$

III. FIND THE VALUE OF k WHICH WILL MAKE THE FUNCTION CONTINUOUS.

17. $f(x) = \begin{cases} x^2 + 4x + 2 & x < 1 \\ kx + 3 & x \ge 1 \end{cases}$

18. $f(x) = \begin{cases} x^2 - \sin(x) + k_1 & x < \pi \\ x^2 - \cos(x) - 2 & \pi \le x < 2\pi \\ x^2 - \tan(x) + k_2 & x \ge 2\pi \end{cases}$

IIII. USING A $\delta - \varepsilon$ PROOF, PROVE THE FOLLOWING STATEMENTS.

19. $\lim_{x \to 2} (4x - 1) = 7$

20. $\lim_{x \to (-2)} (-3x + 4) = 10$